"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

"SCIENTIFIC RESEARCH AND EDUCATION IN THE AIR FORCE"

AFASES 2012

ASSOCIATION for
RESEARCH and EDUCATION

ISSN, ISSN-L: 2247-3173

INTERNATIONAL SCIENTIFIC COMMITTEE

Presidents ship:

Cdr Prof.**Gabriel-Florin MOISESCU**, PhD
Doc Ing **Pavel NEČAS,** PhD

Members:

Col Prof **Mihail ANTON,** PhD
Col Prof Eng **Cristian BARBU**, PhD
Col Eng **Miroslav BAUER,** PhD
Cdr Prof Eng **Ghiță BÂRSAN,** PhD
Prof **Dorin BOCU**, PhD
Alenka BROWN-VANHOOZER, PhD
Cdor Prof **Vasile BUCINCHI**, PhD
Assoc.Prof. Dipl.Eng. **Pavel BUCKA** PhD
Prof Eng **Gavrila CALEFARIU**, PhD
Assoc Prof Math **Sergiu CATARANCIUC**, PhD
Prof **Cristina CISMASIU**, PhD
Prof Eng **Ioan CURTU**, PhD
Assoc Prof **Aurel Ion CLINCIU**, PhD
Prof **Philippe DONDON**, PhD
Prof **Finn FORSUND**, PhD
Prof Eng **Elena HELEREA,** PhD
Prof **Lennart HJALMARSSON**, PhD
Prof **Sergiu IVANOV**, PhD
Prof **James KEAGLE,** PhD
Prof **Marcela LUCA,** PhD
Assoc Prof **Doru LUCULESCU**, PhD

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

CS1 Eng **Catalin NAE,** PhD,
Prof Eng **Vasile NĂSTĂSESCU**,PhD
Prof **Stefan NEDELCU,** PhD
Col Prof Eng **Ioan NICOLARESCU**, PhD
Prof **Ilie NUCA,** PhD
Prof Eng **Adrian OLARU**, PhD
General (r) Prof **Mihai ORZEATA**, PhD
Prof **Marian PEARSICA**, PhD
Prof **Philippe PERROT,** PhD
Col Prof Eng **Toma PLESEANU**, PhD
Prof Eng **Gabriela PRELIPCEAN**, PhD
Prof **Mihai ROMAN**, PhD
Prof **Daniela ROSCA**,PhD
Cdr Prof **C-tin ROTARU,** PhD
Asher SHAFRIR, PhD
Cdor Prof Eng **Gheorghe SAMOILESCU**, PhD
Prof Math **Florentin SMARANDACHE,** PhD
Prof Eng **Milan SOPOCI,** PhD
Assoc Prof **Lavinia STAN**, PhD
Col Prof **Leontin STANCIU**, PhD
Prof **Stelian STANCU**, PhD
Col. Prof **Robert SZABOLCSI**, PhD
Prof Eng **Alex STEFAN,** PhD
Prof Eng **Luige VLADAREANU**, Ph
BG(ret) Prof Eng **Rudolf URBAN,** PhD
Prof **Joseph ZARKA**, PhD

ORGANIZING COMMITTEE

***Chairman*:**

Capt Cdr Prof **Mircea BOSCOIANU**,PhD

Vice-chairman:

Assoc Prof Eng **Lavinia GAVRILA**, PhD

***Members*:**

Assoc Prof **Daniela BELU**, PhD
LTC Lecturer Eng **Laurian GHERMAN**, PhD
Lecturer Eng **Liliana MIRON**, PhD
LTC Eng **Vasile SANDRU**
Lecturer **Mihaela GURANDA, PhD**
TA **Gheorghe RADU,** PhD
Capt Eng **Cornel ARAMA**, PhD
TA Math **Bogdan MUNTEANU**
Capt TA **Cosmina DRAGHICI**
TA Capt **Catalin CIOACA**
Math **Carmen URSOIU**

THE SESSIONS SECTIONS

1. *MANAGEMENT, MARKETING, FINANCE*

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

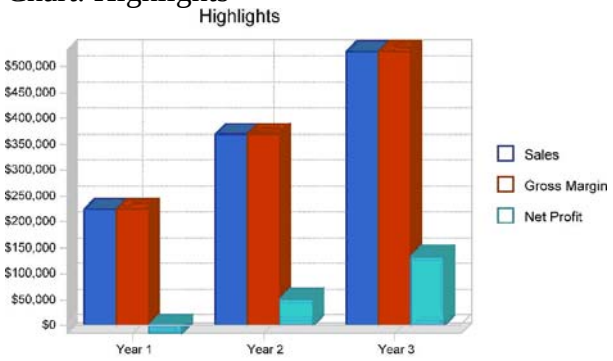
T&A Agency

Taninna AIT ALI SILMANE

Manhattan Institute of Management, New York, USA

1. Executive Summary

Communication is a really important principle for the smooth running of a company. Nowadays, the competition is so tough currently for brands that they must find a way to differentiate. T&A Agency will provide them this differentiation. To allow them to play the game well, T&A Agency will develop for our customers an effective communication strategy by using all communication materials needed like advertising, design, visual identity, internet, …, to access the top of the advertising market.
T&A agency leitmotiv will allow us to adapt our abilities to every project specialized within the fashion industry and perform as the most efficient as we will. T&A Agency will become the most efficient advertising agency because we have a wide range of abilities that allow us to cover every sides of the communication field.
As a small communication agency for the beginning, we will target every type of customers while keeping in mind to always follow our premium-services values. After reaching a certain level of awareness and serious reputation, we will be more specialized in terms of target.
Thanks to the global and specialized skills of all the T&A Agency coworkers, we will be able to build from nothing a strong and powerful communication strategy for all our customers, from establishing a communication strategy to evaluating the communication axes relative to the field of competition including building the basic message that will be declinable on all communication materials. In this way, T&A Agency will become the leader on the advertising market.
Chart: Highlights



1.1. Mission

T&A Agency will provide to our customers the best tools to "**Make the Difference**". We will create the event around a message with the most impact to seduce the public and create for them a real sustainable image. The main motto of T&A Agency is the "**Creativity**". The work that we will accomplish will ensure **relevance**, **creativity** and **reactivity**.
Moreover, T&A Agency will highlight our work :

- to develop the image of a company both externally and internally,
- to promote an event, to motivate, inform and involve a team,
- to grow and develop loyalty of costumers or potential investors.

T&A Agency want to become the first partner

of companies to design and embrace the companies' pursuit of promotion and awareness.

2. Company Summary

T&A Agency is a global communication agency which offer to take over all communication needs of a company through the five main centers of the field of communication as communication audit, consulting, global communication (commercial communication (or product), corporate communication, brand communication, event communication corporate and financial communication), graphic studio (visual design, special effects, editing and image processing, shooting, object identification, virtual Intelligence …), internet (creation of dynamic showcase site, e-commerce) and multimedia (E-CARD, CD-ROM).

2.1. Company Ownership

Taninna AIT ALI SLIMANE is the owner of T&A Agency.

2.2. Start-up Summary

Taninna AIT ALI SLIMANE will incur a long-term business loan. Therefore, the following table and chart show projected initial start-up costs of T&A Agency.

Table: Start-up Funding

Start-up Funding	
Start-up Expenses to Fund	$34,500
Start-up Assets to Fund	$215,500
Total Funding Required	$250,000
Assets	$60,000
Non-cash Assets from Start-up	$155,500
Cash Requirements from Start-up	$0
Additional Cash Raised	$155,500
Cash Balance on Starting Date	$215,500
Total Assets	
Liabilities and Capital	
Liabilities	
Current Borrowing	$0
Long-term Liabilities	$100,000
Accounts Payable (Outstanding Bills)	$0
Other Current Liabilities (interest-free)	$0
Total Liabilities	$100,000
Capital	
Planned Investment	
Taninna Ait Ali Slimane	$0
Other	$0
Additional Investment Requirement	$150,000
Total Planned Investment	$150,000
Loss at Start-up (Start-up Expenses)	($34,500)
Total Capital	$65,500
Total Capital and Liabilities	$215,500
Total Funding	$250,000

Chart : Start-up

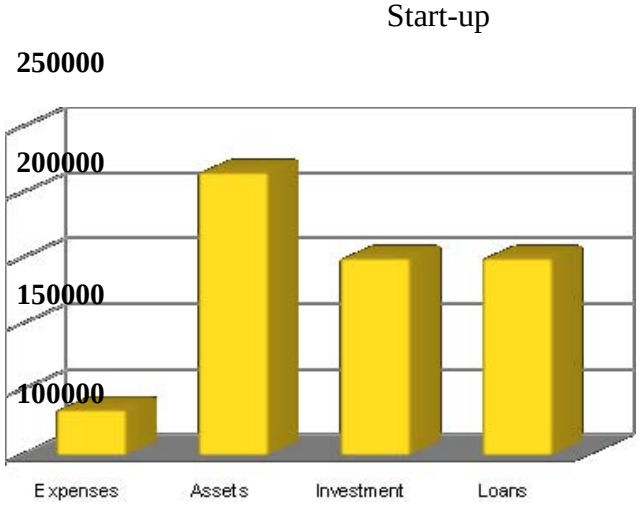


Table: Start-up

Start-up

Requirements	
Start-up Expenses	
Legal	$1,000
Stationery etc.	$1,000
Brochures	$1,000
Advertising	$20,000
Expensed Computer Equipment/Software	$10,000
Insurance	$0
Rent	$1,500
Research and Development	$0
Other	$0
Total Start-up Expenses	$34,500
Start-up Assets	
Cash Required	$155,500
Other Current Assets	$60,000
Long-term Assets	$0
Total Assets	$215,500

Total Requirements	$250,000

3. Services

T&A Agency will offer an entire communication strategy from the pre-questionnaire and building the basic message that will be declinable on all communication materials to post-campaign analysis. The services will include the following :

- Pre-questionnaire before establish the communication strategy as the following :

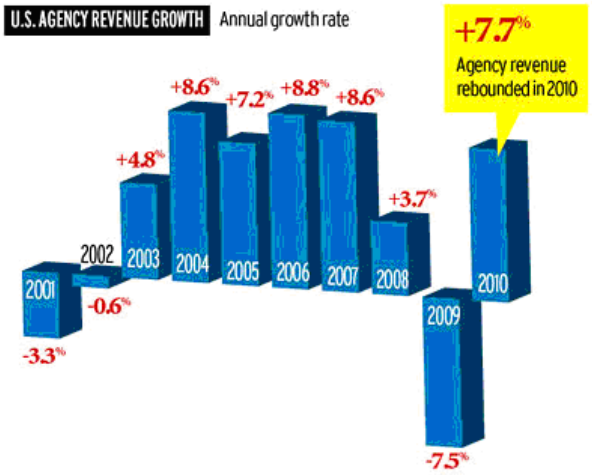
-WHAT: what product, service, action, what do we want to promote?
-WHY: what are the objectives? (type of objectives: awareness, image, behavior, information)
- TO WHOM: to which targets? (Setting targets, and their motivations and brakes.)
- HOW: what budget is allocated?
- HOW: by what means - tailored to each target, and based on budget
- WHEN: depending on what planning
- FOR WHOM: who is the voice messages of the organization?

- The marketing analysis of the company (its culture, its values, its place in the market) and the product, brand, competitive environment, the needs expressed … results in a position of product.
- The development of various actions based on chosen targets and positioning : axes and themes of messages; visual symbols, graphic …
- The choice of means of communication (external communication: media; direct marketing, sales promotion, press and public relations, website; internal communication : intranet, corporate press …)
- The post - campaign analysis with a monitoring of performance and possible readjustment of objectives, resources or supports.

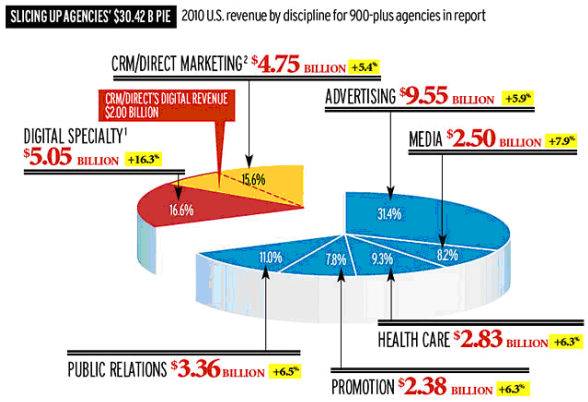
With our "Gold Rules" of creativity, relevance and reactivity, T&A Agency will adapt our services to each customer relative to what they need.

4. Market Summary Analysis

After a recession in 2009 ended in June, the marketing and communication market « has come back to life ». According to the Ad Age Agency Report (survey on the performance of more than 900 U.S. agencies), U.S. revenue for marketing - communications agencies in 2010 increased by 7.7% to $30.4 billion.



Source: Ad Age Agency Reports.



1 Digital - specialty agencies.

2 CRM/direct agencies had $4.75 billion in revenue including $2.00 billion from digital services. Numbers rounded. Source: Ad Age Agency Report 2011.

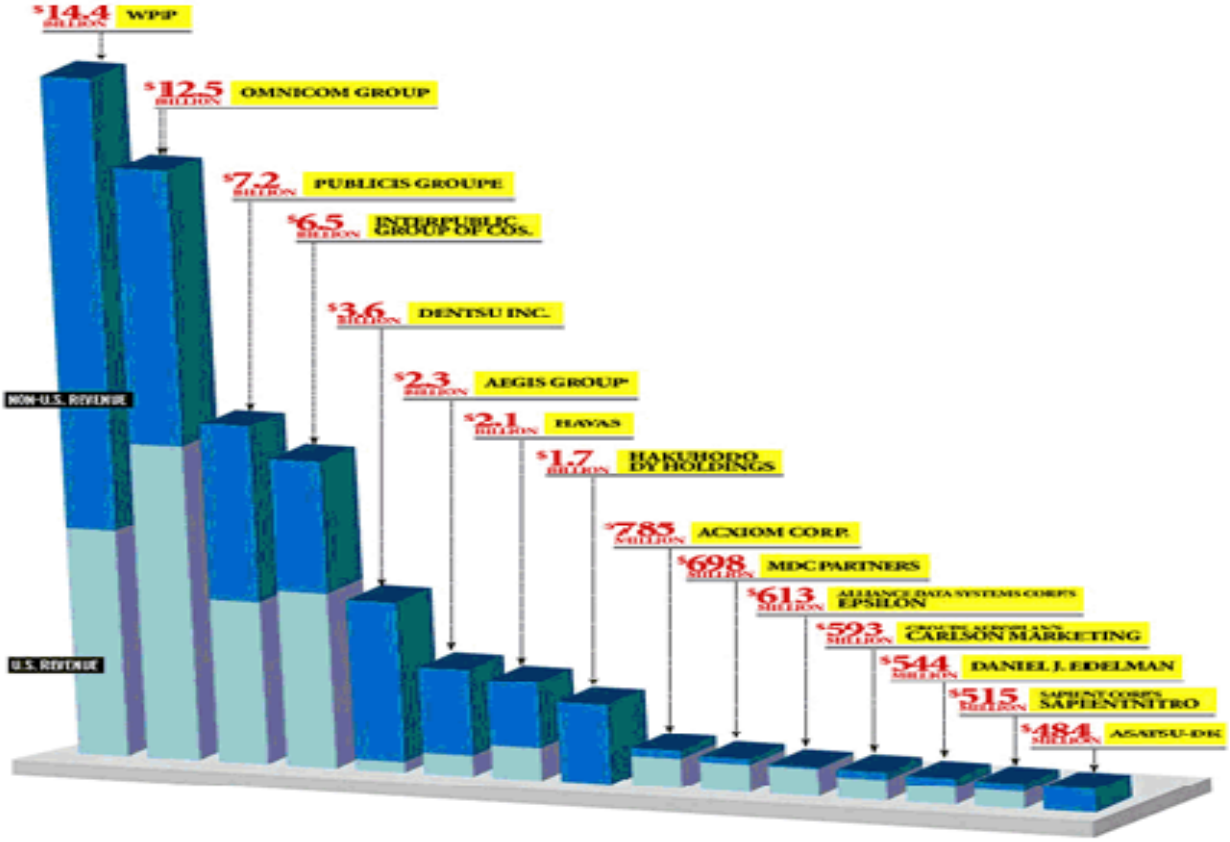
The U.S. marketing and communication market is very saturated and difficult to enter in. Indeed, to survive, the agencies need to find a efficient positioning. So, new agencies like T&A Agency must have a innovation idea. Nevertheless, specialist advertising agencies can also be"full - service" which means that like T&A Agency, the target is specific but they offer all the general advertising agency services in the specialized field they chose.

Concerning the main competitors on the market, the leading US Agencies in 2010 by revenues from all disciplines (advertising, media, marketing services) are classified in the following table :

Acxiom	Starcom USA	Goodby Silverstein	Waggener Edstrom
Epsilon	Rosetta	Cline Davis & Mann	Arnold Worldwide
DraftFCB	Saatchi & Saatchi	Wieden & Kennedy	McCann Healthcare
McCann Erickson	Burson-Marsteller	Harte-Hanks	Critical Mass
BBDO	Grey	Integer Group	Mullen
Leo Burnett/Arc	Hill & Knowlton	Martin Agency	Sudler & Hennessey
Rapp	Ketchum	iCrossing	Tribal DDB
JWT	OMD	Doner	GolinHarris
SapientNitro	R/GA	Ogilvy PR	Porter Novelli
Edelman	Meredith Integrated	Organic	VML
Euro RSCG	Deutsch	AKQA	Initiative
Digitas	Digitas Health	Euro RSCG Life	GyroHSR
Wunderman	Richards Group	George P Johnson	Possible Worldwide
Weber Shandwick	MEC	G2	Accent Marketing
Razorfish	Ogilvy & Mather	MediaCom	MRM Worldwide
Y&R Advertising	Publicis	Universal McCann	GMR Marketing
Fleishman-Hillard	Hill Holliday	McGarryBowen	Octagon
inVentiv	GSI Interactive	RPA	Proximity Worldwide
Carlson Marketing	Mindshare	Momentum Worldwide	Kirshenbaum Bond
DDB	Campbell-Ewald	Interbrand	SolutionSet
TBWA	MediaVest USA	Horizon Media	Jack Morton
Merkle	Zenith Media	Marketing Arm	Goodness Mfg
OgilvyOne	Ogilvy CommonHealth	DraftFCB Healthcare	Grey Healthcare
Aspen Marketing	Cramer-Krasselt	Zimmerman Partners	MS&L
IBM Interactive	Crispin Porter Bogusky	Tracy Locke	Ruder Finn

(www.adbrands.net)

The market is leaded by four multi - agency conglomerates which are WPP, Omnicom Group, Publicis Groupe, Interpublic Group of Cos. in 2010.



2010 worldwide revenue for world's 15 largest agency companies. Some figures are Ad Age estimates. Some U.S. figures reflect North America.
See expanded information on these companies: AdAge.com/agencyfamilytrees2011.
Source: Ad Age DataCenter.

4.1. Market Segmentation

In view of the oversubscribed market, T&A Agency will be specialized in the communication of fashion brands and companies. So, we will be focused on the specialist advertising agencies of fashion industry.

Since T&A Agency is specialized in the communication of the fashion and apparel industry, the main competitors of T&A Agency are summarized in the following table :

Table : Main competitors of T&A Agency

That! Company	Mission of their advertising company : To ensure that the client is happy. A happy client is a busy client. Nothing else matters. It just so happens it takes a lot of energy, dedication, confidence and leadership to develop creative, effective advertising campaigns with measurable results. We expect nothing less from our creative masterminds and analytical professionals, and you should expect nothing less from your advertising agency. World Headquarters

	(Central Florida), That Company, Advertising Agency Division, 8500 US HWY 441, Leesburg, Florida, 34788 – Sales Office in New York, New York : 917 - 934 - 3575.
Art Zulu Inc.	A design firm specialized in brand identity, positioning, and launching located in Mahnattan.
Bergman Associates	A New York based design and advertising agency offering a full range of unique services: logo design; corporate identity creation; branding; art direction for photography; graphic design; advertising; marketing; editorial design and package design. Bergman Associates was founded in 1991 by internationally recognized creative director Robert Bergman.
ThincTank NY	offers a complete range of brand consulting for apparel and accessories brands. 1. Brand Planning and Development : they identify a brand's core values and design toward 2. Product Design and Development : ThincTank offers partial or full service in product design from silhouettes, fabrication, trims, graphics, graphic application, to technical drawings and wet processes. ThincTank specializes in the Mens sportswear, Womens sportswear, Denim, Accessories, Market / trend / vintage research. 3. Brand Identity Design : ThincTank utlilizes a variety of innovative processes to develop following: Naming and Taglines, Logos and packaging, Brand signature details, Brand identity manuals, Brand image book They approach each client on an individual basis, as they know there's no such thing as off - the - shelf brand strategy. 4. Marketing and Art Direction

4.2. Service Business Analysis

According to John Durrel (1998), branding represents “a consistency of quality and meaning associated with a designer’s collections that will carry over from year to year”. Despite changes in design from one season to the next, these changes in fact reinforce the particular company’s image. (N. M. Rantisi, 2001).

The fashion industry brings in more than $973 million every year. Like in the advertising market, new fashion brands and companies in the apparel and fashion industry must be specialized and different from the competitors to survive on the market. As the industry grows and in order to be the most aware and well - known from the customers, they must appeal advertising services provided by advertising agencies for the fashion industry like T&A Agency to promote products and service.

5. Strategy and Implementation Summary

T&A Agency will use our services to launch our proper advertising campaign and establish our
customers.

The global fashion apparel industry is one of the most important sectors of the economy in terms of investment, revenue, trade and employment generation all over the world.

The retail industry is US the number one growing industry and the fashion retail is the top growing and largest in the retail industry of the U.S.

5.1. Marketing Strategy

J. Richardson, 1996, stated : « In rapidly changing and highly competitive industries such as the fashion retail market where products have short product life and differentiation advantages may be quickly imitated, it is important for fashion companies to be sensitive to changes in fashion trends and to be able to swiftly change their line of production when the need arises ».

Besides, according to the Census Bureau, the total sales in the U.S. retail industry in 2008 is $4.475 trillion. Over - all, the total sales of the top ten companies in the global retail industry is $978.5 billion in 2007, according to international consulting group, Deloitte. Retailing is the primary driver of the global economy, making such large sums of sales annually.

More precisely, the fashion industry remains one of NYC's largest and most prominent sectors[1]. It employs 165,000 people, accounting for 5.5% of NYC's workforce[2], generates $9 billion in total wages and tax revenues of $1.7 billion[3] and serves as headquarters to over 900 fashion companies[4]. Therefore, the NYC's fashion retail market is growing at a considerable rate. From 2010–2025, it is projected that employment for NYC clothing and accessories stores will increase by 13%[5]. Consequently, T&A Agency can expect a rise of our customers since the fashion industry in New York City is hugely developped.

In addition, T&A Agency appeals a considerable social media strategy through growing and developed social medias as Facebook, Twitter, Google+, … :

http://www.facebook.com/#!/pages/TA - Agency/165429243567738

https://twitter.com/#!/TandAAgency

https://plus.google.com/u/0/b/115904250739256193883/#

http://onlinecounselinghour.com/?mlp=ta - agency

5.2. Sales Strategy

Because of growing numbers of competitors on each market, the differentiation is essential. Most of the companies establish tenders in order to find their advertising agency. A tender is a procedure by which a potential buyer requests different suppliers to make a business figured proposal in response to the detailed formulation (specifications) and his need (product or service). Tenders can also be placed outside the specific legal framework, by companies looking for suppliers. Some websites have also specialized in the passage of tenders easily available online for free even. In a simplistic way, the tender can be analyzed in five steps : writing of the briefing, preselection of the guested agencies, presentation of the briefing, the 1st round, and the 2nd round. Regarding the rounds, it is expected that during the first round agencies present their strategic recommendations (corporate communication and operational) and their policy recommendations for the next three years. No creation is requested for the first round. One budgetary approach is requested for this first round, particularly on agency fees. During this exchange, the agency will also present the material and human resource. One goal is to recruit a permanent and stable partner.

The advertising agencies are actually in

[1] Industry Snapshot – Fashion in New York City, 2011, New York Economic Development Corporation.
[2] NYS Department of Labor, 2009
[3] NYS Department of Labor, 2008, 2009; NYCEDC, 2008 (derived from NYS Department of Finance and NYS Department of Management and Budget)
[4] Hoover's, 2010
[5] Moody's Economy.com, 2010

competition so T&A Agency must be different and attract the customers. In the same way of our three « Gold Rules », T&A Agency offers customized services in order to establish a perfect communication plan which fits with the needs of the company. No more unnecessary expenses and inconsistent communication budget, T&A Agency is creative, reactive and relevant to listen to our clients and guide them to a project as impactfull as it must be. Our customized offer leads to several plans and packages that would be the most personalized and relevant to the project as possible.

T&A Com+ (Communication Strategy)	$10,000
Separated Items (Pre-questionnaire, Marketing analysis of the company, Various actions, Means of communication, Post-campaign analysis)	$3,000

T&A Agency works with relevance and reactivity. Consequently, the packages can be customized according our clients' needs. In a way to differentiate from our competitors, our price are not high because we establish a commission on the consequences of our campaign. It will ensure our clients our involvement and guarantees regarding our work.

5.2.1. Sales Forecast

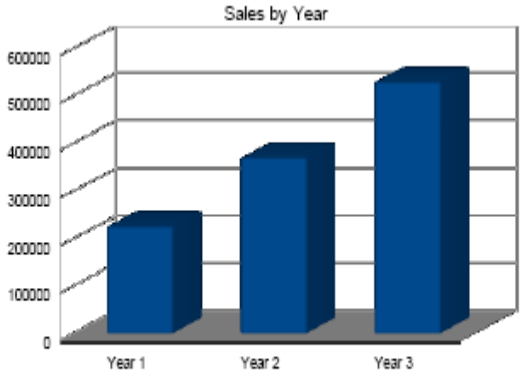
The following is the sales forecast for three years.

Table: Sales Forecast

Sales Forecast			
Year 1		Year 2	Year 3
Total Sales	$225,830	$370,000	$530,000
	Year 1	Year 2	Year 3
Direct Cost of Sales	$2,000	$5,000	$7,000

Sales Monthly

Chart : Sales by Year



5.3. Competitive Edge

The competitive advantage of T&A Agency are the following :

T&A Agency highlights our work with the three "Gold Rules" : creativity, reactivity and relevance.

T&A Agency is specialized in the fashion industry then we can focus our skills in a specific field that our co‐workers master.

All the broad range of services that we provide will allow T&A Agency to build from nothing a strong and powerful communication strategy for each customer relative to what they need.

The attention of T&A Agency to our client lead us to propose different kinds of payment and customize our package to embrace the needs of our customers.

6. Management Summary

Taninna AIT ALI SLIMANE will be the CEO

of T&A Agency. To be effective, T& A Agency will also hire a skilled staff that can provide all the promises that we follow.
The company plans to hire personnel as the agency begins to get large numbers of contracts.
At the beginning of our agency's life, the staff will be composed of the basic departments that T&A Agency need before get wider :

- A sales manager that will fulfill the commercial function in the agency. The tasks of the sales function in fact contain two dominant axes : internal and external coordination and the elaboration of the communication strategy.
- A creative manager who oversees teams of creative (copywriters and art directors, within a creative team) in order to identify in the business strategy a simple idea, strong and concise. The creation is the label of the agency and its image against the outside.
  The creative department must be able to summarize the business strategy into a simple idea, strong and concise data and translate it into art. The creative work as closely with the other two departments that are the business strategic functions and executive functions.
- The board is part of the media strategy consulting communication. T&A Agency can provide this service divided in two essential and distinct poles, one on the analysis and media studies and corresponding to the tasks of media planning, the other pole is oriented to functions of a commercial, media buying and negotiation. These functions will be provide by a senior research fellow and/or a media planner.
- Then, the art buyer is in charge of the executive function which is essentially a role of production and manufacturing. It embodies and expresses the most relevant creative idea. He manages the implementation and technical implementation of communication campaigns.

6.1. Personnel Plan

The summarize of the T&A Agency staff is in the ollowing table : Table : Personnel Plan

Personnel Plan

	Year 1
Taninna AIT ALI SLIMANE - CEO	$32,000
CFO	$28,000
Sales Manager	$25,000
Creative Manager	$25,000
Project Manager	$25,000
Media Planner	$25,000
Art Buyer	$25,000
Secretary/Receptionist	$18,000
Other	$0
Total People	8
Total Payroll	$203,000

7. Financial Plan

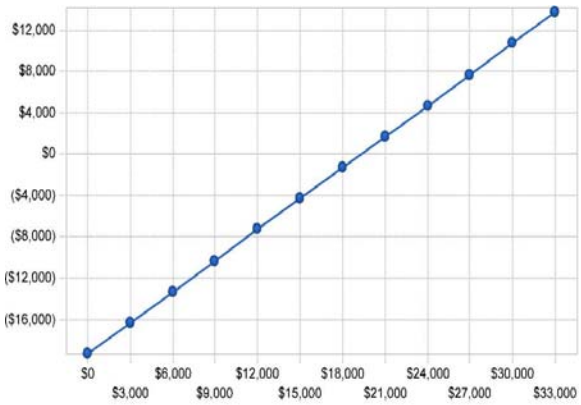
7.1. Breakeven Analysis

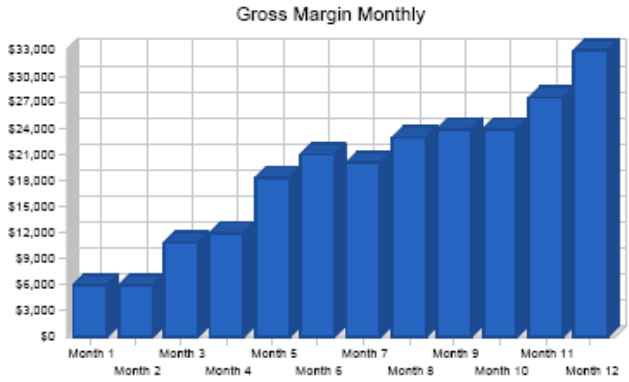
The monthly sales break-even point is shown in the table and chart below. Table: Break-even Analysis

Break-even Analysis

Monthly Revenue Break-even	$19,308
Assumptions:	
Average Percent Variable Cost	0%
Estimated Monthly Fixed Cost	$19,308

Chart: Break-even Analysis





7.2. Projected Profit and Loss

T&A Agency will be profitable from the second year and will grow by almost 9% after the second year.

Chart: Profit Monthly

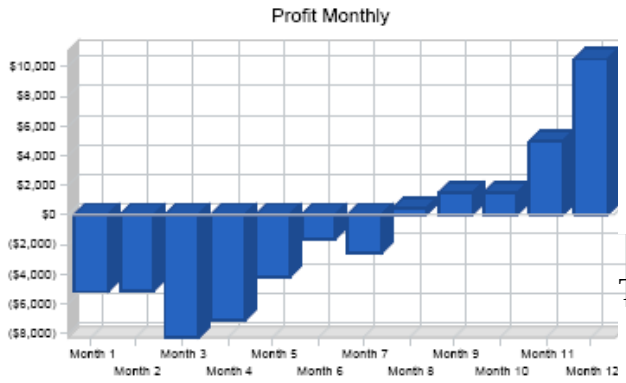


Chart: Profit Yearly

Chart: Gross Margin Monthly

Chart: Gross Margin Yearly

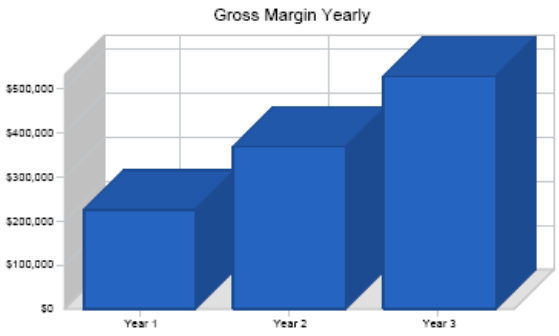


Table: Profit and Loss

Pro Forma Profit and Loss			
	Year 1	Year 2	Year 3
Sales	$225,830	$370,000	$530,000
Direct Cost of Sales	$2,000	$5,000	$7,000
Other Production Expenses	$0	$0	$0
Total Cost of Sales	$2,000	$5,000	$5,000
Gross Margin	$225,830	$370,000	$530,000
Gross Margin %	100.00%	100.00%	100.00%
Expenses			
Payroll	$203,000	$236,000	$277,000
Sales and Marketing and Other Expenses	$48,000	$60,000	$80,000
Depreciation	$0	$0	$0
Leased Equipment	$0	$0	$0
Utilities	$2,400	$2,400	$2,400
Insurance	$0	$0	$0
Rent	$18,000	$18,000	$18,000
Payroll Taxes	$21,300	$27,150	$30,300
Other	$0	$0	$0
Total Operating Expenses	$292,700	$343,550	$407,700
Profit Before Interest and Taxes	($5,870)	$81,450	$197,300
EBITDA	($5,870)	$81,450	$197,300
Interest Expense	$8,916	$6,999	$4,999
Taxes Incurred	$0	$22,336	$57,690
Net Profit	($14,786)	$52,115	$134,611
Net Profit/Sales	-6.55%	14.09%	25.40%

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

CHILDREN'S OBESITY IN THE UNITED STATES AND THE ACTIONS OF THE MEDIA.

Mathilde BERNADAC, Assha GHORI, Julie CANNENTERRE, Nicole MOU, Solinda MOUL

Manhattan Institute of Management, New York, USA

INTRODUCTION

In 2011, Michel Obama has launched a campaign called « let's move »[1]. It points out the fact that a lot of areas of the United States are free of supermarkets which conducts people to feed themselves in the local markets that usually do not provide fresh food. She has obtained from the most important retailers, such as Wal-Mart, Supervalu, Walgreens, the ability to propose a wider range of fresh products for lower prices. That is why one of the biggest retailers 'engagements is to open supermarkets in those areas. For instance, Wal-Mart promised to open between 275 and 300 supermarkets in those specific regions: 330 million dollars are dedicated for this national project. Why that much? For the reason 32% of children (from 2 to 19 years old) are obese[2].

Obesity is one of the sicknesses the easiest to recognize but hardest to treat and prevent. In the United States, it has become the major health issue for the government because of disastrous data showing its rapid increase in the last few years. In order to fight against this dramatic phenomenon, the government and media have decided to collaborate, targeting parents first. Indeed, children are the first victims and recent studies have shown than more than 80% of the children will be obese if their parents already are[3].

There is a difference between overweight and obesity. Overweight is the fact to have "an extra body weight from muscle, bone, fat, and water"[4] . However, obesity is "having a high amount of extra
body fat". The use of Body mass index (BMI) is based on height and weight and help doctors and specialists understand the issue.

We will illustrate our project with a current polemical issue. With their well known slogan "It took us 30 years to get us all talking about childhood obesity", Strong4life are at the core of the debate with their polemical campaigns. Their main objective is to target parents in order to make them realize the danger occurring to their children if they do not fight against their health problem[5]. It can have several consequences such as coronary heart diseases, gallstones, diabetes[6].

In our project we will introduce you first the methodology we will adapt for our researches, before going ahead and exposing the main facts of our topic. Then, we will talk about the strategies the media have adopted in order to struggle against obesity and how they have implemented them within the American society. Finally, we will relate our topic with our MIM courses such as Managing Innovation and Technology and Social Media. In our annexes, you will be able to see the interviews we will realize thanks to the direct contribution of American protagonists.

METHODOLGY

The second chapter will focus on methods. For the issues oriented paper on The impacts of

social campaigns on children's obesity in the US, it has to be decided whether a quantitative or qualitative research has to be adopted. Choices of methods will be discussed and justified in order to accurately lead the project on the Issues oriented paper.

Quantitative or Qualitative?

Characteristics of both researches

Researchers can carry out their researches with a lot of different methods but there are two main researches which are the quantitative and the qualitative. However, debates between those two types of methods have never stopped thus this issue has been a dilemma since ages. Nonetheless, before going into the process on an investigation both quantitative and qualitative methods have to be studied in order to be conscious of strengths and weakness of each and then justify the research method used.

Strauss and Corbin (1998, p.92), affirm" *quantitative research is empirical research in which the researcher explores relationships using numeric data*" where as qualitative research "is *any type of research that produces findings which have not been discovered through statistical procedures or other means of quantification*". The main difference concerns the scientific argument thus the quantitative research is supposed to be more factual and reliable because information and evidences can be figured out with numbers and theories. In general, quantitative method are used to analyze factions of people and demographic. Pickard (2007, p. 146) said the purpose of survey research is to gather and analyse information by questioning individuals who are either representative of the research population or are the entire research population. However, qualitative research also uses surveys because it has a descriptive aspect useful for qualitative data.

Which research?

Patton (1978, p.28) assumes both quantitative and qualitative type of data has both limitations and strengths. That is why some researchers will recommend the triangulation (Simon and Hittleman 2001) which consist in using data from different types of researches. Besides, "*mix method*" (Creswell and Clarck, 2006, p.136) is "*the use of multiple data collection techniques compensates for any limitations of individual techniques*" (Marshall and Rossman, 1990, p.42). Mix method may appear as a way to present deeply a study but even if using the strength of each research can compensate the weakness of both, only the qualitative research is here useful to this research study.

It follows from all this analysis that quantitative research is not appropriate in this research study. Numerical data, graphics or statistics are not useful to demonstrate and determine the the impacts of social campaigns on children's obesity in the US. We have fixed that three interviews will be a great opportunity to collect different rich data and opinions from three different interviewee. The results of these interviews will then be discussed and analysed.

Interviews

During the research interviews will be done to collect data because the researcher is searching for rich and descriptive details. Pickard (2007) established "*Interviews are usually used when we are seeking qualitative, descriptive, in-depth data that is specific to the individual*"; In general, interviews are used for "*descriptions and feelings about current events and predictions of future events*".

During the three interviews a semi-structured interview will be used: prepare a number of questions in order to design and give a framework to the interview. However, depending on the flow of the interview and the answers of the interviewee some more questions may be asked and other not.

MAIN FACTS

Over the past decades, obesity has become a major concern in the United States. Indeed, alarming data reveal one person for three is concerned about this sickness. The rate has not diminished for 10 years in any of the 50 states of the country and until 2006, there was an evolution of 5% per year. This phenomenon keeps on bringing worries to the government and institutions because it is the only one cause of deaths (among alcohol, drugs and sexual relations) which has known a boom that high for the last few years[7]. Children have become the first preoccupation because of the

dramatic increase of obese among them: 23 million.

Every year, the government must deal with the growth of its budget granted to the medical sector because of those health issues. It represents more than 10%, which means an amount of $147 billion per year. An overweight person will have a medical budget care superior of 40% in comparison with a healthy person. According to the last researches from Ali Mokdad and his coworkers from "Centers for Disease Control and Prevention", every year, this sickness is responsible for more than 400000 deaths, second cause after the tobacco (with 430000 deaths)[8].

Obesity does not result from only one factor and can be explained by several ones. The most important will obviously concern food habits of American people. In the daily file, snacking and nibbling have become common gestures for a majority of the population, who has lost regular and specific lunch and dinner times. This loss of references explains the disorientation of the body and the inability to regulate itself. Its desire of food will be high and constant all day long. This new way of consumption has considerably been encouraged with the high development of fast food chains. Some researches show that ¼ of the population is at least eating once a day in a fast food. The common American orders every week 3 hamburgers and 4 portions of fries. The movie "Super size me", from Morgan Spurlok, illustrates perfectly the effects of junk food on the body and its health consequences. Indeed, it is a documentary following him for one month, eating in the famous restaurant chain "Mac Donald" 3 times a day. The title of its film is humorously sarcastic and makes reference to the menu "super size" he had to chosen to eat, which made him took more than 11kgs. As a consequence and after only 30 days, he got kidney, liver and cholesterol issues. Thanks to this report and its worldwide extension, the restaurant will be forced to stop providing this menu[9].

Furthermore, the tendency of the society, promoting technology and the use of high tech items instead of practicing sports, has committed disastrous consequences on the daily habits of American teenagers.

Consequences on the body resulting from obesity are numerous: diabetes, hypertension, sleeping problems, dependence towards some aliments and so on. However, this sickness will affect as well the psychological state of people concerned. Indeed, the victims will usually feel guilty of their body, ashamed and depressed because of the reject from the others. Unfortunately, society can be cruel with the weakest and most sensitive persons. They are most of the time targets of sneers, mocking remarks and even insults. A famous research from Yale University reveals that obesity is the 4th major cause of discrimination, behind the sex, age and origin factors.

At school, students do not feel sorry and are most of the time extremely unkind with their school friends who are not following the common norms. They do not hesitate isolating one of the children because of the overweight problem. However, discrimination goes on even after school, once the person will start searching for a job. It will be more difficult to obtain a work because of prejudices existing within the society and having a big influence: indeed a boss will perceive an obese person as someone lazy, without perseverance and any goals in his life. Furthermore, it can have negative consequences in the daily life as well. For instance, when taking common means of transport, a new legislation has been applied where are asking obese people to pay two tickets instead of one. Regrettably, this new law it is not an isolated fact.

Some surveys affirm in United States in 2035, 37% of men and 44% of women of 35 years old will be obese. It is a result without any precedent and alerts all the institutions and pushes them to react. This is the reason why the government and institutions keep on searching solutions more and more innovative in order to fight against this sickness. The medical field is effectuating some researches and provides advice to the population through slogan such as “eat to live: don’t eat to live” or “eat healthy”. The government has launched several actions in order to fight against obesity in the United States. Today, there is a law on which they are working on, which would impose a tax on products judged unhealthy and dangerous for the population. Furthermore, many associations have been created, such as “The National Action Against obesity”, whose main aim is to reduce the discriminations and prejudices existing within the society10].

Solutions in order to fight against obesity are numerous but complicated and can not guarantee a full success. The problem is obesity results from unhealthy behavior from the person, attracted by the abundance and rapidity of food consumption. Causes are social, scientific and morals and create a reject from the society and numerous discriminations. It is a situation where it is often scarce to get better on our own: help is vital in the cure process.

As a consequence, we could wonder if the solution the most efficient would be the media influence, in order to help changing the state of mind and behavior of the daily life[11].

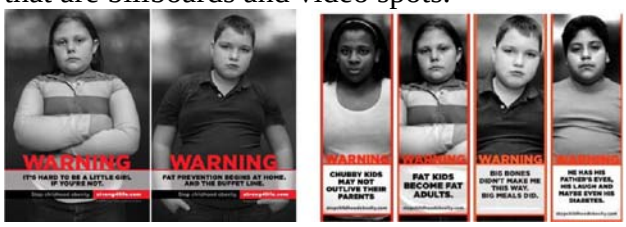
STRONG 4 LIFE‘S CASE

The organization

Strong4Life has been created recently in January 2012 in Georgia[12] in order to protest against the obesity phenomena among children. Strong4Life has launched a controversial campaign in a society where obesity is perceived as a burning issue but above all as a taboo[13]. Various campaigns aimed to target grown up so as to make them realize of their lifestyle; however Strong4Life has decided to target children in this campaign but creating a feeling of guiltiness in parents’ minds[14]

Campaigns

The campaign appears in two main medium that are billboards and video spots.



Analysis of the billboards campaign

The first billboard is an image mainly in black and white except from the word “warning” that is written in capital letters and in red and the lines that separates the pictures of 4 kids. This underlines the fact that this image will warns us about something. First of all, the four children are in bad mood, obviously fat and crossing their arms, as a sign of confinement and isolation as the code of body language suggest us. Then the 4 kids are all from various ethnical origins: White, Black, and Hispanics, which underlines the idea that obesity among children is a general issue that concerns all social categories and races.

All children have a picture with a message at the bottom of their pictures in capital letter, the rectangular aspect and the short message reminds us of the message preventive message written in the cigarettes box that are made to warn people. This parallel let us understands that obesity is something parents can prevent from growing concerning their children.

The messages we can read are:

- “*Chubby kids may not outlive their parents*: This sentence aims to be provocative as there is a morbid implied suggesting to parents that because of them their own kids may die due to their obesity.
- “*Fat kids become fat adults*”: This sentence sounds like a proverb or moral expression that is common and those parents should know.
- “*Big bones didn’t make me this way, big meals did*”: This sentence tends to reinforce the idea that being obese is directly a consequence of junk food and the big amount of food that children eat under the eyes of their parents.
- “*He has his father’s eyes, his laugh and maybe even his diabetes*”: This sentence stands out how children tend

to reproduce their parents habits, parents are the example of their kids so they should be a model to follow concerning the healthy habits to adopt to avoid overweight.

Analysis of the video spot: available at: http://strong4life.com/ (Bobby, "why am I fat")[15]

This spot made in black and white lasts 33 seconds. There are various scenes:

-the first scene shows two empty white chairs in a unknown place and a kid and we guess its mother come from different sides to sit face to face. They are both overweighed.

-The second scene focus on the children that says "mom, why am I fat" with a sad face then we see also the mother that has no answer and only sigh .

-Then we have the message "75%of Georgia parents with overweight kids don't recognize the problem, stop sugarcoating it, Georgia".

The aim of this video spot is clearly to make guilty the parents of those overweighed kids. The main point of this video turns around the question that the kid ask to his mum as he doesn't why he is different from the other kids and why this is happening to him. Besides, the reaction of the mother shows how parents tend to hide the reality pretending not seeing the overweigh problem of their kid. This spot is creating with a lot of pathos, meaning the use of emotions and empathy is high but also with some logos due to the figure and percentage presented at the end of the spot.

Impacts of this campaign

Many debates and controversial problematic have been raised with this campaign[16] People have been chocked and impressed by such a campaign.

Positive aspects:

-a campaign that created the buzz: even if the campaign might be seen as hard as it changes people' habits and eye on obesity, it can finally be said that associations and governments are trying to fight against this issue.

-denunciation of children's taboo around obesity and overweigh: this underlines children's unhappiness being in such a body and being unable to do something.

Negative aspects:

-the major negative aspect is that some specific children have been pointed out with this campaign and some people may think this is not going to help them in their life.

-Another negative aspect, is that people may feel rejected by such a campaign thinking that the American society will not accept those kind because they are not "normal" and people want them to be in a same bag.

RELATION WITH MIM COURSES

International Trade and Business (Annexes 1 & 2)

Globalization has affected every daily life of people all around the world. Every country has seen a change, either via its economy, culture or social characteristics. The massive exchanges of goods and people have participated in the change of the population's way of lives. Food habits are one of the characteristics which have known a considerable impact over the last decades, having consequences on the culture of population. Indeed, an important event has been the extension of fast food chains, such as Mac Donald's, Burger King, Subway or KFC. Before the extension of Mac Donald's, fast foods were not so popular among the population and the competitors were few on the international market. By promoting junk food, snacking and nibbling gestures, they have profoundly affected the worldwide culture, especially the American one where they are the most numerous. Indeed, this country has the most important number of fast

foods and almost 2 million of people are working in this area. As a consequence, of part of the economy rely on their profitability. Teenagers represent a key target in their strategy and the use of mass communication will permit them to attract and influence better their target, from their youngest [17] age.

Social media management

The relationship between media, food habits, nutrition and sportive activities are complex but one thing is sure: the implication of media can not be denied in the recent obesity boom. For the last few years, the amount of advertising and commercials promoting high-fat, high-salted and high-sugar foods have increased significantly. Every day, teenagers are target of verbal and non verbal messages encouraging them snacking, nibbling or go to their favorite fast foo whenever they want during the day. Furthermore, the consequence of media on the behavior is the inactivity process which has and keeps on increasing. The problem with American young people is their dependence towards media: A famous study from Kaiser Family Foundation revealed a child between 8 and 18 years old will be in direct relation with social media 6 hours and 43 minutes every day. Every tools studied during our lecture have been used to encourage people follow the mass consumption state of mind through several means of communication (Facebook, Google). This is the reason why the influence media can have is highly criticized in the society. They need to have a sense of ethics and think about the impact they can create on the population. In order to fight against obesity problem, the government and associations have decided to focus their hopes on media. The number of campaigns and advertising promoting healthy food and sportive activities have highly increased but it might be too last to inverse the previous impact the have had[18].

Managing innovation and technology:

Because of mass communication, companies need to work very day on their strategy marketing to keep the customer focus. Indeed, every day a person will be the target 15000 stimuli. This is the reason why, in order to fight in a more efficient way against obesity, associations have decided to innovate in order to maximize their impact. The case of strong4life campaign illustrates perfectly the concept we learnt during this lecture. Their advertisements and commercials, only on black and white, diffuse chocking images, slogan. It has created a buzz few days only after the launch of the campaign. Innovative strategies for media seem to be the only one strategy to keep on struggling against obesity if they want to avoid seeing 37% of men and 45% of women obese in 2015. The United States need a wake up call[19].

CONCLUSION

Obesity in the United States is a concern everybody is aware of. The reason why we have decided to focus our paper on it is for the reason we wanted to analyze the situation from another angle, less tackled: the children. In the course of the drafting of our project, we have been able to analyze the situation from a professional and neutral point of view thanks to the lectures we have been attending to during this semester.

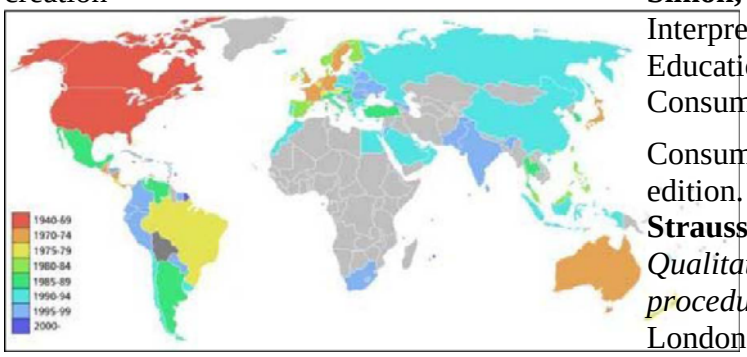
Each year, the number of victims keeps on increasing dramatically putting the government in a sensitive situation. Indeed, this sickness is not only limited on a the physiological aspect, but affect the psychological stability of the patient which is even more the negative effects are not limited only to the shape of the body, otherwise to the psychological side as well which is sometimes even worst. As a consequence, the government and associations have decided to behave and fight against this phenomenon changing their strategies. Until now, the impacts are negligible and the American population does not seem more concerned and involved in this common struggle. The association strong4life has adopted another approach, focusing more on strong images and slogans using parents' guilt. The opinions among people diverge, which has been illustrated even stronger with the interviews we had the opportunity to realize thanks to the contribution of two witnesses.

The main issue is obesity is part o the American daily behavior and can not be changed only with restrictions from so government or speeches from influent people.

In spite of the disastrous assumptions revealing in 2025 almost half of the population will be obese, the government and associations keep on expressing their hopes. We could end our paper wondering if the wake up call for the United States has not become only a utopia…

ANNEXES

Annex 1: "Extension of Mac Donald's since it creation"



The graphic above represents the year of implementation from the famous chain Mac Donald's. We can notice the United States was the first location but then, encouraged by globalization, it has successfully spread its influence all over the world.

Annex 2: "Number of Mac Donald's in the USA"

Each light on this cart shows the implementation of a Mac Donald's restaurant. We can see their significant presence of the territory and understand better the changes of food habits they have been responsible for[20]

METHODOLOGY: REFERENCES

Creswell, J.W and Clarck, V.L.P. (2006), Designing and Conducting Mixed Methods Research, Sage Publications, Inc, 1 edition.

Patton, M.Q. (2002), *Qualitative Research and Evaluation Methods*, London, Sage (268).

Pickard, A. (2007), *Research methods in Information*, Facet publishing.

Simon, A.J and Hittleman. (2001), Interpreting Educational Research Interpreting Educational Research: An Introduction for Consumers of Research an Introduction for Consumers of Research, Practice Hall, 3rd edition.

Strauss, A and Corbin, J. (1998), *Basics of Qualitative Research: techniques and procedures for developing grounded theory*, London, Sage.

REFERENCE

1 Le point, « USA, actions against obesity », available at : http://www.lefigaro.fr/flash-actu/2011/07/21/9700120110721FILWWW00330-usa-actions-contre-l-obesite-infantile.php(last viewed February, 10th 2012)

2 Unknown author, "Children's obesity in the USA", available at: http://www.actualites-newsenvironnement.com/16192-obesite-infantile-Etats-Unis.html (last viewed February, 11th 2012)

3 Unknown author, "facts for families", available at: http://www.aacap.org/cs/root/facts_for_families/obesity_in_children_and_teens (last viewed February, 10th 2012)

4 National Heart Lung and blood, « What are

overweight and obesity"available at: http://www.nhlbi.nih.gov/health/health-topics/topics/obe/ (last viewed, February, 10th, 2012).

5 Strong4life, "Learn" available at: http://strong4life.com/ (last viewed February, 10th 2012)

6 CDC, « Obesity and overweight for professional: health consequences » available at: http://www.cdc.gov/obesity/causes/health.html (last viewed, February, 11th, 2012).

7 Unknown author, "Mortelle obésité aux Etats Unis", available at http://www.futura-sciences.com/fr/news/t/medecine/d/mortelle-obesite-aux-etats-unis_3395/, last viewed February 26th, 2012

8 Claude, « Evolution de l'obésité aux USA depuis 1985", available at http://www.infrench.net/2008/02/08/evolution-de-l-obesite-aux-usa-depuis-1985/, last viewed February 26th, 2012

9 Unknown author, « Super size me » available at http://www.rottentomatoes.com/m/super_size_me/, last viewed February 26, 2012

10Unknown author, "Obesity in the USA" available at http://tpe1es-obesity-usa.e-monsite.com/pages/solutions, last viewed February 26th, 2012.

11 M Deieil and Dr Ashton, "Lutte contre l'obésité: les USA contre le reste du monde" available at http://www.obesitydiet.com/lutte-contre-l-obesite-les-usa-contre-le-reste-du-monde-M2-R230.html, last viewed February 26th, 2012.

12 Unknown author, "Stong4Life" available at : http://strong4life.com/ (last viewed, March 4 2012)

13Unknown author, "Obesity and media" available at " http://www.mamavation.com/2012/02/victory-strong-4-lifebillboards-coming-down.html (last viewed, March 4 2012)

14 Unknown author, "New campaigns" available at http://www.washingtonpost.com/blogs/onparenting/post/strong4life-campaign-shocks-us-into-caring-about-childhood-(last viewed, March 4 2012)

obesity/2012/01/02/gIQAwCdYYP_blog.html

15 http://www.youtube.com/watch?v=ysIzX_iDUKs&feature=youtu.be

16 Unknown author, "Campaign is Georgia" available at: http://www.about-face.org/georgias-strong4life-campaignrelies-heavily-on-fat-shaming/ (last viewed, March 4, 2012)

17 http://rw303.wetpaint.com/page/McDonald%27s,+globalization+and+culture.

18 http://www.ucsfbenioffchildrens.org/education/obesity_and_the_media/index.html

19 http://www.etopia.be/spip.php?article569

20http://marie-et-pauline-tpefastfood.e-monsite.com/pages/les-fast-foods-un-mode-de-restauration-qui-s-estpropage-dans-le-monde-entier.html

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

HOW DO COMPANIES INNOVATE AND ATTRACT CONSUMERS THROUGH EXPERIENTIAL MARKETING?

Julie CANNENTERRE, Nicole MOU, Solinda MOUL, Mathilde BERNADAC, Assha GHOR

Manhattan Institute of Management, New York, USA

INTRODUCTION

Nowadays, in a competitive context, many companies should innovate in order to maintain their own businesses and remain competitive. Besides, customers are more and more demanding and it is difficult to meet customer's needs.

Thus, companies invest huge amount in Research and Development in order to offer the best suitable product or service to customers. They also have to invest in marketing because it is one of the best ways to increase sales.

According to the AMA, Marketing is «the activity, set of institutions, and processes for creating,
communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large."[1] In Traditional Marketing, the purchasing process mainly takes into consideration rational decision through senses such as sight, touch and taste which are integrated to the product it selves. In the 80's, new senses (hearing and smell) had been developed and added to the products and we can experience it through the product but also in the stores.

For instance, experiential marketing is an innovative way to appeal consumers through its various elements. Indeed it consists in bringing consumers into contact with the product through emotions, logic, senses etc. in order to create memorable experiences.

But using experiential marketing requires precautions because if we have a bad experiential marketing, it can lead to sales decrease.

Yet, how do companies innovate and attract consumers through experiential marketing?

First, we will see strategies, processes and how to measure experiential marketing in companies'
point of view.

Then, we will focus on customers' analysis as how they perceived all information they experience and also how they could be influenced in their purchasing behavior.

And finally, we will study the pros and cons of experiential marketing.

I. COMPANIES POINT OF VIEW

A. Why do many companies chose to use experiential marketing in their strategy?

Experiential marketing is becoming very popular in corporate world as a new way to appeal the consumer's attention. As a unique approach, companies are using such kind of tactics because it can appeal many consumers and create an impulsive purchase. Then, it

[1] American Marketing Association, February 2012. From http://www.marketingpower.com/AboutAMA/Pages/DefinitionofMarketing.aspx.

could be a way for a company to be known and recognized thanks to specific things the customer experienced within the store.

First, many companies chose to use experiential marketing because it can help to promote and launch a new product on the market. Indeed, it can help a product to be more competitive than the others on the market (have a competitive advantage). In a competitive context, companies should attract their consumers by giving them the opportunity to try the product in their hand. Their products should be different from their competitors and firsthand experience is one of the best ways to help the consumer to discover and really understand the functions of the product. According to the consumers, it is easier to understand the functions of a new technological product when he can experience rather than read about it.

Besides, such kind of marketing campaign can create word of mouth about a product which is a key element in the product promotion. Indeed, word of mouth is becoming really important thanks to the increase of social networking websites.

Word of mouth is the most efficient and credible marketing campaign because satisfied consumers make recommendation based on their personal experience to other people. Friends and acquaintances try the product and can convey directly their first impression and information about it. For instance, 90% of consumers trust in friends or acquaintances recommendation[2].

Finally, the goal of experiential marketing campaign is to increase immediate sales given that consumers can try and use directly the product before buying it. This kind of tactics can create impulsive purchase and so increase sales because the fun and the participation of trying a product lead consumers to buy.

Thus, for these reasons, experiential marketing campaign is quickly becoming popular as an innovative way of promoting brands and products to consumers.

B. Implementation of the experiential marketing: definition of tools.

Experiential marketing focus on creating strong connections between brand and customers through senses[3].

In order to create these connections with customers, companies have to appeal customer's senses.

The five senses are categorized into different types of experiential marketing and are used differently by companies.

Here are the different types:

Visual Marketing: Sight is the sense the most used in marketing because it is the most stimulated by the environment. By this fact companies use many colors and forms to appeal customers because they help to build a brand identity. Indeed, many brands are associated to a specific color because it is memorized more easily in the audience' mind[4]. Sometimes even if customers do not know the name of the brand, they can quickly identify the product thanks to the color of its packaging.

The colors of the surroundings, lights, materials or layout are also important criteria to take in account in selling points. Visual marketing is a powerful tool in particular in the food and beverage industry. Indeed, everybody already assimilated the brand Coca-Cola with its red packaging or Danone with its blue packaging.[5]

Auditory marketing: In advertising it is the use of music or sounds to promote a message in order to consumer remember it more easily. But from now on, this technique is also very important to create an atmosphere in adequation with the image of the brand.

For instance a beauty salon will use music

[2] Consumer Trust in Advertising by Channel (Trust Somewhat/Completely) from "Trust, Value and Engagement in Advertising" - Nielsen Global Online Consumer Survey, July 2009

[3] "Experiential Marketing, How to Get Customers to Sense, Feel, Think, Act, Relate" pdf

[4] http://www.imaginevisualmarketing.com/resources/reports/articles_whitepapers/visual_marketing.html

[5] http://www.danone.com/en/company/global-presence.html

without lyrics or with natural sounds more favorable to the relaxation while a fashion shop will use more loud and rhythmic music to attract young people. We can say that music is an integrant part of the atmosphere in any selling points or restaurants.

Tactile marketing: Touch is very important in marketing. Indeed often the clients need to touch the product in order to test its texture, its quality etc… that is why marketers try to take in considerations these elements during the conception of the product choosing appropriated materials but also during the commercialization by the selection of the packaging[6]. For instance restaurants take into account the weight of the cutleries or the softness of the napkins because these factors can have a repercussion on the customer's perception. In selling points, sampling are always at the disposition of customers in order to they experience the products. It is the case in Apple stores where the audience is free to test all the products.

Olfactory marketing: Firms use smell as a key component of the experiential marketing by the use of natural or artificial smells. Indeed, we can notice that smell is connected with emotions but also according to the Proust effect, smell spontaneously evoke autobiographical memories[7].

This technique is mostly used in the food industry by the use of artificial smells to attract customers. For instance, even if Starbucks use the major techniques of experiential marketing such as music, decoration, and lightings, Starbucks focus especially its strategy on the smell. Indeed, when we enter in a Starbucks outlet we are directly appeal by the coffee aroma which dominates all the setting[8]. We can notice the same fact in supermarkets where rotisseries or bakeries increased their sales thanks to the use of artificial aromas that fills the surroundings of the store.

Gustative marketing: This technique is mostly used in the alimentary market. Companies often use gustative marketing to convince customers to purchase by making blind - tests or directly with sampling. Indeed customers are more enthusiastic to buy a product they already tasted in the past. Nowadays because of the globalization and the emergence of news tastes, food industry have to adapt constantly its offer to meet customer's expectations that is why most firms have their own gustative laboratories to test new trends and create new savors[9].

To conclude we can say that in order to have a successful implementation of Experiential Marketing, companies have to understand the importance of the "total product experience" by the use of customers' senses.

C. Measure the impact of experiential marketing

We have previously seen that companies make strategies and use different tools to implement experiential marketing. Above all, to be able to measure the efficiency of this concept is a main concern.

Measures of marketing experiential could be the same measures as traditional marketing as Web analytics, social media metrics, and media opinions. According to Craig Wilde, an experiential marketing expert, we could use

6 The concept of Sensory Marketing, pdf

7 http://chemse.oxfordjournals.org/content/25/1/111.full

8 http://www.neurosciencemarketing.com/blog/articles/espresso-sensory-selling.htm

9 http://www.netpme.fr/marketing/714-marketing-gustatif.html

the « ART » approach to measurement[10]. First of all, it consists in "A" like *Activity*, meaning that the company overviews all its marketing efforts and sees how it is engaged and whether it reaches its objectives or not. Then, the "R" remains the degree of *Relevanc*e of all the efforts, if experiential marketing strategy build by the company is well planned, executed. Finally, the "T" (like *Target*) is linked to the audience target, which corresponds to the initial and final target the company aimed at. This approach is efficient if the company knows exactly its goals by using experiential marketing.

The impact have to be measurable, we can considered in term of human aspect, that is to say by the company's staff feedbacks towards experiential marketing (we mean, how the tools are perceived from employees point of view), in term of business, by monitoring the sales (increase, decrease of sales before and after using experiential marketing) and through financial aspect, by emphasizing return on investment (if the budget and the investment worth the final result the company reached).

Staff **feedbacks**. Employees' point of view on the use of experiential marketing could be a useful tool to know the degree in which they are comfortable with the different tools. Then, they could give suggestions to their managers. A research and a survey leads by Brandweek in 2006[11], shows that one third of the employees surveyed, consider "experiential marketing as the lifeblood and the core of the organization". That means that this kind of marketing is relatively well accepted by employees. However, it could not really measure the impact of this strategy because it is more linked with perception and feeling of the employees.

Monitoring **sales**. It is a real tangible parameter. We have the example of Panasonic, in 2007 the company wanted to launch its new product HD plasma TVs, as it considered that advertizing only through televisions adds would not be as efficient as with an implementation of experiential marketing strategy. Next Marketing, a consulting agency proposed a tractor - trailer tour through the USA[12], which is composed by three trucks that contained a full HD 3D home theater and could welcome 25 to 35 customers to experience. Plus, in its media strategy, Next Marketing planned the tractor tour in conjunction with sport games periods like NBA basketball games or baseball games… According to Next Marketing study in 2007, 60% of visitors purchased Panasonic HD plasma within 30 days after participating to the tour. Consequently, experiential marketing could be measured by monitoring sales.

Return **O**n **Investment**. According to *Investopedia*, the Return On Investment (ROI) can be calculated by divided the gain of investment minus the cost of investment by the cost of investment. An example of monitoring experiential marketing with ROI, is to test the new marketing approach on a targeting market and compare the results to a segment of the market which the company did not use the experimental approach. Then we could understand if this technique was more or less efficient that traditional marketing. Different software and material are developed to help company managing and monitoring their performance. For example, we have Kneebone[13], which is a company that offers services that help companies to find parameters to analyze their performance in their marketing strategies; then provides customized solutions and developed tools. Companies like Nintendo and Dell are their customers.

We have an example of the U.S army concerning ROI tool to measure experiential marketing from experientialforum.com[14]. In a

[10] Unknown. 2011. 4imprint Inc. From web, http://info.4imprint.com/wp-content/uploads/1P-06-0311-March-Blue-Paper-Experiential-Marketing.pdf. February 2012.

[11] http://www.forward-fast.com/picts/WP40BrandExp_1008.pdf

[12] http://everyjoe.com/technology/panasonics-full-hd-3d-trucks-coming-to-you/

[13] http://www.kneebone.com/resources/performance-algorithm/

[14] http://experientialforum.com/articles/09awbwmwxm.pdf

few words, the U.S army planned in 2008 a virtual game project in order to recruit potential young males. The main goal of the program was to increase ROI, by adding more experiences in the recruitment. The U.S army saw that this process was 10 times more effective than the traditional way of advertising: television. For instance, TV ads cost $150 million per year. Colonel Casey Wardynski, director of the U.S Army's office summed up very well how TV ads are not relatively effective: "with advertising you know what you're spending but you don't know what you're getting". He compared an approximately rate to compare the traditional way with the experiential marketing tool. TV ads "cost - per - person hour" would cost $2.50 to $8 whereas the total cost of the game project would be $7 million, so a "cost - per - person hour" of 22 cents.

Finally, experiential marketing could really have an impact on a company, provided that it manages its strategies, tools and measurement correctly and pertinently.

Companies find strategies to attract consumers; we will see now how customers react to all the experiences they face and how experiential marketing influence customers decision making to purchase.

II. CUSTOMERS' ANALYSIS

A. Customers' perception.

The use of Experiential Marketing could influence perception. According to Stephen P. Robbins & Timothy A. Judge, from Essentials of Organizational Behavior, perception "is a process by which people organize and interpret their sensory impressions in order to give meaning to their environment."[15] We have some factors that could influence perception, which are the situation, the perceiver and the target. When Experiential Marketing is used, the situation is the environment where the customers are, the store, the perceiver is the customers and the target is the product, the service, the brand or an experience itself. Based on studies from Bellizzi, Crowley and Henderson in 1983[16], atmosphere and above all, the components of this atmosphere (like color, music…) could influence customers' perception of the cost of shopping. Consumers find pleasing the aesthetic of the store design, and psychotically perceive and associate the product as at high quality and high price. Gordy Players[17] also underline this constant association from customers. For example, based on its researches, classic music could help the customers perceiving the use of the product as a soft and with high quality, whereas with jazz music, customers tend to think that the way of consuming this product should be like romantic. Then, customers could perceive the brand differently.

However, the perception consumers have about the products within the store is not really objective. In fact, based on Schlosser researches, the store is like a social identity that attracts consumers not only based on the products appeal. So, the customers' perception could also have a negative consequence on a brand's image, because it could give a

[15] Stephen P. Robbins & Timothy A. Judge, *Essentials of Organizational Behavior*, 11th edition, 2011. Kindle format. Last reviewed March 2012

[16] http://mba.tuck.dartmouth.edu/pages/faculty/kusum.ailawadi/research_articles/jr - retail%20branding.pdf

[17] http://www.uclouvain.be/cps/ucl/doc/adcp/documents/13 - 10 - 2011_G._Pleyers_marketing_sensoriel.pdf

different interpretation from the one the brand would like to show.

We saw how the atmosphere created by Experiential Marketing influences customers' perception. Customers have a real need of experiencing things. That is what we will explain in the following part.

An important customer's need: to experience. We can notice different kind of needs. The most relevant are physiological and hedonic needs[18].

Drink, and eat are physiological needs as individuals all primary need these to survive. Then, we will focus more on hedonic needs as experiences are more likely qualify to satisfy a pleasure. Experience is defined as, according to the Romanian Economic Journal [19](Dainora Grundey, The Romanian Economic Journal. *Experientia*l *Marketin*g *vs.Traditiona*l *Marketing*: *Creatin*g *Rationa*l *an*d *Emotiona*l *Liaison*s *wit*h *Consumer*s ") a subjective episode in the construction/transformation of the individual, with however, an emphasis on the emotions and senses lived during the immersion at the expense of the cognitive dimension." The experience living is related to emotional significance. It is like a sensitive thing called stimuli leads to a personal satisfaction or dissatisfaction and then to an experience. The main goal of Experiential Marketing is to make customers experiencing. Experiencing lasts from the store's atmosphere (feeling process), through the decision making (thinking process), then purchasing process (the action of purchasing) and the after sale (customers could memorize the brand). The roles of emotions in behavior; the fact that consumers are feelers as well as thinkers and doers; the significance of symbolism in consumption; the consumer's need for fun and pleasure; the roles of consumers, beyond the act of purchase, in product usage as well as brand choice, and so forth"[20]. We will see now, how Experiential Marketing could lead to purchase.

B. How experiences lead to purchase?[21]

According to a study called "Best experience brands" published by Jack Morton Worldwide and conducted online in 2011 among 1,605 consumers (USA, UK, Asia and Australia) the brand experience drives consumer purchasing decisions. Indeed nowadays people are more exigent and want to buy products that satisfy personal emotions and also that provide them the right information. How people experience and interact with brands can be a critical point of differentiation from competitors and a reason for consumers to become customers and advocates. For instance, 60% of consumers agreed with the statement "My overall experience with a brand is the single biggest factor in whether I decide to purchase a product or service" and only 5% were disagreed. Furthermore, although most of the survey respondents were living in regions suffering from economic uncertainty, many (that is to say 44%) would pay more for brands that offer a unique experience. Only 6% were disagreed. Consumers were asked also to rank what are the experience drivers that deliver a unique brand experience. Here is the result:

1) Initial impression the brand makes on you
2) Continues to serve and engage you after you have become a customer
3) Understands your needs
4) Differentiates from similar products
5) Employs people who anticipate your needs

---

18 Martins - Baltar M. La notion de besoin: etude sémantique et application à la description linguistique. N°36, 1977, pages 25 - 39. From http://www.persee.fr/web/revues/home/prescript/article/lfr_00238368_1977_num_36_1_4839 Last reviewed March 2012

19 Dainora Grundey, The Romanian Economic Journal. *Experientia*l *Marketin*g *vs.Traditiona*l *Marketing*: *Creatin*g *Rationa*l *an*d *Emotiona*l *Liaison*s *wit*h *Consumer*s ". From http://www.rejournal.eu/Portals/0/Arhiva/JE%2029/JE%2029%20Grundey.pdf last reviewed, March 2012

20 Dainora Grundey, The Romanian Economic Journal. *Experientia*l *Marketin*g *vs.Traditiona*l *Marketing*: *Creatin*g *Rationa*l *an*d *Emotiona*l *Liaison*s *wit*h *Consumer*s ". From http://www.rejournal.eu/Portals/0/Arhiva/JE%2029/JE%2029%20Grundey.pdf last reviewed, March 2012

21 http://www.slideshare.net/jackmortonWW/best-experience-brands-a-global-study-by-jack-mortonworldwide-10365627

All these data highlight the fact that experiential marketing plays a key role on consumer's behavior.

The fact that they have the possibility to discover the product, its characteristics by touching,

smelling it or that the staff is particularly pleasant and competent can change consumer's perception

and be determinant factors that can lead to purchase.

However, even if the influence of experiential marketing is strong across all groups, the study demonstrates that there are some demographic differences.

For instance, women are more responsive and receptive to experience. 47% of them would be ready to pay a premium price for experience against 41 % of men.

As women influence most household purchase decisions, this is an important insight to take in account for marketers in the future.

Same fact for people over 55, they are less willing to pay a premium for brands that offer a unique experience (47% of younger and middle - aged consumers vs. 37% of seniors).

To conclude numerous factors can influence consumer's purchase but some targets will be more

responsive to experiential marketing such as women and young people.

III. EXPERIENTIAL MARKETING: PROS AND CONS.

After seeing the different aspects of experiential marketing through companies' point of view and then in customers' behavior, both advantages and disadvantages could be identified.

A. Pros

a. Companies point of view

Generate more sales: First, Experiential Marketing can lead to impulsive purchase and then create immediate sales.

Differentiation from the competitors: As the environment is becoming more competitive, thanks to the experiential marketing, the product's company can be really different from its competitors.

Measurable results / ROI: A good experiential marketing can provide measurable results concerning the Return on Investment.

Enhances brand image: Experiential marketing can strengthen brand image's company thanks to supporting brand positioning by creating presence and maximizing awareness.

Extends brand advertising: companies can develop its advertisements and campaigns through nontraditional marketing channels which are less used by companies.

Attracts new customers: The creativity and uniqueness of its various tactics can help companies to appeal and target new customers.

Long term customer relationship: Thanks to Experiential Marketing, companies can create a long term relationship with their customers as they become more loyal to a brand. Indeed, customers are directly linked to the product and the brand.

b. Customers point of view

Comparison between traditional marketing and experiential marketing in customers in their decision - making[22]. This comparison is based on a French economist Bernard Schmitt's research in 2001. In the traditional marketing approach, customers have tendency to use rational decision - making process, where it is said that their main goal is to solve

[22] http://www.rejournal.eu/Portals/0/Arhiva/JE%2029/JE%2029%20Grundey.pdf

a problem. Customers are like analyzing the different process and measuring the information they get to finally make a decision. So, this approach is a little narrow minded. In the contrary, with experiential marketing, the customers are less selective concerning the products they are looking for. The emotions tend to affect the customers in correlation with what they have already experienced. They could have a better overview of all the products that are proposed to them.

Influence. Customers are the direct target of experiential marketing. Companies need them to experience to influence them. Then, if the targets are the customers that are defined as "influencers"[23], they could share their experiences and use positive word of mouth so the other customers may not feel as "influenced" by the company itself but it is like they have been recommended by their peers.

Personal experience value. Experiential marketing could increase customers personal experience value. From the book *Authenticity*: *What Customer Really Want* (Pine & Gilmore, 2007)[24], the authors identify that the environment, the immersion of the customer into it and the constant stimulation for participation, have a great impact on "memorability" of customer. Through the different senses used during an experience, customers could relate them with their previous experiences and could be more or less, lead to a purchasing behavior.

Brand recognition. People could likely gather all together and especially grouped by specific target when they go through the same experiences. For instance, in 2009, AmEx has launched a new U.S Open iPhone application and fans were invited to participate to a special virtual session "Play with the pros". The brand asks for the recognition of tennis fans and importantly potential future customers. The company that organized this event was Momentum, and the manager said that "Experiential marketing is like any form of great communication. Unless you truly understand the needs and desires of your target audience, then your brand is just 'there.' Significantly, a unique experience means a unique recognition, and then it could lead to build brand loyalty[25].

Above all, experiential marketing brings satisfaction to customers. As it allows customers to be directly approached and be a part of the experience.

B. Cons

Despite of many advantages of engaging in experiential marketing there are also some limits.

Here are the following:

Product or services can be a fail if the campaign produces a **negative experience** to the customer. For instance if a business use too much tools at the same time such as high music, strong smell, bright colors, customers can feel invaded and can leave the shop. So it can lead to a decline of visits in the business and a loss of potential customers.

Subjectivity: Determination of positive experience and negative experience is subjective and depends on customer preferences[26]. Indeed human preferences are not the same everywhere. People's emotions and perception are difficult to predict because their needs and behaviors are not alike across demographic boundaries[27]. For instance according to a sensory survey about McDonalds restaurants, a third of customers thought that the restaurants smelled like stale oil. 42% of British McDonalds customers thought the same, and both groups indicated that this smell diminished their enjoyment of the food. To the contrary half of customers said they liked the smell, and that it made their

23 http://www.destinationcrm.com/Articles/CRM-News/Daily-News/Experience-the-Benefits-of-Experiential-Marketing-47179.aspx

24 http://experientialforum.com/articles/09awbwmwxm.pdf

25 http://www.destinationcrm.com/Articles/CRM - News/Daily - News/Experience - the - Benefits - of - Experiential - Marketing - 47179.aspx

26 http://www.tutebox.com/3019/business/marketing/experiential - marketing

27 http://www.martinlindstrom.com/global - brands - a - matter - of - time/

mouths water[28].

The consistency: When the experiential marketing is applied in several locations it is important that this experience be delivered in a consistent manner over time and across geography. However, it is difficult because people are different and also their way of working. The staff must be well equipped, amiable and professional. The best way to ensure this consistency is through ongoing training which plays a key role in the successful implementation of experiential marketing because at the end it is the staff who delivers the total product experience to the customer[29].

Expensive: To develop experiential marketing campaigns involves high costs. Indeed it is rarely used for large scale campaigns because there are budgetary restraints. Furthermore international campaigns for experiential marketing are extremely rare. These larger campaigns are usually combined with more traditional campaign to make the most of the experiential events[30].

IV. RECOMMENDATIONS

As we know, the settlement and execution of an experiential marketing is not an easy task and companies should be really careful. Indeed, using this kind of marketing requires strong precautions as it is really difficult to settle it. Thus, for a successful experiential marketing campaign, companies should follow some advice.

- First, they should hire an agency specialized in experiential marketing to help the company for the settlement of the campaign because experiential marketing agencies have strong background and experience in this field and have experts in strategy, planning, creating and innovating, logistics etc…
- They should clearly identify and know their target audience and then focus "on the right program at the right place for the right reason"
- Create an interactive and sensory experience and encourage hands-on participation
- Differentiate the experiential marketing plan from the competition's plan - Pre-promote the event and create news relevance to attract media coverage - Create and present a quality experience with quality people and attention to detail - Use the latest technology and give personalized attention to all customers
- Develop a feedback and follow up system to build brand loyalty and retain customers
- Make it fun

CONCLUSION

Through our studies, we saw that companies have to build a whole strategy to implement Experiential Marketing such as: well define their target market, which tools to use and what the impacts they will have on their business.

Concerning customers' point of view, based on different analyses, we could see that this marketing strategy has an influence on how they react and buy things. More importantly, consumers are looking for experience. It will lead to an added-value for the customers. Since they could live a different experience, or at least identify themselves to the brand, they will be able to buy and moreover be loyal to a brand.

However, we should be cautious about

[28] http://www.neurosciencemarketing.com/blog/articles/does-your-marketing-smell.htm Martin Lindstrom, « Brand sense » 2005, Chapter 4, P67

[29] Experiential marketing, p 5, pdf accessed on March 2nd 2012

[30] http://ezinearticles.com/?An-Introduction-to-Experiential-Marketing&id=5190954

Experiential Marketing as it has both pros and cons, depending on how it is settle, it will not have the same consequences.

To conclude, experiential marketing is a powerful marketing tool which can help the company to launch a product successfully. Yet, these tactics requires some precautions as it is a risky marketing campaign. If campaign activation and project management failed, companies can waste time and money even if they have the most innovative concept and strategy on the market.

Thus, the company should ensure their events are well organized and targeted in order to get rapidly best results. If the marketing campaign is well run, the firm can have brand advocates who will convey the company's brand messages through word of mouth and become a loyal customer for life.

REFERENCES:

1. From the article "How an Experiential marketing agency can help to promote a new product", Author Horace Tait, dated of June 2009 www.EzineArticles.com/5190372, last viewed in Feb 2012.

2.Unknown author, www.company.trnd.com/fr/about - word - of - mouth, Last viewed in Feb 2012

3.Unknown author, ww.entrepreneur.com/article/159474 Last viewed in Feb 2012

4."Experiential Marketing, How to Get Customers to Sense, Feel, Think, Act, Relate" pdf, accessed in February 22th 2012

5.Unknow author « Is Your Organization Using Effective Visual Marketing?" accessed on February 23rd 2012 http://www.imaginevisualmarketing.com/resources/reports/articles_whitepapers/visual_marketing. html

6.http://www.danone.com/en/company/global - presence.html accessed on Febrary 23rd 2012

7. Högskolan i Halmstad, "The concept of Sensory Marketing" pdf accessed on Frebruary 23rd 2012

8. Simon Chu and John J. Downes, "Odour - evoked Autobiographical Memories: Psychological Investigations of Proustian Phenomena" accessed on February 25th 2012 http://chemse.oxfordjournals.org/content/25/1/111.full

9.Unknown author,"Sensory Marketing to Jolt Espresso Sales" accessed on February 25th 2012 http://www.neurosciencemarketing.com/blog/articles/espresso - sensory - selling.htm

10. Marie Kerveillant, « Le marketing gustatif » accessed on February 25th 2012 http://www.netpme.fr/marketing/714 - marketing - gustatif.html

11.Unknown. 2011. 4imprint Inc. From web, http://info.4imprint.com/wp - content/uploads/1P - 060311 - March - Blue - Paper - Experiential - Marketing.pdf. last retrieved February 2012.

12.Unknown. From web, http://www.forward - fast.com/picts/WP40BrandExp_1008.pdf last retrieved February 2012

13.Robin Parish, 2009. " Panasonic Full HD 3D trucks coming to you". From web, http://everyjoe.com/technology/panasonics - full - hd - 3d - trucks - coming - to - you/, last retrieved February 2012.

14.Official website Kneebone : http://www.kneebone.com/resources/performance - algorithm

15. Unknown. From web: http://experientialforum.com/articles/09awbwmwxm.pdf, last retrieved February 2012.

16. Jack Morton Worldwide, "Best Experience Brands" accessed on March 9th 2012 http://www.slideshare.net/jackmortonWW/best - experience - brands - a - global - study - by - jack - mortonworldwide - 10365627

17. Martins - Baltar M. La notion de besoin: etude sémantique et application à la description linguistique. N°36, 1977, pages 25 - 39. From http://www.persee.fr/web/revues/home/prescript/article/lfr_00238368_1977_num_36_1_4839. Last reviewed March 2012

18. Stephen P. Robbins & Timothy A. Judge, *Essentials of Organizational Behavior*, 11th edition, 2011. Kindle format. Last reviewed March 2012.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

LOGISTICS OPERATIONS AND TEORETICAL CONCEPTS-IDENTIFY SPHERES OF IMPROVEMENT AND AMELIORATED MANAGEMENT

Jeanina CIRCO (STANCU)

Faculty of Engineering Technology and Industrial Management, Transilvania University of Brasov, Brasov, Romania

Abstract: Drawing flow value must be a repetitive process in which we all steps including the ordering process to delivery process.Through a new value will map flows exploit opportunities for improvement identified in the current map. We will use FIFO and HEIJUNKA method for determining the time of receipt of order to dispatch them.
Even if you do not purchase new technology that was moving towards standardization, we can optimize the new procedures appeared in the literature are known internationally but still in the early stdiul for some companies in Romania. Depending on the decisions of change processes chessboard will look different, definitely better on the money and time.
In the following we talk about the logistics systems that are currently in a company that produces bakery-Vel Pitar and another company EcoPaper SA is a company specialized in producing paper for corrugated cardboard, using as raw material 100% waste paper and cardboard, thus contributing to environmental protection.
What I propose, in this article, is to implement ***Keine Touch*** *technology, computer controlled, as follows: raw material, paper, already filtered into the production process, noting that the stock of raw material to be started at the end line and the finally bales and barcode serially taken by crane and then stored.*
Types of management used by the two companies are: management by objectives, management and product management on the budget. The exception is participatory management is today used by the japanese.
The objectives of each company is different, but the logistics do not break news. I saw that there are two leading companies, but the stability of the product or range of products.

Keywords: flexible processes, demand for products, material flow, information flow, visual management .
,

1. INTRODUCTION

The industry Logistics and Supply Chain is full of daily challenges. As in any field of activity for Logistics and Supply Chain information flow is crucial for the proper conduct of business. For a good and efficient collaboration between supply chain participants is necessary for all to speak the same language, the same understanding of a particular concept / term specific when using it.

Survival and growth is dependent on the existence of a management that is based exclusively on the use of economic instruments, for all management decisions as resource efficiency and profit maximization.

From a macro perspective, due to international conflicts (fight for markets, military conflict), "economic element" or

"economic weapon" has influenced the world of logistics industry in recent years.

Also at the macro level, influenced as measured by the financial industry, contribute to instability and lack of financial assistance allocated by the IMF and World Bank Group, which forced managers to loans with high interest and short repayment terms, payment rates triggering the growth process.

2. GENERAL AND THEORETICAL CONCEPTS

Of course, profit and cost efficiency characterize the products and services at the microeconomic level.

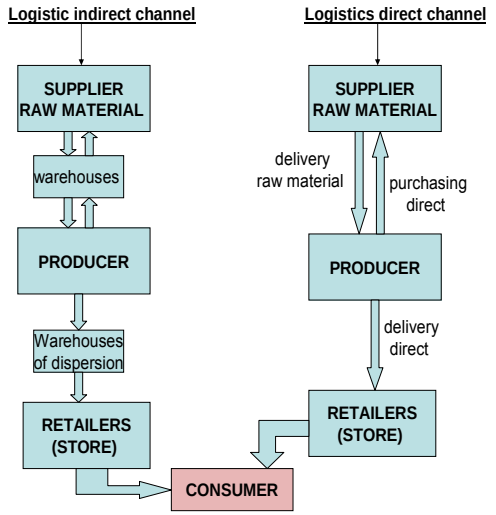


Fig.1 Logistics Supply Chain variants .

We speak so much logistics or logistics function as on the part of the organizational structure of companies in an efficient manner, saving substantial operational costs and that support is essential to implement the marketing strategy of the company, allowing to provide customers with improved service permanently.

Logistics, in an enunciation own, means the acquisition, movement, storage and delivery functions including transport, distribution and storage of materials and stocks. Today is the strategic management of a supply chain that transforms any resources.

2.1 The systemic approach.

In this article we contribute to the clarification of "logistics" and "supply chain". We begin with the evolution of logistics management to better understand current logistics context. To achieve this objective, we describe developments and will show little impact of these changes on logistics management in the table. There are three different periods of logistics management: the period of "logistics separate" from the "integration" and period "Logistics Cooperation."

The systemic approach of the company and use all the knowledge in the field of logistics, management of existing resources gives managers the opportunity to meet objectives, allowing them to react quickly and take informed decisions. Thus there is an adaptation of the structure and activity of the company to external environmental conditions, process ensuring internal stability of the organization.

“Technology is defined by Krajewski and Ritzman (2000, p. 17) as ‘the know-how, physical things, and procedures used to produce products and services’. Over the past two decades, the development of high-technology-based firms has been actively encouraged by governments and development agencies (Westhead & Storey, 1994) as a source of competitive advantage. In many cases, small high-technology-based firms have effectively exploited market opportunities. This has been helped by the emergence of generic technologies, most notably information technology that is knowledge intensive rather than capital and labour intensive (Rothwell, 1994, p. 12). Such technologies have been effectively used to open up new market niches for smalland medium-sized firms (SMEs). Accordingly, high-technology firms have become well established as sources of both competitiveness and employment creation (Oakey, 1991).”

2.2 Improving planning and management, transparency and simplicity.

What is good in one of them and can implement the other. Let's take them one by one:

Vel Pitar Group is the leader of the Romanian bakery and milling and a major player in the production and distribution of

biscuits, wafers, specialty cakes and pastries because:

- Made his presence felt with several production centers
- Short production lines
- Integrated management system implemented
- The first to have invested heavily in new technologies
- Regular evaluation of customer satisfaction for continuous quality improvement and safety products and services

Vel Pitar Group has invested in cutting-edge production lines, fully automatic operation from mixing and packing up the process. Products made on these lines are high quality (long freshness, color and shape constant), and productivity is increased.

Investment in new technologies have allowed the packaging, the entire process of production and use **Keine Touch technology** - without prejudice (consumer product is the first person to reach).

This new technology can be implemented in any production flow.

EcoPaper S.A. is currently the top corrugated paper manufacturers in Romania.

The basic raw material is the waste of paper and cardboard. The company has authorized the recovery and authorization for the collection of waste. In a short time the company has gained a well-defined market segment being number one in top consumer waste paper and cardboard so.

To efficiency these activities were conducted:

• modernizing the reception and storage by computerized tracking

• purchase of scrap balers with a capacity of 200 tons / day

• purchase specific equipment for handling and shipping

• arranging for transportation and storage platforms paved bales of waste paper

I propose to implement **Keine Touch** technology, computer controlled, as follows: raw material, paper, already filtered into the production process, noting that the stock of raw material to be started at the end line and the finally bales and barcode serially taken by crane and then stored.

Another proposal is to build it and loading ramps for trucks, a more efficient work and time by the warehouse workers.

The main suppliers are companies producing waste, corrugated cardboard packaging and companies dealing with the collection of domestic waste paper. Was necessary to introduce a clear and well-founded strategies to ensure appropriate quantities of waste in the production process, and a minimum stock. Therefore the company is situated in a table 1, at INTEGRATED LOGISTICS, that production from the bakery found at the LOGISTICS COOPERATION.

Today the situation presented in table 2, the production of bread is found in the last section where there is cooperation between the manufacturer-supplier-customer and paper production is found in the first column where manufacturer is king.

Processes used in food production is the methods FIFO and HEIJUNKA because the products are perishable.

Control method called flow quantity of products in terms of specialized Kanban (the stock) with push production system is used for paper manufacturing industry, and JIT, pull production system by the bakery. "Transition from the old way of development and production to the new is available everywhere at the same time" japanese experts say when are required changes for the better.

Table 2. Analysis of some logistics indicators

PERIOD / BACKGROUND	YEARS 1940-1970	YEARS 1970-1980	YEARS 1980-2000	2000- TODAY
report request / offer	request > offer	request = offer	request < offer	request < offer
knowledge demand (order)	production is determined	predictable with errors accepted	production based on the statistics	uncertain
priority manufacturer	quantity	flexibility	quality	speed response
life cycle product	long	medium	short	very short limited edition
choice customers	limited	very diversified	diversified	personalized
size market	national	commerce with countries neighboring	continental	world
relationship between producer / customer	the producer is king	client is king	cooperation between customer and producer	cooperation between producer, supplier, customer
philosophy chosen management	mass production	0 mistakes 0 stock	internal supply chain	0 response time simultaneous engineering integrated supply chain

Control method called flow quantity of products in terms of specialized Kanban (the stock) with push production system is used for paper manufacturing industry, and JIT, pull production system by the bakery.

3. CONCLUSIONS

Today, especially in future socio-economic and natural environment in which firms operate is increasingly complex and uncertain risks generator. In terms of logistics organization, surpassed other food processing industries, it was always one step ahead.

If we talk about flexibility, fewer manufacturing operations to manufacture paper, in food flexibility is varied on request.

In terms of visual management can say that in the paper manufacturing industry is still room for improvement.Such developments occur against a background of significant movements in economic activity: the tendency of economic globalization, accelerating the pace of change, transforming knowledge into a great resource on which competitive advantage.

The decisions of managers are given by:

- Priority on the organization, considered essential criterion of profit
- Integrated management reins in knowledge related to immediate needs
- No confidence in competition
- The main objective is profit, not market share growth

Traditionally, operations and logistics activities anticipated future transactions. It is recommended to use real-time logistics, a strategy to reduce risks of anticipation of demand.

Finally, the performance analysis, consists of the analysis of final results, analysis of leading indicators, indicators decomposition depending on what interests us and draw action plan.

ACKNOWLEDGMENT

This paper is supported by the Sectoral Operational Programme Human Resources Development (SOP HRD), ID76945 financed from the European Social Fund and by the Romanian Government under the contract number POSDRU/107/1.5/S/76945.

REFERENCES

1. Krajewski, L. J., & Ritzman, L. P. (2000). *Operations management: Strategy and analysis* (5th ed.). Reading, MA: Addison-Wesley Publishing Company.
2. Oakey, R. (1991). *High technology small firms: Their potential for rapid industrial growth.* International Small Business Journal, 9, 30– 42.
3. Oakey, Ray (Editor); Groen, Aard (Editor); Cook, Gary (Editor). *New Technology-Based Firms in the New Millennium*, Volume 8.

Bradford, GBR: Emerald Group Publishing Ltd, 2010. p 187.

Available from: http://site.ebrary.com/lib/unitbv/Doc?id=10440371&ppg=173-196 Accessed: 12/01/2012

4. Rothwell, R. (1994). *The changing nature of the innovation process: Implications for SMEs.* In: R. Oakey (Ed.), New technology-based firms in the 1990s (pp. 11– 21). London: Paul Chapman Publishing Ltd.
5. Westhead, P., & Storey, D. J. (1994). An assessment of firms located on and off science parks in the United Kingdom.

London: HMSO. Winter, S. (2003). Understanding dynamic capabilities. Strategic Management Journal, 24, 991–995

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

INCREASING EFFICIENCY CUSTOMER SERVICE BY LOGISTICS MANAGEMENT OPTIMIZATION

Jeanina CIRCO (STANCU)*, Nouras Barbu LUPULESCU**

Faculty of Engineering Technology and Industrial Management, Transilvania University of Brasov, Brasov, Romania

Abstract: *Implementation of Lean principles has become a survival strategy in a production environment where cost reduction is an uncertain state of affairs on the market of the 21st century. So we use new methods of production management in the long term, to help us to identify losses and increase production capacity while reducing costs.*
This article reveals the problem confronting the insurance on logistics activities. My objective is to bring value to these activities by attaching the device to the entire computer network.
In the following I will detail the benefits seen from puncture of logistics (the time), which will be obtained after implementing this system.
It will propose a reorganization of the production.Solving problems is based on several principles of Lean manufacturing concepts and methods by which we get the expected results and profit.

Keywords: *Logistics insurances, customer service, industrial optimization, cost profitability,*

1. INTRODUCTION

In this article I will show you how to make an insurance integrated system, seen in logistical point of view.

Follow the solution through process optimization, better management of activities and obtain business information in real time.

Because I worked in their internal system, and now I work still in the insurance system but from outside, not as an employee, I can say I know the gaps or problems involved in logistics insurances of Romania.

In the insurances are two categories of people who have this occupation: one that is employed (insurance inspectors) and other agents (the brokers).

Logistics is a real time strategy to reduce risks of anticipation of demand. To expect as much as performing operations and logistics activities a proportional reduction risk can be determined, but we face stockouts and possible delays of orderings. This leads us to improper customer service.

We depart from their development strategy and long term is to make profit.

The proposed solution integrates both existing modules (financial accounting, management, logistics, sales) and other additional features such as supply management, advanced production planning combined with traditional planning of the necessary raw materials and monitoring the workload devices.

In the organizing production, we are interested in the planning and production programming.

Very unstable and unpredictable environment is many times negative consequences. The adjustment process is not

simple, if not fit into a plan to prefigure the way forward and the consequences.[3]

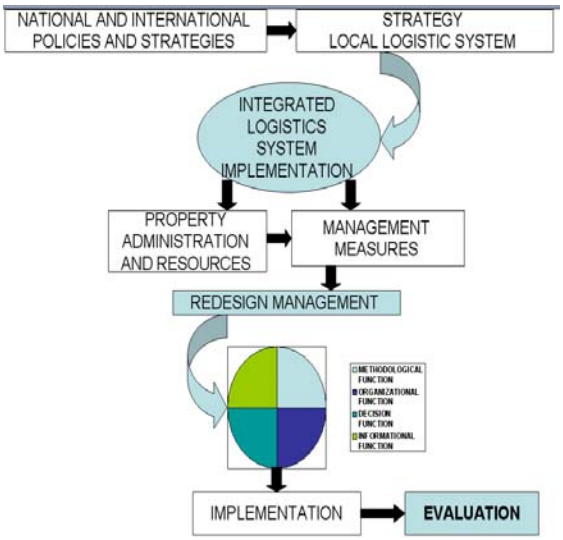


Fig.1 The strategies

The concept of serving customers is to ensure chain actions and satisfying customer needs to start receiving orders and continued with post-sell services.

The insurance agents often happens that the area remained without products for sale, so that new technology helps to sell the place, what the client wants.

The methods used here: Just-In-Time (JIT), pull production system, OTED method - One Touch Exchange of Die.

Just-In-Time (JIT): A production system that produces and supplies only as needed, only when necessary and only in the amount necessary, as requested by the client. JIT is one of the fundamental concepts of the Toyota production system. JIT includes three components: pull production system, the total available production and continuous flow. The goal JIT is to eliminate all losses, to achieve the best possible quality, lowest possible cost and lowest terms of production and delivery. Although simple in principle, JIT system requires discipline and sustained effort of analysis and synthesis of data related to production processes for effective implementation. The concept belongs to Kiichiro Toyota JIT system, the founder of Toyota Motor Corporation in 1930.[1]

We meet terms like PULL, which means “that no one upstream should produce a good or service until the customer downstream asks for it, but actually following this rule in practice is a bit more complicated.” [4]

For knowledge of the whole process, I can say that we solve this problem by SMED method - Single Minute Exchange of Die, that is "manufacturing change within 10 minutes". This is a fast and effective way to change the manufacturing. SMED method is used for setting and adjusting process of bringing up to normal operation with minimum loss. Last version of the method, the literature is OTED - One Touch Exchange of Die (manufacturing change of a single touch), to another production in less than 100 seconds. In this last version I developed this idea where the followed operations are measuring individual and total time. I can tell that we do a standardization of products by introducing barcodes.

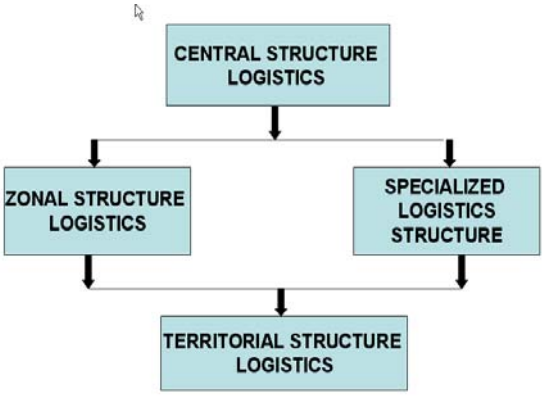


Fig.2 Actual logistics structure.[2]

The structure can be reduced only in the CENTRAL STRUCTURE LOGISTICS. This new organization is currently used in transportation in the form of flowers with a single command center.

In the present, all the system of insurance production, distribution materials is required by an employee specialized on serving inspectors and agents.

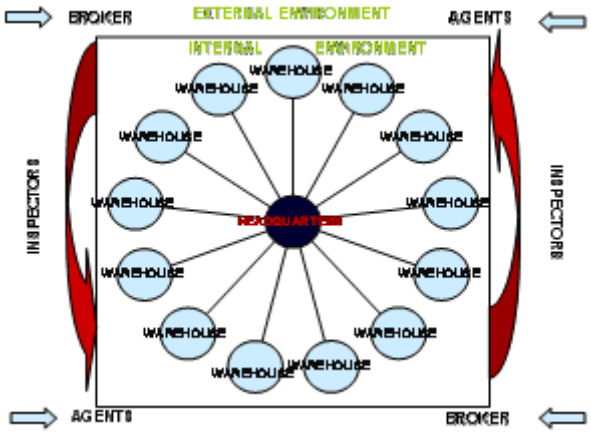


Fig.3 Proposed logistics structure.

This structure will be detailed in a next article.

The problems faced by retailers and distributors are:

- Availability only during working hours
- Frequent calls to checks managements
- Losses of time to this checks
- Uncontrol in the real time
- We can not know the stock actually used
- Fractures of stock due to lack of materials
- Inefficient orders
- Quality of service
- Costs repeated with movements
- Cost effective and a small profit
- Few sales

2. THE IDEA, IMAGE AND PLAN

2.1 The idea

The idea described in this article is to attach a device (a box) found in the products box that will work during 24/24 hours. This device lets us imagine that a reduced deposit, which will be linked to the central server, will be operated by one person who will have remote access at any time to view the stocks in certain locations.

The Enterprise Resource Planning - ERP system, will allow only certain people depending on where it occupies in the company hierarchy. These devices will be in each branch or agency and will serve both professional staff and collaborators.

2.2 Diagrams and charts.

In real time logistics strategy to reduce risks to anticipate demand, according to classical theory, is to establish and define the relationship between consumer-price-income.

See customer at the heart of all actions, according to figures:

Fig.4 Customer surrounded by various factors

Fig.5 Logistics function perceived as a global function.

The circles are valid for only if it sees the interests of both parties, the client and the company. The further directions will be to improve each function of the flow showed.

3. CONCLUSIONS

My knowledge is based on my studies in logistics of specialized acquired, which allowed me to make these claims and propose these optimizations.

The solution to this problem will connect: distribution, production and sales. Thus we can say we have a continuous flow manufacturing, control quickly, perhaps even a integrated supply chain.

The company will have tools which controls and blocks access to the network.

The solution described in this article does not exist in the insurance field, it's in manufacturing industries (eg: food industry, automotive parts production)

The solution will be offered to all insurance companies in the country and foreign country.

In the future we plan a patent system, but in the part of monitoring and control.

ACKNOWLEDGMENT

This paper is supported by the Sectoral Operational Programme Human Resources Development (SOP HRD), ID76945 financed from the European Social Fund and by the Romanian Government under the contract number POSDRU/107/1.5/S/76945.

REFERENCES

1. Liker, J., *LE MODELE TOYOTA – 14 Principes qui feront la reussite de votre entreprise*, Paris: Pearson Education France (2006).
2. Marin, D., *Managementul logisticii*. Craiova: Published by Sitech (2005).
3. Maxim, E., *Strategie si planificare strategica*. Iasi: Published by Sedcom Libris (2010).
4. Womack, J.P., Jones, D.T., *Lean Thinking*. London: Published by Simon&Schuster UK Ltd (2003).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

ASPECTS ABOUT INSSURANCE MARKET EVOLUTION IN THE EUROPEAN UNION. CASE STUDY: BELGIUM, HUNGARY AND ROMANIA

Gherasim Solovestru DOMIDE*, Alexandru DOMIDE **, Octavia DOMIDE ***

* Academy of Economic Studies, Bucharest, Romania, ** EPHEC, Bruxelles, Belgium *** Rocredit Broker de Asigurare SRL, Baia Mare, Romania

Abstract: *This paper aims to analyze the value of insurance premiums underwritten on the insurance market in the European Union in general and in 3 countries of the Union in particular, namely: Belgium, Hungary and Romania. It was analyzed if and how much the economic crisis had influenced the value of life and non-life premiums, during this period of time. From the analysis of financial results of the three countries we found several common features such as: concentration of insurance markets in the three countries. We also noticed that insurance premiums for motor insurance class hold an important place in the total underwriting of insurance premiums in the three countries reminded above.*

Keywords: *insurance market, evolution, insurance premiums, market concentration*

1. INTRODUCTION

The insurance market is a significant component of financial markets in any country. Both in economic growth conditions and international financial markets crisis, the financial founds of the insurers represent an important element for the national economies. We follow the dynamics of underwrite premium volume for different classes and types of life and non-life insurances, from economic area such as European Union focusing on the example of three countries belonging to it.

In our study we had analyzed the value of insurance premiums underwritten by the European insurers. The analyze period is between 2007 till 2011 for the life and non-life insurance sector. In these periods we can observe also the financial crisis effect on the insurance market.

From the 27 European Union states, we have analyzed the achievements of Belgium, Hungary and Romania insurance markets. For each one of these counters we encounter certain features of subscription.

We have selected Romania and Hungary as countries that joined European Union structure in different periods of economic development. Belgium was included in our study because is a member state from the beginnings, since the establishment of the European Union. She is the country with economic stability and with a high rate of people information and education, regarding the need of protection against risks through insurance policies.

In all this three countries, the motor insurance represent a significant percentage from total subscriptions. This percentage is between 10% in Belgium, and 78% in Romania.

2. INSURANCE MARKET EVOLUTION

2.1 Evolution of European Union insurance market. Analyzing the value of written insurance premiums by the insurers of European Union countries from 2007 to 2011, we have found that on all European markets the volume had decrease with 11,3% from 2007 to 2008. The largest decrease was resisted on the life insurance sector. For 2009 the market maintained its downward trend, but in a small percentage, compared to 2008 this was 0,5%. From 2010 the European Union market began again to grow, but at the end of 2011 the value of written premiums didn't reach the amounts from 2007.

Table 1.1 shows the evolution of European Union insurance market. The evolution was not presented in all European Union countries, in Romania and Hungary insurance markets continued to decline in 2010 and 2011.

Table 1.1 Evolution of European Union insurance markets. ***- Millions Euro-***

	2007	%	2008	%	2009	%	2010	%	2011*	%
Total market	1.182.000	100	1.060.000	100	1.058.000	100	1.115.000	100	1.140.000	100
Life	765.000	65	642.000	61	648.000	61	688.000	62	691.000	61
Non life	416.000	35	418.000	39	411.000	39	428.000	38	449.000	39

Source: Authors processing of informarion provided by www.insuranceeurope.eu * for 2011estimates based on insurers report

Chart 1.1 Evolution of European Union insurance markets.

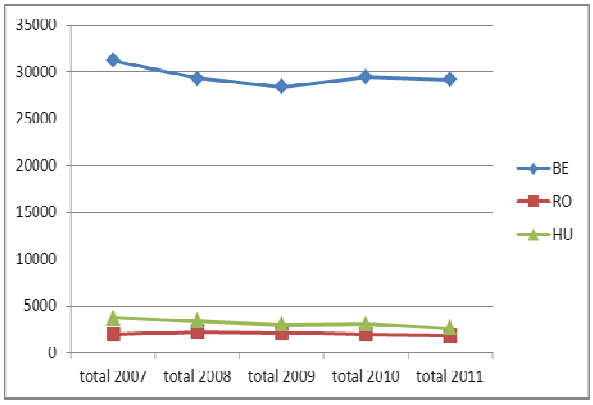
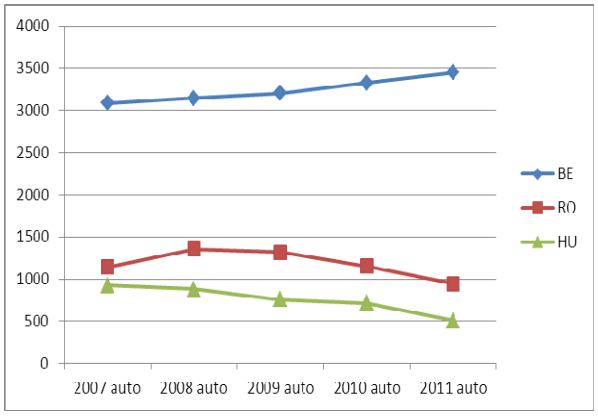


Chart 1.2 Evolution of European Union auto insurance markets



2.2 Evolution of Romanian insurance market. At is results from the table 4.1, in the period 2007-2010 the number of insurance companies hasn't change significantly in Romania and Hungary, and in Belgium it had remain the same. Regarding their activity by analyzing the value of insurance premiums underwrite by insurers in each country in the same period we made the following findings: In Romania between 2007 and 2009 there are two insurers who have over 10% from the market share ant the top four over 50% so, 10% from the insurance companies own over 50% from the insurance market. In the same time, on the first place was one of the largest European insurers, Allianz that in the following years, 2010-2011, went to the second position, the first being taken over ASTRA Asigurari whose capital is entirely Romanian. This is also the first Romanian company that had extended the activity abroad, opening a first branch Romanian office in Hungary. During the analyzed period the second and the third place where occupied also by ASIROM and OMNIASIG, companies

that have the same main stakeholder, the VIG Austria**.**

Chart 2.1 Evolution of Romanian insurance market

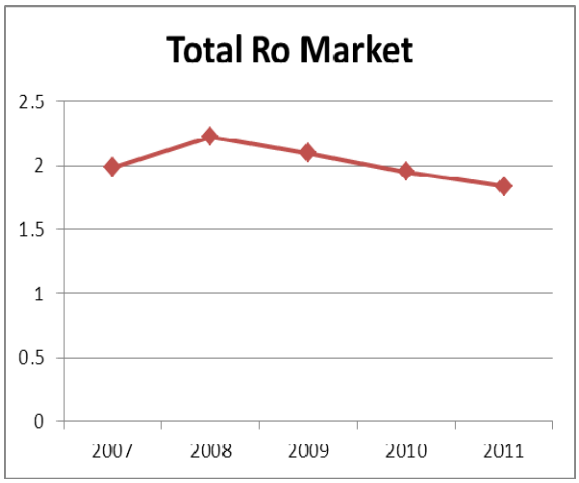
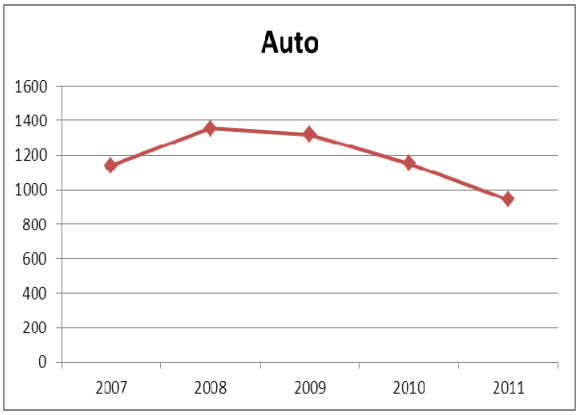


Chart 2.2 Evolution of Romanian auto insurance market



2.3 Evolution of Hungarian insurance market. In Hungary during 2007-2011, top 3 insurers have market shares above 10% and top 5 market shares above 65%. This indicates that 12% of insurance companies own more than 70% of the market. In the same period, on first place was one of Europe largest insurer – Allianz and on second place was the European Group Generali. For the analyzed period third place was own two years on the row by the Holland financial group ING, and in the last 3 years by the French group Groupama. Ranking top three insurers in Hungary and market shares are shown in table 5.2.

Chart 3.1 Evolution of Hungarian insurance market

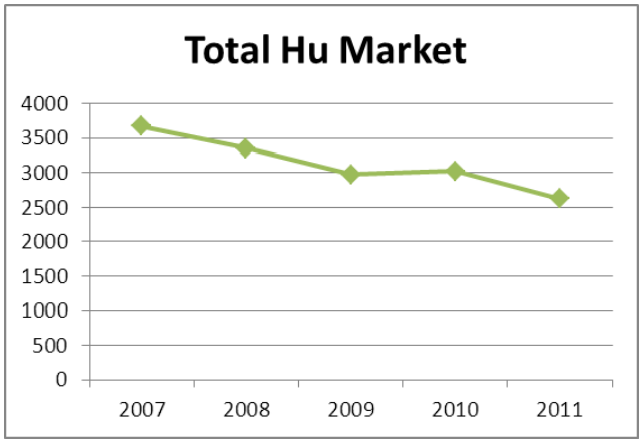
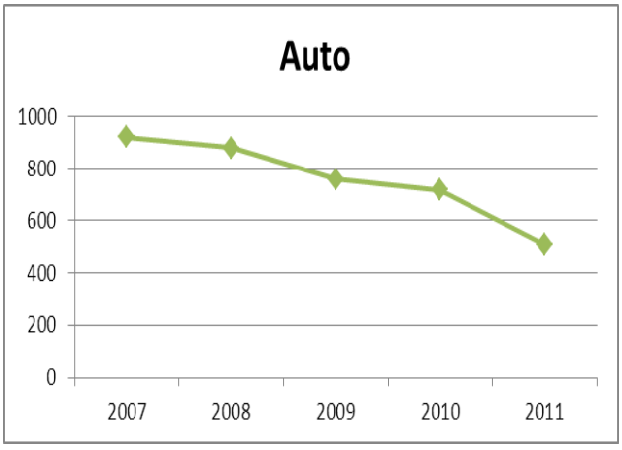


Chart 3.2 Evolution of Hungarian auto insurance market

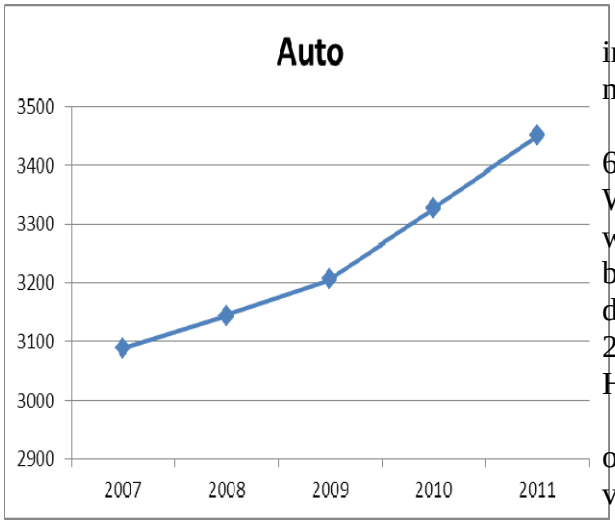


2.4 Evolution of Belgian insurance market. We find significant stability on the Belgian insurance market. During 2007 to 2011 the number of insurers had encounter no change, top three insurers have market shares between 10% and 54%. These insurers have in total over 65% from the market shares. In this

period on first rank is the insurer Fortis, followed by the French AXXA on second. They haven't change position in five consecutive years. Top three Belgian insurers from 2007 to 2011 and their market shares are presented in Table 5.3.

Chart 4.1 Evolution of Belgian insurance market

Chart 4.2 Evolution of Belgian auto insurance market



2.1.Evolution of Romanian insurance market

3. CONCLUSIONS & ACKNOWLEDGMENT

The financial market crisis had a different manifestation on the insurance market of European Union countries. Overall in 2008-2009 was registered a market decline, after that the market started to grow but widowth reaching at the end of 2011 to the market levels of 2007. In some countries such as Romania and Hungary the crisis effects from the insurance market where felt since 2009 and decline further till the end of 2011.

We have seen, in the analyzed countries that we have an insurance market concentration. From 2007 to 2011 this concentration has maintained. Greatest concentration is encountered in Belgium where firs insurer, from the total of fifteen authorized, takes market shares of 25%. In Romania, compared to Belgium, the insurance market is ten times smaller and the insurance companies are three times bigger. Top five insurers have over 52% market shares.

Motor insurance rates are between 10% in Belgium, 25% Hungary and 72% in Romania.

Since the beginning of the financial crisis in Romania and Hungary the auto insurance market decreased and in Belgium increased.

On average the life insurance represent 65% of European Union insurance market. Written premiums from this category declined with the onset of financial crisis, after that they began to grow annually, but at the end of 2011 didn't reach the 2007 values. They represent 20% of Romanian insurance market, 55% Hungarian market and 65% for Belgium.

From these three countries, Belgium is the only one where the life, non-life and motor vehicles insurances are maintained in medium percentage.

As follows we present the tables used in our analysis. The Source for all tables is authors processing from the European Insurance Database presented in references. * unaudited data or estimations based on reports.

Millions Euro

	2007	%	2008	%	2009	%	2010	%	2011*	%
Total Market	1.987	100	2.226	100	2.097	100	1.951	100	1.839	100
LIFE	401	20	451	20	385	18	388	20	403	22
NON LIFE	1.586	80	1.775	80	1.712	82	1.563	80	1.436	78

2.2.Evolution of Hungarian insurance market

Millions Euro

	2007	%	2008	%	2009	%	2010	%	2011*	%
Total Market	3.672	100	3.372	100	2.978	100	2.934	100	2.639	100
LIFE	2.007	55	1.743	52	1.474	49	1.495	51	1.414	54
NON LIFE	1.665	45	1.629	48	1.504	51	1.439	49	1.225	46

2.3. Evolution of Belgian insurance market

Millions Euro

	2007	%	2008	%	2009	%	2010	%	2011*	%
Total Market	31.192	100	29.278	100	28.385	100	29.414	100	30.752	100
LIFE	21.683	70	19.352	66	18.371	65	19.103	65	20.297	66
NON LIFE	9.509	30	9.926	34	10.068	35	10.311	35	10.455	34

3.1 Evolution of Romanian auto insurance market

Millions Euro

	2007	%	2008	%	2009	%	2010	%	2011*	%
Total Market	1.987	100	2.226	100	2.097	100	1.951	100	1.839	100
Auto	1.141	72	1.356	76	1.321	78	1.154	74	944	66

3.2 Evolution of Hungarian auto insurance market

Millions Euro

	2007	%	2008	%	2009	%	2010	%	2011*	%
Total Market	3.672	100	3.349	100	2.978	100	2934	100	2.621	100
Auto	922	25	881	26	759	25	717	24	509	20

3.3 Evolution of Belgian auto insurance market

Millions Euro

	2007	%	2008	%	2009	%	2010	%	2011*	%
Total market	31.192	100	29.278	100	28.385	100	29.414	100	30.752	100
Auto	3.088	10	3.144	11	3.206	11	3.326	11	3.451	11

4The evolution of insurance companies in Romania, Hungary and Belgium

Country /No. Of Insurance Companies / Year	2007	2008	2009	2010	2011
ROMANIA	42	44	46	44	44
HUNGARY	31	31	32	32	32
BELGIUM	15	15	15	15	15

5.1 Market share of top three Romania

TOP 3	2007	2008	2009	2010	2011
1	Allianz 19,86%	Allianz 18,09%	Allianz 14,50%	Astra 16,10%	Astra 15,99%
2	Omniasig 15,43%	Omniasig 16,78%	Omniasig 12,56%	Allianz 14.,3%	Allianz 10,44%
3	Asirom 9,35	Asirom 9,30	Astra 9,13%	Omniasig 13,79%	Omniasig 10,06%

5.2 Market share of top three Hungary

TOP 3	2007	2008	2009	2010	2011*
1	Allianz 19,7%	Allianz 21%	Allianz 19,90%	Allianz 19,80%	Allianz 17,50%
2	Generali Providencia 14,90 %	Generali Providencia 15,10 %	Generali Providencia 15,40 %	Generali Providencia 15,20 %	Generali Providencia 14,55 %
3	ING 13%	ING 10,9%	Groupama 10,50 %	Groupama 10,82 %	Groupama 10,81 %

5.3 Market share of top three Belgium

TOP 3	2007	2008	2009	2010	2011*
1	FORTIS 24,7%	FORTIS 22,3%	AG Insurance 24,2%	AG Insurance 22,8%	AG Insurance 21,9%
2	AXA 16,7%	AXA 16,1%	AXA 16,4%	AXA 15,7%	AXA 13 %
3	ETHIAS 12,9%	ETHIAS 12,6%	KBC 13%	KBC 12,7%	KBC 12,25%

REFERENCES

1. Buffet Warren, Soros G, *Economic crisis and its prophets*, Bucharest, Publishing house Letter (2010)
2. Annual Reports 2007, 2008, 2009, 2010, Hungarian Financial Supervisory Authority;
3. Annual Reports 2007, 2008, 2009, 2010, Romanian Insurance Supervisory Commission;
4. Assurinfo no.30-buletin hebdomadaire du 20 octobre 2011;
5. Assurinfo no.32-buletin hebdomadaire du 21 octobre 2011;
6. Assurinfo no.33-buletin hebdomadaire du 22 octobre 2011.
7. Http: //www.insuranceeurope.eu (accessed in 20.03.2012)
8. http://www.pszaf.hu (accessed in 20.03.2012)
9. http://www.1asig.com (accessed in 15.03.2012)
10. http://www.1asig.ro (accessed in 15.03.2012)
11. http://www.assuralia.be (accessed in 25.03.2012)
12. http://www.csa-isc.ro (accessed in 15.03.2012)
13. http://www.mabisz.hu/images/stories/docs-eng/publications/yearbook-2007-2010-english (accessed in 20.03.2012)
14. http://www.mnb.hu/arfolyam-lekerdezes (accessed in 20.03.2012)
15. http://www.xprimm.com (accessed in 15.03.2012)

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

HOLIDAY EFFECTS DURING QUIET AND TURBULENT TIMES

Ramona DUMITRIU*, Razvan STEFANESCU*, Costel NISTOR*

* Faculty of Economics and Business Administration, University **"**Dunarea de Jos**"**, Galati, Romania

Abstract: *The objective of the paper is to examine the possible holiday effects in the stock returns from a group of 28 countries. In our investigation we employ daily values of some representative indexes from January 2000 to December 2011. We split this sample in two sub-samples: before and during the global crisis. We identify the pre or the post holiday effects using regressions with dummy variables. The results indicate significant changes from the pre-crisis period to the crisis period. We find that such changes were more consistent in the case of emerging markets in comparison with the advanced financial markets.*

Keywords: *Calendar Anomalies, Global Crisis, Holiday Effect*

1. INTRODUCTION

In the last decades, the presence of calendar anomalies was largely approached in scientific papers for practical and theoretical reasons. The knowledge about the financial markets evolution regularities could be exploited by the investors. The calendar anomalies were often used in theories that opposed the Efficient Market Hypothesis (EMH) which stipulated that past evolution of stocks couldn't serve to predict their future evolution.

The holiday effects are among the best known calendar anomalies consisting in significant differences between the stock returns of the days that precede or follow the public holidays and the rest of the working days. There are two forms of the holiday effects:

- the pre-holiday effect, which refers to the days before the public holidays;
- the post-holiday effect, which refers to the days after the public holidays.

Empirical researches discovered evidences about the holiday effects presence on several stock markets. Lakonishok and Smidt (1988) found for the daily values of Dow Jones Industrial Average (DJIA) returns a pronounced pre-holiday effect for a long period of time [12]. Pettengill (1989) identified significant differences between the pre-holiday returns and the rest of the working days for US both large and small firms [18]. Ariel (1990) investigated the returns of indices provided by the Center for Research in Security Prices (CRSP) and he proved the existence of a significant pre-holiday effect [1]. Cadsby and Ratner (1992) studied calendar anomalies for the capital markets from ten industrialized countries and they found significant holiday effects for five of them [5]. Kim and Park (1994) identified holiday effects in the United States, in Japan and in United Kingdom [11]. Tan and Wong (1996) analyzed the Singapore capital market and they concluded that in pre-holidays the returns were significantly higher than in other working days [19]. Arsad and Coutts (1997)

studied prices anomalies on the London International Stock Exchange and their results supported the holiday effects presence [2]. Meneu and Pardo (2004) analyzed the most important individual stocks of the Spanish Stock Exchange and they discovered high abnormal returns on the trading days prior to the public holidays [16]. Lucey (2005) found a significant pre-holiday effect on the Irish equities evolution [13]. Hansen et al. (2005) tested the calendar effects significance for capital markets from ten industrialized countries and their results indicated that pre-holiday returns were among the best five for the United States, for Norway and for Italy, while the post-holiday returns were among the best five for Norway [8]. Marrett and Worthington (2007) investigated twelve indices from the Australian stock market and they found pre-holiday effects for three of them [15].

There were, however, researches which failed to provide any evidence of the holiday effects. For example, Blandon (2010) analyzed calendar anomalies for the LATIBEX market, formed by Latin-American companies quoted in the Spanish Stock Exchange, finding no holiday effects [3].

Several attempts were made to explain the holiday effects since their discovery. Some of them are based on the behavioral finance approaches and on the investors' psychology. The optimism that animates investors in the days that precede public holidays is considered responsible for high returns, while the lower performances from post-holidays are viewed as corrections after these shocks [4, 20]. There are also theories that contest the independence of the calendar anomalies. For example, Pearce (1996) revealed that almost half of the public holidays occurred on Monday [17].

For the investors which intend to exploit a form of seasonality in the stock prices evolution it is important to analyze its persistence in time. As Dimson and Marsh (1999) concluded in their seminal study, the publication of an anomaly could cause its disappearance or reversal [7].

Several papers revealed, for many stock markets, changes in time of the holiday effects [6, 14, 19, 21]. Sometimes, these changes were provoked by dramatic events such the financial crises [9].

In this paper we investigate the holiday effects presence before and during the global crisis for a group of 28 countries. We use daily values of representative indexes from the stock markets of these countries and we try to identify pre or post-holidays effects by regressions with dummy variables.

The rest of the paper is structured as it follows: the second part describes the data and the methodology employed in our investigation, the third part presents the empirical results and the fourth part concludes.

2. DATA AND METHODOLOGY

In our investigation we employ daily closing values of the stock market indexes from 28 countries for a time period between January 2000 and December 2011. Based on MSCI Index Base Dates we split this group of countries into two broad categories: developed markets and emerging markets.

In order to identify the changes induced by the global crisis we divide our sample in two sub-samples:

- first sub-sample, corresponding to a pre-crisis period, from 1st of January 2000 to the 15th of September 2008 (when it was announced the bankruptcy of Lehman Brothers);
- second sub-sample, corresponding to the crisis period, from the 16th of September 2008 to the 31st of December 2011.

We calculate the returns of the indexes using the formula:

$$R_t = \ln(P_t) - \ln(P_{t-1}) \quad (1)$$

where:

- R_t is the return on the day t;
- P_t is the closing market index price on the day t.

We identify pre or post-holiday effects performing regressions with dummy variables:

$$R_t = \gamma_0 + \gamma_1 PRE\_HOL + \gamma_2 POST\_HOL + \varepsilon_t \quad (2)$$

where:

- PRE_HOL is a dummy variable taking the value one for the trading day before a public holiday and zero otherwise;
- POST_HOL is a dummy variable taking the value one for the trading day after a public holiday and zero otherwise.

We test all the time series for heteroskedasticity and autocorrelation. In the case we identify only heteroskedasticity we apply the White's corrections to standard errors and p-values. When we detect both heteroskedasticity and autocorrelation we use the Newey - West corrections.

3. EMPIRICAL RESULTS

The Table 1 presents the regressions results for the developed markets. We found no evidence of pre or post-holiday effects, before or during the global crisis, for seven indexes: AEX General, Hang Seng, Straits Times, S&P TSX Composite, Swiss Market, Standard & Poor's and All Ordinaries. Three indexes exhibited before the crisis pre-holiday effects which disappeared during the crisis: ATX, CAC 40 and FTSE 100. For Taiwan Weighted the pre-holiday effect appeared only during the crisis. Before the crisis we found post-holiday effects for four indexes: BEL-20, ATX, CAC 40 and Nikkei 225. During the crisis this anomaly disappeared for Nikkei 225 but it appeared for FTSE 100.

The results of regressions for the emerging markets are presented in the Table 2. Four indexes: CROBEX, BSE 30, KLSE Composite and TA 100 exhibited no holiday effects before or during the crisis. We identified pre-holiday effects before the crisis on four indexes: BET-C, Bovespa, Seoul Composite and IPC. For all these indexes the pre-holiday effects disappeared during the crisis. Instead, these anomalies appeared for other four indexes: Jakarta Composite, Shanghai Composite, BUX and Athex Composite Share Price Index. Two indexes, PX Index and BET-C, exhibited before the crisis post-holiday effects which disappeared during the crisis. For other two indexes, Jakarta Composite and MerVal, these calendar effects appeared during the crisis.

4. CONCLUSIONS

In this paper we studied the holiday effects from 28 stock markets for two periods: the first from January 2000 to September 2008, when the financial markets experienced relative quiet evolutions and the second one during the actual global crisis. Our investigation revealed significant changes in pre and post-holidays effects from quiet to turbulent times.

For many countries, the holiday effects identified on quiet times disappeared during the global crisis. We could link this evolution with the decline of pre-holiday euphoria, which is one of the main explanations of the holiday effects. Instead, during the turbulent times, many investors are probably worried about the changes that could occur during the public holiday and they prefer to sell the high risk assets. There are also some countries where the holiday effects, which hadn't been identified in the quiet times, appeared during the global crisis. Some of them, as Hungary and Greece, are European countries highly affected by the global crisis. Others, as Indonesia, Taiwan and China, are countries from the South-East Asia with high economic growth in the last years. In such economies, in the turbulent times, the investors' behavior could be very sensitive to expectations about events that could occur during the public holidays.

We found significant differences in the holiday effects evolutions between the developed markets and the emerging markets. On developed markets, the holiday effects experienced much more stability in comparison with the emerging markets. This situation could be explained by the fact that in general the impact of the global crisis was more consistent on the emerging markets than on the developed markets.

REFERENCES

1. Ariel, R., High stock returns before holidays: Existence and evidence on possible causes. *Journal of Finance* 45(5): 1611 - 1626. (1990).

2. Arsad, Z., Coutts, J. A., Security price anomalies in the London International Stock Exchange. *Applied Financial Economics* 7(5): 455 - 464 (1997).

3. Blandon, Jose Garcia, Return's Seasonalities in the LATIBEX Market. *Revista de Analisis Economico*, Vol. 25, No. 1, pp. 3-14. (June 2010).

4. Brockman, P., Michayluk D.. The persistent holiday effect: additional evidence. *Applied Economics Letters* 5(2): 205 - 209. (1998).

5. Cadsby, Charles Bram, Ratner Mitchell, Turn-of-month and pre-holiday effects on stock returns: Some international evidence. *Journal of Banking & Finance*, Volume 16, Issue 3, Pages 497-509 (June 1992).

6. Chong, R., Hudson, R., Keasey, K., and Littler, K. Pre-holiday effects: International evidence on the decline and reversal of a stock market anomaly. *Journal of International Money and Finance*, 24, 1226-1236. (2005).

7. Dimson, E., Marsh, P. Murphy's law and market anomalies. *Journal of Portfolio Management*, 25, 53-69. (1999).

8. Hansen Peter Reinhard, Lunde Asger, and Nason James M., Testing the Significance of Calendar Effects, Federal *Reserve Bank of Atlanta, Working Paper* 2005-2 (2005).

9. Holden, Ken, Thompson, John, Ruangrit, Yuphin, The Asian crisis and calendar effects on stock returns in Thailand. *European Journal of Operational Research*, Elsevier, vol. 163(1), pages 242-252. (2005).

10. Keef, S.P., Roush, M.L. ―Day-of-the-week effects in the pre-holiday returns of the Standard & Poor's 500 stock index. *Applied Financial Economics*, 15, 107-119. (2005).

11. Kim, Chan-Wung and Jinwoo Park, 1994. Holiday Effects and Stock Returns: Further Evidence. *The Journal of Financial and Quantitative Analysis*, Vol. 29, No. 1. pp. 145-157. (Mar., 1994).

12. Lakonishok, J., Maberly, E.. The weekend effect: Trading patterns of individual and institutional investors. *Journal of Finance* 45(1): 231 - 243. (1990).

13. Lucey, B.M., Are local or international influences responsible for the pre-holiday behaviour of Irish equities?. *Applied Financial Economic* (2005).

14. Marquering, W., Nisser, J., Valla, T. Disappearing anomalies: A dynamic analysis of the persistence of anomalies. *Applied Financial Economics*, 16, 291-302. (2006).

15. Marrett, G. J., Worthington, A. C., An empirical note on the holiday effect in the Australian stock market, 1996-2006, University of Wollongong. *School of Accounting and Finance Working Paper* Series No. 07/11. (2007).

16. Meneu, Vicente and Angel Pardo, Pre-holiday Effect, Large Trades and Small Investor Behaviour. *Journal of Empirical Finance*, Volume 11, Issue 2, March 2004, Pages 231-246. (2004).

17. Pearce, Douglas K., The robustness of calendar anomalies in daily stock returns. *Journal of Economics and Finance*, Volume 20, Number 3, 69-80 (1996).

18. Pettengill, G.N., Holiday Closings and Security Returns. *Journal of Financial Research*, 12, 57-67. (1989).

19. Tan, R., Wong, N.T., Calendar Anomalies In The Singapore Stock Market. *Singapore Journal of Stock Exchange*, June, 6-13. (1996).

20. Vergin, R. C. and J. McGinnis Revisiting the holiday effect: Is it on holiday?. *Applied Financial Economics* 9(3): 477 - 482. (1999).

21. Wing-Keung Wong, Aman Agarwal and Nee-Tat Wong, The Disappearing Calendar Anomalies in the Singapore Stock Market. *The Lahore Journal of Economics* 11 : 2 (Winter 2006) pp. 123-139 (2006).

APPENDIX

Table 1 - Estimated coefficient of regression for developed markets

Index	Before the crisis			During the crisis		
	const	pre_hol	post_hol	const	pre_hol	post_hol
AEX General	-0.0326075 (0.0314608) [0.30011]	0.126011 (0.155799) [0.41872]	0.42162 (0.315495) [0.18156]	-0.0487961 (0.0660461) [0.46022]	0.578339 (0.644339) [0.36967]	1.68807 (1.03018) [0.10167]
BEL-20	-0.0140631 (0.0259824) [0.58839]	0.0436764 (0.1791) [0.80736]	0.569178 (0.254351) [0.02534**]	-0.0626982 (0.0597737) [0.29451]	0.439873 (0.399067) [0.27067]	1.50304 (0.630492) [0.01735**]
Taiwan Weighted	-0.0215681 (0.0354362) [0.54282]	0.0793878 (0.197617) [0.68793]	0.092035 (0.283748) [0.74570]	-0.0103438 (0.0536593) [0.84719]	0.771576 (0.303215) [0.01112**]	0.43046 (0.475395) [0.36548]
ATX	0.0243068 (0.0243393) [0.31807]	0.212556 (0.110614) [0.05479*]	0.289749 (0.157816) [0.06650*]	-0.100213 (0.0836856) [0.23146]	0.46745 (0.402354) [0.24566]	0.433921 (0.656797) [0.50902]
Hang Seng	-0.0036987 (0.0320519) [0.90814]	0.0920851 (0.169028) [0.58595]	0.179194 (0.242752) [0.46049]	-0.0356625 (0.0745747) [0.63263]	0.435673 (0.468409) [0.35258]	0.598024 (0.45073) [0.18494]
Straits Times	-0.0058228 (0.0261801) [0.82401]	0.031657 (0.139893) [0.82099]	0.146481 (0.182831) [0.42311]	-0.0066412 (0.0530025) [0.90032]	0.139749 (0.355163) [0.69407]	0.546956 (0.677707) [0.41986]
S&P TSX Composite	0.010084 (0.0227573) [0.65773]	0.0037797 (0.111773) [0.97303]	0.283012 (0.200373) [0.15797]	-0.0293777 (0.0622735) [0.63723]	0.0773305 (0.214469) [0.71852]	0.538173 (0.363856) [0.13950]
Swiss Market	-0.0131117 (0.0261949) [0.61674]	0.163237 (0.123567) [0.18663]	0.227362 (0.190292) [0.23229]	-0.0106538 (0.0517575) [0.83697]	-0.142735 (0.419136) [0.73353]	-0.457011 (0.674614) [0.49831]
CAC 40	-0.0278097 (0.0306059) [0.36364]	0.440745 (0.13241) [0.00089***]	0.593794 (0.286582) [0.03838**]	-0.0546225 (0.0682985) [0.42407]	0.698159 (0.52379) [0.18293]	1.35683 (0.722814) [0.06084*]
DAX	-0.0145083 (0.0332359) [0.66250]	0.464072 (0.18767) [0.01348**]	0.0894356 (0.437846) [0.83817]	-0.0049968 (0.0658933) [0.93957]	0.528084 (0.407144) [0.19497]	-0.366427 (0.661704) [0.57989]
FTSE 100	-0.0235883 (0.0254844) [0.35476]	0.276294 (0.148398) [0.06276*]	0.175264 (0.20347) [0.38912]	-0.0146677 (0.0592876) [0.80466]	0.291387 (0.21087) [0.16740]	0.7106 (0.37173) [0.05627*]
Standard & Poor's	-0.0091456 (0.0253619) [0.71843]	0.0144746 (0.113843) [0.89884]	-0.025141 (0.142653) [0.86012]	0.00186778 (0.0674073) [0.97790]	0.240503 (0.423348) [0.57012]	-0.106702 (0.38972) [0.78431]
Nikkei 225	-0.0504494 (0.0319163) [0.11410]	0.0462626 (0.110951) [0.67675]	0.576414 (0.200604) [0.00410***]	-0.0767815 (0.0708407) [0.27875]	-0.205473 (0.327461) [0.53053]	0.761613 (0.539121) [0.15813]
All Ordinaries	0.017687	0.0580814	0.0464089	-0.032376	0.31268	0.221229

	(0.0184754) [0.33851]	(0.103652) [0.57530]	(0.181663) [0.79839]	(0.0499242) [0.51684]	(0.333134) [0.34821]	(0.246595) [0.36991]

Note: Standard Errors are within round brackets, while p-values of the statistical tests are within the squared brackets.

Table 2 - Estimated coefficient of regression for emerging markets

Index	**Before the crisis**			**During the crisis**		
	const	**pre_hol**	**post_hol**	**const**	**pre_hol**	**post_hol**
CROBEX	0.0677542 (0.0295166) [0.02180*]	0.117473 (0.118059) [0.31983]	-0.060608 (0.133376) [0.64958]	-0.0862212 (0.0645811) [0.18222]	0.493399 (0.491361) [0.31560]	-0.190338 (0.389321) [0.62505]
PX Index	0.00143294 (0.0289779) [0.96056]	0.262531 (0.174206) [0.13191]	0.417237 (0.195973) [0.03333**]	-0.0627432 (0.0744568) [0.39965]	0.416841 (0.566706) [0.46221]	0.400434 (0.501889) [0.42518]
BET-C	0.0728586 (0.0295037) [0.01361**]	0.587697 (0.188711) [0.00187***]	1.06965 (0.431443) [0.01324**]	-0.0390125 (0.0742) [0.59919]	0.594205 (0.369483) [0.10817]	-0.629303 (0.676777) [0.35272]
Bovespa	0.0325835 (0.0413507) [0.43079]	0.486912 (0.195716) [0.01293**]	-0.0846322 (0.206955) [0.68262]	0.0117187 (0.0810892) [0.88513]	0.00713362 (0.25647) [0.97782]	0.271723 (0.336854) [0.42010]
Seoul Composite	-0.0111984 (0.0405356) [0.78237]	0.369656 (0.138206) [0.00754***]	0.317084 (0.317084) [0.21384]	0.0276231 (0.0632281) [0.66231]	-0.0535583 (0.372066) [0.88558]	-0.0099817 (0.599474) [0.98672]
BSE 30	0.0293893 (0.036513) [0.42097]	0.16382 (0.146796) [0.26456]	0.217843 (0.217395) [0.31643]	-0.0168153 (0.0673484) [0.80290]	0.100154 (0.332232) [0.76314]	0.483848 (0.410215) [0.23855]
Jakarta Composite	0.0514878 (0.0325847) [0.11423]	-0.0131068 (0.135775) [0.92311]	-0.102612 (0.170296) [0.54687]	0.0848183 (0.0643783) [0.18805]	-0.385688 (0.212886) [0.07041*]	0.692518 (0.339438) [0.04166**]
Shanghai Composite	0.0182577 (0.0331412) [0.58175]	1.34147 (3.886) [0.72997]	-3.12918 (11.3067) [0.78199]	-0.0218391 (0.0619656) [0.72460]	0.511231 (0.227886) [0.02515**]	0.514976 (0.586386) [0.38009]
BUX	0.0352781 (0.0309973) [0.25520]	0.0482806 (0.127249) [0.70442]	-0.0311874 (0.210172) [0.88205]	-0.000043 (0.07967) [0.99957]	-0.790729 (0.371243) [0.03347**]	0.199966 (0.82732) [0.80907]
MerVal	0.0278962 (0.0474027) [0.55626]	0.192684 (0.232422) [0.40718]	0.318763 (0.248613) [0.19992]	-0.00805019 (0.085836) [0.92530]	0.0667229 (0.217448) [0.75904]	1.23216 (0.593753) [0.03829**]
KLSE Composite	0.000987126 (0.0209674) [0.96245]	0.0471481 (0.115402) [0.68291]	0.19824 (0.165212) [0.23031]	0.082899 (0.0541508) [0.12619]	-0.131166 (0.206108) [0.52470]	-0.569805 (0.574474) [0.32156]
Athex Composite Share Price Index	0.234809 (0.267227) [0.37967]	-0.354297 (1.77006) [0.84137]	0.0849023 (3.40889) [0.98013]	-0.228943 (0.0833038) [0.00612***]	1.15126 (0.499368) [0.02139**]	0.30388 (0.60522) [0.61573]
IPC	0.0718107 (0.0307048) [0.01944**]	-0.320249 (0.179795) [0.07502*]	-0.106727 (0.20727) [0.60666]	0.0335757 (0.0588002) [0.56815]	-0.0681973 (0.24576) [0.78147]	0.536675 (0.447604) [0.23087]
TA 100	0.0263518 (0.034578) [0.44610]	-0.0245662 (0.0997893) [0.80557]	0.0713 (0.205461) [0.72861]	0.0788864 (0.0750868) [0.29379]	-0.239756 (0.157033) [0.12725]	-0.13197 (0.247619) [0.59422]

Note: Standard Errors are within round brackets, while p-values of the statistical tests are within the squared brackets.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

ACTORS INVOLVED IN PROJECT MANAGEMENT

Vasile DUMITRU

"Spiru Haret" University, Brasov, Romania

Abstract: *The internal organization of project management implies both the actors that take part in it and other specific connected elements pertaining to the project development. By the manner in which activities within the project are conducted, performance of the system is identified. The actors involved in project management include the project manager, the project team and the secretariat of the project and all of them hold specific competences and responsibilities. The connected elements are identifiable with those people affected by the development of the project results, those that promote the project, governmental agencies, mass media, citizens and others.*

Key words: *Project, project management, actors involved in the project.*

During the course of the project, both private individuals and legal individuals representing firms and organizations participate. These people may influence either positively or negatively the project in motion, as a result of the position they take in relation with the actors or the connected elements.

1. The project management

The project manager is assigned the project by the top management, so that he or she can access and understand the inclusion of the project within the general framework of the primary organization. The project manager's Curriculum Vitae is one of the most important among the documents required for funding; therefore the CV needs to include such elements requested by the funds provider, and mainly proofs of his or her experience in running projects. Thus, it is interesting to present certain pre-activities regarded as projects.

The term 'official' project manager is often used in reference to the project manager who is not the same with the real initiator of the project, due to such credibility and experience issues which may later on enhance the chances for the project to be accepted and funded. Two major threats result from such an instance, and, unfortunately, they are frequently met[1]:

- the 'puppet' manager risks not being able to manage with his/her partner contacts and fund providers because he or she is not updated with regard to the project in motion, or does not know all details, whereas the project initiator is the person who takes care of such details;

- the project manager, after the project is approved, may not accept his or her status of a 'puppet', and wishes to impose his or her authority; in this case a de-motivation of the initiator and of the team occurs; moreover the project manger may not understand the goal of the project since the project is not his or her own concept; as a result wrong research

[1] Irina Manolescu, Managementul Proiectelor, Editura Universității "Alexandru Ioan Cuza", Iaşi, 2005,p. 50

directions may appear, alongside with other types of conflicts.

The project manager's responsibilities include:

- preparation of a budget and an activity schedule on various intervals of time;
- selection of team;
- providing necessary resources;
- other routine details that contribute to the project development.

The description of the manager's responsibilities must be achieved in accordance with the type of project and the organization that selected it. there are differences between the project manager and the 'functional' manager[2]:

- the former focuses on synthesis, whereas the latter stresses upon analysis;
- the functional manager is a direct, technical supervisor; the project manager is a 'facilitator'. The latter detains detailed knowledge in two or three areas of expertise, yet rarely does he know any of them in depth. In conclusion, the project manager is rather a generalist than a specialist. Although he is responsible for the project, the functional manager makes a series of decisions: who the people included in the project are; technical details such as how the project or the use of resources are going to be accomplished. According to the project administration, this functional manager may as well not be directly responsible for the final results.
- the project manager holds greater autonomy upon the top management of the company. The direct superior of the project manager may apply a strict supervision upon any action and may impose on him what exactly he or she needs to do. The entire authority, which normally should be delegated to the project manager, is hold, in this case, by the superior – a situation known as 'micromanagement'. The system blocks creativity and initiative of the project's team, and usually only mediocre results if not a failure are produced. There is not an efficient method for annihilating micro-management.

The project manager's responsibilities are divided into three main areas[3]:

- in relation with the organization he or she belongs to; administration of resources; meeting terms and a correct communication, as well as a careful management of the project;
- in relation with the project; the manager has to make sure that the integrity of the project is secures, despite conflicting requests made by any of the interested parties;
- in relation with the members of the project's team; since the team works for somebody who is not their direct boss, thus, the relationships among the team's members are tighter than expected, especially in situations when the team members are full timers in the project. The project manager's responsibility toward the team is dictated by the finite nature of the project and by the specialized nature of the team.

The key abilities of the project manager are[4]:

- communication (listening to and persuasion);
- organization (planning, establishment of objectives and analysis);
- team building (empathy, motivation);
- leadership (energy, delegation of authority, positive attitude);
- adaptation (flexibility, creativity, patience, perseverance);
- technical skills (experience, project know-how).

The project manager may be elected and named as soon as the project has been selelcted for funding, but in most cases the manager is selected prior to this moment. Sometimes, during the last stages of the project, the manager is changed. The transition is difficult and the results are sometimes unsatisfactory.

The most desired attributes of a project manager are: a complex professional experience; maturity; availability; good relationships with the top management; motivating for and able to keep the team united; prior experience in working with more than one departments.

[2] Idem, p.51

[3] Idem, p.51-52

[4] Idem, p.52

The selection of project managers often implies such criteria as[5]:

- credibility – technical and administrative;
- sensitivity – in both political and technical acceptance;
- leadership – in tight connection with the ethical component;
- ability to face stress.

The success within a major project may promote the project manager to one of the top management positions of a company.

2. The project's team

The project's team consists of selected personnel, in relation with their project responsibilities; its members belong to a variety of fields of expertise and specializations; the team is subordinated to the project manager. The members of the team need to be motivated, involved in the project, to possess aptitudes for working in a team, to have communicative competences, to be creative, and to display strong personalities so as each may contribute to the project's successful accomplishment.

The project manager needs to bear in mind that, usually, a team is established ad-hoc, but its members must possess knowledge in specific areas. Within new teams, there is an evolutionary process made up of specific stages, as follows[6]:

a. Stage I – Orientation; characterized by: limited engagement in relation with considerable expectations; a lot of fears (what is expected from an individual; which is his or her role in the system etc.); exploration of the environment; individuals depend largely on authority and hierarchy; the need of belonging to a group/team and to occupy a specific position.

b. Stage II – Frustration; consists of actions of the kind: discovering discrepancies between hope and reality; dissatisfaction caused by own dependence on authority; arguments on objectives; tasks and action plans; the feeling of lacking orientation and competence; negative reactions related to leaders and participants; competition for key positions and/or drawing attention; manifestation of some polarized feelings – dependence and independence.

c. Stage III – Taking a new path; includes reception of dissatisfactions; building a new bridge over the gap between expectations and reality; annihilation of polarization and discovery of guilt; development of harmony, trust, availability to provide help and respect; development of self-trust and optimism; open relationships among the team' s members and gradually increased feed-back; distribution of responsibilities and control; establishment and use of a team's own communication.

d. Stage IV – Production; aims at establishing co-operation within the team; collaboration with the entire team and sub-teams; living the sensation "together we are strong"; the feeling of own value (accepting duties without fear); alternative management; pride of having accomplishing tasks successfully; an increased level of production.

During the on-going process of the project, the project team is subjected to a series of perturbing factors that slow down its evolution. Among the perturbing factors, we can mention cultural, organizational and

[5] Idem, p.53
[6] Wolfgang Lessel, Managementul proiectelor-cum să planificăm eficient proiecte şi să le transpunem cu succes în practică, Editura Bic All, Bucureşti, 2007, p.90-91

individual factors, grouped according to the following statements[7]:

- lack of communication or defective communication; the team members that hold weak rhetorical skills cannot communicate and abandon their attempt at expressing arguments, thus leading to the information and justification loss;

- inadequacies related to authority; attention is paid in accordance with the speaker's position; if issues are not clearly and objectively stated, the decision-making process deteriorates, whereas motivation and communication are inhibited;

- troublesome relationships; if relationships between the team's members are not based on reciprocity principles, information and arguments may not be accessed or taken into consideration;

- decisions; sometimes, attention is focused on decisions that are less important, to the detriment of essential ones;

- stating creative opinions; futuristic opinions and genial ideas are often mocked at by the members of the team; thus leading to a lack of motivation in their initiators and further decreasing the creativity potential; occasionally conflict may emerge from such instances.

A presentation of the perturbing factors highlights the fact that steps must be taken at the level of the project's team, in order for simple rules of engagement and co-operation to be established.

3. The project's secretariat

By the term 'secretariat', one understands "an office within an institution, company or political or mass organization meant to deal with and solve current issues pertaining to its management"[8].

The secretariat is a direct and indispensable auxiliary part of the management, whose major role is to ease the management in its evolution, thus creating its proper conditions for accomplishing its main tasks: planning-organization-command-coordination-control.

The specialized literature defines the secretariat as a nucleus (a grouping of positions and personnel that occupy them) involving complex activities, characteristics and individual tasks. This group of specialized people are gathered under a hierarchical authority (secretariat directors, heads of departments, chiefs of secretariat), which is, in its turn, directly subordinated to the management and whose duties implies tasks specific for the secretariat job. Inside a secretariat, work is related to complex activities such as:

- activities specific to the secretariat (taking and transmitting telephone messages, shorthand writing, photocopying of materials, typing of documents dictated by chiefs, documents classification, correspondence administration);

- activities leading to tasks and duties accomplishment, as they were stipulated in one's job description (documentation, correspondence, protocol, organization of events etc.);

- activities decided on and initiated by secretariats (training of subordinated secretaries);

- activities on behalf of the managers (official guests, participation at talks with business partners etc.).

Activities include specific tasks and tasks need specific skills to be achieved. The task represents one department's area of responsibility and accomplishment of tasks by a department implies the competence of the department's members to fulfill duties resulting from these activities.

The secretariat holds global tasks that are further detailed for each of the person working there. The secretariat activity includes the following tasks and duties[9]:

- executing general recording activities (sorting, recording, dating, and distribution of documents) whenever there is not a specialized department of records;

- correspondence activities, for both received and sent documents; reading of received correspondence, notification of

[7] Rupert Eales-White, Cum să formezi echipe eficiente, Editura All Beck, Bucureşti, 2004, p.21-32

[8] Secretariat-definition/DEX online

[9] ebooks.unibuc.ro/StiinteADM/secretariat/8.htm

management regarding the correspondence, its recording, distribution and monitoring received correspondence, drawing of replies based on prior analysis, their typing, presenting replies to chiefs for signatures, preparation of correspondence for mailing, its delivery to the department of records or sending it, and wherever the case is, facilitating correspondence transportation by organizing the couriers' tasks;

- documentation activities: detection of internal and external sources; selection of materials; presentation of resulting materials in tables, charts, statistics etc., classification of documents, organization and ensuring the well functioning of the project archives;

- shorthand writing of the minutes of meetings, conferences, business meetings, transcription of dictated materials, either orally or over the telephone;

- multiplication of materials: typing using either a typewriter or a computer (using the blind method), use of a printer or photocopiers, correcting typing errors, familiarization with error correction systems for editorials;

- translations in and from the language of specific documents, correspondence, documenting materials, knowledge of a foreign language in its written and verbal form;

- protocol and public relations issues: drawing of plans for the well going of meetings with people other than the institution's personnel, reception of guests and business partners, knowledge regarding behavior specific to the visitor's country of origin, preparation of protocol correspondence on occasion of various events;

- keeping record of necessary secretariat stationery articles and personnel (record of supplies for the secretariat department), record of extra-hours, leaves, business travels, delegations and professional events;

- preparation of business travels, booking of tickets, hotel rooms, obtaining visas, documents preparation, establishing contacts with people whom the manager is supposed to meet and drawing the schedule;

- knowledge of and use of modern office devices (computers, photocopiers, fax machines, recording-classification devices, interphone etc.) ; good skills for computer typing and computer's programs destined to such operations;

- organization of the informational system: reception, administration and transmission of data;

- drawing basic accountancy of the project;

- reception and transmission of telephone messages;

- organization of meeting and materials to be used for meetings;

- following labor rules;

The project secretariat is an ad-hoc organism meant to manage activities and documents resulting from the project in motion. The secretariat is subordinated to the project manager or to the department assigned to monitor the on-going process of the project within the primary organization. The activity performed within the secretariat of the project may lead to an increased efficiency of activities of the whole project or may foresee possible drawbacks. Therefore, special attention should be paid to the organization of the secretariat's space, equipment and quality of personnel.

The secretariat focuses its attention on the following main activities:

- a centralized administration of documents;

- a centralized monitoring of costs;
- drawing reports.

The project secretariat may be established within an already existent secretariat, in case of small projects, or by setting a distinct secretariat, able to serve one (in case of large projects) or more than one projects.

For a normal development of activities within the project, it is imperious for the project to be well documented. By this, we understand "the totality of data and documents with regard to a specific aspect or a specific area"[10]. The project documentation refers to the totality of documents and data that was or will be available for one or more people from the project's managerial team or their hierarchically positioned superiors.

Data and documents include: an exchange of correspondence with customers or suppliers; an exchange of correspondence between the company's departments; contracts and annexes to contracts; specifications; goods orders; notes of telephonic conversations; minutes; graphics and technical documents. For a good preservation of the projects' documentations, the company's archive should be used; in the absence of such a department, other organizations of this type may be contracted.

Bibliography

1. Rupert Eales-White, *Cum să formezi echipe eficiente*, Editura All Beck, Bucureşti, 2004.
2. Wolfgang Lessel, *Managementul proiectelor*-cum să planificăm eficient proiecte şi să le transpunem cu succes în practică, Editura Bic All, Bucureşti, 2007
3. Irina Manolescu, *Managementul Proiectelor*, Editura Universității "Alexandru Ioan Cuza", Iaşi, 2005
4. Constantin Posea, Ioan Valentin Marcel Posea, *Managementul proiectelor*, Editura Fundației România de Mâine,Bucureşti, 2012
5. Secretariat-definiție/DEX online
6. ebooks.unibuc.ro/StiinteADM/secretariat/8.htm

[10] documentație-definiție/DEX online

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

OPERATION RESEARCH IN THE DECISION MAKING PROCESS AND LOGISTIC SUPPORT PLANNING

Tomáš DVOŘÁK*, Petra KVAPILOVÁ*

* Department of Logistics, University of Defence, Brno, Czech Republic

Abstract: *This paper is a contribution to a further development of logistic support and planning of the Czech Armed Forces. Main idea is to promote and deliver a proper operations research framework into the operations planning process and into the entire environment of military missions and operations. From the point of view of the decision making process the Czech armed forces widely employ empiric approach and on site solutions. This paper promotes scientific methods to the system of logistic support enabling the army to operate both effectively and economically. Our proposal includes a research of mathematical methods and heuristics being used by NATO countries and/or in the civilian sector. Integrating such methods into the military decision making process chain may largely contribute to support fundamental decisions in a more accurate and sophisticated way with potential economical side effects.*

Keywords: *operation research, decision making, logistic support, planning*

1 INTRODUCTION

Paradigm shift in the North Atlantic Treaty Organisation´s (NATO) and the European Union´s (EU) security and defense policy, comes along with new challenges and tasks for the armed forces (AF), while making it necessary to modernize and reform logistics systems. Limited budgets require military commanders to implement economic austerity measures at all organizational levels and among all activities. The Military Strategy of the Czech Republic mentioned the need to achieve greater efficiency especially in logistics. Efficiency goes together hand in hand with right decisions. The NATO-standard operational decision-making process (ODMP) clearly provides a complex framework to enable proper decisions to be made. However still only few NATO countries employ a skilled operations research (OR) staff to carry out more advanced analytic and evaluation methods and procedures. This paper outlines some ideas considering certain improvement possibilities for the decision support and planning.

2 SYSTEMS FOR DECISION SUPPORT

The systems for decision support include a wide variety of models, simulations and other software applications that are designed to facilitate and improve decision making. These systems simulate various operating environments and may include conditions of uncertainty and analysis of "what happens, when ..." used algorithms or heuristics. [1]

The decision support systems, which may include decision analysis systems, predictive models, simulation models or linear

programming models, can integrate tools of the artificial intelligence. [1]

2.1 Using the simulation for decision support

The simulation is a method that creates models of the situation and may determine the likely changes that occur during the implement of an alternative or a change of variable. [1]

The computer simulations allow users to overcome the problems of implementation of dynamic programming module random effect and the need for a large number of calculations. The computer simulation can be characterized as the display of the behaviour of the real object on the computer. Using simulation provides many advantages such as the simulation time can run faster than real, so it is possible to evaluate a large number of alternatives [2] and the cost for changes of the test options are a fraction of the cost than if the change was implemented in the process.

Computer simulation is only a tool for decision support and can not find an optimal solution of the problem. Decision-maker must change the structure of the system, changing the variables that can affect the real environment and using model chooses the best combination of the variables. [3]

For the correct functioning of the application of simulations is observed these follows rules [3]:

- knowledge of the modelled object or process;
- effectiveness of the design;
- collection of the necessary information;
- identification of the variables;
- review of the changes that occur in the real system.

For computer simulation is possible used countless of the software applications, as well as spreadsheets (e.g. MS Excel).

2.2 Supply Distribution Model – software application designed for the computer simulation for decision support

In the process of planning and the various stages according to the requirements are presented information and intentions of in logistics assessment and analysis of the options activity. The planning process is always directed to accept of the decision and issued tasks to subordinates.

During the planning process is prepared necessary documentation for the organization and management of logistics support. The decision making and the planning processes are running concurrently, in which authority and logistics commander thoughtfully prepare future operation and logistics support of this operation. [4]

The part of logistics information system of NATO LOGFAS (Logistics Functional Area Services) is a simulation tool for decision-making support in the supply process. This is SDM (Supply Distribution Model), which allows test and simulate the situation for the replenishment of the generated scenarios, identify bottlenecks and other problems in the supply chain, and then analyze the outputs. The scenarios that are created for modelling supply chains, based on defined parameters and factors that affect the calculation of the inventory.

Using SDM in the process of planning and decision-making is shown in Figure 1.

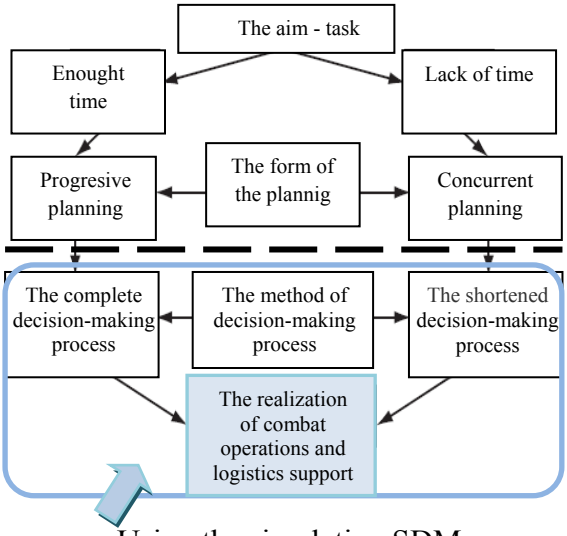


Figure 1 planning and decision-making process with the involvement of SDM

In the decision-making and planning process are prepared the alternative solutions of logistics support. These options can be used to test and evaluate SDM simulation outputs. Supply Distribution Module provides two types of outputs. One of them is the indicator of inventory when inventory items do not fall to below Reorder Level or on Zero Level.

This information can be read from graphs or Shortfall of Commodities Report. The second indicator is the capacity utilization of transport assets. This information is provided by the Transportation Asset Utilization Report. It follows that the simulation of SDM is the support for decision making; it is shown in Figure 2

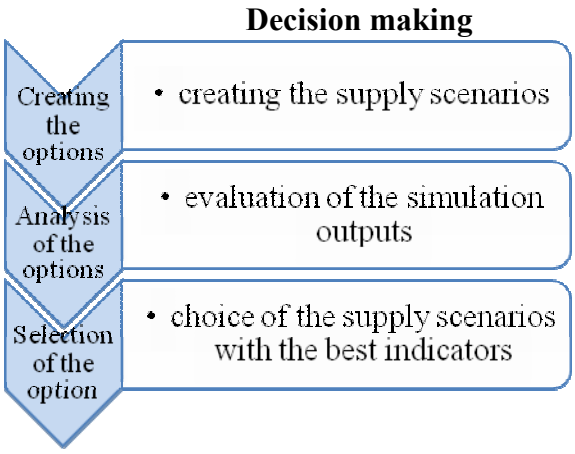


Figure 2 Scheme decision making for supply

The advantages and the disadvantages are assessed for each option. The Pre-established criteria and priorities can be used of selecting the best solution. In the process of comparing alternatives is possible to use a variety of methods, such as the method of weighted correlation tables. The evaluation of criteria is relatively objective expressed in terms of numbers, which are the result of subjective assessment. For each numerical expression of the value criteria is assigned so-called the weight. [4]

Supply Distribution Model can be used as a support tool in planning and decision making in the phase of preparation operations, but also during the operation. When working with a model during the operation it is possible set, edit and change the input parameters and evaluate the situation - "what happens, when ...".

It is possible to test events that occur with a probability based on developments in the area of operation. From the simulation outputs is possible to adopt measures that would mitigate the adverse impact on the entire supply chain.

2.3 Finding the entry point for operations research methods

Optimization effort is a logical result of efforts made to more efficient spending of resources, especially financial, and working time. If a better solution than the current one is found, it is possible under given conditions to maximize logistical support.

The ODMP is taught to officer cadets of all military services in many nations, including the Czech. It is designed for hierarchical organisations, clear goals, and rational decision makers. Characteristics of the ODMP are [5]:

- It emphasises the planning process before an operation begins.
- It assumes a hierarchical organisation.
- It is a successive, top-down decomposition process.
- Planning at each level of decomposition is largely linear; see Figure 3.
- Planning at any given level can only begin when planning is complete at the next level up.

Warning orders allow some overlapping.

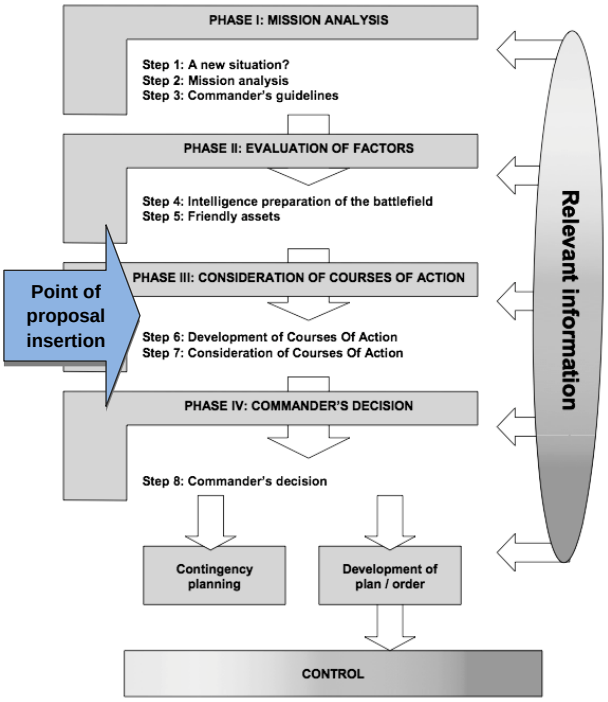


Figure 3 NATO-standard operational decision-making process

Czech army does not systematically employ OR specialists even on a strategic level. The whole ODMP as shown above is typically run according to doctrine however with only standard tools relating to decision-making such as risk and centre of gravity analysis and limiting factors evaluation. Phase 3 of the ODMP is an ideal time for OR implementation (assuming trained and skilled Operations Research/System Analyst (ORSA) with appropriate knowledge of military logistics).

In US Army the ORSA, Functional Area 49 (FA49) for military, Career Program Series 1515 for Army Civilians, is a science professional who produces analytic products (e.g. decision aids, models) to underpin decisions by Commanders and to enable solutions of varied and complex strategic, operational, tactical and managerial issues. ORSA personnel use quantitative and qualitative analysis throughout the decision-making process. ORSA personnel are adept at problem solving, identifying risk, and communicating results and recommendations. Some of ORSA´s Unique activities:

- Data analysis;
- Decision models;
- Nodal or flow modelling;
- Qualitative assessments;
- Probability assessment;
- Trending and forecasting;
- Geospatial analysis;
- Effects assessment;
- Logistic support analysis.

ORSA techniques help to allocate scarce resources, and to prepare, plan, analyze, and assess operations. [6]

Project management implementation:

All military plans consist of a certain time scale. There is chain of activities to be done subsequentially or simultaneously each with duration. There is a deadline as well. For a reasonable decision-making a time management is something not to be omitted. The Critical path method using a Gantt chart is one of a many possibilities how to plan and watch your project. The Program (or Project) Evaluation and Review Technique, commonly abbreviated PERT, is a statistical tool, used in

project management, that is designed to analyze and represent the tasks involved in completing a given project. Knowing the likelihood of a project (or a plan) being finished in a certain time might be a strong argument in COA decision briefing (ODMP phase 3).

Optimization of supply chain in the area of operation:

It can be viewed as an effort to find the best distribution solution. The level of logistical support generally depends on time and resources as key factors for optimization. The Operational Decision -Making Process (ODMP) should include an appropriate design of an optimal distribution model before the courses of action are presented to the commander. In case the distribution dependent system components are stationary (e.g. bases, security stations) the so-called ex-post optimization has to be put into consideration. If the system elements are movable (e.g. new operation) from the point of view of distribution strategy optimization the OR provides two applicable methods:

- Method for optimal distribution system structure (Object Localization models – e.g. distribution centre localization);
- Method for transportation routes optimization (Optimal distribution chain between system elements – typically Travelling Salesman problem).

The result of an optimal placement of the distribution centre (DC) is an area defined by boundary lines. That particular area shows where the cost function is minimized - the cost of potential supply will therefore be minimized. As mentioned above, the deployment of this model must be preceded by consideration about how the distribution will be done. Whether supply will be transported on roads or, for example air (mostly straight line flight – e.g. helicopter dropping material). This decision will set conditions for the problem formulation.

Optimal distribution chain between system elements:

If it is not possible for any reason to use the services of a distribution centre (typically the deteriorated security situation in the neighbourhood), it is essential to find another way to supply. Usually it is necessary to get along with a limited transport capacity. For an optimal distribution chain in some cases a Traveling salesman problem (TSP) might be employed. The problem belongs to the category of Non-linear programming with a typical computational complexity.

Clearly there are other various OR methods or special heuristics which have a potential to be involved in the ODMP.

3 CONCLUSION

Together with the rise of importance of simulations provided by the SDM module the OR research methods mean a real challenge for the planning staff. The authors propose the ideal theoretical entry point for most OR methods the Phase 3 of the standard ODMP. The ORSA personnel are actively involved in the whole ODMP and increase the effectiveness of this process by ensuring analytical rigor and continuity throughout mission planning, execution, and assessment though.

The ORSA helps Commanders to derive maximal benefit from its skills. With more ORSA positions among NATO countries and complex interoperability issues the Czech Armed Forces need to consider the implementation of such staff into its structures.

REFERENCES

1. LAMBERT, D. STOCK, J., ELLRAM, L., *Logistika.* Praha: Computer Press, 2000. 589 p. ISBN 80-7226-221-1.

2. DANĚK, J., *Využití simulačních metod pro podporu manažerského rozhodování* [on-line]. 2011-09-30. Available http://www.humusoft.cz/archived/pub/witness/syst9903/sim_rp.htm

3. GROS, I. *Kvantitativní metody v manažerském rozhodování*. Praha: Grada Publishing, a. s., 2003. 432 p. ISBN: 80-247-0421-8.

4. Armáda České republiky. *Použití jednotek logistiky pozemních sil ve vojenských operacích*. Vojenská publikace. Praha: 2008.

5. DE JONG, J. L. 2006 CCRTS The state of the art and the state of the practice. *Hybrid Metaheuristic Planning and Military Decision-Making: Commonalities between theory and practice. 2006.*

6. ORSA HANDBOOK FOR THE SENIOR COMMANDER. In: Fort Belvoir, Virginia: Center for Army Analysis (CAA), 2008. Available: http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA489398

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

EFFECTS OF FINANCIAL CRISIS ON EUROPEAN STATES. THE CASE OF ROMANIA

Constanta ENEA*, Constantin ENEA**
*Department of Management, Marketing and Business Administration
Faculty of Economics and Business Administration, Constantin Brancusi University of Targu-Jiu
Romania
**Department of Law, Faculty of Public Administration and Comparative Politics
Constantin Brancusi University of Targu-Jiu, Romania

Abstract: *For now, the forecast growth in terms of Romania for 2012 remains 3.5%, but is likely to be revised down, IMF experts believe.*

Current domestic and international situation still remains, a difficult and requires high-order budget constraints. Add to these difficulties related to the need to adjust the budget deficit and current account values that make it possible to finance them.

In this context, the new Government will promote a coherent set of policies and macroeconomic adjustment measures, coupled with monetary policy, to ensure sustainable economic growth, maintaining the investment attractiveness of Romania, and a favorable business development, market employment and living standards. During the high economic growth, fiscal policy was expansionary type and is inadequate. Construction budget and execution for 2008 have encouraged unwarranted increase spending on goods and services at the expense of investment. Reduced administrative capacity has led to low absorption of structural funds.

All this has led to slippage of the objectives set by the convergence program.

Keywords: *financial crisis, economic, obstacles, weather,*

1. INTRODUCTION:

On November 26, 2008, the Commission adopted the Communication "A European Economic Recovery Plan" ("Recovery Plan") to act to exit Europe in the current financial crisis. Recovery Plan was based on two mutually reinforcing main elements. First, short-term measures to boost demand, save jobs and restore confidence and secondly, "smart investment" to yield higher growth and sustainable prosperity in the longer term.

In the current financial situation, Member States have been tempted to act individually and, especially, to start a competition of subsidies to support their companies. Experience shows that such individual actions can not be effective and could seriously affect the domestic market. When granting support, taking into full account the specific economic situation today, it is crucial to ensure a level playing field for European companies and to avoid a situation where Member States would start a competing grants, which would not be sustainable and would be detrimental to the Community. Competition policy has exactly that role.

2. EFFECTS OF FINANCIAL CRISIS ON EUROPEAN STATES.

In the 10 years of EMU, significant economic differences between Member States were masked and recedes by European leaders, but fully settled by people exposed to further austerity measures. Efficiency and sufficiency of the nominal convergence criteria set by the Maastricht Treaty, the main conditions for joining the euro zone, have been shaken by economic developments in recent years. Gaps between euro area countries have been placed in the spotlight of international crisis, which deepened the financial problems and macroeconomic imbalances in poorly performing countries.

Even now, European leaders acknowledge the existence of a partial economic and monetary union with two speeds, ignoring causes deepening gap between the core of the euro area and the periphery. European policymakers have finally understood the importance of resolving the causes of disparities and imbalances in the euro area and acted. Many will say enough, but they acted. Was built, finally a preventive mechanism to monitor and alert for the European states.

Alert mechanism is the main tool of analysis built a dashboard based on 10 macroeconomic indicators. They capture both external imbalances and competitiveness, and those internal guidelines setting thresholds that serve as warning levels. Any deviation from the range indicator set indicates high risk.

First Annual Report of the Commission on the alert mechanism was published in the February 14, 2012 and identified 12 member states of EU macroeconomic risks require thorough analysis: Belgium, Bulgaria, Cyprus, Denmark, Finland, France, Italy, United Kingdom, Slovenia , Spain, Sweden and Hungary. States receiving financial assistance program of the EU and the IMF - Romania, Greece, Ireland and Portugal - are already under an enhanced economic surveillance.

Scoreboard emphasizes the loss of competitiveness and the risk of imbalances in weaker European economies over the past decade. In Ireland, for example, housing prices have increased by 55% before the international crisis, signal overheating real estate sector. Private debt has doubled, reaching in 2010 highest in the EU, 341% of GDP, and wages have increased annually by at least 10% by 2009. Greece has high trade deficits and spent more than disposable incomes constantly missing ranges for exports and debt. Public debt increased to 104% of GDP in 2001 to 145% of GDP in 2010, standing now at over 160% of GDP. In addition, unemployment was around 10% since 2001. So precarious situation of the Greek economy is not known yesterday, today, but there were clear signals, but neglected throughout the past decade. Portugal has the same problems and with high trade deficits and high levels of private debt, as it ranks 3rd in EU, after Ireland and Cyprus.

Scoreboard and the evolution of strong economies. In the 10 years of Economic and Monetary Union, Austria has never achieved the public debt limit of 60% of GDP - which is the one of nominal convergence criteria. Instead, Germany has missed it in nine years, and France in eight years, emphasizing more conceptual than practical character of the Maastricht criteria, included in the Stability and Growth Pact. In addition, France has consistently failed criterion of export market share dynamics, losing ground to other countries every year since 2001.

3. EFFECTS OF FINANCIAL CRISIS ON EUROPEAN STATES. THE CASE OF ROMANIA

Beginning (pre) visible current financial crisis are still in 2007.

Specialists have started from a fall in U.S. housing market. But no one was able to show the time derivative imminent crisis.

Understanding springs that caused the financial crisis is still incomplete. Like derivatives, is already hard to identify source, to reach base and tangible arguments

can supports a theory which tends increasingly to the theory of relativity.

Now there are two basic manifestations of the crisis, visible in the U.S. and the West:

(1) assets "toxic" invested in but which are capable of producing income and

(2) liquidity crisis based, above all, confidence.

These two factors are sufficient to start a spiral in which an element is an obstacle to solving the other and can pull drift and others (being, from this point of view, things are almost unpredictable).

For Romania, the issue of "toxic assets" is less important but the liquidity problem has already been imported and is manifested clearly. And here the big problem, liquidity, is that increased interest and that there are problems with loans. The big problem in Romania are older: chronic external deficit. And lack of liquidity makes it just very difficult to finance. Romania is now a family situation, metaphorically speaking, that constantly and kept postponing debt to pay its debts, always turned to credit cards and now the credit limit is already reached, in this case, the family can not reach by credit card or can not receive money from another bank. The only solution is to make financial savings, otherwise it will go into default, with painful consequences.

Therefore, the main financial problem is the external deficit of Romania. This is the problem and the solution to saving or expenditure restraint can not be avoided, it is clear that spending restrictions ahead.

Government will try (which is already) to limit those expenses which immediately turns the application, and private companies, affected both by the lack of liquidity and the declining demand will try to turn a reduction in expenditures. In this way, family, already indebted and poor funding opportunities will be faced with real crisis, one different than the TV. But one aspect worth discussing is the measure adopted by central banks to cut interest rates near zero funding. This should solve the problem of funding, banks now having access to almost free money. Technically, it probably is, but basically, the psychological factor (you can read: disbelief) seems to play a blocking role. And this distrust will continue as long as the crisis mechanism is not clear and will not be public.

Analysis of the 10 indicators in the year 2011 shows that Romania has no internal macroeconomic imbalances, falling within the proposed economic parameters, but identified two potential external imbalances and competitiveness. The first is the current account deficit averaged over the past three years, of -4.1% of GDP, slightly below the range of variation of -4% to +6%. The second is the net investment position of -63% of GDP which puts us beyond the maximum number of 35% of GDP.

In this context, the alert mechanism of the imbalances that occur in the European economies is more than welcome. The existence of such a mechanism during the last decade we would be protected from loans and speculation puzzling brutal austerity measures and would be significantly reduced global crisis impact on European countries. The presence of this European mechanism alert, Romanians will be better protected from economic measures bad, populist politicians.

4. CONCLUSIONS:

About Romania, IMF representatives said they still maintain the 3.5% growth forecast for 2012, but representative for Romania and Bulgaria the IMF, Tony Lybeck,

warned that in any revision of the agreement that we have completed IMF and European Commission are reviewed and the economic forecasts and that most likely they will be revised down.
Financial crisis are felt strongly in developed European countries, already faced with significant slowdown of global economic growth or even recession.

The main effects of financial and economic crisis currently facing Romania are:

• reduce liquidity in the banking sector, while increasing internal and external financing costs;

• access to credit crunch the population, economic agents and public sector;

• increasing the number of persons unable to repay bank loans and interest rates;

• lower domestic production with negative effects on wages, keeping the number of jobs and the profitability of companies;

• lower rate of growth in government revenue caused by the decrease in general activity in the economy (automotive, steel, nonferrous metals, construction, furniture, textiles, etc..)

• loss of purchasing power and quality of life;

• slowing GDP growth.

Effects of the crisis occurred and strong general government revenues, by reducing them even amid economic growth. General government deficit estimated for this year will be over 3.5% of GDP, with negative implications on the macroeconomic balance, especially the current account deficit, which remains at high - around 13% of GDP . The public deficit is above limits set by the Maastricht Treaty (3% of GDP).

The crisis will end, according to European Commission representatives that only when all European countries will implement macroeconomic and structural policies right after they start to show the fruits. Items as labor market flexibility, market more competitive, more educated workforce and more effective institutions can help restore sustainable economic growth, says Bas Bakker, one of the IMF report on economic developments in European countries. "One of the lessons we learned from the past is the difference they can make policies even if financial markets are sometimes pessimistic, a good combination of economic policies can make a difference. Our current forecast is that it will reduce economic growth in Europe from 4.4% to 3.4% in 2012. This is a slow, true, but not a disaster. Of course there are risks and it is possible for growth to be even lower, but the correct economic policies We believe that these risks can be controlled, "said Bas Bakker.

The collapse of government in Romania increased uncertainty, threatening the reforms and may therefore negatively impact the country's financing capacity, according to credit rating agency Moody's (note signed by analyst Atsi Sheth). "Although the new government announced that continued support from the IMF / World Bank / EU is a priority, the rhetoric of the past and unpopularity of austerity measures reduce the likelihood that the government in Romania to continue reforms before elections. Blocking reforms would worsen conditions obtaining loans by the government, which must refinance the 2012 debt of 13 billion dollars, "according to Moody's (Moody's is a rating agency, and one of the major rating agencies who kept Romania in the category of rating recommended investments throughout the financial crisis).

The political situation affecting financial soundness of Romania by three factors.

The first of these is the reduced likelihood of implementation of structural reforms that would boost GDP growth to 1.9% located in the fourth quarter of last year compared to annual average of 6.6% recorded in the five years preceding the crisis financial crisis. Moody's expects GDP growth to continue to slow in the first half of this year, due to difficult economic conditions on domestic and regional market.

The second factor is the increasing probability that some fiscal consolidation measures implemented in the last three years, as tax increases, pay cuts and benefit increases to be reversed before the election. Any reversal of fiscal consolidation measures

would delay reducing the budget deficit to 5.2% of GDP in 2011 to 3% in 2015, in accordance with the Maastricht criteria.

The third negative factor mentioned by Moody's political instability is likely to continue to discourage foreign investment, which depends Romania to finance the current account deficit (of about 4.7% of GDP in 2011) and the budget deficit.

Immediately after the fall of Ungureanu, analyst Atsi Sheth told AFP that Romania's rating stable outlook already includes political uncertainties will persist during the election, and any government, new or interim, will make the effort to maintain support from the IMF and EU. Sheth noted that the baseline then considered the rating agency, even before the vote of no confidence in Parliament, was that this year will be difficult fiscal consolidation, the impacts of economic contraction in the euro area on exports Romania and investment perspective.

BIBLIOGRAPHY:

1. Apostol, D. (2009) *Crisis, Fifth powers*, Bucharest, Publishing House legal
2. Buffett, W (2010), *Economic crisis and its prophecies*, Bucharest, Lier, 2010;
3. Canton, J. (2010) *Future Challenges*, Bucharest, Polirom;
4. Daianu, D, (2009) *Capitalism way?*, Bucharest, Polirom;
5. Daianu, D, (2009) *Coping with financial crisis*, Bucharest, Rosetti Educational Publishing;
6. Gheorghiu, A (2011), *Economic and financial analysis at the microeconomic level*, Bucharest, Publishing House
7. Isarescu, M, *Issues of monetary policy in an emerging country, The Case of Romania*, Barcelona 2008, Publications of the Royal Academy of Economics and Finance
8. Lybeck, Johan A (2012), *History of global financial crisis (2007-2010)*, Bucharest, Polirom
9. Peicuti, C, (2012), *World in crisis. System errors*, Bucharest, Polirom
10. Roman, C, Mosteanu, T (2011), *Public Finance institutions*, Bucharest: Economic
11. Radulescu, A, article published on the website, http://profitbursier.ro/Raport-macroeconomic-mondial-martie-2012.html, accessed on 21.04.2012,
12. *** Official Journal of the European Union Commission Communication no. 2009/C 83/01 - Temporary framework for State aid measures to support access to finance in the financial and economic crisis - extracted, accessed on 25.04.2012

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

ROMANIAN ECONOMIC DEVELOPMENT INDICATORS IN FRONT OF THE FIGHT WITH ECONOMIC CRISIS

Constanta ENEA*, Constantin ENEA**
*Department of Management, Marketing and Business Administration
Faculty of Economics and Business Administration, Constantin Brancusi University of Targu-Jiu
Romania
**Department of Law, Faculty of Public Administration and Comparative Politics
Constantin Brancusi University of Targu-Jiu, Romania

Abstract: *The data recorded on the front fighting the global economic crisis are contradictory: while some, especially from overseas, already singing funeral European Union, leading EU leaders to calm us, speaking of a new rescue strategy, the re main banks and by removing 60% of Greece's debt to private banks.*

The danger of a new recession still haunts, the old continent.

Earlier last year, international institutions forecast growth for the country of 0.2% and 2.6% for 2011. Currently estimates indicate a growth around 2%. Is a result that shows that we succeeded. I managed to set realistic goals, and they have achieved. I emerged from recession. We have four consecutive quarters of growth. Without an action plan courageously and well done, this was not possible. The fight was given on several fronts that targeted 11 key reforms and much needed for the Romanian economy. It's about the budgetary reform, including staff salaries budget, internal administration, the labor law and social dialogue, the fiscal framework, the public pension system, social support, but also in education, health, justice and not Finally, reform of state enterprises.

Keywords: *economic indicators, developments, undershot, economic crisis, financial crisis*

1. INTRODUCTION:

Earlier last year, international institutions forecast growth for the country of 0.2% and 2.6% for 2011. At present, 2012, estimates indicate a growth around 2%. Is a result that shows that we succeeded.

Ministry of Finance and Economy Ministry experts argue strongly that we managed to establish realistic goals, and they've achieved. I emerged from recession. Based on financial indicators registered, we have four consecutive quarters of growth. Without an action plan courageously and well done, this was not possible. The fight was given on several fronts that targeted 11 key reforms and much needed for the Romanian economy. It's about the budgetary reform, including staff salaries budget, internal administration, the labor law and social dialogue, the fiscal framework, the public pension system, social support, but also in education, health, justice and not Finally, reform of state enterprises.

Forecasts in the last months of 2011 the 6th position Romania among the countries with the highest growth, after Lithuania (3.4%), Estonia (3.2%), Latvia (2.5%), Poland (2, 5%), Bulgaria (2.3%) and above the EU and the euro area to 0.6%, 0.5% (according to recent estimates by the European

Commission). In this case, the 2012 budget was built on an economic growth of 2.1%, considered tangible, realistic, supported by industry with export potential, the service sector and construction sector recovery, driven by public investment infrastructure and housing.

To do an analysis of financial indicators during the crisis that affected the whole world need to start from the evolution of these indicators over the last year but it is envisaged and their forecast for next year. This evolution can be studied in the following table:

2. DEVELOPMENTS AND FORECASTS OF ECONOMIC AND FINANCIAL INDICATORS IN CRISIS CONDITIONS.

To do an analysis of financial indicators during the crisis that affected the whole world need to start from the evolution of these indicators over the last year but it is envisaged and their forecast for next year. This evolution can be studied in the following table:

Developments and forecasts of key macroeconomic indicators of Romania

Indicators	Unit	2008	2009	2010	2011	2012	2013	2014
GDP	Mild.lei	62,9	60,4	71,8	82,1	91,6	101,0	110,8
Consumer price index	%							
- Average of		112,7	100	107,4	107,2	106,9	105	105
- End of year		107,3	100,4	108,1	108	105,7	105	105
The exchange rate of leu	Lei/USD							
- Annual average		10,39	11,11	12,37	11,73	11,93	12,00	12,00
- The end of Euro		10,4	12,3	12,15	12,00	12,10	12,10	12,10
Export	Mil.USD	1591	1283	1541	1875	2100	2350	2625
Import	Mil.USD	4899	3278	3855	4650	5150	5650	6200
Trade balance millions	Mil.USD	-3308	-1995	-2314	-2775	-3050	-3300	-3575
Industrial production	Mild.lei	30,0	22,6	27,1	31,4	35,3	40	44,3
Agricultural production	Mild.lei	16,5	13,3	19,7	21,7	23,4	24,8	25,9
Investments in fixed capital	Mild.lei	18,2	10,9	12,9	15,9	18,2	20,6	22,7
Average nominal monthly	lei	2530	2748	2972	3300	3650	4000	4400
Labor remuneration fund	Mild.lei	19,4	19,9	20,8	24,0	26,9	29,8	32,8

Source: Ministry of Economy

These data are based either on actual developments or estimates and forecasts. According to current actual data provided by the Ministry of Finance and Ministry of Economy, Section economic reports and financial analysis, the main domestic sources of investment and consumption growth remain. Exports and imports will experience a slowdown in growth around a still double-digit positive rate of about 11% in 2012. Government decided to continue boosting public investment, both covered from internal resources and, especially in external grants. Real growth of total investment in the economy for 2012 is estimated at 4.5%, double the projected growth. On the one hand, public investment will amount to 38.1 billion lei, namely 6.6% of GDP, more than 2 billion from 2011. If in 2010 we ranked first in the EU as a share of public investment in GDP, a level of 5.8% of GDP, the budget allocation for public investment in growth, there is every chance to maintain our leading position in ranking this year. On the other hand, private investment will fall at least as of 2011. Also there were opportunities created by public-private partnerships.

Opportunity of economic growth in Romania (2.1%), four times the EU average in

2012 (0.6%), you capitalization of European funds by attracting at least 6 billion, so the degree absorption to significantly exceed 20% at the end of 2012, compared to 5.5% in late 2011.

Agriculture contributed substantially to growth in 2011, recording the most spectacular increase in the third quarter, exceeding 22%. Although agriculture is heavily dependent on weather conditions and growth seems impossible to repeat this year, the good news is that we can turn to export pork to give one example. At the end of 2011 we obtained the right to export pork and pork products in the EU and third countries, the European Commission's decision. Gross average wage in the economy will be greater than 4% this year, generating an increase in household consumption by 2%. On this projection for 2012 forecasts show an increase in household consumption by 2%. Romanians' living standards, so it will improve. Average salary will increase by 4.5% more likely to reach 2,117 lei in 2012, while average consumer price index will be about 3% in 2012. Unemployment continues to decline in 2012 to about 410,000 people. Socially assisted persons, but able to work, will have to return to work for a living, after reorganizing and transparent system of social assistance. GDP per capita at purchasing power parity estimates in 2011 to 11,400 euros by the European Commission is projected to grow by 5.3% to around 12,000 euros per capita in 2012.

The main signals indicates a 2012 year stable macroeconomic our country. Currently, stability is the watchword and the European level, knowing that in the last quarter of 2011 and first quarter of 2012 the euro area will experience a recession despite German economic strength to resist the effects of shocks generated by sovereign debt crisis. The measures adopted in Romania and fiscal targets in the budget strategy for next three years and protect us from economic shortfalls us responsible, so we fit in parts from 2012 Maastricht Treaty. First, Romania will exit the excessive deficit procedure, having a budget deficit of 1.9% of GDP on cash, safe under 3% in terms of commitment.

We proved we are capable of such performance. In the first 11 months of the year just ended, the budget deficit reached 2.98% of GDP, and estimates for the entire year we sit very close or slightly below the 4.4% target set in early.
Second, public debt will remain well below 60% of GDP set by the Maastricht Treaty. We had the 5th lowest in the EU public debt, 35.8% of GDP in 2012 under the European Commission forecast in November 2011.

Third, after 22 years of losing battle with inflation, the central bank gives us a reasonable fit to the target of 3% this year. Efforts we have been sprinkled with feedback only noticed in the press, but valuable to encourage investors to evaluate the responsibility we acted: in July 2011, rating agency Fitch revised the rating positively Romania, in the category recommended for investment, while Portugal, Italy, Greece and Spain have been downgraded.

Export oriented industry maintained strong growth in 2011. The state aid schemes have facilitated the transition from intensive specialization in labor intensive specialization in technology, and support exports of technology intensive products, particularly in the automotive sector. The main government programs supporting business and stimulating access to finance, aid and state guarantees, still more than budgeted in 2012.

We can not ignore the fact that we are in the digital age, information technology and energy efficiency. Romania has competitive

advantages in these areas. For example, the infrastructure and communication technology is attractive because of the global recognition specialists and energy mix is the envy of many other states.

At European level see a 2012 year of austerity. Tough measures to reduce public debt and deficits too high and the challenges raised by healthy economic recovery have made their mark on each European country. Recently, Angela Merkel, referring to the sovereign debt crisis, emphasize that we are witnessing "the most difficult hours of Europe after the Second World War". Uncertainties in the EU are the main risks to which we remain vigilant, as the degree of interdependence between countries is a reality that can not be ignored.

Thick ropes that are tied to the EU - in particular trade and foreign direct investment, to give a few examples - are the main sources that will hinder growth. In addition, Romania could be affected indirectly by the turbulence on international financial markets by increasing investors' risk aversion on our entire region.

Therefore, the first development in 2012 is possible moderating the growth of exports, 11%, as noted above. The slowdown is visible since the end of 2011. The decisive moment to reorient our exports to emerging markets, where opportunities are huge, but very sharp price competition to compensate for the Community's external demand.

Romania's long-term priority remains eliminate the development gap with the EU average. At 5 years after joining the European Union, Romania performs mediocre in the race to catch up economically among the 12 new Member States. We recovered 8 percentage points of the distance to the European average in terms of GDP per capita in 2006-2010. So far we have reached 46% in European average, equivalent to a GDP per capita of 11,400 euros. By comparison, Estonia (64% in 2010 compared to 66% in 2006) and Slovenia (85% in 2010 compared to 88% in 2006) have departed from the European average and the Czech Republic (80%) and Latvia (51%) gaps have kept constant.

Moreover, Romania has recovered 6.8 percentage points of the gap of labor productivity per hour worked compared to the EU, currently reaching 42.3% of the EU, unlike Slovenia (-4 pp 79 5% of the EU at present) and the Czech Republic (-0.6 percentage points, 67.8% of the EU at present) who have distanced themselves from the EU between 2006 and 2010. Although we handle comfortably in May in the European Union with the lowest public debt, remain vulnerable to the implications of international market turmoil on the cost of external borrowing. Romania's foreign debt amounted to 97 billion euros in first 10 months of 2011 and was slightly up by 4.9%, to end of 2010. Three quarters of the foreign debt is private and should be honored by business and in fourth is public (16.2% of GDP in 2011). If we add domestic debt, total debt amounted to 33.4% of GDP in 2011. Over 77% of total external debt on medium and long term, and the remaining about 23% should be honored in the short term.

Any blockages in international financial markets will mean higher interest payable. The cost of external funding can fluctuate strongly correlated with international sentiment. However, total public debt (external and internal) will not increase more than 34% of GDP in 2012. Foreign direct investment hit by financial crisis, has not yet returned. In 2010, FDI volume was 37% lower than the previous year, amounting to 2.2 billion. The negative trend continued in 2011: the first 10 months, FDI were 43.8% lower than the same period of 2010, reaching 1.3 billion euros, two times more than Bulgaria. CNP forecasts indicate a negative trend reversed in 2012, the FDI estimated at around 3 billion euros, about two times higher than in 2011. Banking assets are held in high proportion, 85% foreign capital. Therefore, if the parent banks of major difficulties, they are likely to significantly reduce their exposure to lending subsidiaries. The risk is doubled by late Romania in developing alternative financing mechanisms, for example stock market, mutual funds or venture capital funds, and low saving rate. Very poor economic and financial culture resulted in a reduced

interaction between the public and the financial system. Half of Romanian have no relationship with financial institutions. Romanians' appetite for saving is 2.8 percentage points below the European average.

If we save more we less vulnerable to adverse external developments.

In fact, the population of Romania has a savings rate of 9.8% in the third quarter of 2011, below the European average of 12.6% (according to the latest data available from 2nd quarter 2011). Moreover, the share of nonperforming loans increased by 1 percentage point between June and October 2011, reaching 14.4%, which embarrass availability of financing the real economy. In June 2011, our net non-performing loan portfolio from Poland (8.7%), Hungary (8.5%) and Czech (6.4%).

3. CONCLUSIONS:

Romania ranks 13th in top 35 most attractive countries for investors in renewable energy sector, before the Netherlands, Japan and Denmark, according to Ernst & Young. Sectors of interest to investors are the oil, steel, electrical and electronic, pharmaceutical and neglected agriculture.

Currently, short-term focus on investment in industries that create jobs in order to create preconditions for wellbeing.

Long-term vision but the Romanian economy's competitiveness is a complex subject that I addressed in the National Competitiveness Council meetings (CoNaCo) dialog with our partners in academia, public and private. Creative industries have been identified as another major focus of Romania's development in this decade.

The world economy is entering a new stage of development more dynamic and creative. It is certain that the new economy will be a creative decade. Romania has the advantage of human resources to be part of this wave. Human capital position us among the richest countries in terms of ingenuity and creativity. A country can not develop the routine, but based on creative ideas. If Romanians can boast of something, that's creativity. Nobody can deny or minimize this advantage!

Issues that should be taken into account are:

- Competitiveness, driven by increasing productivity without losing jobs, and economic integrity;
- Competence and integrity among political candidates in the election campaign will be included regardless of their political - or do not see how you could be avoided the trap of populism in a fierce electoral race;
- Righteous judgment in court.

In short, judgment and performance in key areas of social life.

Much of our efforts can fails if we fail to change the mentality of civil servants. Incompetence, detachment and lack of immediate reactions to keep up with political will and citizens, with our political and economic objectives, no longer find their place in a competitive economy.

It would be great to have the media not to cultivate public ignorance, but the high quality of public debate. Catastrophic or hesitant approaches, even when in the service of the opposition, no longer justified. In fact do nothing to undermine the most important ingredient of economic growth: confidence. Investor confidence and trust employees.

Together, with all we can fulfill the promise of prosperity for Romanian!

4. BIBLIOGRAPHY:

1. Apostol, D. (2009) *Crisis, Fifth powers*, Bucharest, Publishing House legal
2. Buffett, W (2010), *Economic crisis and its prophecies*, Bucharest, Lier, 2010;
3. Canton, J. (2010) *Future Challenges*, Bucharest, Polirom;
4. Daianu, D, (2009) Capitalism way?, Bucharest, Polirom;
5. Daianu, D, (2009) *Coping with financial crisis*, Bucharest, Rosetti Educational Publishing;
6. Gheorghiu, A (2011), *Economic and financial analysis at the microeconomic level*, Bucharest, Publishing House
7. Lybeck, Johan A (2012), *History of global financial crisis (2007-2010)*, Bucharest, Polirom
8. August. Peicuti, C, (2012), *World in crisis. System errors*, Bucharest, Polirom
9. Roman, C, Mosteanu, T (2011), *Public Finance institutions*, Bucharest: Economic
10. Radulescu, A, article published on the website, http://profitbursier.ro/Raport-macroeconomic-mondial-martie-2012.html, accessed on 21.04.2012,
11. Smith, A, (2009), *The Wealth of Nations*, Bucharest: Public
12. http://www.andreeavass.ro/blog/2012/01, January 2012, accessed on 25.04.2012
13. http://www.mf.gov.md/common/middlecost/CCTM2014/01.08.11/Anexa_1macro.p
14. http://www.mfinante.ro Section finaicare report and economic analysis, and strategies and programs accessed on 25.04.2012
15. Processing of PNR data on NIS and NBR. accessed on 25.04.2012
16. National Prognosis Commission http://www.immoss.ro/usr/casete/70/indic-macro-2010-2011.pdf, accessed on 25.04.2012
17. Preliminary Forecast of macroeconomic indicators for the years 2013 - 2015, accessed on 25.04.2012
18. http://www.wall-street.ro/tag/indicatori-macroeconomici.html, accessed on 25.04.2012
19. http://discutii.mfinante.ro/static/10/Mfp/pdc/Programconvergenta_ro.pdf, accessed on 25.04.2012

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

INTERNAL/MANAGERIAL CONTROL – SUBJECT OF THE PUBLIC INTERNAL AUDIT

Sebastian FLOŞTOIU

"*Alexandru Ioan Cuza*" University of Iaşi, România
Faculty of Economics and Business Administration
Telephone number: 0722294739; e-mail: sebitic@yahoo.com

Abstract: *The current article is intended to be a synthetic presentation of a comparison between the internal/managerial control and public internal audit, in an attempt to comprise similarities and differences, based on the premise that both functions used by the manager have the same general objective, namely the attainment of the entity's goals under conditions of economization, efficiency and effectiveness.*

Keywords: audit, internal control, public institutions, risk management

1.INTRODUCTION

We began our approach from the finding that, unfortunately, in current practice, the confusion between the concepts of internal control and internal audit still persists among military organizations. This confusion has been fueled by the frequent use of the term internal control instead of audit, and vice-versa, which introduced the idea that the two concepts are similar. Dealing with the persistence of such contradictory realities, Jacques Renard, in his book entitled "*The Theory and Practice of Internal Audit*" (p. 15), formulated the following explanations which we share in full, namely: *on the one hand, the audit is suffering from an excess of media coverage of the term "audit", and, on the other hand, internal audit is not always and everywhere called internal audit, being confused with terms like "inspection", "financial control", "internal verification", and "internal control".*

Therefore, even though both activities include elements that make them similar, there are more features that differentiate them from the point of view of the concepts, the legal framework, the organization, the methodology, the use of findings and the way of reporting within the public entities.

2 DEFINING INTERNAL / MANAGERIAL CONTROL

The Romanian expression "control intern" derives from the English term "internal control", which received the most inappropriate translation, as it was not taken into account that, for the Anglo-Saxons, "to control" mainly means, "to own the control / to keep under control", and only secondarily "to check". In Latin countries it is exactly the opposite way. Consequently, the meaning of the expression "internal control" being much wider, it cannot be assimilated to a form of traditional inspection, verification or control, but it does not exclude it either. Therefore, in its widest acceptation, internal control is the

answer to the question "what can there be done to keep the best control of the activities?"

After the transition to the market economy, the control activities were fundamentally reorganized, and, step by step, there was a switch to a new system of control having a new basis and new tasks, a system which was flexible and efficient, focused on the risks for the institution and in support of the management. Thus, "since 1999, the following have been introduced in the Romanian control system by law: the concept of internal control and the concept of internal audit only for public institutions, which has imposed the need for the clarification of the concepts and practices in the field. Through this law, internal control is proposed in a European manner, meaning that only its general and specific functions are provided, the way of organization and exercise being settled by the general management of the public institution "[4].

The organization of the system of internal control is the task of the management of the institution which updates it continuously according to the evolving risks and the emergence of new situations within the institution. It has been gradually understood that internal control is a process and not a function and each activity must have its control component, which helps it be effective. Lately, the "control has evolved, and is still evolving, through continuous improvement of the organization and the management systems, as well as of the environment in which they work and which, in turn, is in continuous motion"[4].

The general objectives of the internal control are the following: to achieve, at an appropriate level of quality, the goals of the public institutions in accordance with their own mission, under conditions of regularity, efficiency, economization and efficacy; to safeguard public funds against losses due to error, waste, abuse or fraud; to respect the law, the regulations and the management decisions; to develop and to maintain some systems for the collection, storage, processing, updating and dissemination of financial and management data and information, as well as some systems and procedures for information.

The internal control, regarded as a manager's activity, is a dynamic process, permanently adapting its tools and techniques to the cultural changes of the institution which are determined by the level of the competence of managers. It is not an end in itself, but a means created to support management processes through the use of specific procedures, techniques, and tools.

In accordance with the normative acts in force, internal control should be organized for each activity and must be made clear in formal written procedures, in the job descriptions, as well as in the regulations for the organization and functioning of the institution.

The activities through which the objectives (general, individual, and derived) are attained are transformed into tasks (basic components), responsibilities and functions (aggregate components) and are assigned to be carried out by the structural components of the public entity (positions and departments). This leads to the definition of an organizational structure which is appropriate to the objectives. The managerial control cannot operate in the absence of a plan and an organizational structure.[19]

The activities that are carried out in an institution can be divided into two categories from a procedural point of view: the procedure of execution and the procedure of management.

The execution procedure focuses on fulfilling the functional duties of the institution according to its established mission, while the management procedure focuses on managing the execution procedure well and on reaching the main aim of the institution. At the same time, the management procedure ensures the functioning of the institution and its success in the external environment, by using most of the management functions for: predicting, organizing, commanding, coordinating and controlling. Life has shown that managers do not think the same way, which also causes different attitudes in tackling and solving problems. There may be so big behavioral differences in management that the consequences of the attitudes can lead to totally different views on management.

Along with governance and risk management, internal control is the third component of the governance of institutions. Good governance depends on risk management to understand the problems faced by the institution and by internal control in order to achieve its objectives.

The general requirements of internal control relate to: ensuring the fulfillment of the general objectives through systematic evaluation and maintenance at a level acceptable to the risks associated with structures, programmes, projects and operations; ensuring a cooperative attitude of the management and execution staff, the staff having the obligation to resolve requests of the management at any time and to entirely support the internal control; ensuring the integrity and competence of the management staff, their knowledge and understanding of the importance and role of the internal control; establishing the specific objectives of the internal control, so that they can be appropriate, comprehensive, reasonable and integrated to the mission of the institution and within its overall objectives; continuous supervision of activities by the management staff and the materialization of the obligation of the staff to act correctively, promptly and responsibly whenever there are infringements of the legality and regularity which apply to carrying out operations or activities at high costs, ineffectively or inefficiently.

The requirements specific to internal control relate to: the mentioning, in written documents, of the organization of the internal control, of all the operations of the institution and of all significant events, as well as the recording and preservation of the documents in an appropriate manner so that they are available at any time to be examined by those in power; immediate and correct registering of all significant operations and events; ensuring approval and conduct of operations only by individuals with special training for these purposes; sharing the responsibilities for the conduct of operations by the same people, so that the approval, the control and the registration are appropriately assigned to different individuals; ensuring competent leadership at all levels; the use of resources and documents only by responsible and authorized individuals; the safety of resources and documents. The literature in the field reveals five functions of management, which is also regarded as the art of leadership. They are the following: predicting, programming-organizing, coordination, command-training and control.

The essential elements of the control in any institution are the following: purpose, engagement, monitoring, and learning. The control is made up of the elements of an institution, i.e. the resources, the systems, the procedures, the culture, the structure and the tasks, all of these collectively helping the people and fulfilling its objectives. The following concepts are important in understanding the nature of the control:

- the control is achieved by people from across the entire institution, including the board of directors, the management staff and other personnel (the individuals are responsible for the design, implementation, monitoring and protection of the control, which depend on many organizational factors that influence their behavior and motivation);
- the people who are responsible, individually or in a team, for the reaching of the objectives must also be responsible for the effectiveness of the control contributing to the attainment of these objectives (those people, managers or not, have a duty to assess the effectiveness of the control in terms of the tasks, the team or the unit for which they are responsible, as well as to communicate the

results of these assessments of individuals whom they must report to);

- the institutions are in a constant process of interaction and adaptation. To achieve effectiveness of the control, its elements within an institution must correspond to the objective; they must be consistent and systematically updated. This means that, if we want to change a particular aspect of the institution, we must also take into account what the consequences on the control would be;
- the control needs to provide reasonable assurance, not absolute assurance. Even when evidence of prudence and understanding is given, absolute assurance is not possible for two reasons, namely:

✓firstly, there are inherent limits of the control which refer to the possibility of the appearance of errors of judgment in decision making, the malfunctioning due to human errors, secret agreements between personnel which may lead to failure of the control activities or can make the management staff to pass over the control. Control may reduce the number of errors and failures, but can provide absolute assurance that there will be none of them;

✓secondly, we can and must take into account the cost-benefit balance when creating the control within the institution. The cost of the control must be judged in relation to the benefits, including the decrease of the risks involved. The decisions made when creating the control require the acceptance of certain levels of risks. Not even results or actions can be predicted for sure.

The assessment of the control necessarily involves an analysis, even if partial, of the administration of an institution. However, the control is not the only element of the administration of an institution and that is why it does not recommend the objectives to be settled but it favors the reliability in reaching them as it follows: it ensures the individuals responsible for monitoring and decision-making that they have accurate and reliable information which allows them to track the results of the actions or of the decisions and to report them; it does not interfere with making strategic and operational decisions which will later turn out to be wrong because the decisions related to the course of action and to the way of taking action are administrative aspects, which are not part of the control.

3.DEFINING INTERNAL AUDIT

In 1941, *J. B. Thurston*, the first president of the International Institute of Internal Auditors, amazingly foresaw that the most brilliant prospect of internal audit would be *"the management assistance"*. In 1991, *Joseph j. Mossis* – the president of the Institute of Internal Auditors of the United Kingdom - made the same remark, but in more precise words: *"it is clear to those who work as Internal Auditors that Internal Audit has a vital role to play, as it helps the management to take the reins of the internal control."* [8]

Before the concept of internal audit gained stability, several definitions of it had succeeded each other throughout time.

The official definition of internal audit was adopted by I.I.A. in June 1999 and is as follows:

"The internal audit is an independent and objective activity which ensures the level of control an organization holds over operations, which guides it in improving operations and that contributes to adding extra value.

The internal audit helps the organization to attain the objectives by assessing, through a systematic and methodical approach, its processes of risk management, control and management of the enterprise, at the same time making proposals to enhance effectiveness" [8].

Additionally, the professional norms developed by IFACI (the International Federation of Automatic Control), define the internal audit as "*an independent and objective activity which ensures the level of control an organization holds over operations, which guides it in improving operations and that contributes to adding a plus of value"* [6].

In our country, at a first stage, the internal audit was defined by Law 672 of 2002 as *"a functionally independent and objective activity which offers assurance and counseling to the*

management staff for the proper management of public revenue and expenditure while perfecting the activities of the public entity; it helps the public entity to carry out its objectives through a systematic and methodical approach which assesses and improves the efficiency and effectiveness of the management system based on risk management, control and administration procedures".

Later on, through the amendments by Law 191 of 2011, public internal audit is redefined for achieving coordination with international standards as follows: *"functionally independent and objective activity with the purpose of assurance and counseling and designed to add value and improve the activities of the public entity; it helps the public entity to fulfill its objectives, through a systematic and methodical approach, it assesses and improves the efficiency and the effectiveness of the risk management, of the control and of the governance procedures".*

Within the new approach, one can identify the basic direction of action of the internal public audit:

- assurance and counseling;
- adding value and improving the entity's activities;
- helps the entity to fulfill its objectives;
- improves the effectiveness and the efficiency of the risk management, of the control and of the governance procedures

This new approach expands the competence of the audit function on all the activities of the audited entity, but, at the same time, raises issues of competence and credibility of the auditors in carrying out the tasks.

This way, the function of audit is at the highest level of the entity - in *the area of management and governance*. This positioning creates special expectations from the audited entity in terms of support for achieving the objectives. The function of *"error hunter"* of the audit can no longer be accepted as it must make its own contribution to attaining the objectives of the entity.

At the same time, the former action limitations induced by Law 672 of 2002 have disappeared. Law 672 of 2002 regards *"the proper administration of public revenue and expenditures, which perfects the activities of the public entity."*

The internal auditors and the manager must be considered partners and not adversaries, as they have the same objectives, including the effectiveness of management and to reaching the proposed targets. The managers must understand the recommendations of the auditors and welcome the aid they receive for the mastery of the continuously occurring and evolving risks. [5]

The way of organizing and functioning of the public internal audit includes both regularity (compliance) and quality, aiming at the functioning of the systems of management and of internal control as well as their performance (system audit and performance audit).

Additionally, according to the standards of the internal control, the internal audit involves three main activities for the proper understanding of its own function:

- the internal audit provides independent and objective assessment of the internal control system of the public entity;
- the internal auditor completes his actions through audit reports, which list the weaknesses identified in the system and make recommendations for overcoming them;
- the director/the manager has the necessary measures, in the light of the recommendations of the internal audit reports, to eliminate the weaknesses detected through the auditing missions.

4.THE RELATIONSHIP BETWEEN THE PUBLIC INTERNAL AUDIT AND THE INTERNAL/MANAGERIAL CONTROL

The internal control and the internal audit activities are two activities which approach totally different procedures and which include elements that make them similar but also differentiate them. The standards of good practice in the field highlight that each employee with internal control duties is responsible for his own internal control within the institution. The responsibility is to the management staff that has organized and implemented the control. To this respect, "internal control is found in the internal structure of each management function, of each activity and is the responsibility of each employee. Therefore, the organization of a distinct department within the institution is not recommended.

Besides own internal control, the management has other control responsibilities which can evolve, decrease or develop according to the risks existing in the department that coordinates it. [5]

The internal audit is intended "to assess and ensure the management regarding the level of functionality of the system of internal control, separately, on each form of its manifestation. [4] "If the original purpose of the audit was the detection of fraud, it has evolved in time so that it currently represents the functionally independent and objective activity of assurance and counseling of the manager of the public institution for proper risk management, internal control and management processes, but it does not assume managerial responsibility[7].

Internal audit and control activities within public entities are related to their management - the process of achieving organizational objectives through engaging and involving the four main functions: planning, organizing, training and motivating, and control. Both activities are organized and conducted in public entities, including public authorities, public institutions, national companies or societies, autonomous public entities and commercial societies in which the state or an administrative-territorial unit is the major shareholder.

Unlike the internal control, the internal audit is an independent activity for objective assurance and counseling intended to add value and contribute to the improvement of the business of an entity, by supporting its objectives in a systematic and orderly approach to the assessment of the processes of risk management of control and governance.

The internal audit, unlike the internal control, is organized as a distinct structure subordinated to the general manager of the entity, being part of the functions of the enterprise.

A synthetic parallel between internal control and internal audit may be the following:

- *The internal control is integrated in the organization, while the internal audit is an independent structure;*
- *If the internal audit is organized at the highest level of the organization's management, the internal control is organized at each level of management;*
- *The internal control is a continuous process while the internal audit is a planned mission;*
- *The internal control states findings, settles responsibilities and watches over the improvement of findings, while the public internal audit states findings and issues recommendations and conclusions;*
- *The findings of the internal control are mandatory unlike the recommendations of the audit, which are optional ;*
- *If the results of the control are reported to the hierarchical superior and not to the highest level of management, the public internal audit has got its own way of reporting to the highest level of management.*

5. CONCLUSION

In conclusion we can say that the audit is not a type of control "disguised" in a different, more modern form. Its role is to be a

correction factor for the adjustments required by the evolution of the entity, so as to ensure organizational efficiency.

The ultimate objective of the audit is to identify results and recommend solutions based on feedback from staff and managers. The audit also involves a systematic examination of the practices and policies implemented in an organization in order to highlight the gap between "**what is being done**" and "**what is necessary to be done**" This is achieved by identifying weak and strong points, as well as by identifying areas that you can improve.

It can also be concluded that the implementation of the control system within the institutions of the Ministry of Defense is the responsibility of the management of the institution, and that the monitoring of the functioning and the efficiency of the system is the task of the internal audit. Internal auditors and managers must be regarded as partners, not as opponents, because they have the same goals, including the effectiveness of management in order to achieve the proposed aims in terms of performance.

The internal audit will attain its objectives only if the system of internal control is well-organized, formalized and periodic, but also endowed with the most complete standards, procedures, guidelines and codes of professional conduct (not ethical codes). These are meant to support the audit morality, taking into account that the auditor must not be subject to any suspicion. The internal audit is considered to be the last level of the internal control system of the institution. It does not carry out activities or inspections, but it evaluates the internal control system and provides the general management with a perspective on its functionality within the institution.

REFERENCES

1. Crăciun Şt., *The Internal Audit*, The Economics Publishing House, Bucharest , 2006;
2. Dascălu E., Nicolae F., *The Internal Audit in the Public Institutions,* The Economics Publishing House, Bucharest, 2006;
3. Ghită E., *Public Internal Audit*, Sitech Publishing House, Craiova, 2007;
4. Ghiţă M., *The Internal Audit*, The Economics Publishing House, Bucharest, 2004;
5. Ghiţă M, *The Internal Audit,* Second edition, The Economics Publishing House, 2009
6. A. Gisberto, C.Ioanăş, *The Audit in the Public Institutions*, CECCAR Publishing House, Bucharest, 2005
7. Morariu A., Suciu Gh., Stoian F., *The Internal Audit and the Corporation Governance,* the Publishing House of the University , Bucharest, 2008;
8. Renard J., *Theory and Practice of the Internal Audit*, the Publishing House of the Organization, Paris, France, 2002, translated into Romanian through a PHARE project, under the coordination of the Ministry of Public Finance, Bucharest;
9. Robert de Koning, Bugd D. G., *Compendium of PIFC: Internal Audit Legislation in applicant countries*, European Commission, 2002;
10. *** The *Audit of Performance. Guidelines*, The Court of Auditors of Romania, Bucharest, 2003;
11. *** *Law no. 672 of 2002 regarding the public internal audit*, published in

Official Monitor no. 953 of December 24, 2002;
12. *** *Financial Audit and Regularity Handbook*, The Court of Auditors of Romania, Bucharest, 2003;
13. *** *Basic Norms of Audit,* The Economics Publishing House, Bucharest, 2001;
14. ****Order of the Minister of Public Finance no. 1702 of November 14, 2005* - Norms regarding the organization and exercise of the counseling activity performed by the auditors within public entities;
15. *** *Order of the Minister of Public Finance* no. *252 of 2004* for the approval of the Code regarding the ethical behavior of the internal auditor;
16. *** *Order of the Minister of Public Finance* no. *423 of March 15, 2004* regarding the amendment of and the additions to The General Norms regarding the exercise of public internal audit activities;
17. *** *Government Ordinance no.37 of January 1, 2004* for amending and adding to the regulations regarding the internal audit;
18. *** *Law no. 672 of 2002* regarding the public internal audit, Official Monitor no. 953 of 2002;
19. *** *Order of the Minister of Public Finance* no. *946 of 2005* for the approval of the Code of Internal Audit, including the internal management/control standards for public entities, and for the development of managerial control systems, Official Monitor no. 675 of 2005, amended and completed through Order of the Minister of Public Finance no. 1389 of 2006, Official Monitor no.771 of 2006;
20. *** *International Standards of Audit, 2005* - www.cafr.ro;
21. *** http://www.actrus.ro/biblioteca/cursuri/finante/mare/a2.pdf;
22. ******* http://www.ifaci.com;
23. ******* http://www.tribunaeconomica.ro.
24. *** http://www.presamil.ro.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

TOOLS AND TECHNIQUES USED FOR PERFORMANCE EVALUATION OF REVERSE LOGISTICS SYSTEMS

Adriana FOTA*, Adela Eliza DUMITRASCU*, Sorin Adrian BARABAS*, Flavius Aurelian SARBU*

*Faculty of Technological Engineering and Industrial Management, Transilvania University of Brasov, Brasov, Romania

Abstract: *This paper presents the main matters of Reverse Logistics as the modern tool used in enterprise management. It is very important to understand the power of Reverse Logistics, because nowadays traditional logistics are not enough in dealing with all the environmental problems companies are facing. Also, you will read about the contribution of Reverse Logistics and supply chain competitiveness, delivery and customer satisfaction, modern techniques and management strategy flows and functional integration within enterprises, and between enterprises. The purpose of quality management systems in Reverse Logistics is to systematically improve the quality of products and business operations through continuous refinement. A quality management system has been established and put into practice according to documented procedures, and based on practical results. In this manner is obtained the system effectiveness.*

Keywords: *reverse logistics, management, systems*

1. INTRODUCTION

Reverse Logistics is defined as "the set of logistics management skills and activities involved in reducing, managing, and disposing of hazardous waste from packaging and production", [4]. It includes reverse distribution, which causes goods and information to flow in the opposite direction compared to normal logistic activities. From a commercial perspective, Reverse Logistics is the process of moving products from their typical final destination to another point, for the purpose of capturing value otherwise unavailable, or for the proper disposal of the products.

The evolution of Reverse Logistics for manufactured products is developing proportionally with the rapid advancements in technology as well as with the subsequent product price erosion, as new and improved products enter the supply chain at a faster pace, [1, 3].

As technology and features improved, price and demand for aging products diminished, as did the ability to recoup costs from returns. Speed to return to market could be measured in resale value.

The strategic objectives in the field of quality are maintaining and continuing the improvement of the Quality Management System (QMS) in accordance with the ISO 9001:2008 quality standards requirements, in all domains of activity, [5]. The increasingly competitive environment requires companies to review, restructure and redirect activities in order to obtain the competitive advantage.

Reverse Logistics, through its activities, is vital in creating such an advantage. If it is seen as a strategic resource, not only as a simple task, it can positively influence the market share and enterprise profitability. Logistics must be seen in context of the evolution of the international business environment. As the awareness of the importance of logistics for a competent organization has increased, so did the need to acquire in-depth knowledge in the field of Reverse Logistics.

2. REVERSE LOGISTICS PROCESS

2.1 Returns planning process

Reverse Logistics, a fairly new concept in logistics, has gained increasing importance as a profitable and sustainable business strategy. The strategic factors consist of strategic costs, overall quality, customer service, environmental concerns, and legislative concerns. The operational factors consist of cost-benefit analysis, transportation, warehousing, supply management, remanufacturing and recycling, and packaging. Insights about these factors together form the state-of-the-art knowledge about the keys to successful design and use of Reverse Logistics systems.

Today, logistics have gone from the so-called traditional approach, focusing on targeting the point of consumption, to addressing the reverse flow and storage (Reverse Logistics) which arise at the point of consumption. The modern concept of logistics covers all activities in the supply- delivery chain until products return - Reverse Logistics. Reverse Logistics should receive increasing attention now that we see the increasing profitability of online purchases. Another aspect to be emphasized is the flow of information which needs to be integrated with the physical flows. Given the multitude of definitions and the experience of the successful firms, logistics, or logistics management, include the following activities: customer service; command process and batch delivery preparation; information distribution; supply forecasting; control and stocks inventory; transportation, storage, raw materials and services acquisition; aftermarket services, packaging, and goods return (Reverse Logistics), [4, 2].

Reverse Logistics is a process in which a manufacturer systematically accepts previously shipped products or parts from the point for consumption for possible recycling, remanufacturing, or disposal. A Reverse Logistics system incorporates a supply chain that has been redesigned to manage the flow of products or parts destined for remanufacturing, recycling, or disposal and to use resources effectively. Reverse Logistics has received a great deal of attention from operations managers and company executives. The effective use of Reverse Logistics can help a firm to compete in its industry, especially when confronting intense competition and low profit margins. The outputs of marketing logistics include not only the distribution (the movement of goods from factory to intermediaries, vendors, and ultimately, to customers), distribution of inputs (the movement of goods and materials from suppliers to the factory), but the reverse distribution (the movement of goods damaged, unwanted or excess, returned by customers or intermediaries). Regardless of whether the product is old or new, the customer will request either an exchange or a refund. An advantage of planned-returns is that it is much easier for the organization to know what is coming back. Developing a comprehensive and cost-effective approach to handling returns is a daunting challenge that reaches well beyond the operational level. Thus, a well-developed Reverse Logistics and management plan can be a vital strategic asset.

The management staff of any organization considers all aspects of Reverse Logistics, including (Figure 1):

- Returns management authorization;
- Collection of products;
- Defect screening;
- Re-flashing and reconfiguration;
- Track and traceability;
- Reassembly and repack;
- Supplier returns and credit.

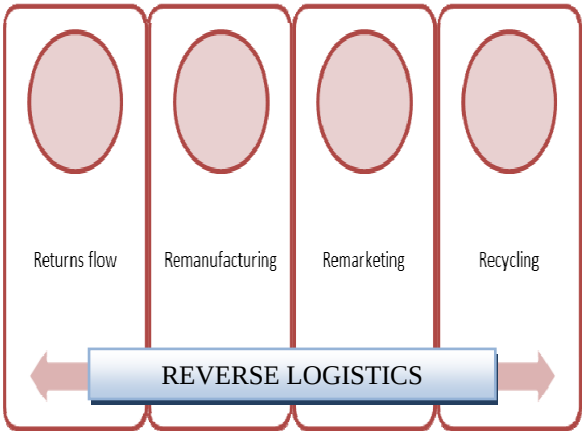


Fig. 1 Reverse logistics process

2.2 Reverse logistics cost. Reverse Logistics programs include: customer retention or satisfaction; container reuse, recycling, damaged materials returns, asset recovery or restock, downstream excess inventory, hazardous material programs, tracking obsolete equipment and recalls. The trade literature has especially touted Reverse Logistics as a primary method of improving efficiency and reducing costs in the for-profit arena.

Reverse Logistics strategy for end-of-life product take-back models were also developed to allow the user to determinate the optimal amount to spend on buy-back and the optimal unit cost of Reverse Logistics. Companies focusing on their core competencies are reluctant to pursue Reverse Logistics strategies and traditionally use third-party providers.

Many companies do not have an awareness of the current costs associated with Reverse Logistics. The reasons for this may include poorly defined processes and lack of system support. Due to the variable nature of returns, both processes and systems must maintain a degree of flexibility to manage the returns process.

In many companies, the cost of logistics activities reaches and exceeds 20% of the total cost of production, fact which could transform logistics into important source of costs. Logistics costs reduction can be made only by ensuring an effective and efficient relation between the service level for consumers and costs. The goal is to create logistics supply chains, namely physical flows of materials and finished products to end users, with low-cost, knowing that these companies' share in total product cost is 30-40% for processed products, [4].

Leading companies today are recognizing the damage that hidden costs of Reverse Logistics are having on their profitability. Increased profits and excellence in the returns management process is found once companies focus on Reverse Logistics. With a logistics team ''thinking in reverse'' and the process automated at the industrial level, an effective Reverse Logistics operation offers a significant opportunity to recover returned goods and money that can dramatically impact the bottom-line of a company of any size and structure.

The areas of hidden labor cost include: customer relations, customer service, finance, traffic and shipping, receiving and warehousing and asset management.
Descriptive statistics were collected for two response variables: average inventories and lost sales. These two response variables are chosen as performance measures for cost, and therefore simplifying the need for a cost objective function. The assumption is that significant reduction in average inventory is a reduction in holding costs and a significant reduction in lost sales also represents a reduction in the lost sales cost. Economic incentives to stimulate/enforce the acquisition or withdrawal of products for recovery are:

Buy back options. Numerous examples of buy back options for unused products are presented in literature. At the moment when a product is sold, the buyer is offered the possibility to sell the product to the seller for a preset price when the product meets some preset requirements at the moment of return which either is based on the use of the product, like kilometers driven, or based on expected possibilities for selling the returned product via a preset last moment of return, for which the option holds.

Costs. This value is paid when a person delivers a product for recovery. Usually the cost depends on the condition and configuration of the product delivered, but sometimes also on the moment when a product is delivered because this may determine the possibilities to reuse it. Well-know examples of companies using fees to simulate the acquisition of products for recovery are car brokers and ''second hand'' shops. Some retailers may take advantage by returning goods to manufacturers for credit in order to enhance their cash flow position. Customer returns are driven by customers taking goods back for exchange, credit or refund.

Reduced new price. A buyer gets a reduction on a similar or different product when he or she delivers a used product fulfilling certain requirements during a certain period of time. A well known example are car dealers, offering a higher refund depending on what is delivered and what is asked for by other potential customers of the dealer. The majority of the transportation costs incurred result from transporting the goods back to suppliers. At a store level, there is no budget to deal with an operation based on the level of sales and therefore there is a potential dysfunctional effect associated with returns since no allowance is made for dealing with return.

2.3 Quality management systems in reverse logistics. A company that holds ISO 9001:2008 certifications tells its customers and the world that it has a top QMS and is totally committed to quality products and services, [5]. Companies that go through the process find that profits increase thanks to opening up market opportunities. Moreover, costs decrease due to improved efficiency. The control operation of the materials flow and information from the retailer back to the warehouse is an essential process for any organization. The supply chain system according to ISO 9001 will improve the quality services to customers. The quality management system (QMS) is ensuring, in detail, that all work required for concept design, development (application consultancy), structural design, procurement, production, sales, delivery, service, and disposal is correctly put on record and carried out in compliance with the given stipulations. As is shown in detail in the ISO 9001:2008 requirements for implementing an efficient and effective quality management system, mainly refer to a range of issues such as purchasing, production, delivery, post-delivery, service.

A QMS for any organization is more vital than a customer's perception of quality because of the intimate relationship it has to every aspect of the business, yet it is constantly given second class treatment with external and manufacturing processes taking precedent in a crowded environment of scarce resource.

3. REVERSE LOGISTICS SYSTEMS EVALUATION

Performance evaluation of a Reverse Logistics systems based on a series of tools and methods that aim to:

- Minimize the total logistics cost;
- A more accurate approximation of the delivery process during the estimated time;
- Monitor and minimize the costs of returns processing;
- Cost reduction of acquisition and transportation for returns product;
- Minimize the total recycling time;
- Total resale revenue; Profitable fees for processing;
- High level of customer satisfaction.

In the following subchapters are detailed several methods used for Reverse Logistics systems evaluation.

3.1 Sensitivity analysis. Sensitivity analysis, which refers to the study of how important results change with changes in estimates, is a "what-if" technique that looks at how a result will be hanged if assumptions change or original estimates are not achieved. It is applicable in any analytical technique involving uncertainty in their underlying assumptions. It is recognized as an aid for validating the model and for identifying model improvement possibilities. Sensitivity analysis may be carried out numerically or by differentiation.

Numerical sensitivity analysis can either be displayed as an absolute amount, or as a percentage of changes from the base estimates, or both. Sensitivity analysis is a method that aims to assess how the output of the model is influenced by changes in input variables. "Sensitivity" or model response to different levels of variability of input variables is emphasized, usually by two graphical methods, namely: "Spider" diagram; "Tornado" diagram.

For "*spider" diagram* it consider first the change in values for each random variable x_i x_i, with λ a certain ratio in minus, and in addition to the nominal values, the variation that can be expressed as a percentage.

The matrix follows the variation of input values, like (1), (2), (3). A "Spider" diagram is obtained by a linear graph representing the values matrix *VF*. Figure 1 is a "spider" diagram in which $\lambda = 10\%$ and $l = 5$. One has therefore obtained a variation of the values of the input variables of $\pm 50\%, \pm 40\%, \pm 30\%, \pm 20\%, \pm 10\%$ compared to nominal values (100%).

From Figure 1 one can see that the variables with the increasing trend (V2 and V1) have a direct impact (or a positive impact) on the final variable of the model, meaning their increase determines the increase of the value of the final variable, where the variables with the decreasing values (V4 and V3) have an indirect impact (or negative impact) on the final variable of the model, meaning their increase determined the decrease of the values of the final variable, in vice-versa. At the same time, one can notice a higher, direct impact of variable V1 and the accentuated, indirect impact of variable V3.

$$VI = \begin{bmatrix} l(1-\lambda)v_{k+1} & (l-1)(1-\lambda)v_{k+1} & \dots & (1-\lambda)v_{k+1} & v_{k+1} & (1+\lambda)v_{k+1} & \dots & (l-1)(1+\lambda)v_{k+1} & l(1+\lambda)v_{k+1} \\ l(1-\lambda)v_{k+2} & (l-1)(1-\lambda)v_{k+2} & \dots & (1-\lambda)v_{k+2} & v_{k+2} & (1+\lambda)v_{k+2} & \dots & (l-1)(1+\lambda)v_{k+2} & l(1+\lambda)v_{k+2} \\ \dots & \dots & \dots & \dots & \dots & \dots & \dots & \dots & \dots \\ l(1-\lambda)v_{n} & (l-1)(1-\lambda)v_{n} & \dots & (1-\lambda)v_{n} & v_{n} & (1+\lambda)v_{n} & \dots & (l-1)(1+\lambda)v_{n} & l(1+\lambda)v_{n} \end{bmatrix} \quad (1)$$

$$VF = \begin{bmatrix} vf_{k+1;l(1-\lambda)} & vf_{k+1;(l-1)(1-\lambda)} & \dots & vf_{k+1;(1-\lambda)} & vf & vf_{k+1;(1+\lambda)} & \dots & vf_{k+1;(l-1)(1+\lambda)} & vf_{k+1;l(1+\lambda)} \\ vf_{k+2;l(1-\lambda)} & vf_{k+2;(l-1)(1-\lambda)} & \dots & vf_{k+2;(1-\lambda)} & vf & vf_{k+2;(1+\lambda)} & \dots & vf_{k+2;(l-1)(1+\lambda)} & vf_{k+2;l(1+\lambda)} \\ \dots & \dots & \dots & \dots & \dots & \dots & \dots & \dots & \dots \\ vf_{n;l(1-\lambda)} & vf_{n;(l-1)(1-\lambda)} & \dots & vf_{n;(1-\lambda)} & vf & vf_{n;(1+\lambda)} & \dots & vf_{n;(l-1)(1+\lambda)} & vf_{n;l(1+\lambda)} \end{bmatrix} \quad (2)$$

$$vf_{j;(l-i)(1\pm\lambda)} = F(v_1,\dots,v_k,v_{k+1},\dots,(l-i)(1\pm\lambda)v_j,\dots,v_n),\ i = 0,1,2,\dots \quad (3)$$

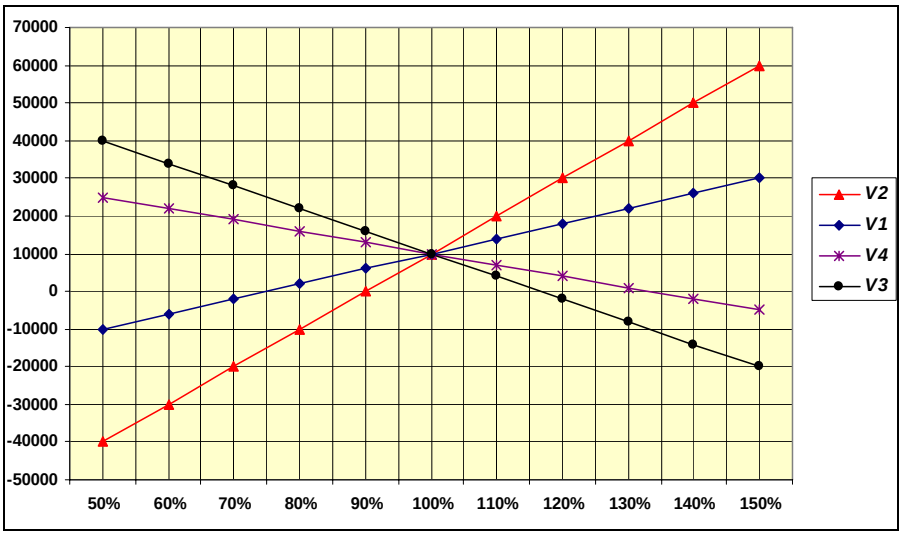


Fig. 2“Spider” diagram

4. CONCLUSIONS

The Reverse Logistics process can have a significant bottom line impact for an organization, and the ability to take advantage of these opportunities may depend on implementation of a proper QMS. Reverse Logistics process presents a lot of advantages, amongst them: a very proper customers service planning; bottom line profits; competitive advantages.

The modern role of Reverse Logistics and materials management requires: qualified collaborators, an efficient integration into the organization’s flow chart, and an interested management team. The process of product return and recycle is efficient when it succeeds in satisfying the customer’s expectations, no matter if we talk about the productive department of the organization or about the end user in a commercial organization. A qualified supply brings an important contribution to the company’s benefits and places the organization’s strategy among its competences.

Organizations have developed such coordination in their logistic chain and reverse logistic system, and they have become models for many managers, willing to improve their organization’s performance and profitability.

REFERENCES

1. Barkera, T. J. and Zabinskya, Z. B., Reverse logistics network design: a conceptual framework for decision making, *International Journal of Sustainable Engineering*, 1(4), pp. 250-260, (2008).
2. Cullen, J., Bernon, M. and Gorst, J., Tools to manage reverse logistics, *Research executive summaries series*, 6(3), pp. 1-8, (2008).
3. Dowlatshhi, S., 2000, “Developing a theory for reverse logistics,” *Interfaces Magazine*, 30(3), pp. 143-155.
4. Militaru, G., Improving reverse logistics operations, *Academic Journal of Manufacturing Engineering Supplement*, 1(3), pp. 84-89 (2007).
5. Standard ISO 9001:2008, *Quality management systems. Requierments*. Asociatia de Standardizare din Romania – ASRO.

ACKNOWLEDGMENT

This work was supported by CNCSIS – UEFISCDI, project number PN II – IDEI code PCE_756 / 2008, no. 641 / 2009.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

TRAINING AS AN IMPORTANT PREREQUISITE FOR THE EFFECTIVE SOLUTION OF CRISIS SITUATION

Viera FRIANOVÁ*

*Department of Management, Armed Forces Academy of General M. R. Štefánik in Liptovský Mikuláš, the Slovak Republic

Abstract: *The article deals with the issues of training of the Armed Forces of the Slovak Republic for the deployment in the disaster and providing assistance to the population during crisis situations arising in the territory of the Slovak Republic. The author's attention is focused in particular on the area of training of professional soldiers in this type of deployment. In the article are also presented the results of empirical research carried out for detection of views and experience of professional soldiers for their readiness to fulfil the tasks of this kind.*

Keywords: *crisis situation, armed forces, training, readiness, survey*

1. INTRODUCTION

As a result of changes in the security environment the significance of the national crisis management is being more and more emphasized in Slovakia. An important and irreplaceable role within the national crisis management is also played by the Slovak Armed Forces (hereinafter referred to as SAF).

The adaptation to the new security environment also means that the SAF have to be involved more in non-combatant operations, e. i. in providing crisis and disaster relief. Experience indicates that the accomplishment of crisis management tasks requires preparation of commanders and headquarters for crisis management as well as preparation of troops for carrying out the tasks related to crisis management throughout the Slovak Republic.

2. PREPARATION OF THE ARMED FORCES FOR NATIONAL CRISIS MANAGEMENT DEPLOYMENT

Activities and issues related to preparation for crisis situations and their management are regulated by the Directives of the Ministry of Defence of the Slovak Republic (hereinafter referred to as MoD). These directives are applicable for the Slovak Armed Forces, the Ministry of Defence of the Slovak Republic, offices and installations of the ministry, non-profit and allowance organizations under the competence of the MoD, military prosecution, organizational elements of the Military Intelligence and Military Police, public enterprises and join stock companies which were founded by the MoD.

Preparation for the crisis management throughout the country requires performance of a number of different activities, such as [5]:

- monitoring and analysing risks and threats which may cause a crisis situation,

- assessment of the security environment in the Slovak Republic,
- coordination of the crisis management tasks with the ministries and other state administration central bodies,
- supporting other control and executive elements of the national crisis management in eliminating security risks and threats,
- providing specialised crisis management training for soldiers and civilian personnel,
- development of crisis management plans,
- coordination of preparation, performance and assessment of crisis management training, etc.

The above-mentioned activities are carried out by individual organizational units of the ministry, depending on their competences.

2.1 TRAINING OF SOLDIERS FOR NATIONAL CRISIS MANAGEMENT DEPLOYMENT

Effective and efficient deployment of the armed forces in non-combatant crisis management operations in the Slovak Republic is dependent upon effective logistic support and adequate technology (available modern and functional armament, technology and material [1], including adequate equipment and suitable protective devices, too) as well as sufficient and adequate readiness of individual members of the SAF.

„When being deployed, the soldiers may face dangerous situations they must be able to face. This, however, is not possible without adequate training. The SAF crisis management deployment experience shows that if the soldier who is deployed is not familiar with the legislature, the research system elements, cooperation principles, protective equipment, safety rules, life threatening objects and dangerous substances, self-protection and self-rescue techniques as well as escape procedures, he may endanger himself, his team as well as health, life and property of the people he is supposed to protect or rescue [2]".

That is why the Chief of the General Staff of the SAF (hereinafter referred to as GS) specified the priority for the training year 2011 the aim of which was to "reinforce readiness and capabilities of the SAF troops assigned to perform the crisis management tasks according to situational plans. These tasks are aimed at providing support to public authorities in crisis management and at monitoring the nuclear and chemical situation"[2]. It is important to [3]: „maintain necessary strength and capabilities of the SAF at the readiness level, which allows them to carry out the national crisis management tasks, including readiness of headquarters to manage these tasks according to situational plans. Performance of these tasks should support public authorities in crisis management and monitoring of nuclear and chemical situation". Following the above-mentioned priority, the Chief of the General Staff issued an ordinance (November 2011) regarding the SAF crisis response operations deployment. This ordinance includes the methodological instructions aimed at unification of processes and activities the SAF members may conduct during their deployment.

2.2 SURVEY OF VIEWS OF PROFESSIONAL SOLDIERS ON THEIR DEPLOYMENT READINESS

The research and development project called "The Potential and Limits of the SAF Logistic Support in Non-Combatant Operations" developed by the Department of Management of the Armed Forces Academy of General Milan Rastislav Štefánik included also a questionnaire survey which was conducted in November 2011. The objective of the questionnaire survey was to find out the professional soldiers' opinion on their deployment readiness. The questionnaire was anonymous so that the respondents could be more candid. It was completed by 106 professional soldiers (89.6% man, 10.4% women) of different appointments and postings from 22 SAF units, offices and installations. The respondents were chosen on purpose. 47% of the respondents (50 professional soldiers) attended the 3-month Junior Command and Staff Officers Course[1],

[1] Note: Course is a part of the SAF officers' lifelong education and is organised by the Lifelong Education

the rest – 53% of the respondents (56 professional soldiers) were members of the Training Battalion Martin[2].

The information obtained from the questionnaire was statistically processed and evaluated by means of descriptive statistics tools in the Microsoft Excel spreadsheet application. The results were presented in text and graphs.

The survey results revealed that up to 54.7% of the respondents have served in the SAF more than 15 years (35.8% from 10 to 15 years, 7.5% from 5 to 10 years and only 1.9% less than 5 years). A sufficiently long period of operation in the SAF creates a presumption for getting rich personal experience that allow the respondents to have not only more professional but also more objective attitude to the researched issue.

Almost 92% of the respondents answered "Yes" to the question whether the crisis response training and disaster relief exercises are necessary for professional soldiers. See Figure 1 for more details.

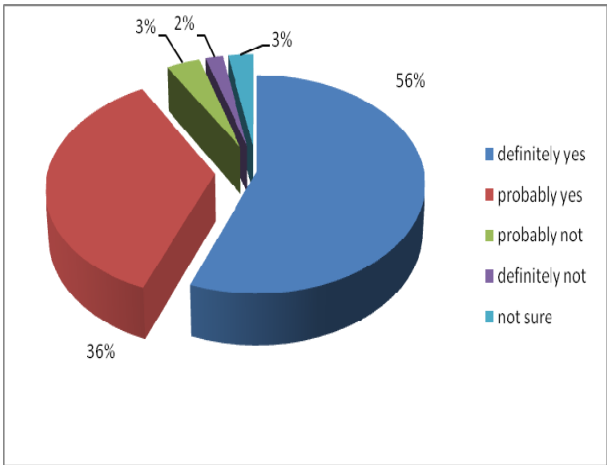


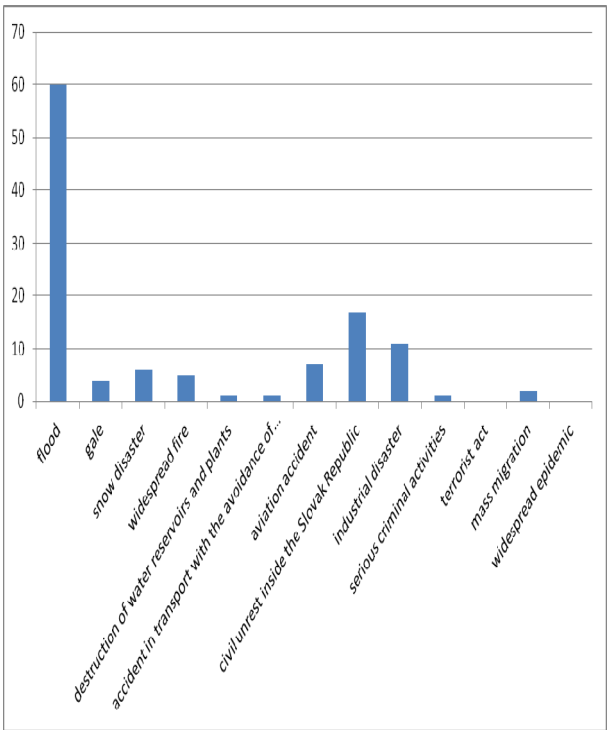
Fig. 1 Is the crisis response training necessary for professional soldiers?

Since we wanted to keep the research results as objective as possible, we decided to obtain the opinions on this issue only from those respondents who already had experience with this kind of deployment. Our set of respondents so narrowed to 69 professional soldiers, who made cca 65% of all respondents. In our next question, we asked the remaining respondents to specify the crisis response operations they have been deployed in. When formulating this question, we followed the crisis typologies presented in specialized literature [4]. Having compared the number of answers, we found out that the professional soldiers are most commonly deployed in disaster relief operations (the most in floods). The survey results revealed that respondents from this sub-group have been assisted in the civil unrest inside the Slovak Republic quite often. Respondents have been deployed in industrial disasters and aviation accidents, too. See Figure 2 for more details.

Fig. 2 The crisis management operations the respondents have been deployed in

Centre at the Armed Forces Academy of Milan Rastislav Štefánik in Liptovský Mikuláš.

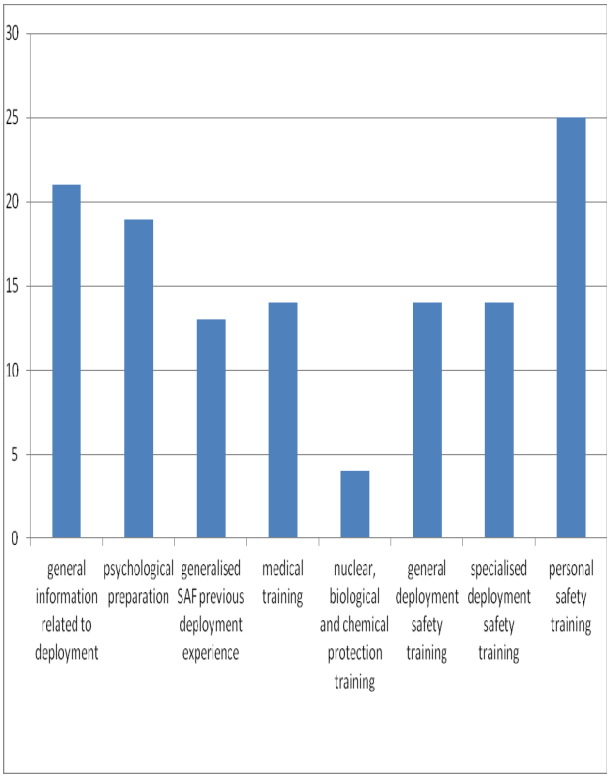
[2] Note: Battalion is a unique body, which carries out all important trainings. It organizes and carries out the initial vocational training of professional soldiers, as well as the specialization courses. Battalion also conducts basic training and further training for non-commissioned career.



According to further research results, only 62.3% of the respondents from this sub-group have completed the disaster relief training.

The research also shows opinions of the respondents on the SAF members` deployment readiness. We suppose that respondents` opinions would be markedly influenced by their personal experience. Only 29% of the respondents think that the SAF members are fully ready for deployment. On the other hand, 37.7% of the respondents stated that they were not fully prepared for deployment and the remaining 33.3% were not able to express their opinion on this issue. In our next question, we asked the respondents to determine the areas in which soldiers are not sufficiently trained (once again, we assumed that the views of interviewed soldiers will be influenced by their personal experience). The respondents mentioned the following areas: personal safety training (e. g. use of protective equipment during rescue operations, self-protection and self-rescue procedures), lack of general information related to deployment of the SAF members in crisis management operations (e. g. knowledge of particular legislative) and insufficient psychological preparation of soldiers. On the other hand, the respondents feel confident and trained enough in the field of nuclear, biological and chemical (NBC) protection. See Figure 3 for more details.

Fig. 3 Areas which the respondents regard as not trained sufficiently



3. CONCLUSIONS

One of the significant factors which have an impact on effectiveness and efficiency of the SAF deployment in non-combatant crisis response operations and disaster relief operations is an adequate preparation for this type of deployment, an inseparable part of which is also training of personnel to be deployed.

The SAF training systems and programmes significantly enable also the SAF crisis response operations training. Despite it, the results of the conducted empirical survey showed that the readiness of professional soldiers for national crisis response operations needs to be improved especially in the personal safety training and the psychological preparation of soldiers. The survey also showed that soldiers suffer from the lack of general information related to deployment. On the other hand, we can be satisfied with the

preparation of soldiers in the field of nuclear, biological and chemical protection.

REFERENCES

1. Kustrová, M. *Modernizácia výzbroje, techniky a materiálu v OS SR. R*. In Armáda a znalostní společnost – AKS 2011: Medzinárodná konferencia BVV Brno. Brno: Univerzita obrany (2011).
2. *Nariadenie náčelníka Generálneho štábu OS SR na vykonávanie výcviku pre nasadenie OS SR pri riešení pomoci obyvateľstvu počas krízových situácií.* [online]. Available: <http://j7.mil.sk/aktualne/nariadenie-na-vykonavanie-vycviku-pre-nasadenie-pri-rieseni-... > (February, 2011).
3. Salaganič, J. *Ozbrojené sily a národný krízový manažment*. In *Doktríny.* [online]. Available: < http://doctrine.vavyskov.cz/2011_1/2011_1_3e.html> (February, 2011).
4. *Sily a prostriedky krízového manažmentu.* [online]. Available: <http://fsi.uniza.sk/kkm/odd/publikacie/km/km_kap4.pdf> (February, 2011).
5. *Smernice Ministerstva obrany Slovenskej republiky č. 39/2009 o príprave na riešenie krízových situácií a o ich riešení*. [online]. Available: <http://ovn.mil.sk/> (February, 2011).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

A MILITARY APPLICATION OF HUMAN CAPITAL MANAGEMENT: MILITARY PILOT TURNOVER

Zeki GULTEKIN, Engin ABDAN, Y. Selim KILIC

*Turkish Air Force Command and Staff College, Istanbul, TURKEY

Abstract: *The issue of employee turnover has been the subject of various theoretical and empirical studies. Employee turnover is intimately related to human capital management. Specific and general training in human capital mostly increases marginal productivity of a worker in any organization. Most of the firms are having difficulties to retain and attract productive and qualified workers.*

From a military aspect, pilot turnover, as a result pilot shortage, emerges as one of the most challenging problems for decision makers. Military pilots are obviously crucial to any mission employing of air power. A poor retention rate for senior pilots, however, is one of the biggest concerns of military organizations. Military invests a considerable amount of money both in human capital and in the training of a pilot. The training of a pilot also takes a substantial amount of time. It is always difficult for the militaries to keep experienced pilots in the service. Experienced pilots frequently separate to fly in the civilian airline sector after their initial commitment period. High attrition rates waste training investments and reduce effectiveness.

It is critical for policy makers to know the reasons for high attrition rates and how they are related to human capital management. Policy decisions may be based on variables that significantly affect retention. In this study, the basic factors affecting the decision of pilots through separation are analyzed. As a theoretical approach, results of other related cases are surveyed and reflected to current study. According to findings both from literature survey and this study, several policy recommendations are presented considering human capital management.

Keywords: *employee turnover, pilot separation, human capital management.*

1. INTRODUCTION

Organizations have begun to recognize human resources as one of the most important issues for competitive advantage. Today, human capital that represents an organization's stock of knowledge, technical skills, creativity, and experience is becoming more and more important. It is considered that the collective attitudes, skills and abilities of employees contribute to development and growth in a similar way to physical assets such as machines and money [1]. So, it is acceptable that organizations invest their resources to acquire, develop, and enhance their stock human capital in order to increase their productivity and so that the income of the organization. Considering human capital as a productive asset, human capital management emerges as one of the most challenging issues for any organization. The success of the organizations, now, depends on their ability to understand how human capital related with their performance and their wealth. The most

competitive organizations applying human capital management well will have the best strategies and methods for attracting, hiring, managing, developing and retaining their human capital. Every environment is unique, that's why, and policy makers need to know how to apply human capital management principles and methods regarding the needs of the organizations At this point, Human Capital Theory helps decision makers to understand employee behaviors within the organizations.

2. HUMAN CAPITAL THEORY AND PROBLEM STATEMENT

Human capital theory assumes that the individual is logical and methodical, and tries to maximize his lifetime earnings by making individual decisions to invest his resources in education. The theory also assumes a link between education, productivity and increases in earnings. Essentially, human capital theory assumes that the stock of human capital is directly correlated to productivity, and the individual worker is compensated for increases in productivity. Since investments in education and training are direct ways to increasing the stock of human capital, the individual will make investment decisions by comparing the costs of those investments to the present value of the increase in income stream they produce. Investments will be undertaken if the present value exceeds the associated costs and the rate of return is greater than that from other available alternatives.

Military organizations invest human capital by giving both general training and specific training. General training refers to basic training that builds skills, which are portable from one organization to another. This form of training is clearly desirable for the employee because it enhances his stock as well as his mobility. Employers need workers who have either received the desired general training from another organization, or will receive it from themselves. For the former, organizations are willing to offer better employment terms to attract them. For the later, the general training is financed by reduced earnings during the training and contractually obligated periods. Consequently, the employer will need to offer improved terms to match other potential employers to retain the services of their trained employee. Specific training, on the other hand, refers to specialized skills training that provide employees the skills, which the employer requires for the organization's unique operations. Organizations provide this form of training to the extent that productivity is enhanced [1]. Military organizations, as well as civilian organizations, also offer specific training. Military offers training in a variety of skills that are very useful in the civilian sector such as piloting. Mostly, return on investment is questionable since military personnel with these skills leave military more readily because they can earn more in the civilian sector. Military pilots are maybe the best examples that receive specific training, which costs a lot.

Military pilots are obviously crucial to any mission employing of air power. A poor retention rate for senior pilots, however, is one of the biggest concerns of military organizations. Pilots usually have five- to ten-year service obligations depending on countries and services. After this service obligation period, they are eligible to separate from service. After the initial obligations expire, the military accepts that it is difficult to retain pilots, who are usually attracted by the job offers of civilian airlines. It is important, for policy makers, to know the factors that explain the separation behavior of the pilots.

3. METHODOLOGY

The study utilized logistic regressions models to measure the determinants of separation by using the sample data [8]. As explanatory variables, the logistic regression model included age at commissioning, gender, race, education level, marital status, number of dependents, commissioning source, and months in grade. Since the dependent variable used in the separation model in this study is binary, which is

retention, logistic regression models are appropriate as a tool for analysis. In this study's model, the dependent variable "Separate" is a binary variable. To overcome the limitations of the Linear Probability Model (LPM), the logistic regression (LOGIT) model was used. The LPM is easy to use, but it has some disadvantages. For example, in LPM, the estimated predicted probabilities can be less than zero or greater than one. Also, in LPM, the partial effects of independent variables are constant. In a LOGIT model, the dependent variable is binary and the general equation may be written as follows:

$$P(y=1|x) = P(y=1|x_1, x_2,\ldots., x_k),$$

In this model, x represents explanatory variables and y represents the dependent variable. It was assumed that the response probability was linear. To avoid the limitations of LPM, a class of binary response models of the form was considered:

$$P(y=1|x) = G(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots.. + \beta_k x_k = G(\beta_0 + x\beta),$$

where G is a function taking on values strictly between zero and one. $0<G(z)<1$ for all real numbers z. This ensures that the estimated response probabilities are strictly between zero and one. In the LOGIT model, G is the logistic function, which is the normal cumulative distribution function for a standard logistic random variable:

$$G(z) = \exp(z) / [1 + \exp(z)] = \Lambda(z)$$

which is between zero and one for all real numbers [17].

This case is referred to as a LOGIT model or, sometimes, as a logistic regression. The function has an increasing curve in z. Since it is nonlinear, the LOGIT model requires maximum likelihood estimation (MLE). In Maximum likelihood estimation computes parameters that maximized the probability of observing what was actually observed.

The estimated coefficients of the explanatory variables give the magnitude and the sign of the partial effects of each explanatory variable on the dependent variable. A positive sign of a coefficient indicates that an increase in x is associated with an increase in the probability of separation. Conversely, a negative sign of an estimated coefficient indicates a decrease in the probability of separation as x increases. The partial effects were found by using the results of the logistic regression. The STATA data analysis program was used to run the regressions and estimate the partial effects.

4. FINDINGS AND PILOT RETENTION

The regression model helped to understand how the chosen independent variables affect pilots' separation decisions. According to the model, the effects of chosen variables are as follows; an increase in age increased the probability of separation decision after the initial service commitment. Considering gender, being female increases the probability of leaving. The study indicates that pilots who are not married are less likely to stay in the service. This study reveals that advanced education has a negative effect on separation of pilots. In particular, pilots possessing an advanced degree, either a Master's Degree or a professional degree, tend to stay in military compared to their peers who had only Bachelors' Degrees. And also, pilots with

more dependants (spouse or children) are more likely to stay in the military. The effect of commissioning source was specifically examined in the model and it is analyzed that pilots having a deeper military background are less likely to leave the service.

There are several other reasons that a pilot chooses to separate from the service. Dissatisfaction about career in military is one of the most crucial factors as well as pay differential in separation decision. Separation from family, overall career dissatisfaction, inadequate career counseling, unattractiveness of some duties, not enough chances for further specialization, inflexible assignment, promotion policies, decreased chances for advanced education and benefit and retirement uncertainties are found to be the reasons of dissatisfaction [6].

The factors mentioned above are obviously trigger pilots to leave the military service. After the initial obligations expire, the military accepts that it is difficult to retain pilots, who are usually attracted by the job offers of civilian airlines. To induce pilots to remain in the service, the militaries had previously developed various pay incentive programs. These programs pay an annual bonus to pilots who commit to certain terms of service. Thus, if pilots choose to stay in the military under an agreement, then they are giving up the opportunity to fly for civilian airlines for that time period. However, for most military organizations, pay incentive programs seemed not enough to keep experienced pilots.

Individuals' behavior is the key to their retention decisions. It is obvious that compensation policies affect a pilot's decision to stay or leave. On the other hand, the effects of those policies differ from person to person. For instance, one pilot who really enjoys military service may choose to stay in the service for less compensation than another one who doesn't enjoy military service as much. Besides individuals' characteristics and behaviors, external influences are important in retention decisions, too. For example, if the civilian job market for pilots were strong, then the motivation to leave would be relatively greater than if the market is poor or the pilots are not needed by civilian airlines.

4. RECOMMENDATIONS

There is no specific way to predict the personal decision of a pilot, but the results of the studies may have some beneficial effects on policy decisions in terms of managing the human capital of military organizations. Civilian and military sector pay differential seems like one of the most challenging problems, revising the current incentive programs may help to reduce attrition and increase motivation. For example, pilots at their early career earn enough parallel to their experience; furthermore, military pays their education and training costs. However the income level doesn't increase much with the experience level increases by time in contrast to civilian sector. While civilian sector offers are important on separation decision, policy decisions on incentives must be revised considering civilian sector.

Being away from family frequently and being stationed in different cities are other problem areas. Policy makers need to evaluate the hardship associated with being away from family while working off base and either increase incentives or improve the quality of life where pilots are stationed.

As this study and human capital theory dictates graduate education is beneficial to both the pilots and the military organizations. Militaries should search for new ways to expand advanced education for pilots. Since advanced education has a significant negative effect on separation of pilots, Militaries should support all its pilots to obtain higher education, such as Master's Degree or an advanced professional degree. This is important since it may be considered that providing education could be difficult during active duty. Advanced education choices for both in-residence and off- duty programs may be diversified for pilots who are deployed in different workplaces. Thus, a pilot may have an opportunity to select an advanced education program that fits his/her

work schedule. It seems that properly arranging and encouraging graduate education for pilots might decrease separation rates through the additional service commitments. Most of the military organizations have advanced graduate education schools, the usage of education programs can be expanded by increasing the number of pilots in those schools. To do so, military organizations can expand its capabilities by investing in the educational capabilities of their pilots.

As mentioned earlier, pilots having a deeper military background are less likely to separate. Policy makers should take the positive affect of military academies as commissioning source into consideration while selecting pilot candidates from different sources. The given motivation, encouraging and teaching the aviation lifestyle to cadets while they are studying at academy, could explain why military academy graduates are more likely to stay in the organization after their initial service commitments.

Another problem area seems like the dissatisfaction about career paths of pilots. The militaries might consider alternative career paths for pilots. Military pilots mostly considered as the future managers for the organizations that they are in. Militaries treat all pilots as potential leaders and assign them throughout their careers to both flying and non-flying jobs. At the other end of the range would be a career track that allowed pilots to spend all of their service time in flying assignments. Between those two extremes might be several other career paths that would combine, in varying degrees, flying and non-flying assignments. By offering different career tracks, the militaries could capitalize on the differences among pilots in how much actual flying they want to do during their careers. However, the creation of separate career paths that allowed some pilots to spend the greater portion of their career flying might limit the pilots' possibilities for promotion. Despite that disadvantage, pilots for whom flying was paramount might be more likely to commit to a long term career if they were assured of a fly-only track [6, 7].

It is important for the military organizations to know the reasons for qualified personnel turnover. In order to achieve that keeping the records of all personnel and having a data center that allows statistical analyses may help decision makers.

Civilian airline impact on pilot separation seems like one of the most challenging issues. Further studies may focus on how critical the demand of civilian airlines and possible precautions.

5. CONCLUSION

Military invests a considerable amount of money both in human capital and in the training of a pilot. The training of a pilot also takes a substantial amount of time. It is always difficult for the militaries to keep experienced pilots in the service. Experienced pilots frequently separate to fly in the civilian airline sector after their initial commitment period. High attrition rates waste training investments and reduce effectiveness. Military organizations have to take some actions against these problems. Managing their human capital seems crucially important. Retention of military pilots is obviously affected by a number factors discussed earlier in this study. These factors trigger pilots to separate from the military for civilian airlines. Military decision makers are concerned with the

effect of civilian airline industry on pilots' separation decisions from military. It is expected that the demand of civilian airlines will be more than the current demand in the future since the industry is getting bigger. On the other hand, it is also a problem if all pilots prefer to stay in the military. For all military organizations, there is force structure and personnel planning. Experience level of personnel, in this case experience level of pilots, is important but there must be a balance between more experienced and less experienced personnel. Decision makers have to consider all the aspects of the problem such as the amount of pilots to be commissioned each year, force requirements, expected civilian airline demand, average experience level needed, the length of initial service commitment and the policies regarding incentives.

REFERENCES

1. 1. Albretch, M.J., *A Discussion of Some Applications of Human Capital Theory to Military Manpower Issues*., Santa Monica, CA, RAND Corporation, 1976.
2. *Aviator Continuation Pay Program.* (2000). Washington, D.C.: Department of the Air Force.
3. Boyce, Harris S., *Tactical Air Command's Pilot Retention Problem,* Research Report no. 3299 (Maxwell AFB, AL: Air War College, 1967)
4. Coughlin, Matthew F., *Development of A Forecasting Model of Naval Aviator Retention Rates*, Thesis, Naval Postgraduate School, Monterey, CA, March 1996.
5. Ehrenberg, Ronald G., Smith, Robert S., *Modern Labor Economics theory and Public Policy.*, San Francisco, CA, Pearson Education, Inc., 2009.
6. Elliott, Marc N., Kapur, Kanika, and Gresenz, Carole Roan. *Modeling the Departure of Military Pilots From the Service.*, Santa Monica, CA, RAND Corporation, 2004.
7. Fullerton, Lt. Col. Richard L., *An Empirical Assessment of United States Air Force Pilot Retention,* The Mershon Center, Ohio State University, Columbus, OH, 1999.
8. Gultekin, Zeki., Canpolat, Omer,. *An Analysis of U.S. Air Force Pilots' Attrition,* NPS, Monterey, CA, 2010.
9. Kahraman, Kemal, (2007), *The Effect of Advanced Education on the Retention and Promotion of Army Officers.,* Monterey, CA, Naval Postgraduate School.
10. Levy, C. M., (1995). *The Civilian Airline Industry's Role in Military Pilot Retention.* Santa Monica, CA: RAND Corporation.
11. Lu, C. C. (1995). *An Emprical Analysis of U.S. Air Force Pilots' Attrition.* Monterey, CA: Naval Postgraudate School.
12. Mattock, M., Arkes, J., (2007). *The Dynamic Retention Model for air Force Officers.* Santa Monica, CA: RAND Corporation.
13. Roth, Russell T., (1981), *The Determinants of Career Decisions of Air Force Pilots*.
14. *U.S. Air Force Official Website*. (2009, November 15). Retrieved November 15, 2009, from U.S. Air Force OfficialWebsite: http://airforce.com/opportunities/officer/ed
15. U.S. General Accounting Office, *The Navy's Pilot Shortage: A Selective Bonus and Other Actions Could Improve Retention,* Washington, DC, February 1980.
16. William, W.Taylor, S. Craig Moore, C. Robert Roll, Jr. (2000). *The Air Force Pilot Shortage.* Santa Monica, CA, RAND Corporation.
17. Wooldridge, J. M., (2009). *Introductory Econometrics, Fourth Edition*. Michigan: South-Western.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

THEORETICAL CONSIDERATIONS ON THE PRIVATIZATION PROCESS IN ROMANIA

Dan HAGEANU

Alma Mater University, Sibiu

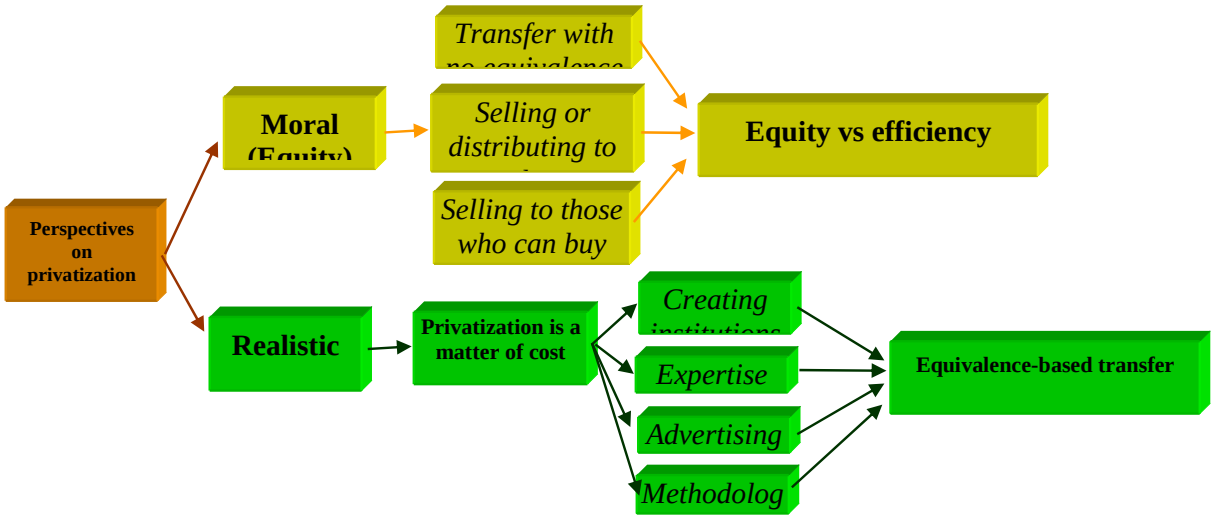
***Abstract**: As in any period of transition, the restructuring processes become effective through the implementation of various strategies. Any strategy envisages a complete picture about the process which consists of objectives, principles, programs and instruments of restructuring programs. Thus, the privatization process in transition countries has involved two aspects referring to moral and realism. In case of the first aspect, that of fairness, in terms of assigning a larger share of the social component of the privatization by which either sale was made to the employees or by a transfer with no equivalence, the process was less efficient leading to a compromise of the idea of ownership. Regarding the second aspect, that of equivalence, this shows that the privatization done is such a manner has undistorted effects in the economic field.*

***Keywords**: capital privatization, economic restructuring, economic reform, investment, capital.*

The legal transfer of ownership from the state to private agents was pursued by privatization. The state has used privatization as a tool for macrostabilization, because the sale losses of state enterprises means reducing arrears, reducing the state budget deficit, limiting the inflationary pressures, etc. [1]

Referring to several points of view, the privatization aimed at: (figure 1)

1. politics - establishment of a new class of capitalists and entrepreneurs;
2. equity, involves transferring ownership of state assets to those who were wronged after the nationalization process or granting ownership of assets of a state company to its employees and staff;
3. efficiency, should lead to increased efficiency of resource allocation in the economy;
4. financial, aims to increase state budget revenues.



- Source: OCDE, 2002 Figure 1.

The evolution of the privatization process in Romania

The most effective method of privatization used by developing countries was that of the large financial groups (investment funds, foreign groups and rent seekers), whereas that used by their own employees and managers (MEBO) were not successful because they were neither able to provide capital to modernize the business, nor had the experience of the market research process and of a strong market-oriented management.

Concerning the reform of property, its immediate effect was creating the new company agents, who were the promoters and operators of its specific interests. The fact that there were delays in this area, the people were brought in the situation to opt either for the "casino economy" structures [2], or not to engage in investment, limiting their actions to the accumulation of money in bank deposits.

In fact, a great success enjoyed also the privatization based on concentrated ownership (by foreign strategic investors able to contribute with increased financial resources to restructure the company, technologies, performance management), as compared to the investment funds or holdings. [3]

Compared to other transition countries, the privatization restrictions in our country affected more the privatization process so that its gradualism has led to low efficiency. Several factors were the hindrance for the dynamic transfer of state property into private property, such as:

- the weak internal capitalization;
- establishment and management of institutions to manage the process;
- the reduced external financial assistance
- the insufficient support from society;
- the lack of domain experts and specific infrastructure;

Most privatizations in Romania were done by selling to foreign companies (eg, Romtelecom, Petrom, the Romanian Commercial Bank, Home Savings Bank, etc.). Among the factors contributing to this type of sale are the large debts of state enterprises and the underdeveloped domestic financial and capital markets.

Another sensitive issue of privatization in Romania was the sale of state enterprises where the privatization marketing has played a fundamental role in this process. It involved several important prerequisites for attracting investment capital:

- a stable political and economic environment;
- good future prospects;
- the realistic evaluation of the company and its price;

- largely giving up regulations;
- an active marketing in the privatization programs.

Promoting a privatization process of this kind (especially in the case of the flagship companies), has brought the countries which have implemented it much higher revenues than the ones from a sale. Privatisation of small and medium enterprises was successful in most of the transition countries, the studies show. [4]

Along with the increase of the number of enterprises which passed in the private sector, the privatization solutions were becoming more complex.

Privatization has effects with implications in the entire economy. Therefore, in the process of restructuring, we can consider privatization as a fundamental pillar, and the privatization process itself should be integrated into the overall strategy, in close relationship with discipline and encouragement in the economy.

The overall reform of the national economic system meant, first, a drastic reduction in GDP.

In this context, the attempt to avoid social instability determined the political leaders to adopt an inefficient policy, respectively to feed the national economy "black holes" from the state budget (industries consuming large resources and failing to sell). This action not only conducted to a delayed privatization, but also extended the transition from the centralized economic system to the market system with long term negative effects on the general economic evolution. Moreover, it strengthened the orientation to purchase necessary products from imports which increased with the opening of the Romanian economy to the external markets.

As mentioned before, in the transition economy countries, a macrostabilization sustained by monetary and fiscal but also by social and commercial real policies, would certify the confidence and social safety of the transition.

The real rate of transition is marked by the evolution in the restructuring plan. Macrostabilization proved its effects only when the restructuring was steadily generating ways of achieving balance in the economy, so that it was manageable on a long term.

The economic stability has an effective value if it supports the social stability, the reconfiguration of the new balance in the social structure of the specific target system.

When along with the restructuring there is also transmitted a rigidity of allocation, phenomena such as arrears, non-contractual relationships, unaccounted business, etc. Liberalization itself is compromised. Thus, we believe that restructuring must begin along with the liberalization and macrostabilization programs. [5]

As for the sustainable growth to be achieved, it is necessary to have a balance between social costs and invested funds.

Restructuring the economy is essentially a process of consolidation of functional markets and augmentation of the microeconomics capacity to adapt to the competitive environment. [6]

Therefore, the main strength of the restructuring was the privatization, which was the main objective and was intended to be the basis for the ownership reforms. Basically, this market-oriented the activity of the enterprises which were formerly owned by the state.

A situation with a special feature is that the concern to stimulate spontaneous privatization was marginalized, which would have led to an open business environment and more attention was paid to the privatization based on transfer of ownership from state to individuals, so that the restructuring power of the privatization became insignificant. The effect of this

situation was one of producing a profit privatization, generating an attitude of decision waiting in favor of the modernization investments [7].

Thus, it came to the unfavorable situation of inadequate restructuring, in which the natural way to reach to a market economy resulted in loss of market, both internal and external, bankrupcy of enterprises, including of privatized ones, the collapse of branches and sectors etc.

Consequently, from the short analysis of the process of privatization in transition countries, we can draw several conclusions:

• in dealing with a highly competitive environment, in order to aquire discipline for the managers of the new enterprise, privatization should be accompanied by measures to increase competition in the market for the goods produced by that company.

• the rapid and effective privatization of small enterprises could be done by open and competitive auctions.

• the effective privatization of medium and large enterprises could be done by strategic investors (especially foreign) by the following methods: direct negotiation with the sealed bid

• possession of power by a single strategic investor involved strong incentives for restructuring, technology, investment in human capital, etc. If they would have used the technique of privatization called "case by case" and a privatization consultant would have been hired - a prestigious financial company - a much higher price had been obtained.

• the necessity of creating a legal framework to protect investors (including the minority shareholders), designing the rules against agreements or conflicts of interest regarding compliance, auditing, regulation of financial intermediaries (brokerage companies, investment funds), banking reform etc.

Another major problem occurred early in the privatization process was that of the functionalization of the bankruptcy law, so that:

• there should be no strong barriers to market exit

• there would be a regulation of the state action in companies where it still held the property rights

• there would be an increase of competition in sectors where there were monopolies and oligopolies.

In strategic areas (especially public utilities), rigorous action was necessary to regulate the new owner (by protecting the public interest), so as not to become from a state monopoly into a poorly regulated private monopoly.

BIBLIOGRAPHY:

1. Dinu Marin, *Contemporary economy. What is transition?* Economic Publishing House. Bucharest, 2000

2. Dinu Marin, Socol Cristian, Niculescu Aura, *The Romanian economy - a vision of post-communist transition*, Economic Publishing House, Bucharest, 2005

3. Sava I.N., *Ten years of transition in Eastern Europe (1990 - 2000),* Cultural Foundation Publishing House, Bucharest, 2000, p.34.

4. World Bank, (2002), *Transition-The First Ten Years-Analysis and Lessons for Eastern Europe and the Former Soviet Union*, Washington.

5. Văcărel Iulian, *Fiscal and budgetary policies in Romania* - 1990-2000, Expert Publishing House, Bucharest, 2001.

6. Dinu Marin (coordonator), *Romanian economy. System companies. Structural diagnosis,* Economic Publishing House, Bucharest, 2001, p.27-29.

7. Lipsey R.G., Chrystal K.A., *Principles of Economics,* Economic Publishing House, Bucharest, 2002.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

MANAGERIAL LEADERSHIP FROM THE PERSPECTIVE OF ENVIRONMENT ORGANIZATIONAL SPORTS

Dorin,IANCU Robert DOBRE, Marius PIȚURLEA

Faculty of Economics, University of Valahia, Targoviste, Romania

Abstract: *Any sport organization needs good leadership and effective management. This may come to realize objectives through organizational environment. Sports gear organizational environment is the main sport organizations because it is based on communication between the organization and external environment, according to that design, so sports organization strategy.*

Key words: *sports organizational environment, strategy sports organizations, strategic vision.*

Sports organizations that any organization operating in a changing environment where its footprint on the development organization. Organizational environment is the factors that influence directly or indirectly objectives, plans and results of organizations. Organizational environment includes external environment and internal environment interact.

The external environment of sports organization

Knowledge of sport organizations external environment is particularly important for their managers, as they, on behalf of the organization they represent, must develop relationships with markets, customers, suppliers, competitors, intermediaries and investors. This is done in terms of a knowledge society. Hence the important role they have departments that organization must make a substantial contribution in the development organization. In order to achieve sporting organization must promote efficient strategy to conquer new markets and resist existing ones. From this perspective the organization's external environment analysis is not only useful but necessary (Douglas Brownlie, 1995).

Organizations external environment consists of factors such as:

- *economic* - Sports organizations operate and develop the economic principles;
- *cultural* - Sport organization in terms of cultural factors is influenced in two ways:
  - of components (values, norms, customs, traditions, customs) of the external environment there;
  - of their organizational culture that has developed over time.
- *politics* - Political factors influencing sport organization can be found in existing government policy on sport and development institutions as a consultant;
- *demographic* - Is the population structure, territorial distribution in

rural and urban environments. It is envisaged that development concerns in sport should contribute to personal development of each individual, on the one hand and providing the necessary logistics, on the other;

- *technological* - Technical factors relate to investment in sports development to ensure conditions for its practice.

Environment an organization has several forms or more states by the organization evolves and adapts. They are:

1. Stable environment. Stability plays a beneficial environment for sports development organization, as it concentrates its efforts on targets that must reach them and not remove the negative effects that have to eliminate. This is the ideal.

2. Unstable environment. Instability is the most common situation in the social economic reality. There are several factors that disrupt society as a whole, organizations are forced to take measures to eliminate dysfunction and to adapt to achieve development objectives.

3. Turbulent environment. The state of turbulence is the most complex environmental condition that affects the very existence of the organization. In these circumstances organizations should make special efforts to ensure its survival.

External environmental components that enter into direct relations organization, permanent and strong need to achieve its objectives dictated by present and future, forms the microenvironment organization (Balaure V., 2005, p 69).

Microenvironment is based organization transformation is the interface between the inputs (resources they consume organization: material, human, financial) and outputs (products resulting from the transformation of resources) that the organization provides market. Sports organizations establish market relations into account:

A. Suppliers - Are those individuals who provide sports organizations equipment, energy, services, labor, information needed to perform necessary activities. Suppliers should be monitored because of their outstanding issues can interfere with sports organization.

B. Customers - Are those individuals or circles of people whom they are addressed sports products and services. Good quality sports products and services brings new customers who come from different backgrounds.

C. Intermediaries - Are those agents involved in the promotion and sale of sports. They promote sports, selling players, clubs and teams contract with the various levels.

D. Competitors sporting organizations are those organizations that have as main objective to participate in competitions in various fields of sport.

Macroenvironment is the variables and factors that form the necessary environment for the conduct of business. Macroenvironment refers to the four factors that affect how tasks are addressed: socio-cultural, technological, economic, political-legal (N. Pop, 2001).

1. Socio-cultural - Considering consumer behavior on the market. Socio-cultural factors relate to age, sex, nationality. For example the distinction between man and woman are made in different geographical areas depending on specific growing area. This has an impact on sports in the area concerns. In some areas of sports culture is very well developed compared with other areas where sports culture is in early stages.

2. Technological factors - Are represented by IT technologies, specific elements of the knowledge society (new forms of communication, technological development, etc..) Which have an impact on the evolution of organizations. For example, the advent of the Internet has produced relevant changes in the organization and functioning of organizations taking into account the processes of communication and publicity of the organization underwent profound transformations in terms of effectiveness and efficiency of the information provided by sports organizations.

3. Economic factors - Refers to the basic elements (resources) underlying functioning of the organization. Any activity needs to take place on economic principles,

even if it is known that in sports activities that often are not profitable. It follows that the principles on which sports are other than a common organization. The human dimension of his sport prevail.

4. Political and legal factors - Refers to the interests of individuals and sports organizations. These factors relate to government policies that promote the facilities and legal regulations for the conduct of sporting activities at all levels (performance sport, sport for maintaining health of individuals).

External environment analysis takes into account all four categories of interacting factors (social, cultural, economic and political-legal) acting on it. This inter-be done in different directions taking into account the context in which act organizations:

-Knowledge management;

-Evaluation performanțelo sports organizations;

-Promotion of flexible strategies by sports organizations.

In their operation sports organizations should consider the environmental changes taking place on time to avoid the disruption by taking appropriate measures. Top management must be able to predict the state of imbalance.

Knowledge Management

With knowledge-based society requires an explosion of information, management of this situation is of great importance for all organizations including sports. To this end management organization should ensure the development and use of cognitive members composing it. From a practical perspective, it is necessary to provide operational information to finding those methods and techniques to ensure optimum within the organization.

Sport organization as any organizationBeyond its particularities, should identify opportunities and provides the environment and in this direction should be taken by carrying out activities to assure accomplishment of the tasks for which there. Aeste actions are:

- development and implementation of activities to be consistent with social needs by:
  - differentiate management functions on different hierarchical levels, at a cognitive level;
  - differentiation by identifying the specificities of each compartment, in structural plan.

- Coordination of all actions are consistent within the organization in accordance with the restrictions they impose on the environment.

- adaptation of organizational structures of sports organizations to environmental requirements, which is reflected in the situational approach (contingency) of the situation of the organization.

It follows, hence, the need for a flexible organizational structure enabling the organization to adapt on the fly. In this context the role of managers is particularly important because they must have the skills and competencies to take the necessary decisions to achieve goals. In this strategic vision is needed to create conditions accountability of decision. To this end the organization should be based on competitiveness given the competition that exists on the market. Decisions must always be taken in accordance with the objectives of the organization and must ensure that appropriate technological support.

These statements become even more necessary as we believe sport organization as an open system in which uncertainty and limited rationality into alternate certainties. Rationality is based on two fundamental principles:

1. Coordination of activities undertaken within the organization by working with the external environment, which are two components to ensure effective management.
2. Continuous adaptation to the environment situations. This is achieved visibility that organizations, highlight the contact with the surrounding world, comparing the situation with the external and internal decision-making in the internal environment in line with what happens outside the organization.

Performance evaluation in sports organizations

Performance evaluation in sports organizations means those procedures regarding behavior management hierarchy of individuals who compose the organization and organization behavior. To this end management organization should take measures to ensure that expected results are the agreed objectives. This depends on how top management organization coordinates its decisions whose consequences to converge towards the targets. It is appropriate for this purpose to identify:

- cause-effect relationships for all the activities in the organization;
- reference standards to be explained to all members;
- distribution objectives compartment levels and even individual level.

What above is, in fact, the rationale for organization management. Since there are fewer failures in business processes, the more we can speak of a management organization. Management organization is required to make public what is happening within the organization to provide the consumer products and sporting as much information and thereby creating a brand.

Although sports organizations have a separate specific, they are not foreign to the phenomenon of innovation. Constantly innovating, both in terms of personal development of individuals who compose it and the technical support you need to give to the organization, top management should identify those methods and techniques necessary to do so. For example the concept of coaching is very important for practical management of sports organizations. Say this thinking only two aspects of innovation in modern management:

- motivation by values;
- programming Neuro (P.N.L.).

All this constitutes the essential argument that the assessment of performance in sport organization is the cornerstone of effective management.

Responsive organization environmental strategies

Sports organization is that orientation strategy, aimed at long term position as well, bringing profit organization, it is the result of efforts to adapt the organization to the organization's environment. A powerful strategy reinforces the competitive ambitions of the organization responsible for creating a dynamic market needs and requirements. Sporting organization in policy are the following issues:

- focus on goals and objectives;
- assurance criterion sports organization.

A sports environment strategy can be developed over a period of one year in small regional competitions, the European Championships two years and four years for the Olympics. Long-term strategy is usually subject to uncertainty. The strategy combines internal environment with good functionality forming the external sports organizations. (Mihailescu N, 2008, p.95.).

The success of an organization depends on how they solved the three criteria antreprenorilale, technical and administrative.

1. Criterion entrepreneurial refers to how the organization is viable products and services they provided, it must be well adapted to the existing market.

2. Technical criteria includes those technical activities leading to the formation of organizational products, delivery requiring the use of specific technologies.

3. Administrative criterion refers to organizational leadership, ie actions entrepreneurial management, which ensures operation.

Creating strategic vision for a sports organization it is the result of using the two types of strategic approaches:

a. practice of effective and efficient management that optimal management of resources available to the organization ensures compliance to all categories of interest;

Achieving such an objective is achieved through coordination and correlation of all actions obţonere performance in the organization. Actions to be to use the organization's management are:

- monitoring of their activities are carried out;
- achieve an optimal flow of information to support timely decision making;
- establish the responsibilities of each member of his behavior;
- avoiding disruptions in the functioning of the organization in all departments.

b. use of environment related opportunities in the organization are:

- implementing the principle of entrepreneurial flexibility;
- encourage a spirit of innovation and creativity;
- promotion strategies to achieve organizational mission performance;
- creating marketing and research and development departments;
- information quickly to what is happening in the market, given the speed with which changes occur in society.

This is very important for the organization and hence for a sport organization is to have a mix of strategies with which they can enter the market and survive in the tough competition.

References:

1. Douglas Brownlie, Handbook of Marketing, Academy of Marketing Publishing, 1995.

2. V. Balaure, Marketing, Publishing Uranus, 2005.

3. N. Mihailescu, Management in competitive sport, Pitesti, 2002.

4. N. Pop, International Marketing, 3rd Edition, Publishing Uranus, Bucharest, 2001.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

MILITARY – POLITICAL CONNECTIONS TO FOOD SECURITY

Stanislav MORONG*, Jaroslav NEKORANEC*

* Armed Forces Academy of General Milan Rastislav Štefánik, Liptovský Mikuláš, Slovak Republic,

Abstract: *By the article analyzes the current state of the economy of the Slovak Republic in the conditions of a relatively open market, which has its parallelism with the economic development of almost all Central and Eastern European countries after 1989. Changes called the restructuring of industry and agriculture, which must have suffered a particularly sensitive to perceive not only from the aspect of food, but also national security. The critical situation of food security, despite all the military-political the repeated creating guarantees and benefits of the global market, the risks that must be taken into account in the framework of strategic planning in the armed forces.*

Keywords: *Defense, crisis, agriculture, manufacture, consumption, food security, the armed forces*

1. INTRODUCTION

In the last decades there has been a lot of reasonable criticism of the authors of the so-called restructuralization of Slovak industry and agriculture. The present-day gloomy state of economy development, while it would be best to call it an economic meltdown, is at best attibuted to naivety, at worst to an intentional act of politicians when releasing the Slovak market to other nations´ companies and international corporations. We will probably never find out who and how participated in harming the public interest, what the provision was for this destruction of our economy. The fact is that the political and private caginess deprived Slovakia from the possibility to become a competition on foreign markets, but Slovakia also lost the ability to maintain socially acceptable limit of unemployment. It became a country, which in the crucial segments of goods is dependent on external supplies, comparable to the countries of Equatorial Africa.

Secondary reason for the continuing process of uselessness of the Slovak agriculture when meeting the domestic demand and the reason for export abroad was also accepting inconvenient additional conditions for this department by EU. These are well-known facts and that is why we are going to deal with them.We can also mention the fact that the unlimited access of

international chain stores to the Slovak market has eliminated several thousands of small businesses – vendors, which has significantly reflected in the agrosector by the loss of purchasers of Slovak agricultural production because in comparison to international businesses it was more convenient for small businesses to enter into contracts with local suppliers.

2. FOOD AND AGRICULTURE IN THE CONTEXT OF GLOBALIZATION

In spite of the mentioned objections to the activities of the (ir)responsible, we can consider all the facts natural and inevitable changes related to the process of globalization, which have affected all European or world countries. Globalization brings along also some space for corrupt behaviour and activities of politicians in a broader than national standard, which creates for an illusion of greater anonymity and worse transparency. The mentioned changes initiated by globalization could in case of superficial perception be an acceptable reason for satisfaction with the given „status quo“, because the allmighty market will anyway find solutions for satisfying the demand and it is not important where do we get the necessary goods from. The growing disproportion between the constantly growing population curve and the sources of limited food production forces us to answer the question about maintaining the current state of political, economical, military relations in the world. The latest development in the world proves that making sure about permanent guarantees military or non-military conflict crisis situations we have to start from the principle that food security of the state is represented by maintaining production sources and output at in this field is possible, but just until the first crisis situation. An example for this can be the limited export of rice from the south Asian countries or the sale of natural gas from Russia to Europe not before satisfying the higher local demand. In suchlike situations all commitments of the country towards the partner are met just in intentions of useless capacities and sources, which are not needed for the stabilization of relations in their own territory. Unless we see the developments on Earth as a constantly changing process it is necessary to think strategically and ask what we are able to do in case of collapse of all these relations for providing the citizens´ needs at national level with the sources that Slovakia despite the turbulences has available. What is the situation of the Slovak agriculture, which is the primary basis of food security regarding its qualitative and quantitative parameters?!

3. FOOD SECURITY – LEFT-OVER OR PERSPECTIVE?

Food security of the state is a condition in which production, trade, transport and storage of food are provided and citizens are supplied regularly (Šimák a coll. 2005). Due to the so-called restructuralization of the industry and other changes in economical policy of SR it is especially important to focus on the expression „ensured production“. If we are to examine the potential and capacities of production of basic foods for the nutrition of the population of SR in case of real failure of external food supplies in some

the level of about 90% of estimated real consumption of basic commodities of local agricultural production (Grznár 2004). Before we analyze the ability of Slovak agriculture to

Year	Area of land- used agricultural soil (ha)	Area of land – arable land (ha)	Area of land – permanent crops (ha)	Area of land – meadows and pastures (ha)	Used arable land – fallow land (%)
2001	2 254 801	1 409 222	28 934	783 905	0,25
2010	1 921 961	1 354 436	22 092	513 029	2,51
Decrease of land in ha	332 840	54 786	6 842	270 876	-
Increase of land in %	-	-	-	-	2,26

meet this quantitative parameter, let us focus on the development of agricultural land resources, which sufficiently give proof about the critical situation in the field directly participating in production capacity of the Slovak agriculture. In times when many countries use literally every centimetre of agricultural land and strictly punish its other than agricultural usage, in Slovakia 270 876 ha of meadows and pastures have vanished in 2001 – 2010 as Chart 1 shows. Even though it is not the only factor affecting the development in beef production, it foretells the decline of production in the field of livestock production. The Chart makes it clear that the tensions in agricultural fund to grow, which consequently shows in further indicators of food security of SR.

Chart. 1 Land use in SR (2001 - 2010)

Source: Slovstat, all other charts using this source and author´s calculations

Giving up the most creditworthy Slovak soil in favour of building industrial parks „on green fields", with the infrastructure built from the money of tax payers for foreign investors is rather one of the forms of sophisticated tool for corrupt activities and consequent private benefits of politicians than a strategic solution for the development of economy and employment. However, Slovak agriculture crisis has a considerably deeper dimension than the reprehensible reclassifying of agricultural land to other, usually non-production categories. The wounds agriculture has suffered approximately two decades ago were so serious for this sensitive organism that in this agony it cannot use even the original fund it had available and other capacities. Slovak agricultural commodities under

significantly inconvenient grant and expense conditions of the transformation process cannot promote themselves regarding the prices on the domestic nor European market. Consequently the agricultural production declines in almost all commodities mentioned in Chart 2.

Chart. 2 Livestock numbers by 31.12.

Year	Cattle total	Pigs total	Poultry total
1970	1 330 091	2 106 575	13 196 302
1980	1 502 809	2 788 124	15 810 863
1990	1 563 070	2 520 524	16 477 763
2000	646 148	1 488 441	13 580 042
2010	467 125	687 260	12 991 916
Decline of the state between the year with the highest production and year 2010 in numbers	1 095 945	1 833 264	3 485 847

With the decrease of breeding the rise of prices is caused by the principle of offer and demand, which then reflects in decrease of consumption, not just of pork, which could be even a positive effect of this economic misery regarding healthy food, but also of commodities that should have higher consumption rates due to their positive effect on the nutrition of population. It is mainly beef, milk and dairy products consumption. The course of consumption of selected commodities is shown in Chart 3, which presents a radical decline of consumption since 1990 until now. Also in this case we can mention the fact that the lack of local production can anytime be replaced by import, which is a common practice in the global environment. On the contrary, this helps Slovakia to break away from less lucrative sectors, to concentrate power and means for more sophisticated production and this contribute to building the so-called knowledge society. Does it have sense to talk about the necessities of maintaining the needed production capacity in agriculture at all? If we can import these commodities under more convenient conditions from countries with well-financed production what can we get from purchase of domestic resources?! If we unlike the politicians have the ability to think strategically in a long-term horizon and do not suffer from the „blind kitties“ syndrome staggering in a strategic interval of maximum four years of administration then it definitely has sense.

4. DOMESTIC FOOD AND CONSUMPTION RATIO

It is an obligation of visionaries and strategists of the society to draw attention to threats and risks which can arise in future and significantly affect economic processes and the security of the state.

Chart. 3 Consumption of selected types of food per 1 citizen in kg

Year	Beef	Pork	Poultry	Milk and dairy products total	Cereals of the value of grain total	Potatoes
1990	21,8	44,5	15,2	226,3	158,6	85,8
2000	9,1	33,1	17,1	160,2	132,7	68,1
2010	4,2	31,6	19,1	163,1	108,6	47,6
Difference in the time of monitoring in %	80,7	29,0	25,7	27,9	32,0	45,0

These threats can originate from the extremes of weather as a result of climate changes, which can cause energy crises we have already witnessed due to long-term cold weather, such as last winter. This course of events may lead to the lack of cereals on the European market, which along with floods, droughts and other extreme weather changes may cause failure of trade with this commodity. We can and must also think about mass deaths of livestock in countries with import policy, the so-called industrially developed countries of the world. Unfortunately, we have to think not just about asymmetric, but also military conflicts of the continental or global character, as claimed by the classic that the world is closer to war when it is being reassured about peace. In the same dimensions within defence planning first we have to decide on the food security concept not just from the perspective of sensibility as the guarantee for existential needs of the population, but also because of the low flexibility regarding the changed security conditions. Unlike the industrial sectors, adapting agriculture to crisis management requirements is not a question of hours or days, but at least months and years. It is clear that such space for reaction to acute threats cannot be created by any crisis situation. Let us now use an example of one commodity and using the previous charts present the readiness of Slovak Republic regarding suchlike situations. The dependence on massive import is not just the problem of wrong business balance of the state, but it as well shows the level of strategic planning in the development of agriculture. Chart 4. Shows the extent to which the principle of food security according to Grznár corresponds with reality. If it was necessary to provide the population with domestic sources even in case of total liquidation of breeding pigs i.e. without preserving piglets and animals intended for reproduction (of the basic herd) Slovakia is able to provide just about 32% of the current consumption. It gets even worse if we consider preserving the basic herd. The share of national production to annual consumption represents almost the opposite of limits set for food security in the given year. It is as well dramatic with food security regarding other crucial commodities produced by Slovak agriculture.

Chart. 4 Example of contradiction between theory and practice of food security regarding selected commodity (pork) in 2010

Year	Average live weight of slaughter pigs (kg)	Average utility weight of slaughter pigs when slaughtered (kg)	Annual domestic production per 1 citizen in kg (with no regard to 30% reproduction)	Annual domestic production per 1 citizen in kg (with 30% reproduction)	Current consumption in the given year in kg	Current limit of food security in kg of domestic production
2010	110	80	10	6,7	31,6	28,4
In the conditions of relative openness of the market we start from the principle that food security consists of maintaining production sources and amount of production at the level of cca 90% of the estimated real consumption of basic commodities of domestic agricultural production (Grznár 2004).						

5. FOOD SECURITY AND RESPONSIVENESS OF THE ARMED FORCES

As it can be illustrated with the examples from the history of military conflicts in the distant or not so distant history, logistic support and providing resources for conducting military campaigns are more crucial for the final success of military operations than technical, technological or quantitative and qualitative advantage over the enemy. Inconsistency in cumulating resources for leading war or quantitatively and qualitatively insufficiently dimensioned material flows was the reason for failures of great and the most developed armies of the world, such as the French army of emperor Napoleon or the German army in both world wars, or the failure of the USA in the Asian battlefields in the second half of the 20th century. Catering of armies during armed conflict primarily affects the morale and thus also effectiveness of the military operations. The basic precondition for an adequate level of catering in field conditions is enough resources for hot foods, or the adequate nutritional value of the meals served to soldiers in form of cold food. The precondition for this is the sufficient basis of internal (military) supplies and the ability of the supply chain of the distribution logistics to provide it on the national or global market. If we ignore the various political proclamations and reassurances about guaranteeing national security based on participating in the principles of collective safety and if we can view the eventual crises as accidental, unpredictable phenomena, we have to consider all possible risks connected to failures of these guarantees. All guarantees are limited by the ability to identify risks and estimated reasons for changes in the security situation. Activation when planning collective defence from the threats, or the threat that could with its intensity significantly overcome the estimated parameters means accepting the necessary countermeasures, which had not been part of any crisis plan. That means that

the community or individual countries have to reconsider their priorities regarding the usage of tools necessary for minimizing the impacts of crisis, primarily the protection of national and then also collective interests.

In this context it is necessary that every member state of any political, economic or military community besides the strategy of collective security has also the concept of national defence, which determines the principles of individual security guarantee in certain areas. It is an alternative, not just in case of failures of contract commitments at political level, whose relativity has been proved throughout history several times not just in the field of military support. Similar change of priorities can be expected in crises caused by the lack of energy resources and of course also of food in regional or global criterion. We can talk about fatal consequences for the North American and European market with beef in case of radical decline of cattle numbers in the countries of Central and South America. We must openly state that in comparison to the situation prior to 1989 when the Slovak agriculture met the demands of the citizens completely, now the situation is absolutely different. If we want to say what impact the responsiveness of the Armed Forces of the Slovak Republic has on the food security of the state represented in Chart 4 on example of beef, we have to state relevant data of standardized consumption of this commodity according to the internal norms of the armed forces. The relevant standard[1] represents the weight of pork included in the daily relevance of food for individual rations, which are divided according to the type of state service and military specialization, as can be seen in Chart 5. Apart from the conservated rations of pork kept at individual levels of supplies in the armed forces totally of 30 DD (daily dose), fresh meat except handy storages for storing food for immediate processing of fresh meat (up to 48 hours), the armed forces are forced to refresh supplies especially from external sources since the first day of preparing hot food during military operations.

When evaluating supply capacities it is necessary to consider the fact that if the current pork production of national resources represents 6,7 or 10 kg of meat from the 31,6 kg annual consumption per citizen, we can deduce that the out-of-Slovakia supplies of 23,9 or 21,6 kg can be considered very risky in case of a big military conflict. This threat can have form of a conflict in the region of the supplier, but the conflict may also radically restrict or eliminate the import of food commodities and any goods in general.

If we need to express the level of providing of the armed forces with pork, which according to the availibility seems the least risky then the armed forces have supplies for 77 or 115 days of conducting military operations. Reflected to the daily ration it

[1] Service regulation of the Office of the state service of professional soldiers No. 34/2010 on providing rations and transport

would by just 0,018 or 0,027 kg in comparison to the standard of 0,089kg. Of course, this is the case if we do not restrict the consumption of civilians in favor of the armed forces.

Chart. 5 Recommended amount of pork in the armed forces

No.	Type of food	ration			
		1	2	3	4
		(in kilogramms)			
1.	Pork	0,069	0,073	0,103	0,103
Average recommended amount per soldier/day		0,087			

CONCLUSION

The author of the article analyzed the course of the Slovak agriculture and focused on the land as a good, which has in the global economic dimensions lost its privileged position of the food base guarantee not just in the common conditions of the market, but also in cases of threats. He highlights the fact that it is not just the guarantee of maintaining sources for food supplies in case foreign supplies fail, but food security is very important for the prevention of internal destabilization caused by external and internal military and non-military threats. The current state of food security of the Slovak Republic does not just affect negatively several important macroeconomical and social indicators as trade deficit, unemployment, or microeconomic parameters in form of inconvenient type of consumed food, its quality, price and other well-known facts, but in fact, it is a hidden lie threatening the existence of the state. A charge activated by flightiness and incompetence when evaluating food dependence, based on the analysis of possible current open food market with no regard to the perspective of threats and consequent risks. This analysis directed to the existence aspects of food security should be a stimulus for more complex and more detailed work with this issues and accepting measures representing a qualitative shift in this field in form of processing these measures into security, defence strategy of the Slovak Republic as well as resulting legislative and internal legal norms.

REFERENCES

1. GRZNÁR, M. a kol.: Trh potravín a jeho fungovanie. Bratislava, Vydavateľstvo Ekonóm, 2004, 214 s. ISBN 80-225-1754-2
2. ŠIMÁK, L. a kol.: Terminologický slovník krízového riadenia, Žilina, zverejnené na http://fsi.utc.sk/kkm/, Aktualizované vydanie 2006, ISBN 80-88829-75-5
3. Služobný predpis hlavného služobného úradu pre štátnu službu profesionálnych vojakov č. 34/2010 o poskytovaní proviantných náležitostí a prepravných náležitostí
4. http://www.statistics.sk/pls/elisw/MetaInfo.explorer?obj=38&cmd=go&s=1006&sso=6&so=17

STUDENTS' INTERNATIONAL CONFERENCE AFASTUD 2012
Communicating A cross Cultures
Brasov, 26-28 April 2012

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

RESEARCH PROJECT "JP MORGAN CHASE & CO"

Johnny MOUSSA, Luc EPOUHE, Collange ROMAIN

Manhattan Institute of Management, New York, USA

Abstract: *In this paper we will be focused on the impact of the 2007 economic and financial crisis on the equity of JP Morgan Chase & Co. In order to do so, a first chapter will be dedicated to overview the financial and economic crisis. In a second chapter we will present JP Morgan Chase & Co, their activities, products, services (…) and in a third chapter we will analyze the fluctuations of the equity of JP Morgan chase & Co on the period of 2007 till 2011.*

1. Overview of the 2007 economic and financial crisis:

Like all previous cycles of booms and busts, the seeds of the subprime meltdown were sown during unusual times. In 2001, the U.S. economy experienced a short recession. Although the economy nicely withstood terrorist attacks and the bust of the Internet bubble, the fear of recession really preoccupied everybody's minds.

In the following we will review the financial crisis and study the case of JP Morgan chase Bank; the impact of the crisis on JP Morgan chase and the procedures they implemented.

To keep recession away, the Federal Reserve lowered the Federal funds rate 11 times; from 6.5% in May 2000 to 1.75% in December 2001. Creating a flood of liquidity in the economy.

It found easy prey in restless bankers and even more in restless borrowers who had no income, no jobs, and no assets. These subprime borrowers wanted to realize their life's dream of acquiring a home. For them, it was a sign of hope. More home loans, more homebuyers, more appreciation in home prices.

This environment of easy credit and the upward spiral of home prices made investments in higher yielding subprime mortgages look like the deal of the century. The Fed continued to lower interest rate. In June 2003, the Fed lowered interest rates to 1%, the lowest rate in 45 years. What a godsend for the whole financial market. Houses' were sold at a huge discount and without any down payment.

Basically it was like everyone could buy his house now and pay for it later. But the bankers thought that it wasn't enough to lend the candies lying on their shelves. They decided to repackage the loans into collateralized debt obligations and pass on the debt to another institution. Soon a big secondary market for originating and distributing subprime loans developed. To make things merrier, in October 2004, the securities exchange commission relaxed the net capital requirement for five investment banks; Goldman Sachs, Merrill Lynch, Lehman Brothers, Bear Stearns and Morgan Stanley. Which freed them to leverage up to 30times or even 40-times their initial investment.

Every good item has a bad side, and several of these factors started to emerge alongside one another. The trouble started when the interest rates started rising and home ownership reached a saturation point. From June 30, 2004, onward, the Fed started raising rates so much that by June 2006, the Federal funds rate had reached 5.25%, which remained unchanged until August 2007.

There were early signs of distress: by 2004, U.S. homeownership had peaked at 70%; no one was interested in buying more. Then,

during the last quarter of 2005, home prices started to fall, which led to a 40% decline in the U.S. Home Construction Index during 2006. Not only were new homes being affected, but also many subprime borrowers now could not withstand the higher interest rates and they started defaulting on their loans. This caused 2007 to start with bad news from multiple sources. Every month, one subprime lender or another was filing for bankruptcy. During February and March 2007, more than 25 subprime lenders filed for bankruptcy, which was enough to start the tide. In April, well-known New Century Financial also filed for bankruptcy. Problems in the subprime market began hitting the news raising more people's curiosity and stories or gossips if I may say started to leak out.

According to 2007 news reports, financial firms and hedge funds owned more than $1 trillion in securities backed by these now-failing subprime mortgages, enough to start a global financial tsunami if more subprime borrowers started defaulting. By June, Bear Stearns stopped redemptions in two of its hedge funds and Merrill Lynch seized $800 million in assets from two Bear Stearns hedge funds. But even this large move was only a small affair in comparison to what was to happen in the months ahead.

It became apparent in August 2007 that the financial market could not solve the subprime crisis on its own and the problems spread beyond the United State's borders. The interbank market froze completely, Northern Rock had to approach the Bank of England for emergency funding due to a liquidity problem. By that time, central banks and governments around the world had started coming together to prevent further financial chaos.

The subprime crisis's unique issues called for both conventional and unconventional methods, which were employed by governments worldwide. In a unanimous move, central banks of several countries resorted to coordinated action to provide liquidity support to financial institutions. The idea was to put the interbank market back on its feet. The Fed started slashing the discount rate as well as the funds rate, but bad news continued to pour in from all sides. Lehman Brothers filed for bankruptcy, Indymac bank collapsed, Bear Stearns was acquired by JP Morgan Chase, Merrill Lynch was sold to Bank of America, and Fannie Mae and Freddie Mac were put under the control of the U.S. federal government.

By October 2008, the Federal funds rate and the discount rate were reduced to 1% and 1.75%, respectively. Central banks in England, China, Canada, Sweden, Switzerland and the European Central Bank also resorted to rate cuts in order to aid the world economy. But rate cuts and liquidity support in itself were not enough to stop such a widespread financial meltdown.

The U.S. government then came out with National Economic Stabilization Act of 2008, which created a corpus of $700 billion to purchase distressed assets, especially mortgage-backed securities. Different governments came out with their own versions of bailout packages, government guarantees and outright nationalization.

The financial crisis of 2007-08 has taught us that the confidence of the financial market, once shattered, can't be quickly restored. In an interconnected world, a liquidity crisis can very quickly turn into a solvency crisis for financial institutions, a balance of payment crisis for sovereign countries and a full-blown crisis for the entire world. But the silver lining is that, after every crisis in the past, markets have come out strong to forge new beginnings.

2. J.P. Morgan Chase & Co:

J.P. Morgan Chase is one of the world's leading global banks, with one of the most extensive client bases in the world. It clients include corporations, governments, states, municipalities, healthcare organizations, educational institutions, banks and investors in more than 100 countries. They provide strategic advice, lend money, raise capital, and help manage risk, extend liquidity and hold global leadership positions in all of our major business lines. Their goal is to help clients succeed, contribute to orderly and well-functioning markets and support global economic growth. One of the most important functions is extending credit to

companies to help them grow.

JP Morgan Chase have been helping their clients do business for more than 200 years, and in the words of one the founders, have a proud history of doing "only first-class business... in a first-class way." Their culture is defined as one driven by performance, partnership, meritocracy, inclusion and directness.

The firm is a leader in investment banking, financial services for consumers, small business and commercial banking, financial transaction processing, asset management and private equity. In the following, we will focalize our interests on two main parts of J.P. Morgan chase's activities; first the mergers and acquisitions and second the equities.

2.1. Mergers and Acquisitions:

J.P. Morgan Chase is one of the leading merger and acquisition advisory firms today, taking a top spot in many of the rankings for this sector. The firm's in-depth expertise extends to a wide range of strategic M&A transactions, including asset purchases and dispositions, restructurings and reorganizations. With its strong relationships with many of the leading financial sponsors groups, J.P. Morgan Chase is also able to help clients gain access to today's growing pool of private equity financings.

Examples of M&A by earn out (2001-2011):

Date	Deal value (mm$)	Target	Acquirer	Target Region	AcquirerRegion	Earn-out (mm$)	Earn-out (%)
24/09/08	23,143.50	British Energy pic	Electricite de France	Europe	Europe	10,100.00	43.60%
29/08/10	24,476.70	Genzyme Corp	Sanofi-Aventis	N.America	Europe	3,664.90	15.00%
18/02/04	2,952.50	Mobile TelephoneLicence	MTN Group	MEA	MEA	2,567.40	87.00%
10/11/08	3,375.00	Marcellus shale assets	StatoilHydro	N.America	Europe	2,125.00	63.00%
8/9/08	7,938.90	Coal seam gas assets	Conocophillips	Australia	N.America	2,000.10	25.20%
30/04/10	2,500.00	BSG Resources (51%)	Vale SA	Africa	S.America	2,000.00	80.00%
21/02/11	9,000.00	Reliance Industries Ltd (23 Oil and GasBlocks)	BP plc	India	Europe	1,800.00	20.00%
8/12/10	1,830.00	Mesoblast Ltd	Cephalon Inc	Australia	N.America	1,700.00	92.90%
30/06/08	3,300.00	Chesapeake Energy	Plains Exploraiton &Production Co	N.America	N.America	1,650.00	50.00%
21/05/10	3,800.00	Piramal Healthcare Ltd (DomesticFormulations Business)	Abbott Laboratories	India	N.America	1,600.00	42.10%

2.2. Equities:

J.P. Morgan Chase is a global leader in

providing a wide range of innovative equities solutions to investor and issuer clients from initial public offerings, secondary placements and equity-linked structures, to private placements, equity derivatives products, and block and portfolio trading services.

Offer of products and services:

- Worldwide trade execution services across all exchanges and electronic networks.
- Program and special equity trading services.
- Transition management services across all asset classes.
- Sales, trading and research services on equity-based derivatives, as well as risk management applications and structured products.
  A full range of equity-linked services, including competitive pricing and complex structuring for new equity-linked issuances, innovative ways to increase conversion premiums for issuers, and sales and trading services for institutional clients.
- Equity structuring and sales services in the primary markets, including initial public offerings, follow-on offerings and convertible securities.
- Clearance of OTC interest rate and credit derivatives, foreign exchange, OTC commodities and fixed income securities.
- Futures and options execution and clearing services on approximately 70 exchanges globally.

2.2.1. Cash Equities:

Serving corporate, institutional and hedge fund clients, J.P. Morgan chase offers a full service global equities platform, with execution capabilities across all listed and OTC market centers globally.

a. Block trading:

- Cash Sales and Trading
- Block Bids
- Reverse Inquiry

b. Special equity trading:

J.P. Morgan chase's Special Equity Group provides the firm's corporate, institutional and private equity clients with structuring advice and trade execution for non-traditional equity transactions. The group provides a multi-disciplinary approach in advising and solving a corporation's equity-related issues.

- Corporate Share Repurchase Programs
- Stock and Portfolio Sales
- Venture Capital Distributions

c. Portfolio trading:

J.P. Morgan chase 's execution capabilities cover the world's major equity markets, with memberships across most major markets (MSCI all country world index, MSCI EAFE…). They use proprietary order management and trading systems, which are designed to help achieve the most efficient and seamless execution from front to back and from inception to settlement.

Types of trade executed:

- Agency
- Guaranteed
- Incentive
- Exchange for Physical (EFP)
- Exchange Traded Funds (ETF)

d. Electronic Client Solution:

Electronic Client Solutions (ECS) designs, distributes and services leading edge analytics, execution and liquidity products globally to the client base. The complete ECS suite of electronic products is designed to source liquidity effectively across an ever-changing landscape of liquidity centers, minimize transaction costs and maintain anonymity for our clients. ECS includes:

- Pre-and post-trade analytics
- Global direct market access and smart order routing
- Global algorithmic trading products
- Differentiated liquidity

e. Commission management solutions:

The Commission Management Solutions (CMS) Program allows the bank to execute trades on behalf of clients at an agreed commission rate. The bank retains a portion of the commission for its clearing and execution services and disburses the remaining dollar

amounts to pay for research or brokerage services.

CMS program different structures:

- Client Commission Arrangements / Commission Sharing Agreements
- Traditional Soft Dollar Arrangements

2.2.2. Equity Derivatives:

Institutional investors, distributors, corporates and private investors benefit from JP Morgan chase's unparalleled scale, breadth and expertise since they are a global firm with extensive knowledge of derivatives across all asset classes and they deliver a wide range of products.

a. Flow derivatives:

- ETFs
- Equity Swaps
- Equity Futures
- Listed and OTC options
- Volatility products

b. Structured finance solutions:

The Structured Finance team combines its expertise in the lending and capital markets offering innovative and multi-faceted structured financing solutions across equities and other asset classes.

- Acquisition financing
- Hedging and monetizing solutions
- Derivatives-based strategies

c. Equity derivatives structuring:

Equity Derivatives Structuring draws from a broad selection of strategies and products in creating bespoke risk management solutions specific to the client's risk-reward profile. The team provides exotics payoffs and cross-asset solutions for clients ranging from pension funds and insurance companies, to private banks, retail banks and asset managers. The Equity Derivatives Structuring group offers tailor-made solutions for clients drawing from the trading and risk management expertise of the entire EDG Trading platform. The primary function of EDG Structuring is to provide clients with the desired product payoff and underlying exposure, with a focus on ensuring seamless ongoing product maintenance.

Solutions Offered:

- Tradable Indices
- Equity Payoffs
- Fund Derivatives
- Strategic/Complex Structuring

d. Convertible equity derivatives:

Convertibles are hybrid instruments that effectively marry the defensive nature of a fixed income instrument with the upside potential in the price of the underlying equity.

3. Analyze of the equity of JP Morgan chase & Co on the period of 2007 till 2011:

JP Morgan Chase & Co has in the first quarter 2008 a net income of $702 million, compared with net income of $3.0 billion in the fourth quarter of 2007. Earnings per share were $0.07, compared with $0.86 in the fourth quarter of 2007. For the full year 2008, net income was $5.6 billion, or $1.37 per share, down 64% from $15.4 billion, or $4.38 per share, in 2007.

When a look is taken on the results of the investment banking operations we will see that net revenue was negative $302 million, a decrease of $3.5 billion from the prior year. Investment banking fees were $1.4 billion, down 17% from the prior year. Advisory fees were $579 million, down 10% from the prior year, reflecting decreased levels of activity, partially offset by improved market share. Debt underwriting fees were $464 million, down 1% from the prior year. Equity underwriting fees were $330 million, down

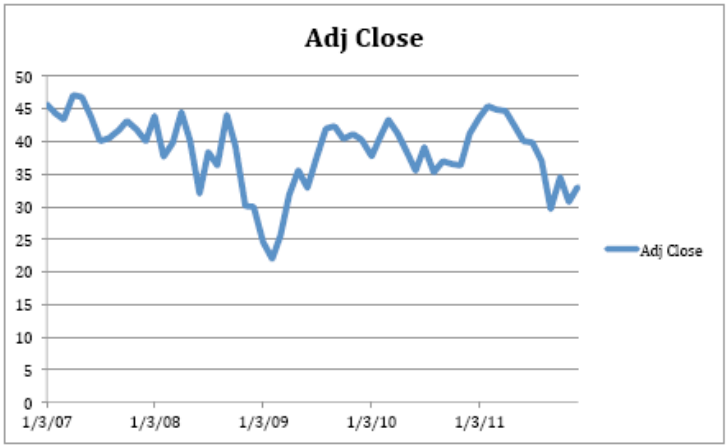
39% from the prior year. Fixed Income Markets revenue was negative $1.7 billion, compared with $615 million in the prior year. The decrease was driven by $1.8 billion of net markdowns on leveraged lending funded and unfunded commitments; $1.1 billion of net markdowns on mortgage-related exposures; weak trading results in credit-related products; and losses of $367 million from the tightening of the firm's credit spread on certain structured liabilities. These results were largely offset by record performance in rates and currencies and strong performance in commodities and emerging markets. Equity Markets revenue was negative $94 million, down by $672 million from the prior year, reflecting weak trading results and losses of $354 million from the tightening of the firm's credit spread on certain structured liabilities, partially offset by strong client revenue across products, including prime services. Credit Portfolio revenue was $90 million, down $232 million from the prior year For the retail financial service the net income was $624 million, a decrease of $107 million, or 15%, from the prior year, as a significant increase in the provision for credit losses was predominantly offset by positive MSR risk management results and the positive impact of the Washington Mutual transaction. Net revenue was $8.7 billion, an increase of $3.9 billion, or 81%, from the prior year. Net interest income was $4.7 billion, up $2.0 billion, or 75%, benefiting from the Washington Mutual transaction, wider deposit and loan spreads, and higher loan and deposit balances. Noninterest revenue was $4.0 billion, up $1.9 billion, or 88%, as positive MSR risk management results and the impact of the Washington Mutual transaction were offset partially by a decline in mortgage production revenue. The provision for credit losses was $3.6 billion, an increase of $2.5 billion from the prior year, as housing price declines continued to result in significant increases in estimated losses, particularly for high loan-to-value home equity and mortgage loans. The provision includes $1.6 billion in addition to the allowance for loan losses for the heritage Chase home equity and mortgage portfolios. Home equity net charge-offs were $770 million (2.15% net charge-off rate; 2.67% excluding purchased credit impaired loans), compared with $248 million (1.05% net charge-off rate) in the prior year. Subprime mortgage net charge-offs were $319 million (5.64% net charge-off rate; 8.08% excluding purchased credit impaired loans), compared with $71 million (2.08% net charge-off rate) in the prior year. Prime mortgage net charge-offs were $195 million (0.89% net charge-off rate; 1.20% excluding purchased credit impaired loans), compared with $17 million (0.22% net charge-off rate) in the prior year. The provision for credit losses was also affected by an increase in estimated losses for the auto and business banking loan portfolios. Non interest expense was $4.0 billion, an increase of $1.5 billion, or 59%, from the prior year, reflecting the impact of the Washington Mutual transaction, higher mortgage reinsurance losses, and increased servicing expense.

We will analyze in the following the evolution of the JPM index compared to the S&P 500 since 2007 till the end of 2011 using data extracted from yahoo finance.

Data: "JPM-NYSE"

Date	Open	High	Low	Close	Volume	Adj Close
12/1/11	30.86	34.19	30.03	33.25	39824000	33.01
11/1/11	32.47	35.18	28.28	30.97	42755300	30.75
10/3/11	30.03	37.54	27.85	34.76	52929900	34.51
9/1/11	37.62	37.82	28.53	30.12	51162600	29.64
8/1/11	41.16	41.37	32.31	37.56	53060700	36.97
7/1/11	40.81	42.55	38.93	40.45	35224400	39.81
6/1/11	42.87	42.99	39.24	40.94	37963700	40.05
5/2/11	45.94	46.07	41.69	43.24	29295500	42.3
4/1/11	46.55	47.8	43.53	45.63	30074100	44.63

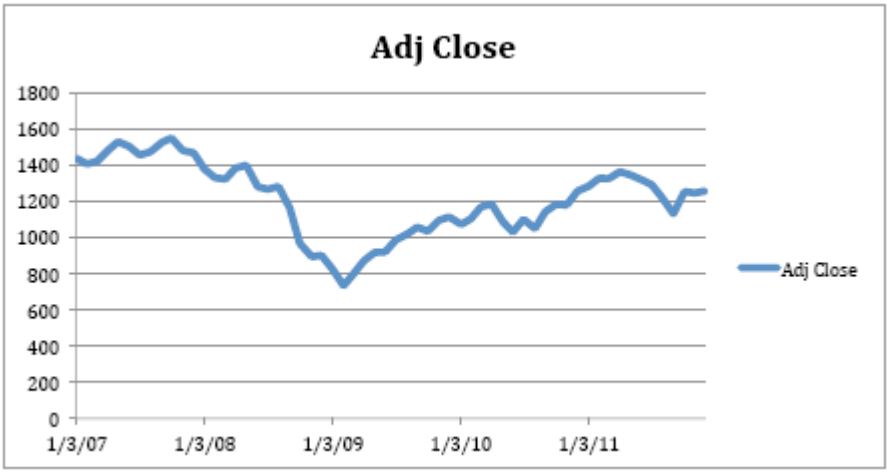
3/1/11	46.47	47.1	43.4	46.1	30781900	44.85
2/1/11	45.2	48.36	44.3	46.69	32819500	45.42
1/3/11	43	45.94	42.65	44.94	42552800	43.72
12/1/10	37.95	43.12	37.65	42.42	30827200	41.22
11/1/10	37.61	41.34	36.83	37.4	37815300	36.34
10/1/10	38.34	40.72	36.21	37.63	46145300	36.57
9/1/10	36.74	41.5	36.66	38.06	36763200	36.94
8/2/10	40.98	41.7	35.55	36.36	34464200	35.29
7/1/10	36.54	41.24	35.16	40.28	40895800	39.09
6/1/10	39.32	39.96	36.51	36.61	45953900	35.48
5/3/10	42.97	43.73	37.02	39.58	58929200	38.36
4/1/10	45.03	48.2	42.23	42.58	47705200	41.27
3/1/10	42.03	46.05	41.34	44.75	34545400	43.32
2/1/10	39.1	42.31	37.03	41.97	49681900	40.63
1/4/10	41.79	45.19	38.07	38.94	56985000	37.7
12/1/09	42.61	43.09	40.04	41.67	35273800	40.29
11/2/09	42.18	44.99	40.75	42.49	34144700	41.09
10/1/09	43.4	47.47	40.53	41.77	41631800	40.39
9/1/09	43.08	46.5	40.75	43.82	35768700	42.32
8/3/09	39.12	44.24	38.99	43.46	42084800	41.97
7/1/09	34.27	39.47	31.59	38.65	51023000	37.33
6/1/09	37.4	37.73	32.18	34.11	66293200	32.9
5/1/09	32.85	38.94	32.06	36.9	80175600	35.59
4/1/09	25.29	35.21	25.29	33	105136100	31.82
3/2/09	21.7	29.6	14.96	26.58	131367700	25.59
2/2/09	25	27.97	18.75	22.85	96059900	22
1/2/09	31.19	31.64	17.7	25.51	82295000	24.56
12/1/08	30.67	37.7	24.61	31.53	53642600	29.99
11/3/08	41.25	42.5	19.69	31.66	76786200	30.11



Data: "S&P 500"

Date	Open	High	Low	Close	Volume	Adj Close
12/1/11	1246.91	1269.37	1202.37	1257.6	3667346600	1257.6
11/1/11	1251	1277.55	1158.66	1246.96	4287457600	1246.96
10/3/11	1131.21	1292.66	1074.77	1253.3	4874946600	1253.3
9/1/11	1219.12	1229.29	1114.22	1131.42	5104933800	1131.42
8/1/11	1292.59	1307.38	1101.54	1218.89	4942913400	1218.89
7/1/11	1320.64	1356.48	1282.86	1292.28	4308168000	1292.28
6/1/11	1345.2	1345.2	1258.07	1320.64	4105601300	1320.64
5/2/11	1365.21	1370.58	1311.8	1345.2	4114534200	1345.2
4/1/11	1329.48	1364.56	1294.7	1363.61	4042194000	1363.61
3/1/11	1328.64	1332.28	1249.05	1325.83	4046691700	1325.83
2/1/11	1289.14	1344.07	1289.14	1327.22	3225297300	1327.22
1/3/11	1257.62	1302.67	1257.62	1286.12	4816605000	1286.12
12/1/10	1186.6	1262.6	1186.6	1257.64	3762922700	1257.64
11/1/10	1185.71	1227.08	1173	1180.55	4354084200	1180.55
10/1/10	1143.49	1196.14	1131.87	1183.26	4432102300	1183.26
9/1/10	1049.72	1157.16	1049.72	1141.2	3993981400	1141.2
8/2/10	1107.53	1129.24	1039.7	1049.33	4044967700	1049.33
7/1/10	1031.1	1120.95	1010.91	1101.6	4704026600	1101.6
6/1/10	1087.3	1131.23	1028.33	1030.71	5235174000	1030.71
5/3/10	1188.58	1205.13	1040.78	1089.41	6626699400	1089.41
4/1/10	1171.23	1219.8	1170.69	1186.69	5847150900	1186.69
3/1/10	1105.36	1180.69	1105.36	1169.43	4702951700	1169.43
2/1/10	1073.89	1112.42	1044.5	1104.49	4658238400	1104.49
1/4/10	1116.56	1150.45	1071.59	1073.87	5071601500	1073.87
12/1/09	1098.89	1130.38	1085.89	1115.1	4163287200	1115.1
11/2/09	1036.18	1113.69	1029.38	1095.63	4443852500	1095.63
10/1/09	1054.91	1101.36	1019.95	1036.19	5451064000	1036.19
9/1/09	1019.52	1080.15	991.97	1057.08	5633064200	1057.08
8/3/09	990.22	1039.47	978.51	1020.62	5764944200	1020.62
7/1/09	920.82	996.68	869.32	987.48	5080675400	987.48
6/1/09	923.26	956.23	888.86	919.32	5330941800	919.32

5/1/09	872.74	930.17	866.1	919.14	6883268000	919.14
4/1/09	793.59	888.7	783.32	872.81	6938945600	872.81
3/2/09	729.57	832.98	666.79	797.87	7633306300	797.87
2/2/09	823.09	875.01	734.52	735.09	7022036200	735.09
1/2/09	902.99	943.85	804.3	825.88	5844561500	825.88
12/1/08	888.61	918.85	815.69	903.25	5320791300	903.25
11/3/08	968.67	1007.51	741.02	896.24	6231635200	896.24
10/1/08	1164.17	1167.03	839.8	968.75	7226593900	968.75
9/2/08	1287.83	1303.04	1106.42	1166.36	6900428500	1166.36
8/1/08	1269.42	1313.15	1247.45	1282.83	4264482300	1282.83
7/1/08	1276.69	1292.17	1200.44	1267.38	5923937200	1267.38



Important statistic keys of the S&P 500 and JPM (adj close):

	JPM	S&P 500
Mean	38.63	1210.65
Standard deviation	5.54	205.43

Using a excel spreadsheet, we calculated also the correlation between the evolution of the JPM index and the S&P 500 portfolio.

Correlation=0.72

The correlation is close to 1, so the evolution of the JPM index and the S&P 500 index is very significant during the 2007-2011 period. We can see this significant correlation on the charts of the adjusted close of PMJ index and the S&P 500 since the variation of both indexes is the very similar. We notice also the peak of the economic and financial crisis in the year 2009, the biggest decline of both indexes in the chose period following the Subprime crisis.

Conclusion:

JP Morgan Chase & co is a leading global financial services firm with assets of $2.2 trillion and operations in more than 60 countries. The firm is a leader in investment banking, financial services for consumers, small business and commercial banking, financial transaction processing, asset management, and private equity. However in 2008 this giant of finance has seen its results fall from $2.3 billion in 2007 to $702 million in 2008. Contagion has affected JP Morgan who owned risky securities. Yet JP Morgan & Chase was one of the banks that have best lived the crisis. From 2009 onwards the results are starting to rebound as it goes from $702 million in 2008 to $3.3 billion in 2009. These good results obtained in the middle of the storm are evidence of the strength of JP Morgan & Chase.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

CURRENT STATUS OF THE IMPLEMENTATION OF HUMAN RESOURCE MANAGEMENT IN TERMS OF THE ARMED FORCES OF THE SLOVAK REPUBLIC

Jaroslav NEKORANEC*, Katarína STOLÁRIKOVÁ**

* Department of Management, Armed Forces Academy of General Milan Rastislav Štefánik in Liptovský Mikuláš, ** Security and Defence Department, Armed Forces Academy of General Milan Rastislav Štefánik in Liptovský Mikuláš

Abstract: *Human Resource Management is one of the key parts of the management of Armed Forces of the Slovak Republic. Human Resource Management system in the armed forces has undergone several significant transformational changes and went through couple of the development stages. Practice and previous experiences confirm that the principles governing military staff will need a systematic change. This change will contain mainly the legislative aspects which will affect new law. These regulations significantly influence the decision-making of citizens to serve in the armed forces. On the other hand, there is also the labour market development determining these decision-making processes. As important as the regulations mentioned above is the stabilization of the military staff. Streamlining and optimizing Human Resource Management in the armed forces will need appropriate and sufficient funding.*

Keywords: *human resource management, professional soldiers, staff planning, professionalization, labour market, crisis management*

1. HUMAN RESOURCE MANAGEMENT – A CRUCIAL FUNCTION OF THE MANAGEMENT

Human Resource Management is one of the crucial managerial functions which significantly influence the progress of the organization in a turbulent market environment. According to M. Armstrong, one of the major management theorists, „Human Resource Management is a strategic and sophisticated logical approach in governing the organization's most valuable assets – people who work in it and who individually and collectively contribute to achieving the economic goals." (2002, p. 27). This definition is associated with the need for continuous quality enhancement of the organization's most important resource – its employees which are necessary to achieve its objectives and the organizational strategy fulfilment. An effective dialogue with employees which makes them feel important and valuable for organization plays an essential role in motivation and performance of employees. Furthermore, employees deepen their relationship with the

organization by this active dialogue and feel the interdependence of their individual aims and organizational objectives which overlap and strongly affect each other. This leads to the recruitment of a stable staff with an eliminated risk of fluctuation to a minimum. This characteristic of Human Resource Management, taking into account the specific environment and tasks, applies also in the Armed Forces of the Slovak Republic.

Human Resource Management (hereinafter "HRM") contains a wide range of coherent activities, such as: job analysis and description of created jobs, staff planning, acquisition, selection and recruitment process, staff evaluation, staff deployment and termination of employment, remuneration of employees, training and employee development, employee welfare, relations with employees, military information system.

In terms of the Armed Forces of the Slovak Republic are individual functions of Human Resource Management expressed by the "Act 346/2005 Coll. on state service of professional soldiers of the Armed Forces of the Slovak Republic and on amendment and completion of certain laws", which came into force on 1 September 2005. The appointments of this law have been developed in a variety of different regulations of individual levels of management of the Armed Forces of the Slovak Republic.

2. HUMAN RESOURCE MANAGEMENT IN A MILITARY ENVIRONMENT OF THE ARMED FORCES OF THE SLOVAK REPUBLIC

In terms of the Armed Forces of the Slovak Republic (hereinafter "AF SR"), as well as in the civil sphere, it is necessary to ensure continuous improvement of skills and abilities of human resources, which are represented by *professional soldiers* working in *squad* structure, *non-commissioned officers, warrant officers, officers, generals.* It is not just about the continuous enhancement of their knowledge, technical competence or physical preparation but also about the improvement of *mental endurance, moral standards and discipline.*

One of the main tasks attributed to Human Resource Management is a requirement to ensure a sufficient number of applicants for civil service entry with the required skills and capacities for the AF SR. The main objective of the military staff reform was the establishment of a *uniform HRM system* for military staff which has to be able to ensure the inclusion of quality staff with the right skills into a right unit in the required time. This aim was achieved through following activities:

- reducing the number of high military ranks, changing the structure and increasing the recruitment of professional soldiers in rank of squad and non-commissioned officers,
- development of military staff with emphasis on leadership, career growth and competitive selection for preferment,
- implementation of an effective HRM system that ensure the continuous professionalization of the AF SR.

The starting point of military staff management is *centralization*. Military staff of the AF SR is managed by the Chief of the General staff of the AF SR. Because of central planning of resources and priorities, funding and material resources intended to supplying all professional soldiers has to be planned from one point.

HRM processes are centralised and standardized. This applies especially to the following processes:

- recruiting and keeping staff,
- system of assigning staff to functions,
- system of evaluating the staff,
- system of preferment and competitive selection of staff,
- system of staff records,
- system of quantity management,
- career development, education, training, rotation of positions,
- leaving active service and care for military retirees.

The entire process of centralisation sets united HRM system for military staff. Centralised system of service evaluation ensures compliance with established standards by professional soldiers in accordance with their rank, their skills and their level of experience. It guarantees equal opportunities for professional development.

The centralised system of preferment considers all professional soldiers in a way

that allows the selection of the most qualified staff with the highest potential. Centralised information system of HRM takes care of stable, accurate and timely data flow of staff records enabling refilling and keeping staff, ensuring maintenance of joint qualification standards and allowing targeted application of personal and financial resources to achieve stated objectives.

3. PROFESSIONALIZATION OF THE ARMED FORCES OF THE SLOVAK REPUBLIC AND MODELS

Establishment of the AF SR raised many issues and attitudes that were for but also against professionalization. These attitudes were not of a destructive nature, on the contrary they brought new approaches. The professionalization process in terms of the AF SR was a very complex issue. The main reasons that led to the professionalization of the AF SR in our conditions were similar to reasons in armed forces of industrialized countries, especially:

- objective requirements to increase the commando force, combat ability, combat readiness and preparedness,
- enhancement of the level of consistency and effective fulfilment of social roles in society in terms of fulfilling its reliable defence and security,
- performance enhancement in terms of using all available resources,
- improvement of maintenance of advanced technology and care of military equipment and weapons,
- enhancement of their compatibility, integrity and standardization with much less fragmentation.

The professionalization of the AF SR was related with a problem of the change in the nature of military profession. *Military profession ceased to be a lifelong occupation.* Legitimate social security benefits for professional soldiers still arouse interest in this profession among young generation primarily from poorer regions of Slovakia where is a lack of job opportunities.

At present, the professionalization is based on the process of recruitment of professional soldiers through a transparent selection based on unbiased choice enabling people with the major assumptions to promote for short-term and long-term service.

Complicated process of transformation and reorganization of the AF SR took place alongside the professionalization. This process is still not finished and will not be finished. Since the beginning of the transformation process, several documents describing the direction the AF SR should move and what objectives must be achieved each year were issued. These follow-up documents are known in practice as *models*. These *three models* have been created:

Model 2010 was put into force in 2001 as the first model with its full name "*A long-term plan of the structure and development of the AF SR"*. This model considered as the aim of the development of the AF SR the transformation of the Army of the Slovak Republic to a relatively small but high-quality, reasonably armed and trained AF SR.

Model 2015 with full name "*A long-term development plan of the of the Ministry of Defence with a view to 2015",* governing the AF SR today, set preconditions for operation and development of the AF SR. *Limits of defence resources consisting of human, material and financial resources* are the decisive factor. The size of the available resources directly influences the quality and quantity of tasks and measures that ensure the defence of Slovak Republic.

Model 2020 is the latest model which should be implemented during years 2011-2012 and will be valid from 1 January 2013. Responsible top managers (executives) recommend retain the structure of the distribution of funds assigned to the Ministry of Defence of the Slovak Republic in a ratio of 80% for operation and 20% for investments and modernization.

Each of these models involves a requirement for admission of new professional soldiers to improve the individual members and the AF SR as a whole.

To conclude this part it is necessary to note that the models constructing the AF SR, as they were declared, are influenced particularly by political and economic factors. Many intensions have therefore not been implemented yet, mostly in the area of technology modernization but also in area related to the development of new social and personnel laws.

4. PERSONNEL PLANNING AND RESPONSIBILITY FOR ITS IMPLEMENTATION IN CONDITIONS OF THE ARMED FORCES OF THE SLOVAK REPUBLIC

Issues like *how many professional soldiers to recruit* and *which features will be considered as most important* should be planned in advance. Hence the personnel planning are necessary for efficient selection of professional soldier in conditions of the AF SR. Personnel planning has to be based on established strategy and outlined objectives of organisation and has to be in compliance with mission and vision of organisation.

Personnel planning in the AF SR are provided by two control components:

1. Ministry of Defence of the Slovak Republic (MOD)
2. General staff of the AF SR (hereinafter "AF GS")

MOD is internally divided into a number of basic organizational units, where the *Section for defence policy, international relations and legislation* has a leading position for personnel planning. The area of personnel planning consists essentially of activities related to *the human resource policy, remuneration policy, social and housing policy, education including foreign language courses and professional sport as well as sending members of the AF SR in operations and missions abroad.*

AF GS is internally divided into many components, where the *Staff for supporting operations* is the most important component in the area of personnel planning. Staff for supporting operations itself is divided into three departments and the most important for necessary tasks of Human Resource Management is the *Department of Personnel Management* divided into four divisions: *division for staff planning, division for integration of programs, division for staff development and division for staff supporting*. Among these divisions, mainly the *division for staff planning* is responsible for activities in the area of personnel planning and ensures particularly fulfilment of these tasks:

- elaborates the policy and concept of human resources for conditions of the AF SR and assures their implementation in relation to professional soldiers and employees performing work in the public interest,
- processes internal normative acts, standards and regulations for the implementation of personnel and social policy and the performance of personnel management in relation to professional soldiers and employees performing work in the public interest,
- processes the tables of numbers of units and equipments of the AF SR,
- oversees the personnel management system in all its areas,
- processes the documents for systematization of military ranks based on the approved internal organizational structure on the unions, formations, units, offices and equipments of the AF SR,
- processes the draft of systematization of functions for professional soldiers in the AF SR and in scope of the head of the staff at the ministry, processes the draft of systematization for temporarily allocated professional soldiers and ensures compliance with the limits of military ranks set by systematization,

- manages the overall limits on the numbers of professional soldiers in accordance with the species of the armed forces, military expertise and military ranks, determines limits for refilling of staff,
- assesses the state of personnel readiness as a part of operational readiness of units,
- plans and manages refilling and development of the AF SR.

Process of personnel planning culminates in the formation of a personnel plan with a specified number of professional soldiers which need to be recruited into the AF SR. Subsequently, personnel planning must be followed by *recruitment and process of refilling of personnel*, where requirements generated from personnel planning are implemented into practice.

The AF SR recruiting *strategy* is based on the search for future professional soldiers among students of secondary and higher education. The situation on the national labour market as well as the number of graduates allows refill the number of professional soldiers with required education.

Recruitment and selection of new professional soldiers is provided by *Personnel office* which is subordinated to AF GS and located in the Armed Forces Academy. *Personnel office* has also eight subordinate *Groups for refilling of personnel* which were recently known as recruiting centres. They are located in county capitals and their current deployment is in these towns: Bratislava, Trenčín, Nitra, Banská Bystrica, Žilina, Trnava, Prešov a Košice. *Groups for refilling of personnel* follow plan indicating their main task which consists of contacting qualified citizens and obtaining the necessary number of them with the required skills.

All people interested in accessing to the AF SR after their successful admissions have to undergo the vocational training whose length depends of their future enlistment. After meeting strict criteria of selection, they confirm by signing a *three-year contract* their function in the AF SR. After those three years, a selection among professional soldiers takes place, when less quality soldiers are obliged to leave the AF SR and are replaced by new applicants. All successful members obtain a proposal for a new contract. The success of the AF SR requires the system of refilling new professional soldiers that is complementary with maintenance programs that are considered a type of recruitment and selection of experienced soldiers during their service.

The entire process of refilling of personnel consists of several selective activities leading to a success. These activities are composed of series of steps like dissemination of information, identification of potential applicants or explanation of options offered by the AF SR. The AF SR need a permanent implementation of *personnel marketing* to obtain a sufficient number of applicants for state service of professional soldier, leading to the formation, maintenance and stabilization of required composition of professional soldiers.

Selection process is the main tool for recruitment and selection of new members of the AF SR of citizens who have registered as candidates for admission into the state service of professional soldiers. If the applicant meets all assumptions progresses to the next round of selection provided by the *Centre of personnel selection* located in Armed Forces Academy in Liptovský Mikuláš. Process of selection in this centre takes two days. First day all applicants undergo the verification of their mental competency by a psycho-diagnostic screening carried out by a psychologist. He also detects their individual and moral assumptions through personal questionnaires and projective

tests and their level of performance through *performance tests*. After completing and evaluating the tests, the applicants undergo an interview with a specialist – psychologist who offers successful applicants the appropriate specializations. The failure in the verification of psychical resistance is the leading cause of rejection of the candidate. *One quarter of candidates fails in psychological tests.* Those who succeed and are considered mentally competent for execution of state service of professional soldier are undergoing tests of physical ability carried out by testing physical performance of citizen under the Announcement of MOD no. 495/2005 Coll.

The career of professional soldier represents a progression of the professional soldier in individual functions during the service. In individual rank corps, the models of military career are generating for each specialization of military expertise.

The process of the career of professional soldiers, their planning, organizing and managing is influenced by these factors:

- minimum time of the state service in rank – after its expiry, the professional soldier is assigned to the first competitive selection,
- second competitive selection which takes place one year after the first competitive selection – these results decide about preferment or inclusion in maintenance program or release of the professional soldier of the service by expiration of the period of his/her state service,
- setting of the period of the state service in rank – before its expiration, the results from the second competitive selection will decide on the perspective of a professional soldier – on his/her preferment or inclusion in maintenance program or termination of the service,
- maximum time of the state service in rank – after its expiry, the professional soldier is released from service,
- release from service by reaching the physical age of 55 the professional soldier.

5. PROBLEMS AND POSSIBLE SOLUTIONS OF THE CURRENT SYSTEM OF HUMAN RESOURCE MANAGEMENT IN THE ARMED FORCES OF THE SLOVAK REPUBLIC

Since its inception, the system of personnel management in the AF SR has undergone several changes which impacted positively but often also negatively the implementation of human resource strategy and policy. The adoption of several laws affecting the state service of professional soldiers (Act 346/2005 Coll.) as well as the Act on social security of policemen and soldiers (Act 328/2002 Coll.) played an important role.

The original Act on state service of professional soldiers (Act 346/2005 Coll.) was modified by successive unsystematic changes to the detriment of the system. The proposed amendments have not been fully accepted and mostly withdrawn because of their large size. At present, a new Act is in preparation on the basis of the original Act with a partial change in philosophy from the temporary service (for some categories of soldiers) to the long-term (permanent) service.

The implementation of the personnel strategy and policy as well as the entire HRM system in the AF SR is determined by financial limits. These limits significantly affect the options for repletion the created structures of the AF SR. The numbers which can be funded should be monitored instead of the table numbers because they truly influence real numbers of the armed forces (since 2010, the AF SR can fill only 92% of positions, which means 13 567 professional soldiers), while the funding ability actually dropped to the current 86,25%.

To the 31.12.2011 was thus repletion of professional soldiers and employees as following: 12 719 professional soldiers of planned 14 747, 4 308 employees of planned 4 422 (97,42%).

Negative phenomena affecting Human Resource Management

The AF SR continues to lose their elaborated position on the labour market,

which also means a loss of competitiveness of military profession on the civil labour market.

To the 31.12.2011, 747 professional soldiers have left the AF SR for various reasons compared to an acquisition of 459 professional soldiers. This fact is affected by a number of factors such as:

- continual organizational changes,
- unstable legislation, which makes the whole system unstable,
- floating degree of costs on defence, etc.

We can consider the fact of *the loss of illusions about military service* upon arrival to a military unit as very negative, where because of *the financial options* a soldier cannot perform the tasks for which he was received.

Commanders often misunderstand the transversal system of releasing the starting positions for recruitment and the related selection of staff to a preferment and replacement after the fulfilment of the commitment.

In conditions of the AF SR, it is not possible to occupy positions that are multiple overpaid in the civil labour market. The increasing of wages in the armed forces ceased to copy the increasing of wages in the civil market. Benefits provided by the armed forces, are overcome by many employers in the civil sector. Uncertainty in the social security of professional soldiers also acts on candidates interested in military service in a demotivating way, and causes interest in the release at own request. Military staff is getting old what creates assumptions for increasing the percentage of releases from obligatory reasons.

For these and the other reasons, the aim of the area of management of military staff will be the reducing of releases of professional soldiers up to 600 in 2012. It will be necessary to *balance the ratio of releasing the professional soldiers and recruitment.* Admittedly, the stabilization of the AF SR is indispensable.

Future development of Human Resource Management in the Armed Forces of the Slovak Republic

At the end of our view at the current state and perspectives of HRM in the conditions of the AF SR it is needed to outline some aspects which give a presumption of its quality development. In this context, it is evident that the entire issue of the management of the military staff depends of the allocated financial resources in the future. Simultaneously, legislation or rather enactment of new laws on military service and social security of professional soldiers play a significant role. In particular, we mean the motivating and stimulating nature of these laws that will affect the stabilization of the staff. In terms of the fulfilment of the personnel strategy and policy of other personnel functions, it is possible to outline as an example the need of quality enhancement of information in the implemented *integrated information system* and by this make the system of personnel management more efficient.

In cooperation with the Armed Forces Academy of the general M. R. Štefánik in Liptovský Mikuláš, there is the possibility of permanent refilling of the armed forces by professionally and linguistically qualified staff and ensure its career support and lifelong learning. It is also possible to provide qualified staff for the needs of national and international crisis management and the needs of filling positions in international organisations.

From the perspective of the implementation of international commitments related to the reorganisation of NATO command structures, it is necessary ensure the practical implementation of political

commitments in this area – 100% occupancy of the allocated international positions within the headquarters and agencies of NATO.

To ensure the tasks of national and international crisis management, it is necessary to design and after the necessary legislative changes to implement:

- effective use of the system of active backups,
- develop military tradition and develop work with families,
- develop work of interest groups, etc.

REFERENCES

1. Armstrong, M.: *Human Resource Management*: The latest trends and practice.
2. 2002. 10th edition. Praha: Grada Publishing a.s., Pp 27. ISBN 978-80-247-1407-3.
3. Bláha, J. – Mateicius, A. – Kaňáková, Z.: *Human Resources for small and medium companies*. 2005. Brno: CP Books, a.s., 284 p. ISBN 80-251-0374-9.
4. *The Doctrine of Human Resource Management of the Armed Forces of the Slovak Republic*. 2008. Bratislava: GS AF SR.
5. Hvasta E.: Current issues and future development of staff of the Armed Forces of the Slovak Republic: Command assembly of the Chief of the General Staff of the AF SR, Bratislava, 31 January – 1 February 2012
6. *Career Order*: The Methodology of the career models of professional soldier by the Chief of the General Staff of the AF SR. Bratislava: AF SR, 2009.
7. *The System of the military staff management of the AF SR*. Bratislava: MOD SR, 2003.

Contact:
PhDr. Nekoranec Jaroslav, PhD.
jaroslav.nekoranec@aos.sk
Mgr. Katarína Stolláriková
katarina.stolarikova@srvs.sk

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

RESEARCH ON THE EFFECTIVENESS AND EFFICIENCY IN QUALITY MANAGEMENT

Adrian NICULESCU*, Radu IOVANAS**

* Romania Draexlmaier Electric Systems Company Ltd.,
**Scientific Coordinator, Transylvania University, Brasov

Abstract: *Effectiveness and efficiency: two terms often confused, two terms that for many users mean the same. Although the standard SR EN ISO 9000:2006 presents definitions of effectiveness and efficiency, it is difficult to assess whether a given activity is or not effective or efficient. The problem is even more complex if we decide to determine the effectiveness and efficiency in quality management processes, belonging in this case to different quality control phases.*
Can effectiveness and efficiency be quantified?
Can they be determined by a formula?
How are the results of calculation to be interpreted?
To answer these questions, we started a project, so as to single out a method for determining the effectiveness and efficiency of quality control processes, as part of quality management, starting the assessment by calculation of these indicators. The project aims to rethink the current concept of quality control activities, by instituting the basic principles of effectiveness and efficiency.
According to academic literature, through efficiency is understood the state of achieving predetermined targets. Effectiveness is assessed based on the effort (material/ human) submitted to the objectives.
Home project aims to:
Improve performance in quality management/control based on measurable objectives;
Determine formulas for calculating the effectiveness and efficiency;
The originality of the paper work consists of determination by calculation of the effectiveness and efficiency of the quality control activity and as well of the interpretation manner of the achieved values.

Keywords*: quality, management, effectiveness, efficiency, running inspection, final inspection*

1. INTRODUCTION

Effective and efficient are very common business terms. Most of people tend to mix their meanings and usage occasionally. It is very important to define the two notions which help us to create a better set of measures. Effectiveness is doing the right things and efficiency is doing the things right. With the help of this project I wanted to determine the calculus relationship between the effectiveness and efficiency of control processes and their verification in practice, applying these formulas within the quality management department I lead.

2. DEFINITIONS

Effectiveness: "the extent to which planned activities are realized and planned results are achieved" [1]

Effectiveness = objective achievement measure.

Effectveness = the ratio of realized and the proposed target.

Efficiency: ”relationship (ratio) between the result achieved and resources used” [1]

Efficiency = ratio of predefined quality objectives and effort required to achieve objectives.

Efficiency is a measure of economic (cost-benefit relationship).

3. RESEARCH METHODOLOGY/ APPROACH

The method is based on a case study, on observations of existent situation and on willing of quality process improvement.

The project is about determination of effectiveness improvement method and the efficiency of quality assurance processes, starting from the calculating evaluation of these indicators. The project’s goal is a rethinking of actual concept regarding the quality control activity on the basis of effectiveness and efficiency principle. Within this project, my goal is to determine the calculating proportions of the effectiveness and efficiency of control processes from the quality assurance activity and their practical check as well, by application of that formula to activity of quality management department of company where I am working.

We started from situation assesment of the quality control activity, namely the control of the various production processes, following the flow chart of the control preocesses (fig.1).

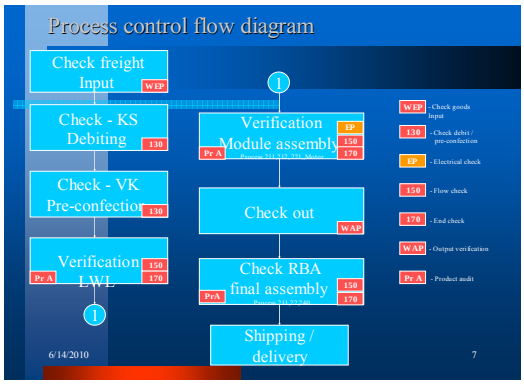


Fig.1 Process control flow diagram

It is very important to identify all phases of control over production process. The well known ”rule of ten: the later a effect is being discovered, the more expensive are implications and its corrections” [2] is also applied in this case.

This rule, applied to production processes in DRM, looks like the figure below (fig. 2).

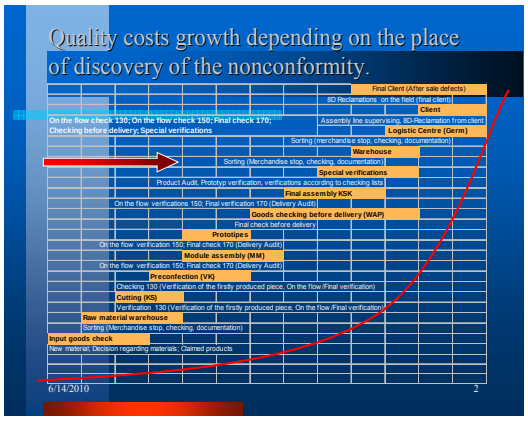


Fig. 2 Increased costs depended on where quality nonconformities are discovered.

We can observed that the highest costs of non-quality, occur when product defects are found in the most advanced stages of execution, exponentially increasing as we approach the final product.

Costs are higher if product errors are discovered by client, or even the end customer or car buyer in the case of auto industry.

Following discussions of the quality management department, have established the necessary steps to determine the calculation formula:

a) Setting the time period for the addition of errors documented for each verification process and within each main production process. Taken into consideration were last 160 days (eight month).
b) Documenting daily life activities for two days of each quality worker, then their categorisation within five main activities.
c) Internal assessment documented errors (sum of the internal evaluation system).
d) Evaluation of errors from complaints (sum of errors recorded in complains).

e) Determination of calculation formulas – defined translation efficiency and effectiveness in specific language quality control processes.

4. DEFINING FORMULAS FOR EFFECTIVENESS AND EFFICIENCY

Formulas were determined from definitions of EN ISO 9000:2006.

Effectiveness means measure to achieve the objective. The objective in this case is finding errors produced on a given production stage.

If we want to determine the effectiveness of finding the errors in a production process, we consider:

$\sum Gf$ = sum of errors discovered on a particular stage of production (cutting, pre-confection, assembly, etc.);

$\sum Gtf$ = sum of all errors that come from a certain stage of production, irrespective of their discovery (cutting operations + pre-confection + internal customer + external customer), it then results in the effectiveness formula:

$$\sum Eft1 = \frac{\sum Gf}{\sum Gtf} \times 100 \ [\%] \quad (1)$$

If we want to determine the effectiveness of finding the errors in a quality process, we consider:

$\sum Gf$ = sum of errors discovered on a particular stage of production (cutting, pre-confection, assembly, etc.);

$\sum Gt$ = sum of all errors that come from a certain stage of production, irrespective of their discovery (rolling control + final control + sorting activities + internal customer + external customer), it then results in the effectiveness formula:

$$\sum Eft2 = \frac{\sum Gf}{\sum Gt} \times 100 \ [\%] \quad (2)$$

Efficiency means relationship (ratio) between the result obtained and resources used.

Efficiency formula for the control process is determined taking into account three elements:

a) $\sum Gf$ = sum of errors discovered on a particular stage of production (cutting, pre-confection, assembly, etc.);
b) T = actual time used for doing a control process (rolling control, final control, etc.), in hours;

The actual time used to process control is determined taking into account the number of people assigned for controlling process, share of time allocated, number of hours worked daily, the number of working day taken into account and the coefficient of leave (medical or recreation).

With other words,

$$T = NP*Pta*h*Nl*Cc \quad (3)$$

where:
NP = number of people assigned for controlling the process;
Pta = Share of time allocated [%];
H = number of hours worked daily;

Nl = Number of working days taken into account;
Cc = coefficient of leave (medical or recreation).

c) Kef = coefficient of efficiency – efficiency ratio which means all verification activities, the ratio of total number of errors found and the total time used for their discovery.

$$Kef = \frac{\sum Gt}{Th} \quad [errors/hour] \quad (4)$$

Where:

$\sum Gt$ = sum of errors from all stages of completion, regardless of place of discovery;
Th = total hours of verification.

Efficiency formula as follow:

$$Efc = \frac{\sum Gf}{T * Kef} \quad [\%] \quad (5)$$

That can cause two leading indicators in evaluating the quality. First, Efc, indicating the efficiency of detecting faults in the production processes (cutting, pre-confection, module assembly, final assembly) or quality (pre-confection processes, rolling control or final examination).

The second, Kef, indicates the productivity of detecting errors general, the control processes (how many errors per hour are found by all checking staff).

5. ANOTHER APPROACH TO EFFICIENCY. EFFICIENCY AS AN ECONOMY

From this point of view, we define efficiency as the relationship between inputs and outputs, performance and costs and/or other disadvantages or losses.

In the following we treat not only efficiency and cost performance, as was treated in previous chapters of the work, but also as a link between planed human resourced and real human resources, necessary for quality control process. Following this idea, efficiency is defined by a relationship between outputs and inputs used or allocated.

In this sense, the question is, first, to establish an optimal ratio between quality human resources allocated to those allocated for production and secondly to determine the efficiency as the ratio of human resources planning and existing.

The average yield of staff is being defined(ratio of number of personnel quality-production = ω) as monthly average quality of staff by the average monthly production staff.

$$\omega = \frac{NP\ QS}{NP\ Prod} \quad (6)$$

Where:
NP QS = number of personnel engaged in quality;
NP Prod = Number of personnel engaged in production.

Optimal value of this report is considered as the objective of efficiency (100%) the share of quality personnel to its employees in production. Optimal value of ratio of specific activity was determined according to the production of automotive electrical wiring. Given the high percentage of manual processes, the optimal ratio is considered to be in the range 4%-5% with the possibility to be amended annually, depending on stability of production or the introduction of projects/new products that need 100% verification of the quality.

This indicator used to assess the efficiency relative to the number of employees. It is calculated as:

$$Efic\ N = \frac{Average\ \omega\ plan}{Mounth\ \omega\ real} * 100\ [\%] \quad (7)$$

Where:
Efic N = Quality efficiency relative to the number of employees in manufacturing;

Average ω plan = average ω plan efficiency, calculated as ratio between average monthly quality staff and average monthly production staff;
Month ω real = the monthly return, calculated as monthly ratio between the number of personnel employed in quality and number of personnel engaged in production.

In fig. 3 is presented the evolution of the indicator during the year 2011.

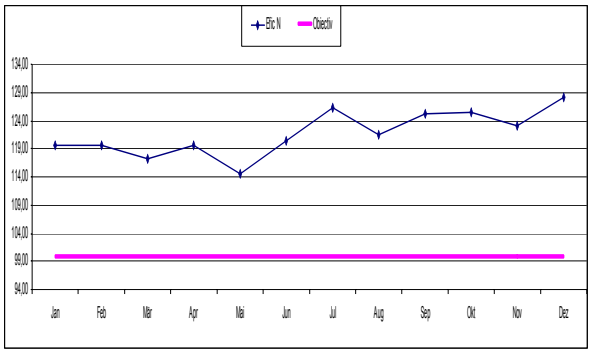


Fig. 3 Developments Nef during 2011

Base on data provided by the Controlling dept., according to the monthly review expenditure, a reported efficiency in personnel costs in the quality department can be calculated. To this end, the following formula:

$$\text{Efic C} = \frac{\text{CPQ plan}}{\text{CPQ real}} * 100 \quad [\%] \quad (8)$$

Where:
Efic C efficiency relative to personnel costs;
CPQ plan = Quality staff costs planned;
CPQ real = Quality personnel expenses, incurred in a particular month/period.

In fig. 4 is presented the evolution of this indicator during the year 2011.

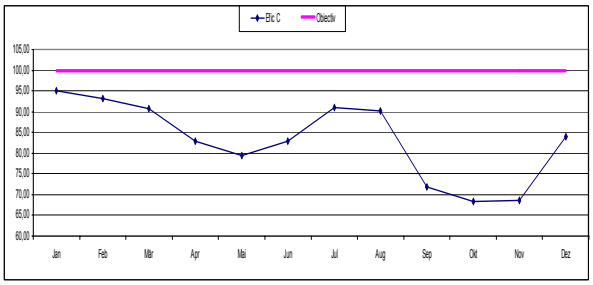


Fig. 4 Evolution of efficiency on staff expenditure, year 2011

As can be seen, although efficiency related to the number of employees has values over 100%, efficiency relative to personnel costs has values below 100%. This is explained by keeping under control the growth of quality personnel, in terms of unscheduled increases in order from customers. If the production department compensated the increases production minutes in additional staff, quality department tried to have a moderated staff increase at the expense of efficiency indicator Efc, relative to personnel costs.

This personnel policy was determined given the fact that besides increasing orders, 2011 was home to a number of new projects in the organization, which, as experience shows, requires a lot of overtime performed in support of production. Quality control activity for projects is not scalable as well as in the case of series product. There are times of crisis, when there are problems in projects, the products have to be repaired/ restored, modified as required, and quality controllers must work overtime to ensure timely deliveries.

Thus explains the inefficiencies related to personnel costs.

As above illustrated, these two efficiency indicators allow quality departments to dimension their quality staff, according the fluctuations in production personnel, but at the

same time, keep within the budgeted expenditure.

This however is possible only by optimizing control processes and by implementing new methods of quality planning, which do not allow low quality level of production, as a result of fewer staff. The size of Quality and Logistics departments have a negative impact on production efficiency gains, just by distributing products based on minutes and staff from the departments above mentioned.

6. ORIGINALITY / VALUE

The originality of the paper work consists of determination by calculation of the effectiveness and efficiency of the quality control activity (quality management process) and as well of the interpretation manner of the achieved values.

The method helps to the decision about the number of persons for an examination process, according to the type of check. For an accordant efficiency, the errors on product have to be detected by the nominated personnel where these are being manufactured, not in the following processes.

7. PRACTICAL IMPLICATIONS OF PROJECT

The effectiveness formula determines in percentage, the reference between the number of errors discovered in a certain production phase, related to the number of errors discovered in all phases, including the errors, noticed by external client.

The efficiency formula determines the discovery degree of errors, by the quality personnel, designated for this purpose on a certain production phase (cutting-off, assembly, final assembly) or on a certain checking process (process inspection, running inspection, final inspections). The number of errors discovered in the incipient production activities, the more the efficiency of the quality control activity is.

Efficiency problem is to answer the question: “do we do things right, correct? , unlike that of effectiveness: do we do the things needed?” (Drucker 2007) [3].

A famous quote of professor Drucker on efficiency sounds like: “Efficiency is doing better what is already being done” [4].

REFERENCES

1. SR EN ISO 9000:2006 Romanian Standard corresponding to EN ISO 9000:2005. *Quality Management Systems – Fundamentals and vocabulary*
2. Krebs, B.,. *10-Regel der Fehlerkosten* [online]. Available: http://www.olev.de/0/10er-regl.htm (June 2010)
3. Drucker, P.,. *Peter Drucker quotes* [online]. Available: http://thinkexist.com/quotation/efficiency_is_doing_things_right-effectiveness_is/218648.html
4. Drucker, P.,. Peter Drucker quotes [online]. Available: http://thinkexist.com/quotation/efficiency_is_doing_better_what_is_already_being/321906.html

BIBLIOGRAPHY

1. Bobancu, S., *Creativitate şi inventică, Universitatea „Transilvania” din Braşov, 2005, p.38,* [online]. Available: http://www.unitbv.ro/LinkClick.aspx?fileticket=C3lkRaJWfNk%3d&tabid=4583 (24.06.2011).
2. Drucker, P.,. *Peter Drucker quotes* [online]. Available: http://thinkexist.com/quotation/efficiency_is_doing_things_right-effectiveness_is/218648.html
3. Drucker, P.,. Peter Drucker quotes [online]. Available: http://thinkexist.com/quotation/efficiency_is_doing_better_what_is_already_being/321906.html
4. Goodman, J.,. *Basic Facts on Customer Complaint Behaviour and the impact of Service on the Bottom line.* [online] Available http://www.newtoncomputing.com/zips/basicfacts.pdf , (06.03.2009)

5. Krebs, B.,. *10-Regel der Fehlerkosten* [online]. Available: http://www.olev.de/0/10er-regl.htm (June 2010)
6. Ministerium der Finanzen August 2000, *Handbuch der standardizierten Kosten- und Leistungsrechnung in Rheinland-Pfalz.* [pdf] Meinz Ministerium der Finanzen. [onliene]. Available: http://www.fm.rlp.de/fileadmin/fm/downloads/finanzen/kosten_leistungsrechnung/007_KLRHandbuch.pdf, (20.05.2011)
7. Șoim, H., Teodoru, M. – *Economie. Microeconomie-Macroeconomie, Mondoeconomie* – Casa Cărții de Știință, Cluj Napoca, 2008
8. *** *Organizarea structurală a unităților economice*. [online] Available: http://www.contabilizat.ro/file/cursuri_de_perfectionare/management_si_marketing/management/cap4.pdf (29.05.2011)
9. SR EN ISO 9000:2006 Romanian Standard corresponding to EN ISO 9000:2005. *Quality Management Systems – Fundamentals and vocabulary*
10. SR ISO/TS 16949:2009 *Sisteme de management al calității. Cerințe specificate pentru aplicarea ISO 9001: 2008 în organizații cu producția de autovehicole și de piese de schimb aferente*, Cap 5.6 Analiza efectuată de management, ASRO, 2009

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

ORGANIZATIONAL CHANGE MANAGEMENT. A CULTURAL APPROACH

Cristian ODAGIU, Marius PIȚURLEA

Doctoral School, VALAHIA University of Târgoviște, România

Abstract: *Although it remains structured on the same fundamental coordinates, management must meet current deep changes taking place in recent years in the context of globalisation. The transition to knowledge-based economy, shaping a future united Europe and the emergence of the concept of euromanager which is becoming better known require major changes in the defining features of the organisational culture.The remodeling plan of the organisational culture is associated with changes in management systems and the need for its professionalisation. The multiple interdependencies between organisational culture and modern management approaches appear as a natural consequence of the need to design and operationalize organisational changes. Understanding and manipulating organizational culture to improve performance is of particular interest in the light of the modernization programme within the public sector. Bibliographic sources of information from the national and international literature on organizational culture provided a picture of cultural management issues in relation to explain dynamics that can be used to manipulate culture to accentuate change. A good practice example of managing organizational culture in terms of implementing change and flexibility is seen in the Department for Sports of the Municipality of Bucharest. A briefly description of the interaction between organizational culture and the agenda for change in the example given develops conclusions and recommendations, in particular identifying appropriate responses that need to be developed in order to create an awareness of organizational culture to further shape the modernization agenda in the public sector.*

Keywords: *management, organizational culture, change, performance, euromanagement, public sector.*

1. INTRODUCTION[i]

Flagship initiatives of the Europe 2020 strategy advertises a continuing vocational training of local management, implying the priority action at all levels: national, both political and economic, of the public administration, businesses, training and consulting organizations.

The current dynamic of the processes of change in organizations requires to the organizational culture to encourage the formation and maintenance of a high organizational capacity, able to achieve rapid react

ons, flexible and grounded to the opportunities but also to the threats from both externally and internally.

In the specific context of the Romanian economy in transition, organizational culture extends its significance and importance, due to its impact on economic and organizational transformations. From this point of view, organizational culture is as important as the effective design of concrete economic changes, that is actually the "soft" to change. A good management at the organizational level involves defining, structuring, the operation and implementation of certain strategies of change and organizational development.

2. ORGANIZATIONAL CHANGE

Generated by the development of the organization or imposed by the need to make corrections in its evolution, organizational change is a reality which implies a proactive or reactive management depending on the requirements of the situation (Petrescu, Stegăroiu, Năbărjoiu, Duică, Popa, 2010: 77-79). This process is continuous, its intensity being influenced by a multitude of factors including organizational culture which plays a pivotal role. As a strategic tool, organizational culture is an indispensable component of an effective and efficient management (Mereuță-coordinator, Pop, Vlaicu, Pop, 1998:117).

The reciprocal relationship between organizational culture and management takes place naturally as the organizations have memories and individuals are strongly motivated to accept the precedent.

Managerial methods for changing organizational culture require staff training in the spirit of culture. For this purpose it is necessary to ensure a real motivation of the employees through the use of selection criteria, promotion and dismissals that reflects values much appreciated (for example the promotion of those who are inventive, creative, loyal to the organization etc.). The use of rituals and ceremonies that reinforce the feeling of belonging to the organization also has an important role in guiding management system by employees to overcome latent elements of the ancient culture (Ionescu, Toma, 2001:254).

Organizational culture is a diagnostic tool and change. Thus, the slow change-oriented cultures, jointed with faith in the ability of their modeling, will succeed in comparison to self satisfied organizations (Ionescu, 1997:135).

The need for the views convergence of the members of an organization has determined that the analysis of the organizational culture can measure the existence of consensus within it. Etzion believes that there are several aspects of obtaining consensus, as shown in the following table (Zghal, 2003:29):

Table 1
Different spheres of consensus in organizations

Consensus	Requirements
General values	social and community values
Organization goals	objectives by which the organization directs its efforts
Means	policies, tactics and tools
Participation	constraints, individual or volunteer commitment
Performance	perception of the relationship between payment and contribution
Cognitive perspectives	an agreement on facts, based on the language, on the reference framework and on the rules that underlie the understanding of reality and facts

A good management system with a crystallized high functionality facilitates the formation of a strong and competitive organizational culture. A vision forward, referencing to the approach of the issues linked to major organizational change operation and modeling of organizational culture involved, implies the existence of a professional management (Nicolescu, Verboncu, 2006:305).

Paying more attention to the possibilities and constraints associated with the organizational culture is a necessary procedure in the process of organizational change. Thus, it can be asserted that the interpretation of organizational culture is an integral part of the management process itself.

Whereas there is no single model to achieve change, managers can achieve to manage it through „*a large variety of ways ranging from an extreme to another, from the pure and simple coercion to the more subtle seduction and the introduction of new technical instruments*" (Schein, 1991:195).

Strategic leadership needs to lead the reforms necessary to change the organizational behavior and practice to create the premises for future organizational changes. These things require that at the head of the organization to be a leader with great skills, having a great experience to solve complex multi-disciplinary problems and to design links and interactions between policymaking and their implementation. At the same time, it is important to confirm that there is a need for a structured balance between the field of experience and the development of specialized skills within the group of management (Schmidtchen et al., 2010:XXI).

3. MODELING OF ORGANIZATIONAL CULTURE

Representing a true „*way of life*" for the members of an organization, organizational culture ensures a social continuity by involving beliefs, shared values and assumptions that exist in an organization (Johns, 1998:277, 278). These elements determine the rules and the behavior patterns that are born of these rules.

An important aspect is that related to the way in which managers can shape or influence culture. The inability of the organizational culture to evolve in accordance with changes due to the new organizational management approaches can have multiple negative consequences for human and economic (Nicolescu-coordinator, 2004:357).

Organizational culture is an important lever in modeling practices in order to improve organizational performance indicators. The desire to get a significant organizational performance involves a strong, participatory organizational culture, paying attention to values and employee beliefs, giving remarkable benefits for the appropriation of the methods for its changing.

Switching to strong organizational culture positively affects the functionality, efficiency and effectiveness of the organizations and their management, thus facilitating the crossing of the period marked by the crisis. Addressed in close connection with the managerial component that interacts with, *reshaping organizational culture which involves its rethinking and rebuilding* amplifies the position of determining the strategy of change in general and the condition of obtaining managerial performance.

Among the recent recommendations for Romania to ensure by strategy organizational culture targeting in close correlation with a performmance management may be mentioned: *"keeping people and innovative ideas within the company, developing a culture focused on trust, the opening to the communications and performing firm actions, identification of alternative major factors of success to exercise*

leadership and to learn how to lead change to corporate level" (Nicolescu, Verboncu, Profiroiu, 2011:107).

The necessity of implementing a professional management at the country level arise from the superimposition of the three particularly complex transitions: *the transition from command economy to a market economy*, which has not yet ended, *the total constructive and functional integration in the European Single Market* and *the transition from the current economy, existing in Romania to the knowledge-based economy,* which is the economy of the future.

The essential characteristics of the managers rely on knowledge, known in the last decade as "T" managers (Nicolescu, Verboncu, Profiroiu, 2011:169) are shown below:

Table 2
The essential characteristics of "T" managers

Major components of the activity	Significance
The horizontal component (the top of the "T")	carried out voluntarily, without constraints, on the basis of willingness to discuss and analyze problems with other managers and specialists
The vertical component ("T-stem")	hierarchical reports carried out in both directions

Typically, the vertical component is prominent throughout the time budget of the "T" manager but, as the organization moves forward toward the stage of knowledge-based firm, the trend of decrease of its share is becoming more evident.

In the context of a professional management, with the initiation of integrating actions that have led to the creation of the European Single Market and to continue the process of enlargement of the European Union, the concept of *euromanagement* has been noted.

Whereas the vast cultural diversity does not allow the EU to apply a certain prototype of management, the possible application of a *diversity management* will provide an european identity for euromanagers and for the exercise of managerial functions in the context of a future United Europe.

Cultural diversity, economic, political and social, the design, development and implementation of strategies at the level of companies that exceed the boundaries of a country, the creation of an european company identity, based on specific economic and social values, the mobility of human resources are some of the characteristics of the euromanagement as a diversity management (Petrescu, Stegăroiu, Năbărjoiu, Duică, Popa, 2010:50).

4. THE CASE OF THE DEPARTMENT FOR SPORTS OF THE MUNICIPALITY OF BUCHAREST (DSMB)

Organizations which have reached maturity or decline stage, characterized by immobility or excessive internal stability which prevents innovation, must modify some parts of the culture to have a good vision (Schein, 1991:195).

A good example of practice of an organizational culture management in terms of implementing change and flexibility is seen in the DSMB. Because the ministries, national agencies and authorities coordinating hierarchically DSMB since december 1989 sometimes attached activities for the youth field, the subject of this example is the 2006-2009 period.

DSMB is a decentralized public service of the National Agency for Sports (for the mentioned period) with legal personality and which provides the implementation of the Government's general strategy for sports in Bucharest by the two priority programmes: "*The Promotion of Sport Performance*" (P1)

and "*The Promotion of Sport for All*" (P2). The institution is financed from the state budget and from own revenues, having as main attribute to support sports activities in the territory according to the Law no. 69/2000 of Physical Education and Sports. DSMB also cooperates with the local authorities of public administration to organize and promote sports activities.

The main problem that stands in front of the management system in DSMB organization refers to the efficiency of the institution activity in terms of budgetary allocations increasingly smaller. This means to find the opportunities of improving DSMB performance indicators in the new created conditions. Therefore, the budgetary constraints and the increase in expectations for public services as well as the number of employees declining, mainly due to inadequate salaries, led the manager to transform his style of leadership.

Manager's influence on organizational culture and thus on the organizational effectiveness of DSMB involved the completion of several stages to change culture. As a positioning in managerial grid styles (caused by organizational internal and external factors and by manager's personality), the modeling of DSMB organizational culture resulted in *displacement of the focus on power and role to focus on tasks and personnel*.

Kilmann, an expert in organizational culture, argued that to change it requires five major steps (Ionescu, 1997:136,137), described below to DSMB:

Table 3

The stages of change in organizational culture

Steps	SDB managerial actions
Revealing the real norms (expected behavior in organization)	disclosed in the meetings of the organization, given the negative impact on the effectiveness of the organizational culture
Articulation of new directions	discussions with members of the organization to develop the organization's current direction and organizational behavior needed to obtain success
Establishing new rules	together with members of the organization preparing the list of new rules that will have a positive impact on organizational effectiveness
Identifying cultural faults	areas where there is a cultural gap between real rules and those that will positively affect organizational effectiveness
Reduction of cultural differences	consensus on new rules and tools design of their strengthening

A comparative method of the research data applied to the institutional performance indicators obtained for four consecutive years (2006-2009) has shown that managerial acts to achieve DSMB objectives represent a first step to performance in the history of this organization. The analysis regarding the

improvement of performance indicators proved that during the years 2007 and 2008, thanks to the unique period of stability at the management level, management tools could be used to influence organizational culture in order to obtain the best performances over both previous and next years.

Recovery rate of the budgetary financing (efficiency financing) for each of the four years (η_F) is the percentage ratio between the aggregate performance indicators (API) and the amount (A) related to financing (in thousands of Ron), according to the formula:

$$\eta_F\ (\%) = API/Ax100 \qquad (1)$$

As an eloquent example of the results of DSMB performance management, in the table below are shown the values of the aggregate performance indicators, of the budgetary financing and recovery rate during 2006-2009 (Odagiu, 2011):

Table 4
Some results for DSMB, 2006-2009

Year	2006	**2007**	**2008**	2009
API	100,04	**123,16**	**161,52**	124,89
A(thousands of Ron)	162	**141**	**140**	203
η_F (%)	61,75	**87,35**	**115,37**	61,52

5. CONCLUSIONS

The importance of understanding, harnessing, managing and maintaining an appropriate culture in public sector organizations cannot be underestimated in terms of its impact on the process of change.

Leadership plays an important role in effectively managing and developing culture in organizations. Kotter's argument since 1996 that the key to a successful organization is "*leadership, leadership and still more leadership*" (Brillantes Jr., Fernandez, 2011:69) has constantly validity.

To make an adjustment to the restrictive conditions, the manager focused on four stakes to obtain performance (Jacob, Rondeau, Normandin, 2008:112), as shown in the table below in the case of DSMB:

Table 5
Strategic change: four types of critical issues

Behavioral type	Ability	Action, meaning
Rational	capacity to improve	to edify a more performant system
Political	capacity to collaborate	to co-opt various partners
Human	capacity to contribute	to mobilize the people involved
Symbolic	capacity to identify himself	to make a sense of changes

This article contributes to the awareness and understanding of culture management in public sector organizations were the challenge is to develop this understanding into practical measures to further bolster modernization and deliver the "*performance culture where indicators inform policy choices, budgetary allocations and the day to day management of operations*" (O'Donnell, Boyle, 2008:73).

REFERENCES

1. Brillantes, A. B. Jr., Fernandez, M. T., "Restoring Trust and Building Integrity in Government: Issues and Concerns in the Philippines and Areas for Reform", *International Public Management Review,* Vol. 12, No. 2, St. Gallen, pp.55-70, (2011)
2. Ionescu, Gh. Gh., *Business Culture. The American Model*, Economic Publishing House, Bucharest, (1997)
3. Ionescu, Gh. Gh., Toma, A., *Organizational Culture and Transition Management*, Economic Publishing House, Bucharest, (2001)
4. Jacob, R., Rondeau, A., Normandin, F., La gestion du changement stratégique dans les organisations des secteurs public et parapublic: le

point de vue des practiciens, *Télescope*, Vol. 14, no. 3, Québec, (2008), pp. 107-113

5. Johns, G, *Organizational Behavior*, Economic Publishing House, Bucharest, (1998)

6. Mereuță, C.(coordinator), Pop, L., Vlaicu, C., Pop, L., *Organizational Cultures in the Romanian Area. Dominant Values and Profiles,* Expert Publishing, Bucharest, (1998)

7. Nicolescu, O**.**(coordinator), *Managers and Human Resource Management*, Economic Publishing House, Bucharest, (2004)

8. Nicolescu, O.; Verboncu, I., *Fundamentals of Organizational Management*, Economics Tribune Publishing, Bucharest, (2006)

9. Nicolescu, O., Verboncu, I., Profiroiu, M., *Health State of Romanian Management in 2010. Diagnosis and Predictable Solutions for 2011 Based on the Interrogations of 1988 specialists*, Pro Universitaria Publishing, Bucharest, (2011)

10. Odagiu, C., „Shaping organisational culture", International Conference *Modern Approaches in Organisational Management and Economy,* Fifth Edition, Bucharest, (2011)

11. O'Donnell, O., Boyle, R., *Understanding and Managing Organisational Culture,* Institute of Public Administration, Dublin, (2008)

12. Petrescu, M., Stegăroiu, I., Năbărjoiu, N., Duică, A., Popa, E., *Change management and risk*, Bibliotheca Publishing, Târgovişte, (2010)

13. Schein, E. H, Plaidoyer pour une conscience renouvelée de ce qu'est la culture organisationnelle, in Tessier, R. & Tellier, Y. (coordinators), *Pouvoirs et cultures organisationnelles*, Presses de l'Université du Québec, pp. 175-196, (1991)

14. Schmidtchen, D. et al, *State of the Service Report 2009-2010*, Australian Public Service Comission, Canberra, (2010)

15. Zghal, R, Culture et gestion: gestion de l'harmonie ou gestion des paradoxes?, *Gestion,* École des Hautes Études Commerciales de Montréal, Vol. 28, No. 2, pp. 26-32**,** (2003).

[i] This article is developed in the project "Doctoral Preparation of Excellence for the Knowledge Society-PREDEX", co-financed by EUROPEAN SOCIAL FUND: Sectoral Operational Programme Human Resources Development 2007-2013. No. contract identification: POSDRU/CPP107/DMI1.5/S/77497

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

ASPECTS REGARDING THE INSURANCE DECISION OF THE INDUSTRIAL PRODUCTION COMPANIES AGAINST EXTREME EVENTS

Florin Cătălin OLTEANU, Gavrilă CALEFARIU, Cătălin CIOACĂ*

*Department of Technological Engineering and Industrial Management,
"Transilvania" University of Braşov, Romania

Abstract: *The majority of insurance decisions have to deal with uncertainties because of the unknown manifestation probabilities of the insured risks.*
This paper presents the application of the decision without experimentation in the process of closing policies for the buildings and goods of an industrial production company by using the minimax decision rule and the Bayes procedure with initial probabilities. Using the initial probabilities distribution, which works in conditions of risk, the decision maker can decide not to close the insurance policy. Their actions will be dictated by their attitude towards risk.

Keywords: *decision, insurance policy, insurable risks, initial probabilities, Bayes procedure*

1. INTRODUCTION

An insurance policy for buildings and goods belonging to businesses covers a variety of insurable risks due to extreme events such as: fire, explosion, storm, landslide, earthquake, flood, theft, vandalism or terrorism [1].

The decision to close such an insurance policy for an industrial production company must be well founded and presents a certain degree of difficulty to the said company's managers due to the size of the premiums versus the big values of the possible damages.

In this paper we aim to solve the problem of the decision regarding the insurance of an industrial production company by using the Bayes decision procedures with no experimentation. They contain both methods for decision in uncertain conditions (the minimax decision rule) and methods for decision in risk conditions (the Bayes decision rule) with which we use the initial probabilities distribution of nature's states coming from the decider's own experience. The decision procedure is used in the paper as an "algorithm for solving a decision problem", algorithm presented extensively in the cited specialty literature [2].

2. FORMULATING THE DECISION PROBLEM

The action space $A=\{a_1,a_2\}$, comprises the actions:

a_1 - the industrial production company closes the insurance policy;

a_2 - the industrial production company doesn't close the insurance policy.

The state space is $\Theta = \{\theta_1, \theta_2\}$, where:

θ_1 - there are no damages;

θ_2 - there are damages.

We note:

P - the insurance premium;

S_A - the insured sum;

D - the value of the possible damages.

The algorithm for defining the decision problem includes:

1. define the consequences (θ_i, a_j), where i=1,2 and j=1,2 (Table 1).

Consequences	Actions	States
(θ_1, a_1)	Insure	No damages
(θ_2, a_1)	Insure	Damages
(θ_1, a_2)	Don't insure	No damages
(θ_2, a_2)	Don't insure	Damages

Tab.1 Consequences matrix

2. associate the profits and costs corresponding to the consequences (Table 2).

Actions	Nature's states	
	θ_1	θ_2
a_1	$-P$	$-P$
a_2	P	$-D$

Tab.2 Profits and costs

3. define the loss function (Table 3):

Actions	Nature's states	
	θ_1	θ_2
a_1	$L(\theta_1, a_1)$	$L(\theta_2, a_1)$
a_2	$L(\theta_1, a_2)$	$L(\theta_2, a_2)$

Tab.3 The loss function

In our case the loss function is (Table 4):

Actions	Nature's states	
	θ_1	θ_2
a_1	P	P
a_2	$-P$	D

Tab.4 Particularizing the loss function

3. THE DECISION WITH NO EXPERIMENTATION

In the case of this type of insurance decision we can use both the minimax decision rule and the Bayes procedure with initial probabilities.

3.1 The minimax decision rule. For each of the two action variants a_1 and a_2, we calculate in the last column of Table 5 the loss function's maximum values [2].

	Nature's states		$\max L(\theta_i, a_j)$
	θ_1	θ_2	
a_1	P	P	P
a_2	$-P$	D	D

Tab.5 Calculating the loss function's maximum

We calculate the minimum of the values in the last column of the previous table $\min_j \max_i L(\theta_i.a_j)$.

According to the minimax decision rule we choose the action corresponding to the line where the minimum is obtained.

Discussion:

- if $P < D$, then $\min_j \max_i L(\theta_i.a_j) = P$,

then we choose action a_1 - meaning that the industrial production company is insured.

- if $P > D$, then $\min_j \max_i L(\theta_i.a_j) = D$,

then we choose action a_{21} - meaning that the industrial production company is not insured.

3.2 The Bayes decision rule with initial probabilities. The decision maker may have certain information regarding the manifestation possibilities of the nature's states, which can then be transformed into a probability distribution of convictions regarding these possibilities. This conviction probability distribution, called initial distribution, has a certain degree of

subjectivity and depends on the experience and intuition of the decision maker [3,4].

Nature's state	θ_1	θ_2
Initial probabilities	$p_\theta(1)$	$p_\theta(2)$

Tab. 6 Defining initial probabilities

Initial probabilities (Table 6) represent the manifestation probabilities of the different states of nature θ_i, that is:

$$\text{Prob}\{\theta=\theta_i\}=p_\theta(i), i=1,2 \qquad (1)$$

They must meet the following conditions:
$0\le p_\theta(i)\le 1$ and $p_\theta(1)+p_\theta(2)=1$.

We note $p_\theta(1)=1-q$, the probability that the damage will occur, and $p_\theta(2)=q$, the probability that the damage will not occur.

The values of the initial probabilities are presented in Table 7.

Nature's state	θ_1	θ_2
Initial probabilities	q	$1-q$

Tab.7 The values of initial probabilities

The Bayes decision procedure guides the decision maker towards the action which will minimize the medium loss evaluated according to the initial distribution.

In the case of discrete distributions [2,5], the medium loss is calculated with the relation:

$$L(a_j)=M[L(\theta_i,a_j)]=\sum_{i=1}^{n}L(\theta_i,a_j)p_\theta(i) \qquad (2)$$

The medium loss for each action a_j, is shown in the last column of Table 8.

Action	Nature's states		$L(a_j)$
	θ_1	θ_2	
a_1	$L(\theta_1,a_1)p_\theta(1)$	$L(\theta_2,a_1)p_\theta(2)$	$L(a_1)$
a_2	$L(\theta_1,a_2)p_\theta(1)$	$L(\theta_2,a_2)p_\theta(2)$	$L(a_2)$

Tab.8 Medium losses

According to the Bayes decision rule, the variant where the medium loss $L(a_j)$ is minimal is chosen.

In our case the calculation of the medium losses is shown in Table 9.

If $L(a_1)<L(a_2)$, then $P<D-q\cdot(P+D)$. After doing the calculations:

$$P<\frac{1-q}{1+q}\cdot D \qquad (3)$$

In this case the industrial production company closes the insurance policy.

Action	Nature's states		$L(a_j)$
	θ_1	θ_2	
a_1	$q\cdot P$	$(1-q)\cdot P$	P
a_2	$q\cdot(-P)$	$(1-q)\cdot D$	$D-q\cdot(P+D)$

Tab.9 Calculation of the medium loss

If $L(a_1)<L(a_2)$, then $P<D-q\cdot(P+D)$. Result:

$$P<\frac{1-q}{1+q}\cdot D \qquad (4)$$

In this case the industrial production company does not close the insurance policy.

4. NUMERICAL APPLICATION

The management of the industrial production company "ALFA" must decide if they will close an insurance policy for

buildings and goods which will cover the risk of fire, explosion, lightning, etc.

The value of "ALFA"'s building is 1.500.000 Euros, and the value of its goods is 5.450.000 Euros. The insurance premium "ALFA" has to pay is 30.000 Euros.

During one year, the company may face one of the situations defined in the state space $\Theta = (\theta_1, \theta_2)$:

θ_1 - no damages;

θ_2 - damages up to 500.000 Euros.

The action space $A = \{a_1, a_2\}$

a_1 - the insurance company accepts the insurance request;

a_2 - the insurance company does not accept the insurance request.

The state space $\Theta = \{\theta_1, \theta_2\}$.

The values of the profits and the costs of the "ALFA" company (Table 10).

Actions	Nature's states	
	θ_1	θ_2
a_1	- 30.000	-30.000
a_2	30.000	- 500.000

Tab. 10 The values of profits and costs

The values of the loss function are shown in Table 11.

Actions	Nature's states	
	θ_1	θ_2
a_1	30.000	30.000
a_2	- 30.000	500.000

Tab.11 The values of the loss function

a) The minimax decision rule

We calculate the maximum of the loss function for each action (Table 12).

	Nature's states		$\max L(\theta_i, a_j)$
	θ_1	θ_2	
a_1	30,000	30,000	30,000
a_2	-30,000	500,000	500,000

Tab.12 The maximum of the loss functions

In our case $P < D$, then $\min_j \max_i L(\theta_i . a_j) = 30{,}000$. Thus we adopt option a_1, meaning the company closes the insurance policy.

b) The Bayes decision rule with initial probabilities

The values of the initial probabilities in our case are shown in Table 13.

We calculate:

$$\frac{1-q}{1+q} \cdot D = \frac{1-0.993}{1+0.993} \cdot 500{,}000 = 1756$$

$P = 30.000$.

Nature's state	θ_1	θ_2
Initial probabilities	0.993	0.007

Tab.13 The values of initial probabilities

We observe that $P > \frac{1-q}{1+q} \cdot D$. According to the rule the company does not close the insurance policy.

3. CONCLUSIONS

The Bayes decision procedures bring the decisions taken in uncertain conditions closer to the ones taken in conditions of risk by using probability distributions. In this paper we used the initial probabilities distribution which is based on the experience and intuition of the decision makers.

In the application we presented by using the minimax rule, which works in conditions of uncertainty, the decision makers should close the insurance policy. Using the initial probabilities distribution, which works in conditions of risk, the decision maker can decide not to close the insurance policy. Their actions will be dictated by their attitude towards risk, meaning that if they are risk averse, they will close the policy, and if they have an "appetite" for risk, they will not close the insurance policy.

4. ACKNOWLEDGMENT

This paper is supported by the Sectorial Operational Programme Human Resources Development (SOP HRD), financed from the European Social Fund and by the Romanian Government under the contract number POSDRU/107/1.5/S/76945.

REFERENCES

1. Negoiță, I., (2001). *Aplicații practice în asigurări şi reasigurări*, Etape Publishing House , Sibiu.
2. Bârsan-Pipu, N., Popescu, I., (2003). *Manage-mentul riscului: concepte, metode, aplicații,* Transilvania University Publishing House, Braşov.
3. Bowker, A. H., Lieberman, G. J. (1972). *Engineering Statistics,* Prentice-Hall, Englewood Cliffs.
4. Hillier, F. S., Lieberman, G. J. (1986). *Introduction to Operations Research*, Mc-Graw-Hill Publishing Company, New York.
5. Achim, M. L., (2008). *Asigurările de bunuri şi persoane în economia cunoaşterii*, Editura Economică Publishing House , Bucureşti.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

EDUCATIONAL MANAGEMENT, A NEW PARADIGM IN SOCIAL DEVELOPMENT

Marius PIȚURLEA, Danuț CĂLDĂRARU, Dorin IANCU

Universitatea ,,Valahia Târgovişte",Târgovişte, România,** Universitatea Bucureşti, Bucureşti, România,*** Universitatea ,,Valahia Târgovişte",Târgovişte, România

***Abstract*:** *Community development, as equation where the educational matters organization with its own programs, projects, missions, objectives and content, allows realization macro and micro level decision, supports educational activities by extending cultural and educational infrastructure, stimulate the beneficial effects of policies in areas social, economic, financial. School like any other organization exists and works because it's an uncertain environment and constantly changing, it has to respond continuously to maintain balance and to develop. In these circumstances school and striping to reconfigure mission in developing social roles, it is by promoting national strategies performance. La we need a strategy developed national professional, directing, to, accelerate and streamline the construction economy knowledge in our country. Such a strategy is required to include the following components: mission, core objectives, strategic options, resources, deadlines and competitive advantages.*

Keywords: *Management education, community development, public policy, community character, resources*

1.INTRODUCTION

Form school mentality that only holders of,, libraries, intellectual undesirable falls. Not Form school mentality that only holders of,, libraries, intellectual undesirable falls. Not purely subjective reasons, but for argument descriptive knowledge of the universe. Search the creativity and pragmatic plan were not those who acquire, store and then disseminate the information. I accept only those who process information from multiple sources familiar with adaptive timing requirements and are dynamic in the identification and interpretation of meanings. Mission and aims of the school revolves around an ongoing concern. Learners to develop their personality, autonomy and creativity. And because the

school can't circumvent other types of learning, social, spontaneous or by imitation, suggest that the idea of convergence of concerns for training, information and spiritual moderation others find themselves in community development models and those of policy. Although that form of expression, community development matters in educational management strategy, however, it can't cover entirely the attitude objects that subscribe to the functional size records, relational or optional. Community Development, agreed in collaboration with educational management, highlights the relationship of individuals to the state, suggests the idea of social participation, even through the missions, purposes, strategies of teaching-learning-assessment, time and resources, facility local community through membership in social integration community and is ubiquitous in social space by communicating and networking. Add that the concept of community development can create dynamic social space convenient for trade and social interaction. School, in the general context, general management education, is nothing but a learning organization. It adapts to new social roles, prints positive energy generating relationships with the local environment and open slot by tightening resource organization. Indissoluble connection with community development policy focuses on shaping forms of selection, arrangement and hierarchy of decisions, the rational use under training and education infrastructure and the continuity of economic and social development. Educational management strategy allows the school to prepare young people, so they put in the service of society and others. Knowledge attitudes deeply rooted in the social cohesion, communication and pro social behaviors are consequences of moral and social education. Transmitters designed intelligence roles, teachers are not only suitable main courses. Is based on interpersonal, cognitive modeling knowledge and actions, creating compatibility with internal systems and union of disciplines. Educational management is sure to limit the effect of organizational closure. Endorsement knowledge, behaviors and personality patterns become bargaining chips for membership of the social environment, to affirm the individual as one who understands that their interests are dependent on social responsibilities. School organization, without intelligence management can't solve equation Strategy for a Community that society so desperately needs today [1].

2.Management objectives and projections in community development

Management practiced in Romania, compared to management prevailing in the European Union, in the opinion of more than two thirds of respondents-less. Almost an eighth of them is considered about the same, and a seventh European average even higher [2].

Assessments are significantly different from the teachers, researchers and consultants, compared with those of managers and specialists from economy. First believes, almost 80%, that management in Romania is lower than that practiced in the EU, compared to 53% as are managers and professionals who share the same opinion. Credibility gap than can be explained mainly by two factors [3]:

- Management practitioners have indicated especially in comparison with EU practitioners, if not profitable actinic short and medium term, it helps managers to have a strategic vision [4].

- A narrow base of knowledge of European management by practitioners in Romania,

compared with teachers, researchers and management consultants who, by nature of current and 'sphere' communication and relational information are involved, perceive more information on international management. Quality and efficiency of management practices in Romania is significantly closer to management of the Central European countries, as shown in Figure 1

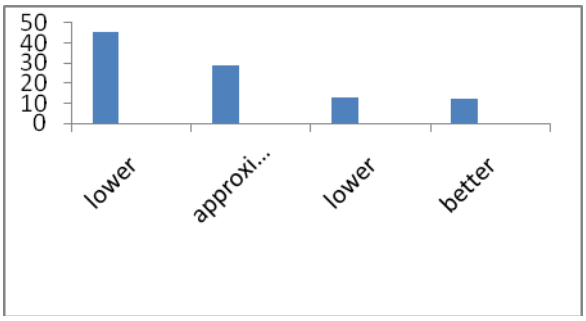


Figure no. 1 - Quality and efficiency of management practices in Romania is significantly closer to the management of Central Europe

Over two fifths of respondents (41.48%) believe that management in Romania is the same or even superior management practices in the economy of Central. The concept of community development is not limited to the narrow sense, the dictionary, but it brings the world of the citizen concerns, the product of school education and one that can monitor and facilitate community services. Community Development was created as a result of participatory observations, which were ranked in the grid by David Osborne and Ted Gaebler (1995), during the conduct of social processes. Communication deficit occurred in local government levels in relationship to mass audiences, with their objects of attitudes, knowledge generated conflicts in plans, their attitudes and skills. Citizen, the beneficiary community, but also as a generator multiplied decisions in relation to the objectives, planned middles forces and contexts, the role of logical relationship win the state, a participant in the social missions and the integrator in the life of the community . Hence, we conclude immediately that individual interests can only be about giving up responsibilities social. Idea long paradigm commonly used, so that the individual is manipulated in community development equation, is found in another register of emergencies. We will put emphasis on community development will move the dial dominated by novelty, effectiveness of decision and major changes in the economic and social development. Although effects community development had prominence and focus on targets in the West, however, theoretical and methodological concerns in Romania is in its infancy. Even if some controversy comes from inventing meanings behind the appraisal outlined emergency community development, we still do not fall to support the objectives are formulated based on insufficiently clear. Community development suggests, appreciated, and organizes communication reveals the social, and desirable behaviors seen in all enliven interest organization networking and negotiation. For school organization, community development, community involvement is

endorsed, networking and negotiation with local community modules, those that will create opportunities to show through voluntary action or by the social protection. Recent research has focused on assessing communication community setting school teachers say that the concern for integration in the internal life of the social environment of the local community in a latent state. Reasons related to subjective reasons, and those objectives. Simply look at the boards that the present representatives of the local community isn't related to modeling communication in the local environment (community). Leaving public school space be reconsidered and adapted to the requirements imposed by Community environment, legal rules, and communicative-discursive concepts that must be every manager, teacher, staff, students, parents or people with public status. Realities of management education in the field of community development

In terms of the meanings made public, school organization has notified the payment legislation develop school partnerships and school levels, school, university, school-community. By 2011, the county school inspectorates levels, active image specialists whose skills aimed at monitoring, modeling and creating institutional news, which emphasized communication with the local environment. The new structural dimensions ignored concerns for public consideration regaining Romanian school. And then, for communication with the community remained the task of director, dean or rector, have no relevance to an assessment or decision designed foreshadowing. Community structures facilitate communication with local school helps identify opportunities to place force educated labor market, increasing confidence that members of society understand the role, mission and purposes of schools, resize networking strategy to members of institutions municipalities, prefectures, county councils, NGOs in reshaping curriculum and adapt to social dynamics, local, regional or national. So far, plans and programs shall be kept school levels, is valued by the inspectorate or ministry and entered into their database. The concept of community development model shape suggests reviewing the decision creates strengths for teaching and training infrastructure, economic and social development resizing mechanism. Secondary education has difficulty in covering objectives means that stimulate community development. That material and financial resources from the public budget, leading to a dependence of the leadership of parishes that converge on the central budget, which it manages the Ministry of Education. For higher education, were at hand, the structural changes and financial policies conjugation forces for renewal. Therefore, it was easy to establish the structures competent ministry of communication and creating public image, commissions for certifying diplomas, degrees and academic certificates, etc. for social scholarships. For now, we can conclude the assertion, that the Romanian higher education is indeed a strategic resource [5].

Community Development, with the four dimensions of her individual relationship with the state, social participation, membership in the local community associational life may develop educational management strategy, in the manner:

- Individual relationship with the company
• Professional Studies;
• Courses and training strategies
• The exercise of social rights;
• Communication with representatives of public institutions.

-Social participation
• Plan, organize and carry out social projects
• Initiation and development of educational marketing strategies
• The teaching of the curricular area

- Membership in the local community

• Design objectives relationships
• Knowledge of formal structure of local community
• Learn, practice and communication standards are validated in the local
• Preparing data to supplement curriculum with information from local, regional or state.
The model adopted current course work increases in relation to increasing the number of students or the amount of knowledge. The new model, the goal is not to transfer knowledge but to build environments and experiences to push learners to discover and solve problems. So, are always looking for more effective learning technologies that are developed, tested, implemented and evaluated by comparison, because focus is more on improving the quality of learning, individual and aggregate, and less on the teaching. Also, the current model promotes rather than facilitating access to higher education success. In this way, changing focus from teaching to learning has a productivity advantage, because it will increase production efficiency of learning outcomes. While instructional design model is that we can increase learning outcomes without increasing investment in resources in this learning-centered model (efficiency) is just the main focus [6].

Feedback on learning outcomes is an important element in the new model, both the teachers and the institutional level. Learning outcomes include everything students performed as a product of the learning experience. From this perspective, any measurement of students' products, obtained after a learning experience, is a measure of learning outcomes, which are more useful to be taken into account than any other resource type entry.

The paradigm of learning environments and learning activities are student centered and controlled by it. They can exist even without teachers. Since teachers defined learning experiences and environments for students, usually in groups of students or other staff - they do not have to attend or participate in any structured learning activity. Learning Theory in the new model considers that all "students acquire knowledge in an authentic way when they are involved directly in the middle of holistic, comprehensive and meaningful, organized by long-term goals." Learning paradigm promoted by Gardner over to the "education for understanding" which is "a sufficient grasp of the concepts, principles and skills that allow individuals to pass on issues and situations we can decide to what extent the powers held at that time are sufficient and how this can advertising new skills or knowledge. " This requires mastery of functional intellectual framework, based on knowledge rather than short-term retention of contextual clues and split" [7].

If the training paradigm, teachers classify and sort students, in the worst cases, those who „cloth" and „who can't understand", because the intelligence and skills are something rare, the paradigm of learning, teachers and all others in the institution are certainly committed to the success of each student. Concept of the potential of each student, learning paradigm adopted is consistent with

an optimism teaching that each individual is likely to succeed. The learning paradigm teachers find ways to develop those vast talents of each student and to pave the way to success. This way does not mean a struggle for individual win-loss, but challenging learning environments based on win-win mentality, cooperative, collaborative and supportive. These environments are built on the principle that the achievements and success are a result of teamwork and group efforts, even when apparently worked alone.

The paradigm of instructional resources are lost not only institutional, but also time and energy students. This loss comes from time spent at various entry queues at bookshops, by blocking them in the hours that must be spent in classrooms or other courses or redundant requirements. In this way we can't learn effectively and efficiently. The authors consider that income may be the most powerful feedback tool for schools and that is also most powerful item that can cause the transition to the new paradigm. Thus, funding will be made based on learning outcomes and institutional results correlated and not hours of training provided [8].

3.CONCLUSIONS & ACKNOWLEDGMENT

Management education in community development equation is based on arguments and intelligent organization, the examples, reasons and authentic evidence, which smoothes out tactics and strategies: modeling decision-instructional teaching infrastructure reconstruction, economic development resize social mechanism.

Opening the school to the local community should not be an option, but an argument for fidelity educational activity extended to: labor reconversion, providing vital human resources required for local areas, fostering volunteerism initiatives for implementing projects, humanitarian aid and charity, restoring, maintaining and strengthening the school image.

The education system in Romania is now felt the urgent need to develop a programmatic document, proposed by the Ministry to establish a period of 10 years, a number of priorities and directions of action taken by school people, the public sector and civil society, central government and local authorities, by all participants in education and, not least of all political forces. The application of these priorities and courses of action would provide minimal guarantees for education to respond adequately to the challenges and pressures of context problematic, complex and unpredictable. However, we rely on the premise that the proposed changes would contribute to the achievement of quality education and thereby to the economy and culture and personal development of children, youth and adults.

REFERENCES

1.A. Kuhn, Thomas S., [1962] (2008), The structure of scientific revolutions, Bucharest, Humanitas Publishing House.

2.Muster, D, 1985, Research methodology in education and injured, letter, Bucharest

3.Planchard, E, 1978, Research in Education, Teaching and Pedagogical Publishing House, Bucharest

4.McMillon, Jones, H, 1992, Educational Research, Harper and Collins, New York

5.Stănciulescu, Elizabeth (2002), about the transition and the university, Iasi, Polirom.

6. Ragojinaru, Adela, 2003, public relations fundamentals, Triton, Bucharest.

7. Vlăsceanu, Lazarus (2007), Sociology and

modernity, reflexive modernity Transitions to Iasi, Polirom
8.Clark, Burton R., (2008), On Higher Education. Selected Writings, 1956-2006. Baltimore: The Johns Hopkins University Press.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

COMPUTER ASSISTED LEAN PRODUCTION MANAGEMENT

Luminița POPA*, Marian ȚEPURU**

* Faculty of Electrical Engineering and Computer Science, Translvania, Braşov, România ,
** S.C. Stabilus, România S.R.L. Braşov, România,

Abstract: *The corporation's great challenge is their ability to adapt to competitive market dynamics, the continuous adaptation of their production systems and technologies by a performance management and leadership of human resources and leveraging the information technology advantages available for managers.*

Keywords: *Lean manufacturing ,Computer integrated manufacturing, SAP supports*

1. INTRODUCTION

The transition to the ideas economy transforms the knowledge economy in the main source of power and the enterpris in a knowledge amplifier. Because of market systems and mechanisms imperfections it is needed to promote the economic intelligence management, the consistency provided by projects and common objectives, the quality of a primate from the relational skills, the cross flow of information. In the era of intelligent information, the manager must know how to add value by finding the way to performance. Currently the product market is characterised of unprecedented dynamism due to competition between producing firms mainly manifested globally on the one hand and, on the other hand, the trend of diversification, customization and frequent change of the types of products produced. In order to survive in such a market, companies must act quickly to improve the activities of production units, the human resources and economics management and to take in consideration new issues until recently were considered the side, such as limiting the environmental impact of industrial activity.

2. THE LEAN MANUFACTURING PRODUCTION

2.1 Definition. *Lean manufacturing is the systematic elimination of waste from all aspects of an organization's operations, where waste is viewed as any use or loss of resources that does not lead directly to creating the product or service a customer wants when they want it. In many industrial processes, such non-value added activity can comprise more than 90 percent of a factory's total activity*[1]. The *"lean manufacturing"* production system is based on the configuration shown in the figure1.

2.2 Outcomes of Lean Manufacturing

[1] *Source: Simon Caulkin. "Waste Not, Want Not," The Observer (September 2002).*

Figure 1. The "Lean Manufacturing" production system[2]

When companies implement several or all of these lean methods, several outcomes consistently result:

- Reduced *inventory* levels (raw material, work-in-progress, finished product) along with associated carrying costs and loss due to damage, spoilage, off-specification, etc;
- Decreased *material* usage (product inputs, including energy, water, metals, chemicals, etc.) by reducing material requirements and creating less material waste during manufacturing;
- Optimized *equipment* (capital equipment utilized for direct production and support purposes) using lower capital and resource-intensive machines to drive down costs;
- Reduced need for factory *facilities* (physical infrastructure primarily in the form of buildings and associated material demands) by driving down the space required for product production;
- Increased production *velocity* (the time required to process a product from initial raw material to delivery to a consumer) by eliminating process steps, movement, wait times, and downtime;
- Enhanced production *flexibility* (the ability to alter or reconfigure products and processes rapidly to adjust to customer needs and changingmarket circumstances) enabling the implementation of a pull production, just-in-time oriented system which lowers inventory and capital requirements.

2.3 Changes in organizational culture after lean implementation

Reduced *complexity* (complicated products and processes that increase opportunities for variation and error) by reducing the number of parts and material types in products, and by eliminating unnecessary process steps and equipment with unneeded features.At the same time, lean implementation consistently fosters changes in organizational culture that exhibit the following characteristics:

- A *continual improvement* culture focused on identifying and *eliminating waste* throughout the production process;
- *Employee involvement* in continual improvement and problem-solving;
- *Operations-based* focus of activity and involvement;
- A*metrics-driven* operational setting that emphasizes rapid performance feedback and leading indicators;
- *Supply chain investment* to improve enterprise-wide performance; and
- A *whole systems view and thinking* for optimizing performance.

2.4 Methods and tools used by the organization. There are numerous methods and tools that organizations use to implement lean production systems. Eight core lean methods are described briefly below. The methods include:

1. **Kaizen** Rapid Improvement Process
2. 5S
3. **T**otal **P**roductive **M**aintenance (TPM)
4. Cellular Manufacturing / One-piece Flow Production Systems
5. Just-in-time Production / Kanban
6. Six Sigma
7. Pre-Production Planning (3P)
8. Lean Enterprise Supplier Networks

Fundamentally, organizations implement lean to achieve the highest quality product or service at the lowest possible cost with maximum customer responsiveness. To accomplish this, they typically focus on three key goals:

[2] *Source: Lean Thinking. Womack and Jones, 1996*

- Reducing product or service production resource requirements in the form of capital and materials;
- Increasing manufacturing velocity and flexibility;
- Improving first time product quality.

3. COMPUTER INTEGRATED MANUFACTURING AND LEAN PRODUCTION

3.1 Computer integrated manufacturing. Computer integrated manufacturing is an automated version of the overall manufacturing process, where each function is replaced by a set of automated technologies. In addition, traditional mechanisms of integration of oral and written communication are replaced by digital technology. With CIM, the three main functions (Product Design and Manufacturing Process Planning and Production Monitoring, Production itself - are replaced by six functional areas:

1. Computer Aided Design;
2. Group Technology;
3. Systems Planning and Tracking Production;
4. Automated Material Handling;
5. Robotics;
6. Computer Assisted Manufacturing.

It can be said that information flow is a determining factor in characterizing the CIM concept. The quality, intensity and speed of information flow have crucial implications on the products. Information technologies are a complex of interconnected disciplines to form integrated enterprises, based on distributed database systems, unified and standardized.

3.2 The CIM concept applied in production. The necessary computing system for integrated production complex software / hardware / communications is capable, based on implemented algorithms, to achieve optimal manufacturing management in real time.

The CIM concept has mainly the next parts:

- **PP&C** - **P**lanning **P**roduction & **C**ontrol;
- **CAD** - **C**omputer **A**ided **D**esign;
- **CAE** - Computer Aided Engineering;
- **CAPP** - Computer Aided Process Planning;
- **CAM** - **C**omputer **A**ided **M**anufacturing;
- **CAP** - **C**omputer **A**ided **P**lanning;
- **CAQ** - **C**omputer **A**ided **Q**uality;
- **CAS** - **C**omputer **A**ided **S**ervice.

PP & C systems are designed to meet the following operational objectives:
- improve knowledge delivery dates;
- improving delivery of information (the information flow);
- reduce delivery times;
- reduction of inventory levels over time, while maintaining levels of availability in materials and components.

Computer Integrated manufacturing system (CIM) is the system in which the processes are headed (partial or total) with a hierarchical network of computers in a new organization system (partial or total) type JIT, in order to increase technical and economical performances.

3.3 Lean execution. *Lean execution* consists of all functions related to pull signal generation, signal distribution throughout the shop floor, and production/material movement tracking.
- Supports different techniques for pull signal creation: terminal, RF handheld, RFID devices, EDI, and XML messages
- Different flavors of kanban – pull – signal distribution: printing, EDI, mail, and so forth.
- Support for different replenishment flavors: internal supermarket- and pacemaker and heijunka scheduling/scheduling and external procurement including Web-based kanban
- RFID-enabled kanban

- Manual and automatic supply to production with container-independent summarized JIT-calls
- Operational method sheets
- Production tracking and back flushing

Lean Manufacturing Performance is shown in figure 2.

4. MANUFACTURING INTEGRATION WITH SAP

4.1 Success in lean manufacturing. Success in lean manufacturing is heavily dependent on quality data collection, integration, and analysis. Through MII – manufacturing integration and intelligence – and SAP Business Objects solutions, SAP delivers the integration, information visibility, alert based process monitoring, and analytical functionality you need to turn data into knowledge.

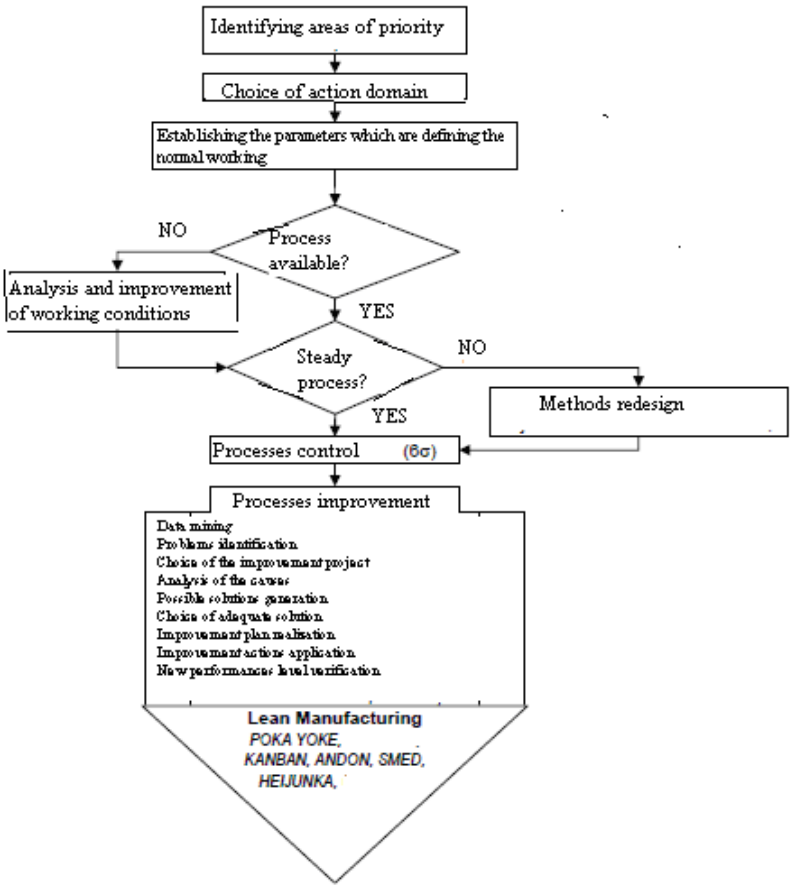


Figure 2. Lean Manufacturing Performance

Its powerful business intelligence solutions and data collection/integration functionality gives you the ability to capture and monitor data on a continuous basis and deliver it to the right person, at the right time and in the right format – all in real time.

Beyond lean techniques, SAP supports most manufacturing processes like high volume make-to-order manufacturing, repetitive manufacturing (order-less production), production order manufacturing, and assemble-to-order manufacturing.

Implementation of Lean Manufacturing principle leads to:

- Reduction by half the length of human effort in production workshop;
- Reduction by half the finished product defects;

- Reduction in third during the preparation of production;
- Reduction by half the production space to obtain the same results;
- Reduction to a tenth or less of work in progress.

Methods of the LEAN:
- OEE (Overall Equipment Effectiveness);
- TPM (Total Productive Maintenance);
- SMED (Single Minute Exchange of Die).

4.2 Total productive maintenance (TPM) and JIT. TPM is a critical technique for Lean manufacturing. Total Productive Maintenance is a technique to increase the degree of efficiency and productivity of the equipment, widely used in developed countries enterprises. TPM can be seen as "preventing damage", not "car repair". So, TPM is an approach based entirely on prevention.TPM seeks to involve all functions of the organization in order to obtain optimal overall efficiency of production equipment. Lean concept implementation begins with the production. Receiving orders until delivery involves developing and implementing a set of measures. Implementing the concept is eliminating waste by managing time of production, from design - production and distribution; planning activities are following the development and implementation of Quality manual.

Just in Time. Just-In-Time (JIT) approach is based on a philosophy built on the next requirements: only items required are produced in required quantities, in required time with the desired quality (figure 3).

Figure 3. Just in Time concept

3. CONCLUSIONS & ACKNOWLEDGMENT

In conclusion, the results of implementing Lean concepts are:
- reduce costs and shorten the reaction time to market signals;
- increase productivity and reduce inventory;
- improving the quality, delivery terms and conditions of work;
- motivating employees;
- total customer satisfaction

CIM is a comprehensive enterprise management processes for industrial automation. It appears as a special program under which industrial automation projects are planned, executed and integrated. CIM creates effective systemic links between isolated compartments that will influence the quality of manufacturing. Lean production eliminates waste and creates continuity in any flow of value creation.

REFERENCES

1. Badea, F., Bagu, C., Deac, V.,. *Managementul productiei.*: Editura All Beck (1999).
2. Bagu, C., Deac, V.,. *Strategia Firmei.*Editura Eficient (1999).
3. Simon Caulkin In *Waste Not, Want Not* . , *The Observer*, September (2002).
4. Womack and Jones. *Lean Thinking* (1996).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

NEW TRENDS IN HUMAN RESOURCE MANAGEMENT IN THE HOSPITALITY INDUSTRY

Constanța POPESCU, Dana – Mădălina AVRAM (RAȚIU)

Valahia University, Târgoviște, Romania

Abstract: *In the new millennium, human resource management in the hospitality industry will focus on talent management, reassessment of what strategic human resource management means in terms of structure, and the human capital and knowledge management will become key themes for organizations. Therefore, vocational training issues, competence development and service quality will be in the future as important as they are at present; technology will continue to revolutionize the way in which the activities of human resource management are conducted; the differences between the generations forming the personnel structure in the hospitality industry will generate new approaches in the human resource management in this field; strategic human resource management and its practices will be flexible enough to add value to the company's future performance.*

Keywords: *human resource management, hospitality industry, strategic management, labour market, human capital, technology, quality*

1. INTRODUCTION

For a long time the economic organizations focused their attention only on the financial goal, that is on making profit, satisfying the solvent demand existing on the market by commercializing their products and services. Today, in the modern economy, the ratio of forces and conceptions evolved, generating an increase in the social goal importance and mutations in the human resource place and role within the organization. Personnel policies also underwent significant development due to the technical changes that generated modifications in labour organization and in people's attitude; due to the economic and social changes materialized not only in an increase in consumers' exigencies, in their cultural level, but also in a major change in their lifestyle, a strengthened role of trade unions and a more developed legal framework; and finally, due to sociological changes manifested as an enlarged knowledge area of the individual's workplace needs (to the knowledge of primary needs, the ones of recognition of social belonging, as well as the consideration of personal, psychological and intellectual motivations have been added).

The increase in the role and importance of human resource management in the contemporary economic organizations is the result of the evolution in this field, of its content and study area enlargement, hence, the personnel function is linked to the company's future development thus becoming a strategic function; the issue of human resources is approached in a systemic, interdisciplinary manner; the personnel working in the field of human resources must satisfy new requirements (knowledge in the field of behavioural sciences, negotiation capacity, etc.); the human resource is approached as investment capital for the company's future development; international human resource management emerges and develops, etc. The aim of human resource management is to integrate the social objectives into the economic objectives, harmonizing the economic constraints with

the need for human and social development, as well as to coordinate and integrate the aspects related to managing human resource into a policy representing the social framework of the company's strategy.

As for the hospitality industry, all the organizations admitted the fact that the human resource represents their most valuable capital. Despite the fact that they built modern properties, they found that the difference between them and the competition is very little, the guest being pampered with the choice. Thus, they realized, that the competitive advantage is offered by their employees' knowledge, skills and aptitudes reflected in the quality of the services provided to the customers.

2. CHALLENGES OF HUMAN RESOURCE MANAGEMENT AND ITS NEW TRENDS IN THE HOSPITALITY INDUSTRY

The organizations in the hospitality industry continue to operate in an environment which is often unpredictable, characterized by a rapid change, context in which human resource management has to meet a series of challenges, of which the following are mentioned:

➢ **The differences between the generations forming the personnel structure in the hospitality industry**

The employees in the hospitality field are more and more numerous and have been classified by the human resource specialists into generation groups according to their attitude to work and their workplace expectations. Therefore, according to the Australian Bureau of Statistics, there is the following classification:

- Builders – represented by the employees born until 1946;
- Baby boomers – employees born between 1946 and 1964;
- Generation X – the ones born between 1965 and 1979;
- Generation Y – employees born between 1980 and 1994;
- Generation Z – employees born after 1994.

Each of these generations has a different attitude to work, which poses serious problems to the employers in the field because the hospitality industry relies to a great extent on team work with a view to maintaining the quality of the services provided to the customers. Chen and Choi researched the structure of the values related to work among managers in the hospitality industry and found the differences among the three generations. All the groups place in the top of work values the lifestyle, personal achievement and control relations, while altruism, intellectual stimulation, labour safety, independence and the economic aspect have been classified differently. Thus, baby boomers placed altruism and intellectual stimulation higher in the top than other groups, while generation Y considers independence and workplace safety to be more important, placing the economic aspect higher than other groups. Solnet and Hood also researched the impact of the generation Y employees in the field of hospitality and the management paradigm changes that will become necessary in order to ensure the success of the employee selection, recruiting, training and motivating activities. Despite being limited, the research into generation Y finds significant differences in comparison with other generations regarding the relation with the workplace, their expectations (intrinsic benefits, self-accomplishment, working climate), values, attitudes and workplace conduct, as well as the fact that they are innate users of social networks, which may be beneficial for the hospitality industry, and therefore organizations should take advantage of it. The companies in the field are now aware of the impact that the communication means have on their trademark reputation, as the customers access social networks in order to comment instantly on the theme of the quality and services provided. Generations X and Y use such means of communication to tell their friends and others their opinions. In this context, human resource managers have to shape their labour force taking into account all these aspects.

➢ **Employees' training, aptitudes and service quality in the hospitality industry**

Worsfold suggested that human resource practices should be considered in connection with the service quality, because in the hospitality industry, the training formed the basis for the employee aptitudes development, involving considerable financial and human resource efforts, meant to ensure the employee performance in achieving the required standards.

Davidson noticed the fact that in the hospitality industry, due to the considerable personnel fluctuation, there is great pressure on the human resource training requirements so as to maintain the service level.

Frash argued that the training must be approached differently in order to maximize its effectiveness. In his opinion three aspects must be focused on, that is: trainees' reactions, principles – actions – techniques and putting the principles learned into practice.

Personnel training in this industry is very important and needs permanent revision so as to satisfy the training needs.

➢ **The fast technological development and the labour force in the hospitality industry**

The impact of technology development and its implementation in the hospitality industry has been studied by MacVicar and Rodger. Computerized technological systems usually increase the efficiency of human resource processes, reduce the administration costs and the running time of the transactions. Despite all these, the results of recent research show the fact that only 14% of the companies reported improvements in the decision making act related to human resources. The problems emerged as a result of the introduction of computerized technological systems in the human resource field include their designing, implementing the procedures, diminishing the employees' freedom of action and their responsibility, causing workplace stress, decreasing attention to customer (computerized technological systems do not allow the employees to negotiate), the personnel having less chances to understand the information provided in comparison with the case when this would have been explained face-to-face.

➢ **Strategic human resource management**

The importance of implementing the strategic human resource management within the organizations in the hospitality industry is emphasized by specific initiatives, such as:

- Increasing the social status provided by the jobs in the hospitality industry;
- Offering alternative apprenticeship models;
- Efficiently managing the differences among the generations forming the personnel structure by attracting young people and elderly staff;
- Increasing the share of the personnel employed for short-time or seasonal activities;
- Improving the correlation between the employee's aptitudes and the job requirements;
- Promoting cost efficiency measures related to the recruiting and selection processes;
- Emphasizing the role of the strategies that might cause the increase of the employee retention (maintenance) rate within the organization, for example:
  - Promoting work – life balance;
  - Workplace culture;
  - Job role and design;
  - Management and control;
  - Flexible work practices and development activities.

The strategic human resource management must be an integrating part of a comprehensive business strategy and must be approached as a way of improving performance.

➢ **Using human resources outside the organization to conduct internal activities**

Using temporary labour force has become the predominant method of employment in the hospitality industry. The personnel employed for a limited period of time or paid by the hour have a weak legislative protection, benefits from low wages and has a low attachment to the organization. However, this procedure creates opportunities for students and young people to realize revenues or to supplement them, if their aim is not making a career in the hospitality industry. What is more, it allows managers to adjust quickly the

company's staffing requirements and fit into the salary budget at the same time.

The reasons that determine the use of labour force outside the company include: specialized subcontracting, costs reduction, market discipline, access to new technologies and skills, change processes and cultural change stimulation. The disadvantages of this method consist of high monitoring and management costs, transaction costs, loss of control, loss of the experienced and skilled personnel inside the company, structural change trauma. Renting labour force, which means in fact employing "work with no obligation", will cause a decrease in loyalty, trust, staff commitment to the company as well as low involvement on the part of the employer in drawing up a sophisticated development strategy of the human resource.

Ensuring staffing requirements and its training represent problems for human resource management in the future as well. In the hospitality industry the personnel structure is composed of the permanent staff, full-time staff, part-time staff, increasingly resorting, however, to the use of external human resources, to the occasional employment with a view to reducing personnel costs. The emergence of a dual labour market may be observed, where a fierce competition for the best people is likely to take place, and under these circumstances, in human resource management, a new trend is becoming visible, that is focusing the attention on the recruitment and talent management activity. The permanent personnel have chances to benefit from wage increases, more attractive benefits and improved working conditions. The recruitment activity of this personnel category, not only of experienced managers, will become much more sophisticated in using behavioural diagnosis and psychometric tests which will most likely be made by specialized companies outside the organization. It remains to be seen how the personnel fluctuation will be affected and whether there are prospects of considering this phenomenon from a dual perspective. Due to the disparate nature of important companies in the hospitality industry and their different operating modes, human resource management will have to focus its attention on talent retention by providing new opportunities for career development. The way in which human resource management will be supported in the future may be viewed as a series of continuums which will set the level and nature of employee involvement, contact with customers and will characterize the manner in which individual enterprises in the hospitality industry will be perceived by both customers and employees. Probably, each company will choose where it wants to be present on each continuum, to combine certain elements, decision that will be influenced by the organization's philosophy, by costs, by the personnel skills and availability, as well as by economic, cultural, religious and environmental circumstances of the geographic area in which they are situated.

Differences among the generations forming the personnel structure will continue to have a major impact on the hospitality industry because labour force has a relatively young profile and the generations X and Y set in motion the social media phenomenon by using socialization sites where they discuss instantaneously all the aspects related to life, including the ones related to the working world.

Labour force training and skills development have been at the forefront of challenges in the hospitality industry for many years and have represented the method of inculcating the performance standards into the personnel and of increasing customer satisfaction. In the future, they will also be a critical area determined by the new employee generations that are to come and by the high personnel fluctuation in the hospitality industry.

Technology has greatly influenced the field of hospitality and especially the business operation mode, if we think, for example, of the online booking engines. It has supported human resource management in all its administrative systems, and in the future it will be able to completely take over some of its functions. Nevertheless, technology has also a negative impact reflected in the increase of employee stress level and in the personal contact reduction.

The strategic human resource management is a complex field in which a wide range of strategies are used in order to improve performance and where there is a heated debate about their correct dimensions and the types of strategies that are to be used.

Using human resources outside the company in order to conduct internal activities has become a method widely used worldwide in the hospitality industry, and it seems that, in the future, this issue will also dominate the theorists and practitioners' activity in the field of human resource management.

CONCLUSIONS

Changes in customer values and expectations will force the hospitality industry to set increasingly higher standards, aspect that will affect the practices of human resource management. Its new or improved techniques will help organizations in the field to administer more efficiently the fast changes occurring in the context of a global economy with diversified labour force.

The greatest challenge that the hospitality industry must face is that of finding and training competent personnel, on a rather limited labour market. In the actual environment, when technological progress revolutionized the concept of hospitality services, it is impossible to offer guests experiences at high performance standards without well-trained and well-informed labour force. This is a resource that cannot be easily copied in a short period of time and which provides to the organization the competitive advantage. The human capital (skills, knowledge and conduct) consolidates the importance of the relation between human resource and competences which aims at ensuring the company's success.

Through efficient human resource management, the employee performance will be channelled into achieving the company's goals and a series of common mistakes will be avoided, for example applying unfair policies related to labour force, filling vacancies with unsuitable people, exploiting employees in order to achieve high profits, employing inefficient labour force, implementing discriminatory practices that do not ensure personnel confidence, reducing investment in employee training which results in a decreased efficiency of the departments where they work.

Human resource managers in the hospitality industry organizations will have to focus their activity on aspects meant to attract well-trained labour force by offering a quality work environment, attractive benefits and career advancement opportunities; to motivate labour force using various motivational tools in order to obtain high performance; to develop staff in order to improve the skills required by their jobs by assessing training needs and selecting the most efficient training means and methods, focusing on the employee continuous training; to keep talented people by means of retention policies and measures taken to prevent migration to competing organizations.

Future research will determine to a greater extent the imminent challenges which human resource management has to face and will penetrate deeper into the essence of its potential trends. Undoubtedly, the hospitality industry will develop and the human resource management in this field will have an innovative character.

REFERENCES

1. Boxall, P. and Macky, K., *Research and theory on high-performance work systems: progressing the high involvement stream,* Human Resource Management Journal, Vol. 19, No. 1, (2009)
2. Chen, P. and Choi, Y., *Generational differences in work values: a study of hospitality management*, International Journal of Contemporary Hospitality Management, Vol. 20, No. 6, (2008)
3. Cho, S., Woods, R. H., Jang, S. and Erdem, M., *Measuring the impact of human resource management practices on hospitality firms' performances*, International Journal of Hospitality Management, Vol. 262, (2006)
4. Crouse Paula, Doyle Wendy, Young Jeffrey D., *Trends, Roles, and competencies in human resource management practice: A perspectives from*

practitioners in Halifax, Canada, Proceedings of ASBBS, Vol.18, No. 1
5. Davidson, M.C.G., Timo, N. and Wang, Y., *How much does labour turnover cost? A study of four and five star hotels*, International Journal of Contemporary Hospitality Management, Vol. 22, No. 4, (2010)
6. Michael C.G. Davidson, Ruth McPhail and Shane Barry, *Hospitality HRM: past, present and the future*, International Journal of Contemporary Hospitality Management, Vol. 23, Iss: 4, (2010)
7. Okumus, F., *Strategic human resources management issues in hospitality and tourism organization*, in Tesone, D.V. (Ed.), Handbook in Hospitality human Resources Management , Elsevier, Orlando, FL, (2008)
8. Ovidiu Nicolescu, Ion Verboncu, *Managementul Organizatiei*, Ed. Economica, (2007)
9. Radu Emilian, Gabriela Tigu, Olimpia State, Claudia Tuclea, *Managementul resurselor umane*, disponibil online la www.biblioteca-digitala.ase.ro
10. Raiborn, C.A., Butler, J.B. and Massoud, M.F., *Outsourcing support functions: identifying and managing the good, the bad and the ugly*, Business Horizons, Vol. 52, (2009)
11. Solnet, D. and Hood, A., *Generation Y as hospitality employees: framing a research agenda*, Journal of Hospitality and Tourism Management, Vol. 15, (2008)
12. Stone, D.L. and Lucaszewski, K.M., *An expanded model of the factors affecting the acceptance and effectiveness of electronic human resource management systems*, Human Resource Management Review, Vol. 19, (2009)

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

CONFLICT - A PERMANENT COORDINATE OF EXISTENCE

Constanta POPESCU, Liviu VASILESCU

University Valahia of Targoviste, Roumanie

Abstract: *Conflict has existed everywhere, where there are people, where there are ideas, values, circumstances, styles and standards that may conflict, which means that anything can be the cause of a conflict: objectives, goals, aspirations, unconfirmed expectations, habits, prejudices, personalities and ideologies, competition, sensitivity and injury, aggression, and more. It is said that "there are more conflicts than grains of sand in the world and it may be true, as true as the fact that our society itself affects our values, principles and beliefs, behaviour and views on conflict. Nevertheless, transposed into specific organizational context, the basic idea is that for any manger, addressing conflict, which is an inherent element of group life, becomes as equally important for organization life as the other management functions.*

Keywords*: conflict, organization, organizational culture, conflict management, intrapersonal conflict, interpersonal conflict, intergroup conflict*

1. INTRODUCTION

In the early approaches of conflict management - in the second half of the nineteenth century to the early decades of the twentieth century, the basic idea was that all conflicts are negative and counterproductive in organizational life, which has determined this process to become synonymous with avoiding conflict, leaving room for a single result, win-lose scenario; in this case, the natural consequence is that of perpetuating the scene of conflict - a situation that managerial vision needs to eliminate. Yet, avoiding conflict is not a performance strategy in the long run; instilling into people involved in the conflict the feeling of being neglected and failing to reconcile differences, the primary source that generates the conflict keeps functioning, and although it can be kept under control for a certain period of time, unresolved tensions reappear, perhaps with more force.

The inter-relationist approach in conflict management has been intensely promoted during the period between the end of the fifth decade and the middle of the eighth decade of the 20th century them; focusing on conflict as a natural and inevitable event in any organizational environment, that perspective proposed not the elimination of the conflict, but its acceptance and the exploitation of its results for the benefit of organizational life.

The 1970s brought to the fore a new perspective on the organizational conflict theory, the interactionist approach, in which, beyond acceptance, conflict is encouraged, starting from the premise that a harmonious organizational life, based on cooperation and without conflicts, manifests a tendency for stagnation, reacting inadequately to the changes and progress of market phenomena.

2. WHY IS IT IMPORTANT THE CONFLICT?

In a tumultuous quantum era - torn apart by economic and financial crisis, characterized by an inevitable process of diminishing of resources, marked by the emergence and also by the disintegration of national state forms and of supranational organizations, confronted with the simultaneous focus and ambiguity of forums invested with position and authority taking over some others – the global human ideal remains that of a society where a culture of peace is prevailing, in which the futuristic projection of a non - conflicting world crosses over the imagination zone into the three-dimensional boundaries of reality; the appearance of this point of transformation is mostly and most consciously determined by the human factor and placed in the stage where the citizens of the planet "will understand global problems, will have the skills to resolve conflicts and to do justice through non-violence, will live according to human rights and equality standards, will appreciate cultural diversity and will have respect for the Earth and for the other fellows."

From the different philosophical angle of pragmatism, conflict appears to be "an aspect of all natural phenomena, an indispensable part of life, of change, of creating new forms. Latent forms in stars or atoms are examples of physical prototypes in which conflict can cause enormous explosions and destruction. Forces influence each other, and so do people, who are in turn also some forces; we are influenced by what we influence. Conflict will end only under the circumstances in which the universe itself achieves a state of perfect equilibrium, in which case we did not exist. Life itself, as representation is a means of maintaining the imbalance. In many cases, conflict is the generator of new solutions rather than the destabilizing form of balance."

The term conflict (< lat. *conflictus*, fr. *conflit*), which is defined in the Romanian language dictionaries with the meanings, "violent material or moral impact clash, clash of interests controversial situation, state of hostility, disagreement, misunderstanding, divergence, difference, dispute, fight, antagonism, argument, (violent) discussion" refers to the awareness of the incompatibilities usually resulted from some form of interference or opposition. Unlike crises that physically and symbolically affect the entire organization, dramatically putting into question its basic values, conflicts are events that affect the symbolic referential system of an organization, but they do not question its fundamental values (e.g. a dispute between the leaders of an organization, a protest of a group, a threat of strike).

When a conflict is looming, managerial perspective and handling are needed, provided that real awareness of its bases happens first. Once you have passed the threshold of recognition and action stages, approach and effective resolution of the conflict become more difficult and thus, the opportunity of obtaining the „optimum" level of conflict is lost.

The crucial role that a real organization manager now has in addressing conflict and crisis is illustrated by a scene of life in antiquity - the misleading polar relation between past and present is actually not an antagonistic one, basically set on exclusion, but one of a

networking reform to which new meanings have been attached. Dissatisfied with the existing education system (as many other parents are nowadays), Philip of Macedonia brings the famous philosopher Aristotle as a private teacher for his son, a 11-year boy named Alexander – to whom mankind will later attach the phrase the Great; for a full year, Alexander had been taught by his master not only almost endless knowledge of mathematics, politics, history and philosophy, but also of leading people. One day, in the middle of his math lesson, Alexander asked, 'How much is one? "And though Aristotle had in mind several answers 'It is a unit, a prime number, half of two, is formed of two halves', aware of his responsibility for teacher, he asked respite for a day to meditate on the answer. The next day, he taught young Alexander - the future warrior king who was to extend the Greek civilization in the world - a real lesson about what it is called today 'leadership': "In the arena of human relations and successful management one means a lot."

The message in the management field that emerges from the Aristotlian lesson is that during a conflict, and even more during a crisis facing the organization, policy makers should give clear evidence that the situation is seriously considered and managed in the spirit of respect for all the rights of the organization members.

However, based on sociological approach on conflict as opposition under the form of a struggle between individuals, groups of individuals, social classes, which results in dysfunctions of social interaction, the managerial operationalization of the term *conflict* is usually in the shadowing characteristics of exaggerated competitiveness, of adversity, of aggression, of incompatibility with 'win-win' situations.

Thus, the maximum degree of conflict is defined in the literature as "a struggle between values and claims of status, power and resources "(L.A. Coser, 1967), "a relation in which each side perceives the goals, values, interests and conduct of the other as antithetical" (J. Burton, 1988), "a form of opposition centered on the opponent, based on incompatibility of goals, intentions and values of the opposing parties." (M. Vlăsceanu in S. Iosipescu).

Lowering the "conflict voltage" is visible in the definition of conflict as a "divergence of interests as it is perceived, or the belief that current aspirations of the parties cannot be simultaneously achieved." (J.Z. Rubin, D.G. Pruitt and S.H. Kim, 1994) or as a situation in which "individuals, obstructed or irritated by another individual or a group, inevitably react in a beneficial or costly manner." (E. Van Vliert, 1997).

The conflict in its conceptual complexity is considered as a three-dimensional psychosocial phenomenon, involving a cognitive component (thinking, perception of conflict), an affective component (feelings and emotions) and a behavioral component (action, including communication), "appearing when two or more parts / systems (individuals, groups, communities) in interdependence are, or they

only have the perception of being, different or even incompatible regarding the needs, goals, values, resources or personality traits, thus the difference or incompatibility produces a state of tension that is required to be discharged." (B. Mayer, 2000)

In attempting a personal definition, conflict is the *processual sequential frame of system non-identification*; *frame* as it cut out of situational reality; *processual* because there is a gradation of conflict, starting with the moment of awareness up to its escalation phase; *sequential* refers to the temporal axis, as conflict can exist only for a determined period of time - even the Thirty Years' War had periods of truce or peace*; non-identification* takes into account the totality of relationships between the conflict causes and types of manifestation: asymmetry, differences, incompatibility, opposition, antithesis, fight, regarding needs, goals, values, resources or personality traits; conflicts occur between the parties, between *systems*, a word which thus focuses both on the individual as a psychosocial system (intrapersonal conflict) and on social aggregate as a whole, including groups (interpersonal and intra-group conflict) and organizations as socio-economic-cultural identities (intergroup conflict).

3. CONFLICT - A CONSTANT PRESENCE IN DAILY LIFE

Regardless of any perspectives, conflict is a"natural consequence of diversity", it is an integrated part of human activity and it is inevitable because of the two key aspects of human behavior, cognition and social interaction. Human cognition is described in psychology as an activity of understanding and a way to understand the world we live in is solving problems or situations that need to be clarified, as a result of confusion or conflict. Conflict between individuals or groups tends to be conducted in terms of their relative power.

Since all human relationships vary depending on the extent and type of power exercised by the systems involved, any type of relationship has a certain degree of potential for conflict. People can exercise their power by means of: resources they may have, charisma, status, their life and work experience or their ability of coercion on the others - or of any combination of these elements. Due to the complexity of human society and implicitly of social phenomena, due to the diversity and size of available power resources, balance is almost an exception. Power is continuously transferred from one individual or group to another. In other words, imbalance or incongruity are born in human interactions; the more social interactions people engage in, the greater number of opportunities for disagreement.

4. SOURCES OF CONFLICT

Conflict has existed everywhere, where there are people, where there are ideas, values, circumstances, styles and standards that may conflict, which means that anything can be the cause of a conflict: objectives, goals, aspirations, unconfirmed expectations, habits, prejudices, personalities and ideologies, competition, sensitivity and injury, aggression, and more.

Essentially, there can be identified three major directions on which the perpetuation of conflict is structured:

- In a world becoming more and more diverse, different people want different things and there are few things that can please everyone

- Regardless of the place or the type of organization we work in, we have something in common with all the other employees, and that is working with people which mean that inevitably, we face conflict. Disagreements,

incompatibilities, aspirations, offended egos are just some of the many reasons why collective activities generate conflicts.

- We live and work in a world that limits our resources; we rarely get exactly what we want, given the existing options and imposed limitations. From this point of view, there are many examples in which conflict is caused by limited resources and organizational constraints.

The most common sources of conflict are considered to be:

- Discrepancies in organizational culture, between systems of values and norms, between behavioral patterns, etc. that guides the behavior of members of an organization.

- Erroneous perceptions of the actual facts, due to prejudices, differences of intentions and interests, but also to the mental image about the opponent perceived as 'evil', immoral', 'ruthless', etc.. This image, shared in the "mirror" by the opposing group, can lead to the failure of any attempt at conciliation.

- Exacerbated competition, coupled with aggressiveness, especially in connection with the distribution of scarce resources necessary for the activities of the involved people or groups.

- Different criteria for defining performance; differences in environment or ambience

- Ambiguity in defining the areas of authority and responsibility

5. CONCLUSIONS

Concluding, we may say that it has become necessary for managers to create the appropriate framework for the outbreak of a small-scale conflict in order to maintain an optimal level of performance achievement in the organization; thus, conflict is conceptualized as a necessary element that conditions progress, both individually, and especially, organizationally and consequently, managers are encouraged to engage in conflict building and exploitation for a continual beneficial change.

Approaching conflict, seen from the perspective of the"nucleus of change", contributes to a more accurate understanding of the major change of the organizational dynamics as well as of its planning and handling. A complementary concept for conflict is education, which is also a fundamental coordinate of human existence and that is the reason why one of the most stringent change in the organizational life is creating a "learning organization" aware of the available options, barriers and ways of learning The school institution is perhaps among the most representative parts, not only of the educational system, but also of the social one for the concept of the learning organization and for the implementation of managerial strategies of resolving conflict.

REFERENCES

1. Bocoș, Mușata; Gavra, Rodica; Marcu Sorina-Daniela, *Comunicarea și managementul conflictului*, Editura Paralela 45 (2008)

2. Borisoff , Deborah ; Victor, David, *Conflict Management: A Communication Skills Approach*. Englewood Cliffs, New Jersey: Prentice Hall (1989)
3. Borisoff, D., and Victor, D.A., *Conflict Management: A Communication Skills Approach*. 2nd ed. Boston: Allyn and Bacon (1998)
4. Botkin, W. James, Elmandrja Mahdi, Maliţa Mircea, *Orizontul fără limite al învăţării*, Editura politică, Bucureşti (1981)
5. Coman, Cristina, *Comunicarea de criză – tehnici şi strategii***,** Editura Polirom, Iaşi (2009)
6. Cucoş, Constantin,*Conflictul valorilor şi educaţia*, http://www.ziarullumina.ro/articole
7. Darling, John; Seristo Hannu; Gabrielsson,, Mika, *Anatomy of Crisis Management:A Case Focusing on a Major Crosscultural Clash within Daimler Chrysler,* LTA 3 / 0 5 (2005)
8. Hague Appeal for Peace, *Global Campaign for Peace Education Statement* - www.haguepeace.org/
9. Iosifescu Şerban., *Management educaţional pentru instituţiile de învăţământ*, MEC, Bucureşti (2001)
10. Jinga Ioan, Vlăsceanu Lazăr, *Structuri, strategii şi performanţe în învăţământ*, Editura Academiei Române (1989)
11. Lazăr N. Bogdan, *Comunicare, conflict şi soluţionare în organizaţii de învăţământ* - http://www.scribd.com/doc/
12. Moscovici, Serge, *Influenţă socială şi schimbare socială*, Editura Polirom, Iaşi (2011)
13. Nurmi, R., şi J. Darling. *International Management Leadership.* New York: International Business Press (1997)
14. Pânişoară, I. O, *Comunicarea eficientă*, Editura Polirom, Iaşi (2004)
15. Păuş, Aura Viorica, *Comunicare şi resurse umane*, Editura Polirom, Iaşi (2006)
16. Petrescu M., Stegăroiu I., Năbârjoiu N., Duică A., Popa E., *Managementul schimbării şi riscului*, Editura Bibliotheca, Târgovişte (2010)
17. Shelton, C.D., and Darling, J.R.,"From Chaos to Order: Exploring New Frontiers in Conflict Management." *Organization Development Journal* 22, no. 3 (2004)
18. Stoica-Constantin, A., *Conflictul interpersonal – prevenire, rezolvare şi diminuarea efectelor*, Editura Polirom, Iaşi (2004)
19. Stoica-Constantin, A., *Psihosociologia rezolvării conflictului*, Editura Polirom, Iaşi (1998)
20. Raportul Comisiei Prezidenţiale „*România educaţiei, România cercetării*", Bucureşti, 6 iulie 2007 - http://edu.presidency.ro/upload/raport_edu.pdf
21. Raportul UNESCO cu privire la educaţia în secolul XXI, *Capacitatea de a învăţa: Comoara din noi*, 1996 - www.unesco.org/delors/

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

COMMUNICATION IMPLIED BY THE PROJECT MANAGEMENT

Constantin POSEA

„Spiru Haret" University, Brasov

Abstract: *Within a society, and especially within projects, the institution or the organization communicates with its own personnel and beneficiaries and the other way round, at various paces, with different intensities and in different manners. By means of communication, the members of an organization coordinate their actions and labor so as to reached established goals. Any activity, irrespective of its type, cannot achieve its objective if there is not communication by whose means a unitary coordination of the efficient organizational behavior is accomplished.*

Key words: *Communication, project, project's team*

To communicate means informing a large audience; transmitting messages; announcing; emitting; broadcasting[1]. Consequently, the verb 'to communicate' refers to the action of transmitting a message about something to somebody. A series of definitions on communication are worth mentioning:

a. Communication, generally, and dialogue, particularly, constitutes the means by which a double informational and affective load is transmitted.[2]

b. Establishing a univocal correspondence between a spatial-temporary universe, A, the sender and a spatial-temporary universe, B, receiver … that includes understanding and transfer and that spreads from the phenomenal field up to the field of symbols connected within a structure.[3]

c. Communication … is the fundamental manner for people's psychosocial interaction, achieved by means of symbols and socially organized significances of reality, in order to obtain stability or some individual or group behavioral changes.[4]

d. A process of emitting a message and transmitting it in a qualified manner, by means of a channel toward a receiver.[5]

e. By communication, one understands a process of transmitting data between a sender and a receiver who are either within the same system or within different systems of message perception[6].

[1] Vasile Breban, *Dicționar General al Limbii Române*, Editura Ştiințifică şi Encilopedică, Bucreşti, 1987, p. 202

[2] Elena Zamfir, *Incursiune în universul uman*, Editura Albatros, Bucureşti, 1982, p. 25

[3] Serraf Guy, *Psychologie de la comunication*, în Cahier Adetem, nr.8, 1963, p.60

[4] *Dicționar de psihologie socială*, Editura Ştiințifică şi Enciclopedică, Bucureşti, 1981, p.54

[5] *Dicționar de sociologie*, Editura Babel, Bucureşti, 1993, p.124

[6] Ovidiu Nicolescu, coordonator general, Dicționar de management, Editura Pro Universitarea, Bucureşti, 2011, p.144

The content of definitions leads us to the following clarifications:

- communication is regarded either as a process of message transmission without their being received, or as a process of their reception in the absence of a conscious transmission;

- there are different degrees of intentionality in communication, both during the transmission and during reception of messages;

- communication is achieved either as an effect, or as a cause of a specific situation, of some social relationships or interactions of the organizational structures for the purpose of accomplishing certain objectives;

- it appears as a linear, circular and interactive process;

- it may be characterized as a source for order, unity, cohesion or conflict;

- it may be achieved in a double way – of influencing others' behavior and of influencing own objectives by others.

The classical scheme of communication may be represented as shown in figure 4.3.1

S sender	→	I information(message)	→	R receiver

Shannon's scheme (1952) presents communication as shown in Figure 4.3.2.

Sender - Coding - Channel - Decoding - Receiver

sender — coded message — receiver

Communication represents, thus, a vital element, indispensable for the efficient functioning of the project's team, irrespective of its nature or size. This principle is found at the basis of project management, because it constitutes a main source for generating unities of views and actions, behavior and interaction, while ensuring the correct understanding of objectives and individual or collective tasks and competing for the social and professional integration of individuals within that particular team.

Within the project's team communication appears mainly with the relationships established between the manager and the members of the team, the primary organization, as well as between the former and the beneficiaries of activities to be performed.

Communication within the project's team is achieved;

- between different levels of the primary organization, in order to transmit orders and data either in written or orally;

- at the same level, in order to meet current tasks and responsibilities;

-- between the project's team and the primary organization;

- between the project's team and the audit team;

- with the beneficiary.

Communication channels used by the project management are formal and informal.

a. Formal (official) channels express communication relationships that result from the organigram, that is, between the team's members there is a systematic and intense exchange of descending, ascending and horizontal messages; without these messages, strictly regulated, the reception and transmission of tasks would not have been possible and feedback or cooperation between levels would have been impeded.

b. Informal channels are established, generally, between people and informal groups within the project but outside the official channel. These channels are made up of employees that share common interests and likes. Data transferred by means of these channels is unofficial and holds a private or general status and it is not verified. Data transmitted via this communication channel

has an increased speed, is efficient and is based on (in most cases) real data, although there are situations when the informal channel also hosts data of the 'gossip' type.

In order to accomplish his or her established role, the project manager will use, more or less consciously, the following functions of communication: informative, command and training, influencing, persuasive, guidance and counseling, instruction, image generator, motivational, promoter of organizational culture, integration and preservation.

a. Informative function refers to the fact that the project manager is confronted with the reception of two types of data: external data- sent and received through specially created structures- and internal data – which circulates via formal and informal channels within that specific organization. The existence of these two types of informational fluxes is because any organization is the result of a cumulus of interactions with the external or internal environment, between sub-divisions of the organization and its members.

b. Command and training function is used by the project manager to ensure the action convergence of the other employees, so as to facilitate the accomplishment of the organizational policies. Decisions and instructions ensure uniformity in practices and procedures, correctitude and completeness of tasks achievement.

c. Influencing, persuading, guiding and counseling function allows project managers, no matter which their position may be, to perform control both over the data in process and over the behavior of other employees with whom managers are in various relationships (hierarchically ascending or descending or horizontal) within that particular structure.

d. Training function guarantees the forming and improvement of abilities and skills of the team's members, as well as those pertaining to managers of an inferior rank, to communicate by means of improvement training courses run by qualified personnel within the institution.

e. Image generator function is achieved through external and informal communication by promoting the institution's image on various occasions and by different methods (communication channels).

f. Motivational function focuses on the issue of engaging the entire personnel of the organization in the activities development, at a superior qualitative level, by promoting a motivating system of promotions, payment etc.

g. Organizational culture promotion function is assured by correlating communication actions with actions belonging to organizational culture, management and leadership.

h. Integration and preservation function gives an employee pertaining to superior hierarchical structures the possibility to assure the functional operability of the department/directorate/office/team he or she leads by a functional informational flow, an optimal use of informational channels so that data overlapping or useless data are avoided; sorting, checking and transmitting of data according to its specificity.

The stages of the communication process may be highlighted as follows:

a. Message coding; consists of a selection of symbols able to express the significance of a message. Communicative symbols are represented by words, images, facial or body expressions, signals or gestures. During speaking, words and gestures may be interpreted in a wrong manner. The reception meanings of words vary, according to contexts in which they are used. As far as gestures as symbols are concerned, frowning may be taken for uncertainty or discomfort or tension; the green traffic light symbolizes "free way". These symbols are yet ambiguous, as people unfamiliar with them or belonging to different cultures may interpret them differently. This explains why gestures, expressions with certain significance may be misunderstood by the receiver. Multiplication of meaning conferred to one and the same symbol leads to a confrontation of the message with difficulties of their selection and combination, so that the beginning of communication is often distorted. Within the project management, the most important codification form is, without doubt, the message codification.

b. Sending the message via a channel; consists of transmission of the codified message, from the sender to the receiver, through the visual, audio, tactile or electronic communication channel. The manners in which messages are conveyed is of vital importance; thus, the channel becomes a component part of the message. Even if the same phrases (words) are used for expressing a message, a change in the channel by telegraphic transmission, adds a note of importance and emergency to the message, as compared with the message transmission by mail.

c. Decoding and interpretation (reception); refers to decoding symbols transmitted and, respectively, explaining their meanings, a formalized process in message reception. These two processes, composing the reception, are powerfully influenced by past experience from the latter part of the process, the feedback, and this is because the sender does not consider necessary to verify the answer.[7]

Communication may be unilaterally or bilaterally achieved, each of this variants having its own characteristics.

Within project management, regarded as an organization, a variety of categories and forms of communication is used, and they are classified according to distinct elements, such as direction, manner of transmission accomplishment, manner of processing or degree of formality.

a. In relation with its transmission direction, communication can be: ascending, descending, horizontal and diagonal.

- Ascending communication consists of message transmission by structures subordinated to managers of an inferior rank and, successively, to superior levels of management. By means of this type of communication there are sent reports, demands, opinions, claims. Ascending communication assures the efficiency of the process since, through it, reception of messages formerly transmitted by managers may be verified. Moreover, via ascending communication, the management of superior rank obtains information on the current situation of the project for each of the sectors or departments, drawbacks in communication, level and nature of recorded most frequent negative outcomes. The message, which circulates from executives to managers, is analyzed through cognitive and/or psychological filters. There are situations when, during ascending communication, and respectively, during specific data, reports, suggestions transmission regarding the content of work and modalities of improving it, managers of inferior rank may believe that

[7] Tudorel Niculae, Ion Gherghiță, Diana Gherghiță. - *Comunicarea organizațională şi managementul situațiilor de criză*, Bucureşti, Editura Ministerului Administrației şi Internelor, 2006, p.24-25

their subordinates might be perceived by superiors as being more competent than they are. Whenever the send data constitutes a feedback to a previous message, the manager may interpret ascending communication as an attempt of having his or her professional competence or authority tested. Therefore, during this type of communication there might appear obstructions having direct effects on the capacity of controlling and maintaining communication.

- Descending communication is a manner of transmitting messages within relationships of hierarchical type, it being accomplished from top management to bottom levels. It is based on decisions, regulations, instructions, tasks assignment, data request. During message transmission, within this type of communication, there is the possibility for the message to be filtered as it is sent from one level to another, due to the fact that each of the levels may interpret messages in relation with its own necessities or objectives. Wherever the authoritarian style of management is applied, this type of communication is predominant throughout the unilateral communication.

- Horizontal communication is achieved between people or departments situated at the same hierarchical level. By its means, activities involving common objectives are more easily coordinated, excluding intervention from managers of superior rank.

- Diagonal communication is accomplished whenever the organization's members cannot communicate via other channels. This type of communication has the advantage of time and costs saving, of using informal relationships, of facilitating a climate based on reciprocal appreciation.

b. In relation with instruments used or manner of transmission, communication may be written, verbal and non-verbal.

- Written communication is the most used form within the project management, because through it internal announcements, reports, decisions, plans, letters to people inside or outside the institution are requested or transmitted. The major problems of written communication consist of clarity, concision, accuracy, yet, whenever all of these are used correctly, they may turn into advantages for this type of communication. The advantages of written communication are: it assures a clearer organization of informational data; it can be at all times checked; it may be used as evidence in case of trials. Some of the disadvantages may include: it does directly connect the addressees; it does not provide immediate feedback; it take time for typing, multiplication and reaching the destination.

- Verbal communication is frequently used. This type of communication is performed through language, nevertheless, it is influenced by personal opinions, values or reference points to which individual appeal when they transmit or receive message. Verbal communication may be achieved through conversations, conferences, meeting, gatherings etc.

Verbal communication may include:[8]

- narratives regarding situations, actions, existential events;

[8] Idem, p. 31-33

- feelings and reactions, at the central level, to certain situations;

- opinions, attitudes that express an individual's position in a specific situation, subjective viewpoints.

Within verbal communication, distortions may appear when messages referring to a departmental issue are transmitted, and reception is achieved by another structure of the system, by mistake. During verbal communication, such confusions are frequent, those who communicate must be aware of the fact that messages do not only include narration of facts and events, but also feelings, opinions, significances given to and perceived by participants at the communicative act. Verbal communication request of the manager not only his or her capacity of emitting signals, but also his or her capacity of listening.

- Non-verbal communication represents an efficient instrument which, when it is skillfully applied, it facilitates emission and reception of messages. By gestures, dress code, body posture and distance a great load of inter-human communication is performed than in any other manner.[9] This type of communication consists of its competition with the verbal communication, which allows for some messages to be sent right away during a conversation between interlocutors. Gestures, mimics, body posture represent stimuli that may be successfully used to increase the efficiency of interpersonal communication. It completes the means used by verbal communication through: highlighting of certain aspects, providing expressivity to the message sent, contradicting or even canceling the verbal message, substituting the verbal message, completing some verbal messages and adjusting feedback.

c. In relation with its course of action or its message transmission technique, communication may be direct, face to face, indirect or mediated.

- Direct communication or face-to-face communication is the most efficient way of building a working relationship. Communication being bi-dimensional (since it involves hearing and sight), it allows the sender to evaluate on the spot the manner in which his or her message was received by the receiver. Sometimes, according to the receiver's reactions, the message may be repeated, rephrased and behavior may be adjusted. Direct communication is especially appealed to in sensitive issues that may involve sensitivities or suspicions from the personnel. The manager delivering bad news to his or her subordinated personnel via short written messages, takes the risk of being judged as incorrect or lacking courage. Under such circumstances, his or her credibility will be at a loss. The advantage of the rapid feedback is completed by that of the non-verbal communication. Facial expressions and gestures are deciphered, analyzed and clarified immediately. Direct, face-to-face communication remains a precise, rapid and efficient manner of communication on which healthy and durable relationships can be built.

- Indirect or mediated communication is accomplished by means of letters, films, discourses, telephone, radio, video-phone etc. and by means of interactive television (teleconferences). Of all the above mentioned instruments, the telephone is currently the most used. Telephonic communication lacks many of the non-verbal messages and therefore, some messages may be only deduced from the pitch and intonation of voice or from speech delivery pace.

d. In relation with its formality degree, communication may be formal and informal.

- Formal communication includes both ascending and descending messages that circulate through the channel of organizational relationships. It may appear under various forms: spoken, written, direct and indirect,

[9] Allan Pease*, Limbajul trupului*, traducere de Alexandru Szabo, Editura Polimark, Bucureşti, 1995, p.7

multilateral and bilateral. Irrespective of its manifestation, formal communication remains a necessity for adjusting the well functioning of the project team.

- Informal communication includes rumors and gossips. Caused by a lack of data or by truncated data that may appear within inter-human processes, informal communication tries to eliminate uncertainty, curiosity or anxiety of some people from the project team.

Several action principles would be necessary for an efficient participation and communication within the project management: professionalism; ensuring participation in decision making by consulting all decisional factors; a greater involvement of the personnel in institutional management and ensuring an adequate degree of permissiveness; the internal communication will hold priority; yet, a balance between internal communication and external communication must be taken into account; communication will not restrict to a mere data transmission but also to listening; thus an exchange of information, ideas and opinions will be considered; investment in the long-term communication, knowledge technique and human capital.

Communication within the project management is one of the major manners by which an institution makes its presence visible, both internally and externally. Under these circumstances, the entire process is connected in an efficient system, resulting in the relationship organizational culture, managerial culture, leadership and communication. Transparency, responsibility and accuracy of messages are major factors for the institutional communication.

Bibliography

1.Vasile Breban, *Dicţionar General al Limbii Române*, Editura Ştiinţifică şi Encilopedică, Bucureşti, 1987
2.Serraf Guy, *Psychologie de la comunication*, în Cahier Adetem, nr.8, 1963
3.Ovidiu Nicolescu, coordonator general, Dicţionar de management, Editura Pro Universitaria, Bucureşti, 2011
4.Tudorel Niculae, Ion Gherghiţă, Diana Gherghiţă. - *Comunicarea organizaţională şi managementul situaţiilor de criză*, Bucureşti, Editura Ministerului Administraţiei şi Internelor, 2006
5.Allan Pease, *Limbajul trupului*, traducere de Alexandru Szabo, Editura Polimark, Bucureşti, 1995
6.Constantin Posea, Ioan Valentin Marcel Posea, *Managementul proiectelor*, Editura Fundaţiei România de Mâine,Bucureşti, 2012
7.Elena Zamfir, *Incursiune în universul uman*, Editura Albatros, Bucureşti, 1982
8.Dicţionar de psihologie socială, Editura Ştiinţifică şi Enciclopedică, Bucureşti, 1981, p.54
9.Dicţionar de sociologie, Editura Babel, Bucureşti, 1993, p.124

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

CHARACTERISTICS OF EXTREMELY ASYMMETRIC RISK

Gabriela PRELIPCEAN, Stelian STANCU*, Gheorghe Ion ROŞCA***
Mariana LUPAN**

*Academy of Economic Studies, Bucharest, ROMANIA,
** Ştefan cel Mare University of Suceava, Suceava, ROMANIA

Abstract: *Dangers are perceived by society as threats, challenges and, in their unwarranted approach, in action, as risks. Risk implies direct, but also assumed threat.*

Modern society's greatest risks are, almost entirely, asymmetric. They engulf the whole sphere of human activities, following man in his every endeavor. The more humanity diversifies and stratifies, the more numerous and acute asymmetric threats become. Because asymmetry implies differences, or, the possibility to act and react differently, with the purpose to surprise, to destroy, to win strategic initiative and freedom of action, and, consequently, to win.

We are hereby presenting a series of theoretical aspects concerning risk analysis and techniques: the scenario technique and probability-impact matrix technique.

In the second part of the work, we will analyze critical infrastructures and the typology of asymmetric risks.

Keywords: *dangers, threats, vulnerabilities, risks, critical infrastructure, risk evaluation, extreme risk, asymmetric risk*

1. RISK ANALYSIS TECHNIQUES

SCENARIO TECHNIQUE

This technique implies the gathering of a group of informed people, specialists in their fields, which are asked to apply their knowledge and imagination to describe one or more possible ways in which an event may unfold, starting from a concrete situation. This type of activity is undergone at all times by anyone who wishes to plan an activity.

There are several ways to generate scenarios, but two stand out:

- generating scenarios in perspective
- generating scenarios from perspective

Generating scenarios in perspective assumes choosing a starting point from present reality and imagining future possible scenarios. This type of a scenario answers the question "What if".

Scenarios from perspective try and determine how current reality may evolve into a given future scenario. This type of scenario answers the question "How do we get to situation X?".

PROBABILITY-IMPACT MATRIX TECHNIQUE

Risk has two fundamental aspects: probability and impact. Table 1 presents such a matrix that combines the following elements:

- Likelihood – on three levels:
  - High probability
  - Average probability
  - Low probability
- Impact – on three levels:
  - Big Impact
  - Environmental Impact
  - Low Impact

PROBABILITY	0	1	2	3	4
80,00%-99,99%	Medium Risk	Medium Risk	High Risk	Very High Risk	Very High Risk
60,00%-79,99%	Medium Risk	Medium Risk	High Risk	High Risk	Very High Risk
40,00%-59,99%	Low Risk	Low Risk	Medium Risk	High Risk	High Risk
20,00%-39,99%	Very Low Risk	Low Risk	Low Risk	Medium Risk	Medium Risk
0,00%-19,99%	Very Low Risk	Very Low Risk	Low Risk	Medium Risk	Medium Risk

IMPACT

Table 1. *Probability-impact matrix 5 levels of risk*

The result of combing these elements is a 3 rows and 3 columns matrix. The intersection of each line with each column represents a certain level of risk. In the case of such a matrix three risk categories can be identified:

- High risk
- Medium risk
- Low risk

PROBABILITY	High	Medium	Low
High	Low Risk	Medium Risk	High Risk
Average	Low Risk	Medium Risk	Medium Risk
Low	Low Risk	Low Risk	Low Risk

IMPACT

Table 2. Probability-Impact matrix

Of course, this matrix can have a far larger number of rows and columns, to better highlight the degree of risk. For example, we will consider a five row five column matrix, corresponding to the following categories of probabilities and effects:

Probability is expressed in 5 percentage intervals between 0 and 99.99%. Events with a 100% probability are not taken into account, as certainties do not require risk analysis.

- Between 0% -19.99%
- Between 20%-39.99%
- Between 40%-59.99%
- Between 60%-79.99%
- between 80%-99.99%

Impact is expressed on a worth scale from 0 to 4, corresponding to 5 levels of severity:

0 – the emergence of an event with 0 impact has no consequences over the analyzed risk, or if its consequences are not notable

- 1 – a 1 degree event has minor consequences
- 2 - 2nd degree impact refers to notable consequences which can affect the well-being of a project or an activity
- 3 – consequences of a level 3 event are sufficiently serious and must be further analyzed
- 4 – level 4 consequences are correspondent to a catastrophy

From this grading of risk components, the following risk categories are distinguishable in the possibility – impact matrix in table 2:

- very low risk – the probability of such an event is almost none
- low risk – this risk category implies either an event with medium chances of occurrence and low impact, or low chances of occurrence and medium impact
- medium risk – an event with a probability above average, possibly even high, but with a low impact, or the other way around, low probability but above average, possibly even high impact
- high risk – when an event has a probability of occurrence of over 40%, and its impact is above level 3
- very high risk – extremely probable events with high impact, above level 3

The probability-impact matrix is a very useful device in risk management. This technique is often used in practice, not only due to the fact that it helps management better catalog risk events to determine which require special attention.

2. CRITICAL INFRASTRUCTURE ANALYSIS

Modeling extreme asymmetric risk events is essential in assessing damage and streamlining governmental intervention. Current techniques are in pursuit of new solutions to analytically and numerically treat asymmetric distributions, with thick ends.

In order to define new solutions, we begin with the hypothesis of a need for a flexible, synergistic answer, which can ensure immediate exposure coverage from asymmetric attacks, based on market functionality and sustained by innovative alternative transfer solutions.

The classic mathematical approach in modeling extreme risks is based on the theory of probabilities and mathematical statistics. The potential value of extreme risks presents asymmetric distribution, with thick ends, difficult to analyze even with the knowledge of behavior of similar evolution. In asymmetric events, the occurrence probability is very low, but with catastrophic impact and losses.

An integrated model describes risks, their evolution and correlations between them, giving new perspective on risk interaction. The complexity and multiple subjective elements of these models turn their application into a challenge. In order to integrate in dynamic financial analysis AFD of extreme asymmetric events, the VaR and TVE concepts are analyzed from a practical evaluation point of view, filtering associated difficulties.

If traditional VaR models tend to ignore extreme events and are concentrated on risk measures for the entire distribution market, the objective is to search for answers that ensure functionality even in catastrophic risks. An answer to this problem is based on utilizing robustness tests and scenario analysis. Dynamic modifications that occur during extreme events can be simulated.

These solutions are useful, but inevitably limited, because they cannot explore all possible scenarios, and, by definition, they do not deliver any indication regarding the behavior of all considered variables.

This specific extreme risk management problem, the impossibility to correctly predict the extreme values involved, denatures results. Researchers have proposed a solution to this problem in the form of Extreme Value Theory, EVT, a branch of statistics developed for optimum usage of limited information about extreme distributions.

In the case of EVT, attention is focused on the POT (peaks-over-threshold) problem of peaks surpassing critical values. Regardless if the end distribution of losses refers to evolution, system, operational or insurance risks, the POT model is a simple, but effective instrument in risk estimation at distribution end.

An original model is being proposed by which the POT method can be embedded in a stochastic volatility framework, in order to achieve superior estimates over the classic VaR model.

A risk model, starting from selecting distributions of particular probabilities; distributions considered from empirical data analysis. In this case, TVE is an instrument that must deliver the best estimate possible of end distribution.

However, even in the absence of useful data, TVE delivers a good guideline of the type of distribution that must be selected so that extreme risks can be correctly estimated and maneuvered.

Active-passive management techniques (ALM) are representative to an extensive number of strategies used in sales and vary greatly whereas complexity is concerned. Since every category presents both advantages

and disadvantages, practitioners have not been able to assert whether simple or complex models are preferable.

DANGERS, THREATS, VULNERABILITIES, RISKS

As social-economic activities develop, critical state and society infrastructures develop alongside them, especially those in industry and energy, becoming more and more vulnerable to various risks and threats.

As science and technology progress, so do vulnerabilities and the risk of an attack or accident that can affect the population, material goods and the environment. The range of dangers and threats faced by ICI and ICEn is fairly diverse, with the incidence of asymmetric dangers rising.

A classification[1] of said dangers and threats, that can be at any time completed or modified, is as follows:

- natural threats/dangers
  - symmetrical: earthquakes, floods, landslides, droughts, etc.
  - asymmetrical: extreme meteorological events, meteorites and other celestial objects, global warming, etc.
- human threats/dangers
  - symmetrical
  - physical, such as a chemical accident, conventional war, etc.
    - cybernetic, such as programming errors, etc.
  - asymmetrical:
    - physical, such as terrorism, organized crime, design faults, faulty operation and maintenance of systems, etc.
    - cybernetic: information wars, network based war

[1] Radu Andriciuc, *Dangers and threats to critical infrastructure,* Psihomedia Publishing, Sibiu, page 5, (2008).

3. TYPOLOGY OF ASYMMETRIC RISKS

Asymmetric risks do not have the same configuration for everyone. This is why they must be looked at and analyzed differentially, based on concrete conditions, strategic options and forces that are or can be engaged in the confrontation. The world is diverse and, as a consequence, so are the possibilities of action or riposte.

Asymmetric risks are, in the USA's vision, mostly different than those faced by third world countries, for example. Differences in technology, civilization, possibilities and, evidently, mentality are expressed, first and foremost, in confrontation strategies, in what we call strategic asymmetry. Thus, a certain risk-riposte asymmetric relation is formed, alongside an asymmetric offense-defense response which will, most likely, dominate conflict typology in the beginning of this new millennium.

Asymmetric threat (risk) typology imposes a new evaluation of strategically vital space, but also of a new philosophy of confrontation, as the world has changed radically and, despite globalization on an economic and information level, it remains extremely different and contradictory.

REFERRENCES

1. Andriciuc, R., *Dangers and threats to critical infrastructure,* Psihomedia Publishing, Sibiu, page 5, (2008).
2. Arambepola, N., Iglesias, G, *Effective strategies for urban flood risk management,* Asian Disaster Preparedness Center, Bangkok, page 2(2009).
3. Armas, I., *Riscuri naturale (Cultura riscului) - Riscuri naturale* – Sinteze pentru pregatirea examenului, page 18, http://www.geodinamic.ro/ curs/Sinteze_ curs.pdf.
4. Cucu, I., *Resursele de apă şi mediul de securitate*, în Impact Strategic, nr. 3[36], (2010).
5. Spencer, H.R., Tessier, A.J., Meghan, A.D., Huebner, M., Cáceres, C.E., *Warmer*

does not have to mean sicker: temperature and predators can jointly drive timing of epidemics, in Ecology, vol. 87, no. 7, (2006).

6. Maló, M.D., *Local Management of Natural Disasters,* International Symposium Connecting Government&Citizen through Ubiquitous GIS, 26-28, Kuala Lumpur, Malaysia, page 14, (2010).

7. Manoliu, M., Bădălan Turcitu, A., Simionescu S., Bărbulescu, A., *România expirată are nevoie de 40 mld. euro ca să nu rămână fără curent, căldură şi drumuri*, http://www.gandul.info/news/romania-expirata-are-nevoie-de-40-mld-euro-casa-nu-ramana-fara-curent-caldura-si-drumuri-5534499.

8. Pigui, T., *Măsuri de prevenire şi protecţie a infrastructurii şi personalului din sistemul Ministerului Apărării Naţionale în zonele seismice,* Colocviu Strategic, Nr. 11, sept. pages 5-6,(2004).

9. Sandu, I., *Evolu□ia regimului climatic în România*,

http://www.mmediu.ro/departament_ape/gospodarirea_apelor/inundatii/prezentarinoiembrie-2009/Clima- romania.ppt%20%5BCompatibility%20Mode%5D.pdf

10. Teodorescu E., et al. Managementul riscului de dezastru Ghid de lucru pentru ONG-urile de mediu in prevenirea dezastrelor, Asociaţia ALMA-RO, pages 25-26, http://almaro.ro, (2007).

11. Tobă, F., Resursele de securitate din perspectiva producţiei şi consumului durabil, în Impact Strategic, nr. 3, (2010).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

PARTICULARITIES OF RISK IN THE CASE OF EXTREME EVENTS

Gabriela PRELIPCEAN,Stelian STANCU*, Gheorghe Ion ROŞCA***
Mariana LUPAN**

*Academy of Economic Studies, Bucharest, ROMANIA,
** Ştefan cel Mare University of Suceava, Suceava, ROMANIA

Abstract: *It is well known that the environment and human society are often affected by the action of extremely dangerous and diverse events, of both natural and anthropic origin, which can create destructive and brutal deregulation in certain given systems and situations.*

A series of theoretical aspects regarding current catastrophic events are presented, as well as their global costs.

In the second part of the paper, hazards and their risk evaluations are presented, thus revealing the types of hazards, their effects, and their associated risk.

Keywords: *natural hazards, vulnerability, risk, risk evaluation, economic effects, social effects, ecological effects*

1. INTRODUCTION

It is well known that the environment and human society are often affected by the action of extremely dangerous and diverse events, of both natural and anthropic origin, which can create destructive and brutal deregulation in certain given systems and situations.

These events (earthquakes, volcanic eruptions, tsunamis, landslides, storms, floods, droughts, fires, technological accidents, conflictual situations, etc.) are generally unexpected, causing numerous victims both in the population and amongst animals, with a large volume of material damage, ecological unbalances, and even grave disturbances of psychic and moral state of the population affected by said phenomena.

Statistical data reveals that in the past three decades, on a planetary level, different disasters have caused the deaths of over eight million people, disease and suffering for over another billion, losses and destruction of material goods worth hundreds of billions of dollars. On average, annually, destruction causes 25000 deaths and approximately three billion dollars in economic damage.

The effective growth of naturally catastrophic events noticed in the present, as well as their global costs, can be attributed to several factors:

- cyclical episodes that govern different natural hazards;
- the global growth of population and its concentration;
- growth of vulnerability of human communities;
- negligence regarding foresight, insufficient measures and activities to prevent disasters;

- population's increased sensibility and demands, coming from an audience more and more preoccupied by threats to its safety and security

The main factor responsible for risk recrudescence is, in our opinion, the growth of vulnerability of human communities. Alongside natural characteristics that determine the degree of vulnerability, man creates or aggravates these vulnerabilities in the following ways:

- placement, for economic reasons, in vulnerable areas, increased urbanization and industrialization at exposed sites;
- occupying and frequenting risk-enabling environments, form and type of space usage;
- rising dependency of the urban environment on various technical networks, susceptible to perturbations, either anthropic (water and heating pipes destruction, electrical networks or telecommunication) or natural in nature;
- growing mobility in subterranean space in the service of urbanization (subway lines, tunnels, underground parkings, etc.) worryingly increase the specter of vulnerabilities;
- subversive behavior multiplication, delinquency (social factors) bring an additional dimension to vulnerability.

2. HAZARDS AND RISK EVALUATION

2.1 Hazard classification

Hazards can be classified by various criteria: origin, manifestation, frequency, damage, potential for damage, etc.

Classification by origin splits hazards in two large categories (Table 1, see end of paper).

By mode of manifestation and period of installation, hazards are classified in*:*

	- earthquakes
	- volcanoes
Violent hazard	- typhoons, tornadoes etc.
	- local storms accompanied by hail, etc.. - catastrophic landslides, avalanches
Progressive hazard	- disturbances Mediterranean (Mediterranean cyclones retrograde evolution)
	- phenomena fry
Slow hazards	- droughts
	- mists of radiation and evaporation

Table 2.

Classification by damage (by Zavoianu, Dragomirescu, 1996):

by Sheehan, Hewit	casualties	at least 100 dead
		at least 100 injured
	damage to the economy	at least $ 1 million
by Swiss Re	casualties	at least 200 dead
	damage to the economy	at least $16,2 million
by Gares, 1994	casualties	at least 200 dead

Table 3.

By surface area, active duration, main effects (by Chardon, 1990):

- Giga catastrophe (volcanic explosions);
- Mega catastrophe (large earthquakes, volcanic eruptions, tropical droughts);
- Mezzo catastrophe (smaller volcanic eruptions, earthquakes with less intensity, cold waves, thunder storms, tornadoes);
- Catastrophe (small seismic, tornadoes, exceptional rainfall);

Spot localization phenomena (slope processes, muddy torrents, hail storms).

2.2 Hazard effects

Manifestation of different hazards creates effects on multiple layers, especially economic, social and ecological.

Economic effects can be best expressed by the damage, both real and potential, that hazards cause:

- real damage is represented by damage produced by the direct manifestation of a hazard can be direct (material destruction, housing, intervention costs, evacuation and healthcare) and indirect (losses recorded by the national economy at units unaffected by the hazard, but whose activity is perturbed by losing connections between them and units directly affected by the hazard)
- potential damage is the damage between the activities that would have taken place on a particular landfill (such as a riverbed) if it were not periodically affected by a hazard (ex: flood) and the results of activities effectively taking place there in the regime imposed by the hazard

Amongst the most important ecological effects we mention: modifications to land elevation, especially whereas balance and equilibrium of slopes, modifications to air quality and surface and subterranean water supplies, soil alteration, modifications to local flora and fauna, both on the ground and underwater, growing risk of endemic disease breakouts, and others. Ecological effects are entirely unquantifiable, and require relief (if at all possible) over extended periods of time.

Social effects of hazards have a much greater severity, whose elimination is a condition with direct implications over the general welfare of the population. They cannot be quantitatively expressed unless in exceptional circumstances.

2.3 Risk evaluation

The study and, more importantly, evaluation of risk is a complex and difficult undergoing considering the multitude of factors, parameters and variables that must be taking into account.

It must rely on an inter-disciplinary approach, both through natural and social studies

- probabilistic or deterministic approaches
- resorting to different resources and theories borrowed from mathematics (fractal geometry, Chaos Theory, probabilistic calculus)
- development by the SIG

Total control over risk is impossible, and it can be at best made more efficient through pragmatic approaches, particularly, normative and probabilistic, which are two complementary approaches, irreplaceable for this operation.

The probabilistic approach tries to anticipate the apparition of catastrophic events in a system's evolution, using probabilistic calculus to determine legitimises that govern risk and potential events. This kind of an approach reveals the proportion and cyclical nature of natural or socio-economic events. The main operations are uncovering factors that intervene in risk enabling and finding correlations between events to promptly discover the risky character of a situation.

A normative approach implies the establishing of norms, thresholds for certain risk factors and systems. Unfortunately, in geographic systems, being extremely complex, setting up clear thresholds is impossible. These thresholds should result from measurements, calculus, experiments and having public or legislative validation to be further respected. Some elements, like pollution, buildings'

ability to withstand earthquakes, etc. have well defined standards, but thresholds for more complex geographical elements have yet to be established, particularly due to their difficulty.

Currently, the international community's efforts are focused on increasing responsibility of post-disaster reactions and measures and pre-disaster attitude and action.

A common means of risk evaluation is graphically representing its two features: probability and severity. If probability is equaled with frequency and gravity is given a set of numeric values, we obtain an F/N diagram (frequency/number). This way, damages can be represented graphically, according to the frequency and their numeric coordinates (figure 1).

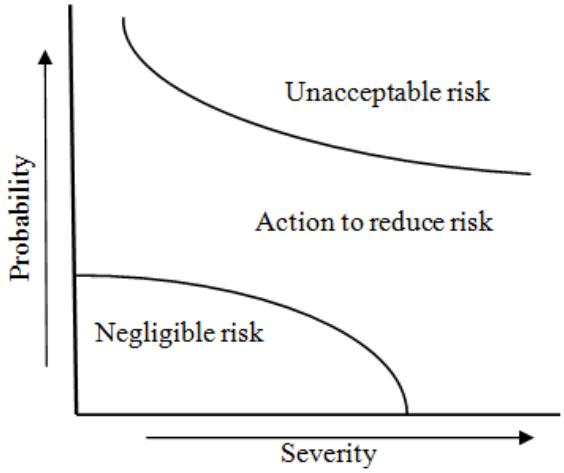


Figure 1.

As a planning device, the field can be separated into three action zones, according to the level of acceptability. If the graphic of the F/N value goes under the incidence of the "negligible" field, there is no need to allocate new resources to reduce the risk; if it falls in the middle area, resources must be redistributed to reduce risks; and finally, if it falls under unacceptable, efforts must be focused concertedly to find an alternative. Positions of these areas are creations of society and are not related to the nature of the risk itself. As the process implies an estimate scale, and this is surely a gross simplification, the accuracy of the results is reduced.

Natural hazard risks study implies an entire problematic that must allow for an objective analysis of the phenomenon, starting with rigorous observation of hazards and ending with evaluation of material costs to diminish consequences and reconstruction of destroyed goods and the environment.

Such a study encompasses a laborious activity, following several aspects:

- the existence and analysis of statistical data from an extended period of time
- establishing medium characteristics of each analyzed parameter
- extracting extreme values, as representations of possible variation limits of the phenomenon, as well as risk thresholds
- calculating the deviation of the respective parameter from the average, taken as normal
- defining the threshold from which a phenomenon becomes a risk
- defining and analyzing genetic factors for each studied risk
- analysis of the manifestation in time and space of said phenomenon
- defining the risk interval
- quantification of the degree of vulnerability (material damage and victims recorded as a result of the manifestation of such risks)
- psychological consequences and the role of education through mass-media
- monitoring risk factors
- evaluating material costs to diminish consequences and reconstruction costs of assets lost and of the environment

In quantifying these factors, the main criteria taken into account are: potential for destruction and severity of consequences (human victims, material damage), frequency (occurrence period) and the difficulty in preventing or diminishing effects.

The study of ecological risks encompasses two distinct steps. First, there is a localization investigation in order to discover what alterations have been brought to the environment or could take effect (risk analysis), and secondly, which alterations can be tolerated (risk assessment).

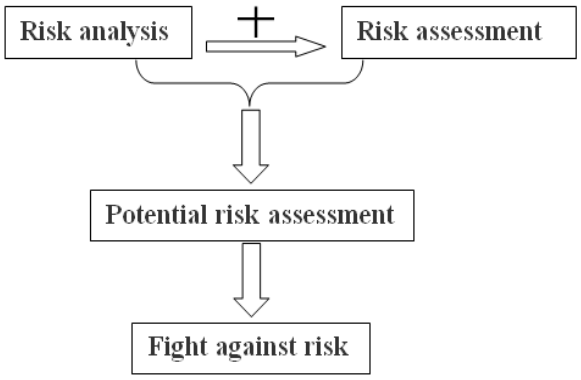


Figure 2.

So, with the help of these two steps we may analyze risks and estimate the kind of dangers, as well as their importance both in the present and in the future, or, in other words, an evaluation of potential risks is done. The purpose of such an evaluation of potential risks is to finally know if there is urgency in any undertaking, to deduce risk-combating measures and, in the case of serious contamination, a remedial strategy.

Risk analysis is done by historically investigating the potentially contaminated site (prior usage, soil occupation, etc.).

A technical analysis is then undertaken, with different methods and techniques, with the purpose of examining the current state of the site. Probes and samples are taken, which are then analyzed in order to determine the type, placement, quantity and concentration of any substance dangerous to the environment. The pursuit focuses on knowing both effective and possible threats, their transportation and evolution across time.

Risk evaluation must be able to answer the question "what is tolerable?", or evaluate what is admissible. In order to do this, risk analysis results are evaluated and compared to set objectives in order to protect the various goods and the environment in its ensemble. They are based on scientific knowledge and social value scales, comprising qualitative and quantitative criteria that define when alternations are no longer tolerable. Legal basis is required, adequate legislation, that contains indicative values and thresholds, clear and concise recommendations in order to evaluate contaminated sites.

The movement of dangerous substances at a site, contaminated by various ways (food chains, airborne, waterborne, direct contact) encompasses several environmental risks.

Thus, based on availability of dangerous substances and their different behavior and different contamination paths, an analysis and evaluation of risk based on substance, contamination type and goods to be protected proves indispensable. It is up to risk evaluation to judge in its entirety the interaction of different sectors over the environment.

When we know what is tolerable, an estimate can be made of potential risks, and then, judicious measures can be taken on the contaminated site. Such a risk evaluation is of course a process that reaches multiple domains, and warrants the inter-disciplinary participation of specialists.

The term *response* refers to any action which takes place during an emergency, both while it is in effect, and after, in order to reduce its negative effects on human health, economic activities and the environment.

Responses to risks are either to prevent or to limit consequences to the population. They are contained, by variable mixes and dosages, in the quadrilateral:

Technical responses – reveal different ranches of engineering studies; their main objective is, if complete annulment of risk is impossible, lessening the intensity of natural risks and limiting the possibility of technological risks. They are civil engineering feats, but their efficiency is still relative.

Spacial improvement responses – are of a preventive nature, destined to limit the vulnerability of territories subject to risks; they have a double juridical control: at authorization level, and another which focuses on eliminating any form of vulnerability which arises from urbanization. These two types of control lead to a more strict or lenient form of constructibility, being often a source of conflicts between public and private interest, between the State and local communities.

Management responses – come from institutions or civil protection organisms; they interfere during and after an extreme event to control it and remove consequences; their actions are practical reflections of operational help and intervention plans, which are reviewed based on experience gained from past catastrophes; the weak link is still the difficulty in reacting to an event that has escaped all prediction, the radically unpredictable.

Insurance responses – have as an essential purpose the repair of damages suffered after an event, by compensating victims; a current food-for-thought theme currently resides with the role that the insurer can have before the event, therefore in preventing (by modulating the values of insurance policies based on the potential risk, but also by technical exigences, contributing to applying indispensable security norms).

RFERENCES

1. Arambepola, N., Iglesias, G, *Effective strategies for urban flood risk management,* Asian Disaster Preparedness Center, Bangkok, page 2(2009)
2. Armas, I., *Riscuri naturale (Cultura riscului) - Riscuri naturale* – Sinteze pentru pregatirea examenului, page 18, http://www.geodinamic.ro/curs/Sinteze_curs.pdf.
3. Cucu, I., *Resursele de apă şi mediul de securitate*, în Impact Strategic, nr. 3[36], (2010).
4. Spencer, H.R., Tessier, A.J., Meghan, A.D., Huebner, M., Cáceres, C.E., *Warmer does not have to mean sicker: temperature and predators can jointly drive timing of epidemics*, in Ecology, vol. 87, no. 7, (2006).
5. Maló, M.D., *Local Management of Natural Disasters,* International Symposium Connecting Government&Citizen through Ubiquitous GIS, 26-28, Kuala Lumpur, Malaysia, page 14, (2010) .
6. Manoliu, M., Bădălan Turcitu, A., Simionescu S., Bărbulescu, A., *România expirată are nevoie de 40 mld. euro ca să nu rămână fără curent, căldură şi drumuri*, http://www.gandul.info/news/romania-expirata-are-nevoie-de-40-mld-euro-casa-nu-ramana-fara-curent-caldura-si-drumuri-5534499.
7. Pigui, T., *Măsuri de prevenire şi protecţie a infrastructurii şi personalului din sistemul Ministerului Apărării Naţionale în zonele seismice,* Colocviu Strategic, Nr. 11, sept. pages 5-6, (2004).
8. Sandu, I., *Evolu□ia regimului climatic în România*, http://www.mmediu.ro/departament_ape/gospodarirea_apelor/inundatii/prezentarinoiembrie-2009/Clima-romania.ppt%20%5BCompatibility%20Mode%5D.pdf
9. Teodorescu E., et al. *Managementul riscului de dezastru Ghid de lucru pentru ONG-urile de mediu in prevenirea dezastrelor*, Asociația ALMA-RO, pages 25-26, http://almaro.ro, (2007).
10. Tobă, F., *Resursele de securitate din perspectiva producţiei şi consumului durabil*, în Impact Strategic, nr. 3, (2010).

Natural Hazards	*geological*		-earthquakes -volcanoes
		Climate	-typhoons -hurricanes -cold waves -hot wave -drought. - waves
	geographical	**Oceanographic**	- tsunami
		Hydrological	- El Niño -folding -fluvial processes
		geomorphological	-mass displacements (landslides, mud flow etc.) -erosion -desertification
	ecological		-species biodiversity
	biological		-epidemics -invasion of locusts
	technological		-technical progress -pollution
Anthropogenic Hazard	*social*		-radioactivity -population growth -urbanization -unemployment

Table 1.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

THE DIVIDEND DISAPPEARING PHENOMENON – A THEORETICAL APPROACH

Maria PRISACARIU *, Diana - Ramona SANDU **

*Phd. Prof. at Faculty of Economics and Business Administration, Alexandru Ioan Cuza University, Iasy, Romania, ** Phd. Asoc. at Faculty of Economics and Business Administration, Alexandru Ioan Cuza University, Iasy, Romania

Abstract: *Explaining dividend policy has been a challenge for economists. Even after decades of study, we cannot say that there were identified and understood all the complex factors involved in this initiative. In this context, however, research has brought into attention a phenomenon, not so new, according to other opinions, the disappearance of dividends. This paper addresses this issue theoretically, in terms of research results centralized for a better understanding of a controversial phenomenon. The different opinions identified confirm, once again, that dividends remain an open issue, in their both forms of manifestation: appearance and disappearance.*

Keywords: *dividend policy, disappearing dividends, clientele theory, catering theory of dividends*

1. INTRODUCTION

Without trying to be an exhaustive approach, this paper aims to identify and bring into attention the results of specialized studies carried out on a relatively controversial phenomenon: the disappearance of dividends. Dividends, as a separate issue have been a subject upon which many and different opinions were expressed. The phenomenon of their disappearance, analyzed in terms of causes, becomes more interesting.

The paper begins with identifying the first observations in the literature about the disappearance of dividends and continues to address relevant and recent results on the studied subject. We respect a temporal coordinate, in order to better understand this phenomenon.

2. THE FIRST OBSERVERS OF THE DIVIDENDS DISAPPEARING PHENOMENON

A controversial study of Fama and French (2001) brought to light a problem, stated before in the media and in the literature: the disappearance of dividends. According to the analysis, the authors identified a lower importance of dividends, as a signal instrument and thus the possibility of eliminating them. They found a major decline in the number of non-financial companies paying dividends and in the actual amount of them. The main identified causes were the decrease in the number of public owned companies and the weakening propensity to pay dividends, in general. Based on these considerations, researchers have established the disappearance of dividends as a real phenomenon.

DeAngelo et al. (2004) responded to the research conducted by Fama and French (2001), based on concrete data: although the number of industrial firms who provided dividends decreased by 50% (a reduction of approximately 1.000 companies), in the last 20-25 years, the aggregate amount of dividends, both in nominal and real terms, between 1987 and 2000, grew by 224.6% overall, with 22.7% in the studied sample. The authors offered two reasons for this paradox: (1) the dividend paying companies that have disappeared from the stock exchange were most of them small and (2) dividends were increased by the major big companies, almost simultaneously. By default, results supported the existence of a high concentration of dividends in a few large firms.

In these circumstances, a new issue appeared - the truthfulness of two important theories: *the dividend clientele effect theory* and *the signaling theory*. The first theory is based on the heterogeneity assumption of dividend policy, to which investors respond by holding or not a certain stock. Given that, between 1996 and 2000, many non-paying dividend companies registered losses. Under these conditions, researchers asked to what extent market offered investors the opportunity to actually create a portfolio of profitable companies and non- paying dividend ones, at the same time. In other words, under the effect of clientele generated by the dividend policy, there ought to be heterogeneity among large companies that were found in most portfolios, assuming that investors differ in their preference for dividend or not. Reality, however, showed that dividend policy depends to a lesser extent of investors preference.

According to the second theory, in the virtue of signaling capacity, small firms especially, less visible, would be entitled to use dividends in order to communicate positive news to market. The fact that large firms, in a small number but with considerable financial strength, offered dividends and enjoyed a strong promotion, questioned the intention of signaling through dividends.

Grullon and Michaely (2002) also responded to the results of Fama and French, saying that the total payments to shareholders as dividends or stock repurchases, did not decrease, especially because of the intensification of repurchases.

In order to better understand why companies would give up to dividends, we should understand the motivations for offering them, at a certain moment in time. At this level, once again, researchers opinions are not unanimous. Baker and Wurgler (2002) explained the fluctuation of the decision to pay dividends through catering theory. Using the methodology of Fama and French (2001), authors went more in the past with the study, beginning with 1963 (to 2000) and identified four trends in the evolution of dividends: two ascending ones and two descending ones, all explained by the catering effect. They sustained that dividends tend to disappear when stock prices go up and tend to reappear after a crash of stock prices.

Managers conservatism in setting dividend policy attracted the attention of many researchers, in their attempt to find the cause of reducing dividends. The starting point was the idea that managers are reluctant to change dividend policy [10, 26]. Moreover, because of this conservatism, setting dividends implies a negative relationship between dividends and risk, so a new element was emerging as essential in the dividend decision: risk [6].

The signaling capacity of dividends acts closely related with the market perception of issuer's risk. The decision to reduce dividends was recorded as having a significantly negative effect on investors who correlated the issuer's risk to the capacity of rewarding shareholders. The danger of omitting dividends stated to be greater than that of reducing them. Following the evolution of dividends distributed by 80 companies, listed on the NYSE, from 1980 to 1985, a period marked by substantial losses, DeAngelo and DeAngelo (1990) found that more than half of the companies with debt repayment difficulties applied, mainly, the policy to reduce dividends instead of eliminating them. A sensitive issue appears in terms of dividend behavior: "managers are reluctant to omit dividends more than reducing them" [10]. A complete withdrawal from dividends, after a history of

distribution, may be a negative signal to the market, that can severely punish stock prices.

Another key element in setting dividend policy was recognized in the company's age [20,24]. As the firm is in a mature phase, the more it is tempted to pay dividends to its shareholders, because is in a relatively safe stage of existence with low risk.

Investors preference for firms that pay or not dividends is another variable in the decision to offer this form of reward. According to some authors, institutional investors are attracted to dividends but not to a special level of them [18]. According to other researchers, individual investors do not prefer companies that pay dividends in a special way, but they choose from them the ones with a higher level of dividends [17]. A relevant study is that of Allen, Bernardo and Welch (2006) who, contrary to catering theory (companies cater to individual sentiments for dividends), support the idea that dividends are used to attract institutional investors, with greater financial strength.

3. RECENT IMPORTANT RESULTS

Recent studies approach the phenomenon of disappearing dividends as a real process explained by some major factors. Vieira (2008) studied this phenomenon on three stock markets, different as size, structure and legal basis (Portuguese, French and British ones), for a period of about 10 years (1992-2002). If on the Portuguese and British markets there was identified a decrease in dividends phenomenon, not the same thing happened on the French stock market. The study concludes that European markets, despite their low value of dividends, have a higher percentage of dividend payers, being representative in this sense the London stock market. Another result of the study was that companies that provided dividends were among the largest in the French and London stock exchanges and among the most profitable, on the Portuguese and also London markets.

Hoberg and Prabhala (2009) examine the dividend policy of firms listed on NYSE, AMEX and NASDAQ, from 1963 to 2004. The authors conclude that 40% of the dividend reduction phenomenon is explained by increased risk and the disappearance of dividends is not correlated with the companies attempt to meet temporary fads of investors (as opposed to catering theory of Baker and Wurgler). Moreover, they confirm the results obtained by Fama and Frech (2001), namely that large profitable firms are more tempted to pay dividends than firms with growth potential, less inclined to pay dividends. Profitability, size and total assets are variables that positively influence the decision to increase dividends [21].

Another recent study which approaches the phenomenon of disappearing dividends is that of Guluzar and Bern (2010). They focus their study on the decision to pay dividends for the companies listed on Istanbul Stock Exchange, between 1991 and 2006. The authors identify a decrease in the number of dividend payers and in the dividend net amount, even if in the studied market they did not observe that dividend concentration, as a specificity for major foreign exchanges. Financial crisis (Asian crisis - 1997, Russian crisis - 1998, banking crisis - 2001) are identified as having a significant role in the declined phenomenon of dividends, in the sense of decreasing profitability and therefore increasing risk for companies.

Among all the results, an interesting one is related to the idea that as a company is more profitable, it has a more propensity to

pay dividends, but the decision does not depend of past earnings. Another result is that increasing indebtedness affects the decision to offer dividends, by reducing them, because of the decreased free cash flow [5]. In addition, firms with growth potential choose to pay dividends, apparently a paradoxical result, given the investment needs, but a truthful one, if we consider the attempt to signal confidence to investors [23]. In conclusion, Bern and Guluzar (2010) argue that of all firms with traditional dividend payments, which choose to reduce them, previously faced with declining revenues, increasing debt and decreasing investment potential.

Another relevant study belongs to Chahyadi and Salas (2010), who argue that dividends have been replaced by stock repurchases and that firm characteristics explain 76% of the decrease in the number of dividend payers, between 1978 and 1998 (profitability, growth opportunities, liquidity, debt). The authors conclude also that the tax factor does not significantly influence the firms decision to pay dividends, as previous researches revealed [9, 12, 27]. Another important result is the failure to confirm the theory of catering. Chahyadi and Salas (2010) find no significant relationship between dividend premium and the decrease in the number of dividend payers.

An interesting approach belongs to Fuller and Goldstein (2011), who aim to find out when dividends matter. The analysis targets the dividend paying firms listed on NYSE, AMEX and NASDAQ, during January 1970 - December 2007. The period of analysis is relatively long, about 38 years, with stages of growth and downturn; this is the reason why authors succeed to capture dividends in correlation with the general trend of stock markets, using, as a main tool, the S&P 500 index - for which they record 268 months with positive returns (growing markets) and 188 months with negative returns (markets in regression). They observe that companies with high dividends have higher yields, with 1 and 2%, compared to non-dividend payers, in times of crisis or in bear markets, regardless of size or profitability. Furthermore, investors react differently to the increase, to the decrease or the maintaining of dividends, in bull markets compared to bear markets, concluding that dividends matter more in declining stock markets [16].

Finally, we bring to attention another paper of interest. The study, belonging to researchers Fatemi and Bildik (2012), performed over 17.106 companies, from 33 countries, between 1985 and 2006, unequivocally concludes that dividends easily disappear. Specifically, the authors identify a sudden drop of them, from 87% to 53%, at a global level and offer, as a main explanation, the increasing use of share buybacks. The last procedure and the seasoned equity offerings allow capital to easily flow from a corporation to another, along a considerable stock market development and sophistication. The authors identify, although in a decreasing stage, a greater propensity to pay dividends for large companies, highly profitable firms and issuers with low growth opportunities. Moreover, there is a variable related to the industry in which issuers act: companies operating in areas such as oil refining, food production, manufacture of electronic materials, production of tobacco, sanitary service are the biggest conservative payers of dividends; of all, more than 75% adopt the practice of offering dividends. Companies that act in mining, oil extraction, medical or business areas pay dividends at a much lower rate, of about 35% [14].

Fatemi and Bildik (2012) identify a decrease not only in the number of dividend paying firms, but also in the actual rate payment among conservative dividend payers. Another important factor identified for the propensity of firms to pay dividends is the country's legal system, common law or civil law. Specifically, the authors note that although the proportion of dividend payers is lower in common law countries, there is a significant decrease in the rate of dividends in civil law countries, given that, simultaneously, in common law countries this rate increased significantly [14]. Due to this phenomenon, along with 1995, the average dividend rate in common law countries was higher than that in the civil law countries. The same researchers confirm the existence of a high concentration

among dividend paying companies, the most large and profitable ones, a result obtained also by DeAngelo and DeAngelo (2004). Specifically, the dividend concentration exceeds 90% in countries like Denmark, Austria, Netherlands and China, a high level of over 80% being recorded in countries like Belgium, Finland, Norway, Italy and Spain. In contrast, a dividend concentration level of less than 50% was identified in 2006 in USA, Japan, Canada, India and Malaysia [14].

Despite all pessimistic expectations, we consider that the decreasing importance of dividends is a temporary phenomenon, whose explanations could be found in firms characteristics, in the investment environment desires and last but not least in the changes of economic and financial environment.

4. CONCLUSIONS

The paper main objective was to theoretically approach a relatively new phenomenon, the disappearance of dividends, by illustrating some of the most relevant studies on this topic. Dividends, as a decision of the company, relentlessly keeps the mystery and attraction. We cannot say that there have been identified the exact motivations behind their offering or their real effects, deliberately caused or by default. Experts opinions are varied. This is why it is more difficult to understand the motivations of eliminating them, although financial practice experienced periods of decline. Studies have shown that there is a phenomenon of reducing them, but our view is that their disappearance is unlikely to happen, considering that dividends are still an important instrument in the financial sector.

Without claiming to have chosen the most important studies on the approached subject, because we might have omitted other relevant studies, we consider the objective of this paper achieved by opening a research appetite for a surprising issue.

REFERENCES

1. Allen F., Bernardo A., Welch I., *A Theory of Dividends Based on Tax Clientele*, Journal of Finance, No. 55, 2000;
2. Baker M., Wurgler J., *A Catering Theory of Dividends*, Journal of Finance, Vol. 59, No. 3, 2004;
3. Baker M., Wurgler J., *Appearing And Disappearing Dividends The Link To Catering Incentives*, Working Paper 9995, available at http://www.nber.org/papers/w9995, National Bureau Of Economic Research, Cambridge, September 2003;
4. Baker M., Wurgler J., *Why Are Dividends Disappearing An Empirical Analysis*, NYU Working Paper, No. S-CG-02-09, November 2002;
5. Berna K., Guluzar K., *Are Dividends Disappearing or Shrinking ? Evidence from the Istanbul Stock Exchange*, Emerging Markets Finance & Trade, Vol. 46, No. 2, March–April 2010;
6. Brav A., Graham J., Harvey C., Michaely R., *Payout Policy in the 21st Century*, Journal of Financial Economics, No. 77, 2005;
7. Brav A., Heaton J.B., *Did ERISA's Prudent Man Rule Change the Price of Dividend Omitting Firms?*, Working paper, Duke University, 2004;
8. Chahyadi C., Salas J., *Not Paying Dividends A Decomposition Of The Decline In Dividend Payers*, Journal of Economic Finance, Vol. 36, No. 2, 2010;

9. Chetty R., Saez E., *Dividend taxes and corporate behavior: evidence from the 2003 dividend tax cut*, Quarterly Journal of Economics, No. 120, 2005;
10. DeAngelo H., DeAngelo L., *Dividend Policy and Financial Distress: An Empirical Investigation of Troubled NYSE Firms*, Journal of Finance, Vol. 45, No. 5, December 1990;
11. DeAngelo H., DeAngelo Linda, Skinner J. D., *Are dividends disappearing? Dividend concentration and the consolidation of earnings*, Journal of Financial Economics, No. 72, 2004;
12. Eades K., Hess P., Kim H., *Time series variation in dividend pricing*, Journal of Finance, No. 49, 1994;
13. Fama E., French K., *Disappearing dividends: changing firm characteristics or lower propensity to Pay?*, Journal of Financial Economics No. 60, 2001;
14. Fatemi A., Bildik R., *Yes, Dividends Are Disappearing Worldwide Evidence*, Journal of Banking & Finance, No. 36, 2012;
15. Ferris, Stephen P., Sen, Nilanjan and Yui, Ho Pei, *God Save the Queen and Her Dividends: Corporate Payouts in the United Kingdom*, The Journal of Business, Vol. 79, No. 3, 2006;
16. Fuller K., Goldstein M., *Do Dividends Matter More In Declining Markets*, Journal of Corporate Finance, No. 17, 2011;
17. Graham J., Kumar A., *Do Dividend Clienteles Exist? Evidence on Dividend Preferences of Retail Investors*, Journal of Finance, No. 61, 2006;
18. Grinstein Y., Michaely R., *Institutional Holdings and Payout Policy*, Journal of Finance, No. 60, 2005;
19. Grullon G., Michaely R., *Dividends, Share Repurchases, and the Substitution Hypothesis*, Journal of Finance, No. 57, 2002;
20. Grullon G., Michaely R., Swaminathan B., *Are Dividend Changes a Sign of Firm Maturity?*, Journal of Business, No. 75, 2002;
21. Hoberg G., Prabhala N., *Disappearing Dividends, Catering, and Risk*, The Review of Financial Studies, Vol. 22, No. 1, 2009;
22. Jensen G., Lundstrum L., Miller R., *What Do Dividend Reductions Signal*, Journal of Corporate Finance, No. 16, 2010;
23. Kato K., Loewenstein U., Tsay W., *Dividend Policy, Cash Flow, and Investment in Japan*, Pacific-Basin Finance Journal, Vol. 10, No. 4, 2002;
24. Koch A., Sun A., *Dividend Changes and the Persistence of Past Earnings Changes*, Journal of Finance, No. 59, 2004;
25. Lie E., Li W., *Dividend Changes and Catering Incentives*, Journal of Financial Economics, No. 80, 2006;
26. Lintner J., *Distribution of Incomes of Corporations Among Dividends, Retained Earnings, and Taxes*, American Economic Review, No. 46, 1956;
27. Michaely R., *Ex-dividend day stock price behavior: the case of the 1986 Tax Reform Act*, Journal of Finance, No. 46, 1991;
28. Reddy Y., Rath S., *Disappearing Dividends in Emerging Markets?*, Emerging Markets, Finance & Trade, Vol. 41, No. 6, 2005;
29. Sharma V., *Independent Directors And The Propensity To Pay Dividends*, Journal of Corporate Finance, No. 17, 2011;
30. Vieira E., *Are Dividends Disappearing Mixed Evidence From Europe*, Journal of the Spanish Association of Accounting and Administration Business, September 2008.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

SOVEREIGN DEBT CRISIS THEORETICAL AND PRACTICAL ASPECTS

Stelian STANCU*, Anca Michaela ANDREI*, Alexandra Maria CONSTANTIN*, George Viorel VOINESCU*

*Academy of Economic Studies, Bucharest, ROMANIA

Abstract: *The economic crisis we are facing can be considered as the law that governs the economic evolution of countries worldwide, now and for the next 10 years. The current problem and part of the economic crisis, sovereign debt, must be approached both theoretically and practically in order to understand and improve monetary financial mechanisms, but also to find methods to diminish countries' dependency to institutions such as the IMF and World Bank, etc.*

This paper aims to look at both theoretical and practical aspects of the sovereign debt crisis, as it expresses the degree of dependency debtor countries have in relation with creditor institutions and other countries.

Keywords: *economic crisis, sovereign debt crisis, econcomic-mathematical model to highlight probability of foreign debt crisis*

1. INTRODUCTION

Countries defaulting, or basically bankrupting, has become an increasingly intense problem in the past 20 years, starting from the 80's. Table 1 shows aspects of what has happened in the economic sphere in the past 30 years.

Country	Number of crisis	Years in Crisis	Crisis episode (entry-exit)
Algeria	1	6	1991–97
Argentina	3	15	1995–96, 2001–
Bolivia	2	13	1986–94
Brazilia	3	16	1998–00, 2001–
Chile	1	8	1983–91
China	0	0	
Columbia	0	0	
Costa Rica	1	10	1981–91
Cipru	0	0	
Republica Cehă	0	0	
Republica Dominicană	1	22	1981–
Ecuador	2	16	1982–96, 1999–01
Egipt	1	1	1984–85
El Salvador	1	16	1981–97
Estonia	0	0	
Guatemala	1	1	1986–87
Ungaria	0	0	
India	0	0	
Indonezia	2	5	1997–01, 2002–
Israel	0	0	
Jamaica	3	14	1978–80, 1981–86, 1987–94
Iordania	1	5	1989–94

Kazakhstan	0	0	
Republica Coreei	2	4	1980–82, 1997–99
Latvia	0	0	
Lituania	0	0	
Malaysia	0	0	
Mexic	2	10	1982–91, 1995–96
Maroc	2	6	1983–84, 1986–91
Oman	0	0	
Pakistan	1	2	1998–00
Panama	1	14	1983–97
Paraguay	1	7	1986–93
Peru	3	19	1976–77, 1978–81, 1983–98
Philippine	1	10	1983–93
Polaonia	0	0	
România	0	0	
Rusia	1	3	1998–01
Republica Slovacă	0	0	
Africa de Sud	4	7	1976–78, 1985–88, 1989–90, 1993–94
Thailanda	2	2	1981–82, 1997–98
Tunisia	1	7	1991–92
Turcia	2	7	1978–83, 2000–02
Ucraina	1	3	1998–01
Uruguay	3	6	1983–86, 1987–88, 1990–92
Venezuela	3	10	1983–89, 1990–91, 1995–98

Table[1] 1. *Countries defaulted and the periods of debt crises*

Presented in table 2 are countries with sovereign debt crises in the 80's and 90's.

[1] Realized by Paolo Manasse and Nouriel Roubini

1991	Algeria	1984	El Salvador	1984	Niger
1983	Argentina	1995	El Salvador	1972	Nigeria
1978	Bangladesh	1987	Ethiopia	1986	Nigeria
1991	Bangladesh	1985	Guatemala	1987	Panama
1983	Brazil	1983	Haiti	1984	Paraguay
1982	Burkina Faso	1976	Honduras	1983	Peru
1986	Burundi	1982	Honduras	1984	Philippines
1979	Cameroon	1998	Indonesia	1984	Senegal
1985	Cameroon	1989	Jordan	1989	Senegal
1973	Chile	1990	Kenya	1972	Sierra Leone
1983	Chile	1998	Korea	1992	Sri Lanka
1985	Colombia	1990	Lesotho	1976	Sudan
1981	Costa Rica	1980	Madagascar	1998	Thailand
1987	Cote D'Ivoire	1982	Malawi	1988	Trinidad & Tobago
1976	Dominican Rep.	1987	Malawi	1991	Tunisia
1982	Dominican Rep.	1982	Mexico	1979	Turkey
1983	Ecuador	1985	Morocco	1984	Venezuela
1986	Egypt	1978	Nicaragua	1975	Zaire
				1978	Zambia

Table 2. *Episodes of Debt Crisis by Year and country*

2. THEORETICAL ASPECTS

2.1. Conceptualizing the sovereign debt crisis

In the following we will present theoretical aspects regarding the sovereign debt crisis.

A country is defined to be in a situation of debt crisis if:

- there are considerable remnant payments or foreign obligations interest of commercial creditors (banks or bonds) surpasses 5% of total remnant commercial debt
- there is a rescheduling or debt restructuring accord with commercial creditors, counted in GDF (Global Development Finance).

In specialty literature, sovereign debt analysis is divided into four categories:

- theoretical models of sovereign debt
- empirical studies regarding debt crisis determining factors
- empirical studies regarding credit rating agency's prediction powers
- empirical studies regarding determining the degree of sovereign debt distribution

Defaulting, a particular aspect of sovereign debt crises, is approached in most specialized literature. According to these studies, there is a series of macroeconomic factors that influence

the probability of defaulting and inability to pay sovereign debt.

2.2. The awareness stage

Sachs, Tornell and Velasco (1996) created a study regarding countries affected by the Tequila crisis, by analyzing the proportion of short term debt (STD) in the overall capital flow, by verifying the existence of a correlation between STD and economic vulnerability of the analyzed countries.

On the other hand, Radelet and Sachs (1998) and Rodrik and Velasco (1999) have shown that the proportion between DTS and reserves help predict capital flow. As their analysis is based on small samples, their conclusions are simply suggestive. Eichengreen and Mody (1998, 1999) demonstrated that the spread risk of loans on emergent markets and bonds leads to an increased ratio between STD and the emitting country's reserves.

Obstfeld (1996) and Krugman (1998) developed a model in order to exit the UME from the second and third generation of monetary crisis. They treat the UME as the promise to participate in a fixed exchange rate program and introduce a control variable for the government, the decision to opt in or out of the euro zone. At the same time, defaulting procedures for sovereign states were analyzed (Sachs, 1995; Fischer, 1998; Miller and Zhang, 2000). By using bigger samples, Frankel and Rose (1996) and Milesi-Ferretti and Razin (1998) did not discover any proof of liquidity effects on monetary crises.

Diamond and Rajan (2000), in the theoretical model they developed, show that when economic circumstances deteriorate, countries with inadequate financial infrastructures, such as the countries affected by the Asian crisis ca only finance short term investments.

Jeanne (2001) shows that the government in a vulnerable country engages in fiscal adjustment only in when it is sufficiently threatened by foreign funds withdrawal, and in order to avoid this phenomenon, creditors must lend money on short term.

In 2010, the financial crisis lead to increasing public debts in the eurozone, so that many economists fear that the euro could collapse (Arghyrou and Tsoukalas, 2010).

International risk factor was vital in determining the spread of the crisis (Codogno et al (2003), Geyer et al (2004), Longstaff et al (2007), Barrios et al (2009), Sgherri and Zoli (2009), Manganelli and Wolswijk (2009), Favero et al. (2010)). This effect was especially powerful during the hardening of financial international conditions (Haugh et al, (2009), Barrio et al (2009)), especially for countries with a high level of public debt (Codogno et al (2003)).

This point of view is contested: Manganelli and Wolswijk (2009) raise the question of whether or not the sanctions imposed by economic markets were sufficient to encourage EU governments to change unsustainable fiscal policies.

The role of liquidity risk is controversial. Codogno et al. (2003), Bernoth et al. (2004), Pagano and Von Thadden (2004) and Jankowitsch et al. (2006)found a limited effect of lack of liquidities in the spread of the economic crisis. At the same time, Gomez-Puig (2006), Beber et al. (2009), and Manganelli and Wolswijk (2009) plead in favor of a more prominent effect, especially in times when financial conditions are rough, times with high interest rates.

Specialized literature that cover crisis periods reveal a consensus on two points of view:

- firstly, the vast spread noticed in the EU is primarily determined by the increased risk factor on a global level. In this process, the local financial sector's role is crucial in its symbiosis with the global financial system, by rising transformation risk into sovereign risk by two methods (Gerlach et al, 2010):
- during periods of governmental financial difficulties, it could be forced to recapitalize bank with taxpayer money, increasing its financial obligations
- lack of liquidity in the banking sector limits credit given to the private sector, causing economic recession, accentuation of fiscal unbalances. Attinasi et al. (2009), Sgherri and Zoli (2009), Mody (2009), Barrios et al. (2009), Gerlach et al. (2010) and Schuknecht et al. (2010) established the importance of the risk factor on a global level during crisis periods and the impact the former has on the latter, through the financial sector
- secondly, during the market crisis, fiscal unbalances and other macroeconomic unbalances (for example, excessively large current accounts) were sanctioned. Markets place even greater pressure on fiscal imbalances (Barrios et al (2009), Haugh el et al (2009), Manganelli and Wolswijk (2009) and Schuknecht et al. (2010)). On the other hand, reality shows that even though a country's role with a specific liquidity risk is not to be ignored, it is still fairly limited (Attinasi et al. (2009), Sgherri and Zoli (2009), Barrios et al (2009), Haugh et al. (2009), and Manganelli and Wolswijk (2009))

3. PRACTICAL ASPECTS

A country is defined as being in a „debt crisis" when it is classified implicitly so by Standard&Poor, or when it receives a large non-concessional loan from the IMF (where large means in excess of 100% of the quota). Standard & Poor rates sovereign emitters implicitly when a government cannot fulfill principal debt or interest for external obligations at the due date (including exchange offers, capital swap of debts, or cash buyback).

3.1. European sovereign debt crisis – 2010 to present

In 2010, the financial crisis lead to further public debt in the Eurozone, so that many economists fear the euro might collapse. Countries with problems include Greece, Portugal, Spain, Ireland and Italy. Diffusion of bond yields between these countries and other EU members, particularly Germany, has dramatically increased.

On the 2nd of May 2010, Euro countries and the IMF agreed to a 110 billion euro loan to Greece, which, in exchange for it, promised an austerity regiment. In July 2011, Greece asked for a new loan, and problems overflowed for Spain and Italy.

In August of the same year, the ECB showed that it is prepared to buy Italian and Spanish bonds to counteract the sovereign debt crisis of these countries. However, the ECB has potential to buy only half of Italian and Spanish transitioned debt.

Characteristics of affected EU countries particularly affected by the sovereign debt crisis

Greece

- annual deficit is under 3%, but not of gross public debt, under 60% of its GDP
- Standard and Poor reduced Greece's sovereign rating under the minimal BBB- requested by the ECB from a major rating agency
- has approximately 360 billion Euro in debts and potential credit losses (12 billion euro from the EU economy)

Portugal

- little under 90% of GDP, still smaller than Greece's 113%

- savings rate was 7.5% of GDP compared to Greece's 6%
- Italy had a savings rate 17.5%, 20% Spain, 19% France and 23% Germany
- country ratings for long term bonds were reduced by Moody to Ba2, which is two levels lower and attributes a negative perspective, which implies possibility for further degradation

Ireland

- passive external & passive internal
- large basis for monetary aggregates, such as M1, went up by 20-30% anually
- choosing bankruptcy instead of salvation
- stocks dropped 95% compared to their maximum
- Irish Crown went down 60% compared to the Euro

Italy

- Italy's debt reaches 120% of GDP in 2011 and will then slowly drop to 118% by the end of 2016
- sovereign insurance bonds against defaulting risks went up 11% when the EU finally gave Greece the cash flow necessary to pay dues in July
- Spanish and Portuguese insurance bonds went up 3%, starting from july 2011, and credit default swap for Italian debt went up to 6.7%
- France's debt is 85% of GDP and is expected to grow over the following years
- as of July 2011, Italian bonds had a 4.9% spread over German bonds reaching approximately two percentage points (Greek-German spread is 13%)
- further interest rate growth could push prognosis for Italy's debt closer to Greece's
- Italy has almost 2000 billion Euro in debt

Spain

- unemployment rate in Spain went up to 20.09% (4.6 million people)
- in 2009, unemployment rate between 16 and 24 years was 42.9%, the greatest in Europe
- real estate bubble growth: 760000 houses were constructed in a year, over 650000 were begun in that year in France and the UK, with a total population almost triple that of Spain

In the US, banks are more exposed in Italy than in any other country in the eurozone, worth 269 billion dollars, according to Barclays. Bank exposure in Spain follows the national exposure, with deficits ranging up to 179 thousand billion dollars.

3.2. Economic-mathematical model to highlight probability of foreign debt crisis

The main equation of the empirical model (Detragiache, Spilimergo, 2011) is as follows:

$P = \alpha_1 s + \alpha_2 c + \overline{\beta X} + \eta$ (1), where:

P – is the probability of foreign debt crisis

$\overline{X}$ - is the exogenous vector of macroeconomic fundamental variables and loan characteristics

s – is the ratio between the short term loan from the total loan

c – is the sum of the credit and interest at maturity level, t, because long term credits (as a ratio of total debt), which will be from here on called service debt, its ratio in the total external loan that must be returned at time t.

Observations: Variables s and c are significant and positively correlated with the crisis probability

η - is the random perturbation

The ratio equation for short term credits is:

$$s = \theta P^e + \bar{\gamma}\bar{X} + \bar{\delta}\bar{Y} + \mu c + \varepsilon \quad (2)$$

P^e - expected probability of debt crisis

$\bar{Y}$ - a multitude of variables that affect short term ratio of debt, *s*, without directly affecting the probability of debt crisis

If expectations are rational then $P = P^e$ and equation (2) becomes:

$$s^e = \gamma'\bar{X} + \bar{\delta}'\bar{Y} + \mu' c + \varepsilon' \quad (3)$$

Observations:

1. Equations (1) and (2) can be estimated as a system.
2. In practice, equation 2 is, probably, weakly specified, because there is no model that applies the structure of external debt to maturity

For these, we will use equation (1) under a form in which we substitute the real value of *s* with the value given by equation (2):

$$P = \alpha_1 s^e + \alpha_2 c + \overline{\beta X} + \eta \quad (4).$$

If short term debt increases the probability of crisis, coefficients α_1 and α_2 are positive and significant. On the other hand, if the correlation between liquidity variables and crisis present the causality from the probability of the crisis to loan structure deadline, then coefficients α_1 and α_2 are not significant.

Data that can e used in the model are: explicative variables like liquidity indicators, control variables like the size and structure of external debt, as well as a set of macroeconomic variables. On the other hand, all variables connected to debt (with the exception of service debt) are delayed by an year, as they are at the end of their time frame.

Macroeconomic variables are delayed similarly, to limit simultaneously generated problems.

4. CONCLUSIONS

The sovereign debt crisis is an important aspect of the current economic crisis and must be analyzed quantitatively to realistically depict the negative reality behind affected macroeconomic indicators.

Mathematical modeling can estimate the probability that a country may find itself in the sovereign debt crisis, thus helping predictions regarding this phenomenon.

Due to the complexity of macroeconomic mechanisms (knowing that economy can be considered a cybernetic system), modifications at a macroeconomic level can affect, through symptoms of the sovereign debt crisis, the future development of the economy.

REFERENCES

1. Bernanke B. S., Gertler M., *Should central banks respond to movements in asset rices*?, American Economic Review, 91, 253–7, (2001).
2. Bordo M., Jeanne O., *Boom-busts in asset prices, economic instability and monetary policy*, Discussion paper 3398, CEPR, (2002).
3. Brunnermeier M. K., *Deciphering the Liquidity and Credit Crunch 2007-08', Journal of Economic Perspectives*, (2009). (http://www.princeton.edu/~markus/research/papers/liquidity_credit_crunch).
4. Burnside C., Eichenbaum M., Rebelo S., *Government guarantees and selffulfilling speculative attacks*, Journal of Economic Theory, 119, 31–63, (2004).
5. Chang R., Velasco A., *A model of financial crises in emerging markets*, Quarterly Journal of Economics 116, 489–517, (2001).
6. Christiano L., Braggion F., Roldos J., *The optimal monetary response to a financial crisis. Mimeo*, Northwestern University, (2006).
7. Corsetti G., Mackowiak B., *Fiscal imbalances and the dynamics of currency Crises*, European Economic Review 50, 1317–38, (2006).
8. Kaminsky G., Reinhart C., *The twin crises: the causes of banking and balanceof-payments problems*, American Economic Review 89, 473–500, (1999).
9. Krugman P., *A model of balance of payments crises*, Journal of Money, Credit and Banking 11, 311–25, (1979).

10. Obstfeld M., *Models of currency crises with self-fulfilling features*, European Economic Review 40, 1037–47, (1996).

11. Smets F., Wouters R., *An Estimated Stochastic Dynamic General Equilibrium Model of the Euro Area*, Journal of the European Economic Association, 1, 1123-75, (2003).

12. Stancu S., Mihail N., *Decizii economice în condiţii de incertitudine. Aplicaţii pe piaţa financiară,* Editura Economică, (2005).

13. Stancu S., Mihail N., *Metode şi tehnici de conducere. Teorie şi aplicaţii,* Editura Economică, (2006).

14. Stancu S., Mihail N., *Macroeconomie. Modele statice şi dinamice de comportament. Teorie şi aplicaţii,* Editura Economică, (2009).

15. Stiglitz J., Weiss A., *Credit Rationing with Imperfect Information*, American Econommic Review, 71, 393-410, (1981).

16. Tsomocos D.P., *Equilibrium Analysis, Banking, and Financial Instability*, Journal of athematical Economics, 39, pages 619-655,(2003).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

THEORETICAL ASPECTS OF MONETARY AND FINANCIAL CRISES. SPIRAL OF LOSSES

Stelian STANCU*, Nora Monica CHIRIȚĂ*,
Alexandra Maria CONSTANTIN*, Anca Domnica LUPU*

*Academy of Economic Studies, Bucharest, ROMANIA

Abstract: *One of the many issues associated with financial crises is related to interest rate policies during and after the crisis. A pertinent opinion is given by Christiano, Braggion and Rodlos (2006), that increased interest rates during the crisis, corroborated with immediate decrease post-crisis is the best handle on such a situation.*

Financial institutions fund new investments with loans and borrowed funds. Consequently, nowadays' financial system looks more like a complex network of financial obligations. With the addition of modern financial techniques such as bonds and options, institutions have more funding options than ever.

Herein fro, a series of theoretical aspects regarding monetary and financial crises are presented, alongside choices of corresponding macroeconomic models and causes of the Great Depression of 1929-1933.

The paper concludes with an explanation regarding spiraling losses as a result of the effects of asset prices. When a large number of upstanding financial institutions suffer a severe financial shock, they face backlashes in their volume and performance. Thus, such an asset price plummet leads to a drop in the population's welfare, inducing yet another backlash on companies, in a descending financial perpetuum mobile.

Keywords*: currency crisis, financial crisis, banking system, the spiral of losses, Great Depression, speculative attack, the shock of the financial system*

1. THEORETICAL ASPECTS OF MONETARY CRISES

Monetary crises are characterized by the exchange rate dropping continuously across a short period of time. In first generation models (Flood and Garber (1978), Krugman (1979)), the collapse of a fixed exchange rate is caused by unsustainable fiscal policies. Extensions of these models which also include in their analysis consumer optimization, inter-temporal budget restrictions at a governmental level are found with Obstfeld (1986), Calvo (1987), Drazen and Helpman (1987), Wijnbergen (1991), Flood and Marion (1999).

The first generation models mentioned before are characterized by the fact that speculative attack time is deterministic, while the exchange rate does to depreciate at the moment of the attack. The solution to such methods is to introduce shocks (Flood and Garber (1984)).

These same models have proven, later on, that raising fiscal deficit, the level of state debt, lowering the national reserve precede the collapse of the fixed exchange rate system

(Corsetti, Pesenti and Roubini (1999), Burnside, Eichenbaum and Rebelo (2001), Lahiri and Végh (2003)).

However, the asian crisis, which started in 1997, proves a close connection between future public deficit and the current change in exchange rates. Dupor (2000), Daniel (2001), Corsetti and Mackowiak (2006) use fiscal price theory to prove that price and exchange rates modify as a response to future public deficit.

In these first generation models, the government exogenously adopts the decision regarding the waiver of the fixed exchange rate regime.

Second generation models, however, present the government adopting multiple rule solutions (optimal multiple) to solve a problem of optimal (maximum), determining if and, if so, when, they will abandon the fixed exchange rate regime (Obstfeld (1994, 1996). The Central Bank minimizes a quadratic loss function, depending on the inflation and real GDP variation compared to potential GDP (Barro and Gordon (1983), Jeanne (2000)).

Third generation models associate the effects of the Payment Balance with devaluation, by assuming that banks and companies from emerging countries borrow money in foreign currencies and give credits in their own currency. However, they are exposed to liquidity shock due to long-term project financing with short-term loans. (Eichengreen and Hausmann (1999)). It is, however, advantageous to expose yourself (as a company) to the exchange rate, if the financed project is guaranteed by the government (McKinnon and Pill (1996), Burnside, Eichenbaum and Rebelo (2001)).

A particularly difficult problem that arises refers to to interest rate policies during and after exchange rate crises. A solution in this matter was given by Christiano, Braggion and Roldos (2006), by raising interest rates during the crisis and immediately dropping rates afterwards.

2. THEORETICAL ASPECTS OF FINANCIAL CRISES

Financial instability (Mishkin (1994)) is characterized by financial system shock. Crockett (1997) says that financial stability refers to the associated stability of key financial institutions and markets, in the sanse that I) financial institutions included in the system are stable, trustworthy and continuously and uninterruptedly fulfill their contractual bonds, without outside financial assistance and ii) essential macroeconomic markets are stable.

Issing (2003) and Foot (2003) suggest that financial stability is intertwined with financial market bubbles or, generally, the volatility of proximal financial markets.

Haldane et al (2004) suggest the following definition: Financial instability can be defined as any deviation from the economic-investment plan on an economy level, which brings financial imperfections in the finance system.

Goodhart et al (2004, 2005, 2006) and Tsomocos (2003) generically say that financial instability is characterized by a high probability of loss or at least lowering of profit.

Until this last of financial crises, which went global, the following major financial crises emerged:

- the Russian crisis, the Texas bank crisis and the crash of the USA Commodity Exchange, all in 1987
- Mexico's financial instability (1995), the Asian crisis, Indonesia, South Korea (1997 0 1998), Russia (1998), Brazil (1998-1999). Their common denominator was a dramatic change in current account, a real and severe depreciation and significant decline in real output.

The Asian crisis was characterized economic recession, a growth in overall losses and banking system crisis.

With certain exceptions, the template to all crises seems to imply the following elements[1]:

- After a period of massive inputs of capital, investors (both domestic and foreign)

[1] Ely R.T., *International Financial Crises: Causes, Prevention and Cures*, Lecture by Lawrence H. Summers

have decided to reduce the volume of assets owned in the country affected in response to changes in economic conjecture. The main sources are:

- concern over the viability of the exchange rate regiment (the vast majority of cases);
- large fiscal deficit (Russia, Brazil);
- high current account deficit (Thailand, Brazil);
- Emphasizing the failure of the financial sector.

These problems result from insufficient capitalization, supervision of banks, excessive leveraging mechanisms, warranties, etc.

- in the meanwhile, investors redirect their attention from situational analysis of the respective country to other investors' behavior analysis. Growing withdrawals from banks are generated from a psychological phenomenon which grabs hold of investors. It was observed in Mexico (1995), South Korea (1997) and seems to be a persistent trait of developed crises in emerging economies.
- withdrawal of capital generates reductions in the rates of Exchange. This leads to:
  - the depreciation of the exchange rate, reducing real income and expenses
  - increased pressure on asset movement
  - increased internal value of foreign currencies
  - reduced eligibility of internal debtors

The Mexican and Asian crises are living proof that informational assimetry can create a financial crisis. Thus, a series of events characteristic of a crisis[2] can be delivered:

- with the onset of the crisis, fiscal deficits did not represent a serious problem for countries in crisis, therefore, inadequate fiscal policies could not have caused the crises
- inflation was relatively low
- a definite conclusion could not be drawn with regards to rising exchange rates of affected countries
- many of the countries affected by the crisis suffered large current account deficits
- asset entries in affected countries were large before the crisis; reversed after the onset of the crisis
- rising number of banks loaning money
- bilateral bank accounts deteriorating
- very low liquidity before the crisis

In Mexico, the GDP growth rate went down from over 4% in 1994 to -6% in 1995, whereas in Thailand, Malaysia, South Korea and Indonesia, it went down from 5% in 1996 to -5% in 1998. These major chances in GDP rates had the same magnitude as what happened in the USA during the 1929 crisis, also known as The Great Depression.

Choosing the suitable macroeconomic model

The choice is made through a strong connection between economic theory and existing data. With these in mind, Pagan (2003) classifies[3] as shown in figure 1.

The abbreviations mean as follows:

[2] Mishkin F.S., *Global Financial Instability: Framework, Events, Issues*, The Journal of Economic Perspectives, vol.13, No.4, Autumn 1999.

[3] arrow indicates the direction of increasing of the amount of statistical data.

RBC - Real business cycle models - a model with infinite time horizon, representative, calibrated agent;

GE - General Equilibrium models - is a model with finite time horizon, representative, calibrated agent;

DSGE - Dynamic stochastic general equilibrium models - a model with infinite time horizon, representative, calibrated or estimated agent;

OLG - overlapping generation models - is a model with infinite, calibrated time horizon;

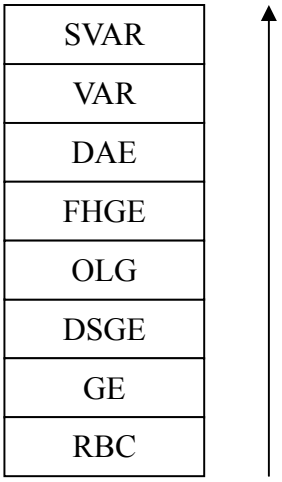


Figure 1. Pagan diagram concerning the choice of suitable macroeconomic model in relation to statistical data

FHGE - Finite horizon general equilibrium models - a model with heterogeneous agents, calibrated or estimated. Endogenous restrictions for liquidity and loss;

DAE - Dynamic aggregative estimated models - is a model with finite or infinite time horizon, large or small scale, reduced form;

VAR - Vector Autoregressive models - one model is estimated;

SVAR - Structural vector autoregressive models - one model is estimated.

3. CAUSES OF THE GREAT DEPRESSION OF 1929-1933

A first remark would be that the crisis of 1929 also originated in the USA.

- the severe deterioration of household balance sheets from 1929 to 1930[4]. In real terms, household debt went up 20%, but the value of financial assets did not keep up and went down, as a result of the stock market crash;
- in the post-war period, increasing debt was balanced by increasing financial assets and net worth (not the case during 1929-1930);
- acute drops in aggregated demand were the result of financial constraints on consumers, manifested only in high-income groups. This phenomenon was not a burden focused only on individuals with large numbers of stocks
- the banking crisis and collapse of the value of gold in the early 30's contributed to the severity of the Great Depression by rising[5] incertitude about interest rates, phenomena sustained by the following:
  - rising incertitude (measured by risk bonuses, in terms of interest rate structure) from the bank crisis period is correlated in a positive manner with the financial market's volatility associated with dropping gold values
  - risk bonuses explain a great part of variations in aggregated investments from the Great Depression
- successive banking crises had a devastating impact on trust, which increased risk bonuses of long term bonds, and transformed businessmen into suspicious debtors
- the federal reserve was forced to make drastic changes in its policy to make gold the valid standard, after

[4] **Mishkin F.S.**, *The Household Balance Sheet and the Great Depression*, The Journal of Economic History, Vol 38, No.4, December.1978.

[5] **Ferderer P.J., Zalewski D.A.**, *Uncertainty as a Propagating Force in the Great Depression*, The Journal of Economic History, Vol 54, No.4, December.1994.

mass speculations that the US would face powerful devaluation in 1931. This policy made the system susceptible to high volumes of assets moving easier, contributing to the Great Depression by rising incertitude;

– during The Great Contraction, deposit institutions exited the banking industry faster than in any other time in the US's history[6], caused by:

– deposit withdrawal, non-liquid assets and the Federal Reserve's unwillingness to act (Friedman and Anna (1971), Wicker (1996));

– economic contraction by lowering asset prices, rising numbers of unpaid loans, banks' insolvency (Temin (1976), White (1984), Calomiris and Joseph (2003)).

4. SPIRAL OF LOSSES

Financial institutions fund new investments with loans and borrowed funds. Consequently, nowadays' financial system looks more like a complex network of financial obligations. With the addition of modern financial techniques such as bonds and options, institutions have more funding options than ever.

The problem becomes complicated and hard to control because most of these credit-related derivatives are transacted at a booth, and not through a clearing house. Thus, the difficulty in estimating the risk exposure of every financial institution, and as a consequence the clearing house's inability to perform its beneficial purpose.

With every bilateral contract signed vis-a-vis a derivative credit, there is at least one additional risk for the parts involved.

The current financial shock is remarkable through what we may call the spiral of losses. This is a result of asset prices. When a large number of upstanding financial institutions suffer a severe financial shock, they face backlashes in their volume and performance. Thus, such an asset price plummet leads to a drop in the population's welfare, inducing yet another backlash on companies, in a descending financial perpetuum mobile.

Figure 2 shows the mechanism of the spiral of losses, with its most powerful impact being in the financial system, where banks obtain their required funding off the spot market.

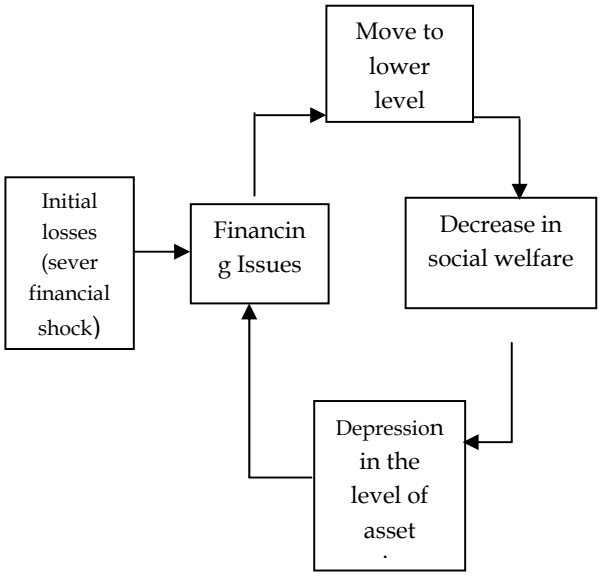


Figure 2. *Mechanism of losses spiral*

Given these circumstances, paying contracted credits is extremely sensitive to

[6] **Richardson G.**, *Categories and Causes of Bank Distress during the Great Depression, 1929-1933: The illiquidity versus insolvency debate revisited*, Department of Economics, National Bureau of Economic Research, University of California, 3151, Social Science Plaza, Irvine, CA 92617-5100, USA , 2007

information circulating the market. Figure 3 reveals this further.

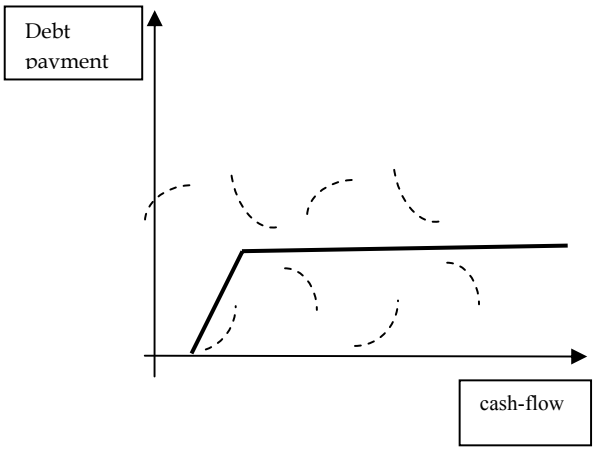


Figure 3. *Sensitivity of debt payment to the information moving in the market*

In order to exemplify this web of inter-dependencies on the financial market, we have 3 banks:

If bank 1 spreads its assets and at the same time reduces the loan it gave out to Bank 2, this will automatically worsen Bank 2's situation. As a consequence, Bank 2 is forced so spread its assets and reduce the loan it gave to Bank 3, which in turn reduces its loan to Bank 1, thus closing the toxic circuit of the three banks being discussed.

REFERENCES

1. Adrian T., Brunnermeier M.K., *CoVaR*, working paper, (2009) (http://www.princeton.edu/~markus/research/papers/CoVaR).

2. Bean C., *Asset prices, financial imbalances and monetary policy: Are inflation targets enough?*, BIS Working Papers No. 140, Basel: BIS, (2003).

3. Bernanke B. S., Gertler M., *Should central banks respond to movements in asset rices*?, American Economic Review, 91, 253–7, (2001).

4. Bordo M., Jeanne O., *Boom-busts in asset prices, economic instability and monetary policy*, Discussion paper 3398, CEPR, (2002).

5. Brunnermeier M. K., *Deciphering the Liquidity and Credit Crunch 2007-08', Journal of Economic Perspectives*, forthcoming, (2009). (http://www.princeton.edu/~markus/research/papers/liquidity_credit_crunch).

6. Burnside C., Eichenbaum M., Rebelo S., *Government guarantees and selffulfilling speculative attacks*, Journal of Economic Theory, 119, 31–63,(2004).

7. Chang R., Velasco A., *A model of financial crises in emerging markets*, Quarterly Journal of Economics 116, 489–517, (2001).

8. Christiano L., Braggion F., Roldos J., *The optimal monetary response to a financial crisis. Mimeo*, Northwestern University, (2006).

9. Corsetti G., Mackowiak B., *Fiscal imbalances and the dynamics of currency Crises*, European Economic Review 50, 1317–38 , (2006).

10. Ely R.T., *International Financial Crises: Causes, Prevention and Cures*, Lecture by Lawrence H. Summers.

11. Ferderer P.J., Zalewski D.A., *Uncertainty as a Propagating Force in the Great Depression*, The Journal of Economic History, Vol 54, No.4, December.1994.

12. Krugman P., *A model of balance of payments crises*, Journal of Money, Credit and Banking 11, 311–25, (1979).

13. Mishkin F.S., *Global Financial Instability: Framework, Events, Issues*, The Journal of Economic Perspectives, vol.13, No.4, Autumn 1999.

14. Mishkin F.S., *The Household Balance Sheet and the Great Depression*, The Journal of Economic History, Vol 38, No.4, December.1978.

15. Obstfeld M., *Speculative attack and the external constraint in a maximizing model of the balance of payments*, Canadian Journal of Economics 29, 1–20, (1986).

16. Richardson G., *Categories and Causes of Bank Distress during the Great Depression, 1929-1933: The illiquidity versus insolvency debate revisited*, Department of Economics, National Bureau of Economic Research, University of California, 3151, Social Science Plaza, Irvine, CA 92617-5100, USA , 2007.

17. Smets F., Wouters R., *An Estimated Stochastic Dynamic General Equilibrium Model of the Euro Area*, Journal of the

European Economic Association, 1, 1123-75, (2003).

18. Stancu S., Mihail N., *Decizii economice în condiţii de incertitudine. Aplicaţii pe piaţa financiară,* Editura Economică, (2005).

19. Stancu S., Mihail N., *Metode şi tehnici de conducere. Teorie şi aplicaţii,* Editura Economică, (2006).

20. Stancu S., Mihail N., *Macroeconomie. Modele statice şi dinamice de comportament. Teorie şi aplicaţii,* Editura Economică, (2009).

21. Tsomocos D.P., *Equilibrium Analysis, Banking, and Financial Instability*, Journal of athematical Economics, 39, pages 619-655, (2003).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

FINANCIAL CRISIS – MACRO AND MICROECONOMIC CONNOTATIONS. MEASURES OF COMING OUT OF CURRENT FINANCIAL CRISIS

George Viorel VOINESCU*,Stelian STANCU*, Alexandra Maria CONSTANTIN*, Anca Domnica LUPU*

*Academy of Economic Studies, Bucharest, ROMANIA

Abstract: *Financial markets have the essential role of channeling funds to those individuals or companies that have productive investment opportunities. If the financial system does not fulfill its role properly, the economy cannot operate efficiently and economic growth is stunted.*

Financial instability takes place when financial system shock infringes on information flux. Thus, the financial system can no longer achieve its purpose of channeling funds to those that hold investment opportunities.

A series of theoretical aspects concerning international financial crises, financial crises on a company level, as well as the role of the Basel II Accord in stimulating risk management throughout financial crises.

The paper ends with presentations of aspects concerning prudential regulation at a macroeconomic level – measures to alleviate the current financial crises. Thus, the greater a company's contribution to the risk in the financial system, the greater the demand for funds, the Pigovian tax, or the compulsory insurance premium.

Keywords: *monetary crisis, financial crisis, banking system, prudential regulation, The Basel II Accord, financial instability, financial system shock*

1. THEORETICAL ASPECTS OF THE INTERNATIONAL FINANCIAL CRISIS

The international financial crisis represents a series of circumstances in which international dimension worsens the effects of a crisis.

The phenomenon of international contagion[1] is represented by[2]:

- common shock (shocks reflected in common household use items);
- commercial connections transfer relative price and income shock from one country to another;

[1] Reinhart C.M., Vegh C.A., *The Unholy Trinity of Financial Contagion*, The Journal of Economic Perspectives, Vol.17, No.4, Autumn 2003. *Contagion* is an episode in which manifests a significant number of effects in some countries after an event - that is, when the consequences are "fast and furious" and develop along a few hours or days. This reaction is the contrast with the case that international response to the news is silent. External common shocks, such as changes in interest rates or oil prices, are automatically included in the definition of contagion. Only when there is excessive correlation between economic and financial variables among countries in response to a shock joint can be considered as is contagion

[2] Ely R.T., International Financial Crises: Causes, Prevention and cures, Lecture by Lawrence H. Summers

- competitive devaluation between competing countries, either amongst each other or on a third market, which explains the lowered value of currencies in many countries;
- financial connections which create correlations between markets;
- lack of liquidity on the market can accentuate contagion;
- investor irrationality: the panic or herd effect;
- reputational externality: crisis in one country affects perceptions and expectations about conditions and vulnerabilities of other countries.

International financial instability[3]

Financial markets have the role of channeling funds to those individuals or companies that have productive investment opportunities. If the financial system does not fulfill its role adequately, the economy can no longer operate efficiently and economic growth is stunted. As a consequence, a financial system can be confronted with information asymmetry problems, in which one part of those involved in a contract knows less (or more) information than the other. Informational asymmetry leads to two essential problems for the financial system: adverse selection and moral hazard.

Adverse selection is in effect before the financial transaction takes place. Akerlof's "Market of Lemons" developed in 1970 showed that second hand car buyers that were partially informed did not want a vehicle priced very low, because they believed the car was suspiciously cheap. Whereas capital markets are concerned, partially informed creditors aren't tempted to give out loans associated with high interest rates, because they believe those that take such loans are very likely not to pay them. The process by which a creditor tries to separate a good debtor from a bad one is an imperfect process, and the fear of adverse selection influences creditors to reduce the quantity of loans they would otherwise give out.

Moral hazard takes place after the transaction has been carried out. It arises because a debtor is stimulated to invest in high risk projects with high payout for the debtor, but the creditor suffers the greater part of the damage if it fails. The potential conflict of interest between the debtor and the creditor implies the fact that many creditors will borrow less than they usually would, so that loans and investments will be suboptimal.

From that regard, the purpose of financial intermediaries, including commercial bank, economic institutions, insurance companies, mutual funds and pension funds, of which banks hold the most important role, is that they have both the capacity and instruments necessary to address information asymmetry issues.

Financial instability takes place when financial system shock infringes on the information flux. Thus, the financial system no longer fulfills its role to channel funds to those that hold investment opportunities. If the financial instability is severe enough, it can lead to almost total interruption of the financial market, a situation generally classified as financial crisis.

There are four essential factors to be considered in generating financial instability:
- the deterioration of balances in the financial sector;
- interest rate growth;
- uncertainty growth;
- deterioration of bilateral non-financial accounts due to fluctuating prices.

2. HIGHLIGHTING FINANCIAL CRISIS ON A COMPANY LEVEL

Acute financial crisis on a company level is manifested when the company involved applies the country's law of bankruptcy and restructuring. There are several stages of financial status on a company level:
- financial stability;
- no dividends awarded, or their payout reduced;
- lack of loan financing
- filing for bankruptcy
- actual bankruptcy and liquidation

[3] after Mishkin F.S., *Global Financial Instability: Framework, Events, Issues*, The Journal of Economic Perspectives, vol.13, No.4, Autumn 1999.

Modeling financial crisis on a company level. Model types.

Regression analysis

Regression analysis[4] is one of the most commonly used methods in econometric approaches and handles description and evaluation of dependencies between a dependent or explained variable and one or more independent or explicative variables, with the purpose of estimating and/or predicting medial evolution of the researched population.

The simplest econometric model is the one in which an endogenous variable is explained by an exogenous variable.

Noting y as the dependent variable with $x_1, x_2, ...x_m$ as independent variables, we have the following discussion:

a) if m=1, we have single variable x and therefore have what is called a simple (unvaried) regression

Being the case of a dependent variable, noted y, and an independent variable, noted x.

The relation between y and x is given by

$$y = f(x) \qquad (2.1)$$

where $f(x)$ is a varied function of x.

If, in the dependency given by (2.1), we presume the function $f(x)$ is linear in x, which is to say,

$f(x) = \alpha + \beta x$ (2.2), with α, β parameters, and we also presume that this relation is stochastic, which is to say $y = f(x) + \varepsilon$ (2.3), where ε is called a significance (specification) error and has a known probable distribution (is a random variable).

Relation (2.3) has two components:

- the first, $\alpha + \beta x$ is the deterministic component of the dependent variable y with α and β representing regression coefficients or regression parameters which we estimate based on y and x values;
- the second, ε, is the stochastic or random element

The error term (stochastic or random component) from a stochastic equation (see relation (2.3)) represents the effect of all omitted variables from the model, but which collectively affect the dependent variable y.

b) if $m > 1$, we have more than one independent variable x and therefore, what is called a multiple (multivariate) regression.

As a consequence, the model's form is given by:

$$y = f(x_1, x_2, ..., x_m) \qquad (2.4)$$

where

$$f(x) = \alpha + \beta_1 x_1 + \beta_2 x_2 + ... + \beta_m x_m \qquad (2.5)$$

in the case of the linear multiple regression, with $\alpha, \beta_1, \beta_2, ..., \beta_m$ as its parameters, and we assume that such a relation is stochastic $y = f(x_1, x_2, ..., x_m) + \varepsilon$ (2.6)

or corresponding to the linear multiple regression and in analytic writing

$$y_i = \alpha + \beta_1 x_{1i} + ... + \beta_m x_{mi} + \varepsilon_i \quad i = \overline{1,n} \qquad (2.7)$$

where ε_i is called a significance (specification) error and has a known probable distribution (is a random variable), and n is the number of observations.

The random variable ε_i measures errors in the random explained variable y and errors from the significant relation between y and its random explicative variables $x_1, x_2, ..., x_m$.

[4] the term of regression was invented by Sir Francis Galton (1822-1911) from England, who studied the link between height of children and the height of parents, noting that, despite the fact that tall parents had children tall and short parents had short children, there was an ascent trend of children by the media. There is therefore a *regression of height of children by the media*. Galton, in his aristocratic style defined this *regression to mediocrity*.

Besides these, regression analysis uses the logistic regression model, part of the non-linear models.

By modeling financial crises at a company level, we will give the dependent variable the value of 1 for when the company is in financial crisis and 0 for when operation is normal.

With P as the probability for certain events to be successful, as subject of the impact of the x factor:

$$P = \frac{e^{y(x)}}{1 + e^{y(x)}} \quad (2.8)$$

with $y(x) = \alpha + \beta_1 x_1 + ... + \beta_m x_m$ (2.9)

from which we may draw the conclusion that

$$1 - P = \frac{1}{1 + e^{y(x)}} \quad (2.10)$$

By dividing relations (2.8) and (2.10) we get $\frac{P}{1-P} = e^{y(x)}$ (2.11)

Logarithm of relation (2.11) is

$$\ln \frac{P}{1-P} = y(x) = \alpha + \beta_1 x_1 + \beta_2 x_2 + ... + \beta_m x_m$$

where:

- $y(x) = 1$, for when the company is in financial crisis;
- $y(x) = 1$, for when the company is operating normally.

3. ROLE OF THE BASEL II ACCORD IN STIMULATING RISK MANAGEMENT DURING THE FINANCIAL CRISIS

The Basel II Accord forced banks and other authorized financial institutions so communicate at the beginning of each day the daily estimated risk to its closest monetary authority, using for this one or more of the VaR (Value-at-Risk) measuring models.

Estimating VaR and daily capital modifications (ΔK)

The Basel II Accord decided the following:

- Value-at-Risk on day t is given by $VaR_t = \hat{Q}_t - \alpha_t \cdot \hat{\sigma}_t$
- the daily capital modification ΔK is given by $\Delta K_t = \max\{-VaR_{t-1}; -(3+k)\overline{VaR_{60}}\}$

where:

- VaR_{t-1} - Value-at-Risk on day t;
- $\hat{Q}_t$ is the estimate revenue for day t;
- α_t is the critical value of a percentage point of estimate revenue on day t;
- $\hat{\sigma}_t$ estimated risk (square root of volatility) on day t;
- ΔK_t capital modification on day t compared to day t-1;
- k is the value of the penalty for violating the Basel II Accord, with $k \in [0,1]$.

Zone	Number of violations of the Basel II	The amount of the penalty for violation of the Basel II (k)
Green	0 to 4	0,00
Yellow	5	0,40
	6	0,50
	7	0,65
	8	0,75
	9	0,85
Red	10 and over	1

Table1. *Areas of penalty under Basel II Agreement*

As a result, the daily capital modification that must be established at the highest level of VaR of the precedent day or at the VaR average of the last 60 days, multiplied by the penalty factor 3+k.

4. PRUDENTIAL REGULATION AT A MACROECONOMIC SCALE. MEASURES TO ALLEVIATE THE CURRENT FINANCIAL CRISIS

The Basel II set of regulations is based on the most accommodating measure of risk, which is the Value-at-Risk (VaR), which expresses only individual banks' risk.

A measurement of risk which focuses on a financial institution's contribution to systematic risk is CoVAR.

CoVar[5] at an institution level is defined as the financial sector's VaR, conditioned by the institution's entry in the situation's alleviation process. The percentage difference between VaR and CoVAR signifies the degree by

[5] Brunnermeier M.K., *Financial Crises: Mechanisms, Prevention, and Management,* http://fmg.lse.ac.uk/upload_file/1197_BrunnermeierPaper.pdf

which a private institution contributes to the financial system's risk.

The greater a financial institution's contribution to systematic financial risk, the greater the demand for funds, the Pigovian tax[6], or the compulsory insurance premium.

Measures of alleviation of the current financial crisis

Of the measures that can be adopted for leaving the current financial crisis, we can enumerate:

- regulating liquidity in the financial system;
- anti-cyclical measures;
- amortizing swap;
- debt buyback at market price by the state;
- nationalization and prompt corrective action;
- partial nationalization and public fund injection;
- state-bought toxic actives;
- adjusting housing prices by mortgage subventions – other than introducing refinancing schemes to minimize the number of lost houses, the government can try to lower mortgage rates and thus make housing cost bigger. This can be done with the support of the Central Bank by its direct purchase of long term mortgages or accepting them as collateral for uncertain loans;
- crisis management – necessitates a certain form of recapitalization or restructuring of the banking system through the government. Recapitalization of a limited sector like the banking sector can e done either on debtors' money and/or tax payer money.

REFERENCES

1. Bean C., *Asset prices, financial imbalances and monetary policy: Are inflation targets enough?*, BIS Working Papers No. 140, Basel: BIS, (2003).

2. Bordo M., Jeanne O., *Boom-busts in asset prices, economic instability and monetary policy*, Discussion paper 3398, CEPR, (2002).

3. Brunnermeier M. K., *Deciphering the Liquidity and Credit Crunch 2007-08', Journal of Economic Perspectives*, (2009). (http://www.princeton.edu/~markus/research/papers/liquidity_credit_crunch).

4. Burnside C., Eichenbaum M., Rebelo S., *Government guarantees and selffulfilling speculative attacks*, Journal of Economic Theory, 119, 31–63,(2004).

5. Chang R., Velasco A., *A model of financial crises in emerging markets*, Quarterly Journal of Economics 116, 489–517, (2001).

6. Christiano L., Braggion F., Roldos J., *The optimal monetary response to a financial crisis. Mimeo*, Northwestern University, (2006).

7. Corsetti G., Mackowiak B., *Fiscal imbalances and the dynamics of currency Crises*, European Economic Review 50, 1317–38 , (2006).

8. Krugman P., *A model of balance of payments crises*, Journal of Money, Credit and Banking 11, 311–25, (1979).

9. Mishkin F.S., *Global Financial Instability: Framework, Events, Issues*, The Journal of Economic Perspectives, vol.13, No.4, Autumn 1999.

10. Obstfeld M., *Models of currency crises with self-fulfilling features*, European Economic Review 40, 1037–47, (1996).

11. Stancu S., Mihail N., *Decizii economice în condiţii de incertitudine. Aplicaţii pe piaţa financiară,* Editura Economică, (2005).

[6] it increases with increasing of CoVAR in the bank and with other measures of systemic risk.

12. Stancu S., Mihail N., *Metode şi tehnici de conducere. Teorie şi aplicaţii,* Editura Economică, (2006).

13. Stancu S., Mihail N., (2009), *Macroeconomie. Modele statice şi dinamice de comportament. Teorie şi aplicaţii,* Editura Economică.

2. SOCIO AND HUMANITIES

Panel 1.Psychology of defense, public order and national security Psychology, transport and services

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

COMMUNITY REINTEGRATION OF ROMANIAN EX-OFFENDERS: MYTH OR REALITY?

Florin ANTONESCU*, Cristina DAMBOEANU**

* Giurgiu Prison, Giurgiu, Romania, ** Institute of Sociology of Romanian Academy of Science, Bucharest, Romania

Abstract: *The study approaches the issue of community reintegration of former inmates, having as starting point the observation that in Romania, the authorities' interest on this topic is almost nonexistent. No law makes references to the social reentry of ex-prisoners although the custodial penalties in our country are on long-term. The study tries to reveal the barriers the inmates who leave prison faced with in their attempts to successfully reintegrate into the community, and also, the role that prison and other community institutions plays in this process. Methodologically, the study consists of a qualitative analysis carried out in 2010 in Giurgiu. Data were collected through interviews with three categories of subjects: prison staff, representatives of community institutions and recidivists held in penitentiary. The study ends with some concluding remarks and reflections about the ex-convicts reintegration into the community.*

Keywords: *social reintegration, ex-inmates, prison, education, psychosocial assistance, community*

1. INTRODUCTION

According to the official data of National Administration of Prisons, almost 12.000 inmates are released from the Romanian detention facilities each year. Some of them are returning to the community after their first experience with prison, others – after multiple incarcerations. Among these ex-detainees are persons with violent behavior, who have committed murders, rapes or robberies. All of them are coming back to the community with different social and psychological needs or problems, which if remain unsolved, could push these individuals back on the route of crime.

Community reintegration of released offenders should be a subject of undeniable significance both for policy makers and general public: through social reentry of these persons, the recidivism rate is diminished and the public safety is increased [1].

2. METHODOLOGY

The study' theoretical hypothesis is that social reintegration of former prisoners represents a process influenced by the personal history of the offenders (relationships with parents, brothers and sisters; relationships with wives and children; educational and employment history; drug and alcohol addiction history; peer group etc.), by their experiences in prison (participation in programs; victimization; misbehaviors etc.), and also by the obstacles or on the contrary, by the social and legal opportunities that the community provides them, after they have left detention [2]. The main objectives of the study were: a) to identify the obstacles and barriers the ex-inmates faced with in the social reintegration process; b) to describe the way in which the prison prepares the inmates for the release into the community; c) to identify the role and responsibilities of various institutions of the community in the process of social

reintegration of those who leave prison. Data were collected in 2010 in Giurgiu, through interviews with three categories of subjects: a) practitioners at Giurgiu prison (director of the institution, social worker, psychologist, priest, chief doctor, educator, worker at prison regime department); b) representatives of different public institutions from Giurgiu county (Probation Service, A.J.O.F.M., Child Protection Department, Local Council, Giurgiu Court); c) 10 recidivists held in custody at Giurgiu prison. They were convicted for theft, robbery, drug offences, rape and murder. The average age of the inmates was 38; most of them had long criminal histories and also, extensive periods of time spent in prisons.

3. RESEARCH FINDINGS

3.1. What are the main obstacles the ex-inmates faced with after their release from prison? Based on their past experiences with community reintegration, the interviewed recidivists have admitted that one of the most important barriers they faced with after leaving prison is the impossibility to find and keep a steady job, which to generate them the necessary incomes for everyday life. In their opinion, this fact is due to the companies' reluctance to hire people whose criminal record in stained.

Interviews suggest however that neither the individuals have the desire to change their lifestyle. Many have the wrong idea that nobody will hire them and therefore they don't try or not perseverate enough in seeking a job. If they were rejected once or twice by the employers, they give up, preferring to return to criminal activities.

Even if they succeed to get employed, they abandon quickly their jobs because, they have argued, the employers – knowing about their criminal past – discriminate them, blaming for anything goes wrong at work.

The low wages with which they are paid is another reason for them to quit jobs, given that they are used with large amounts of money gained from criminal activities. In addition, the fact that they have to wait a month in order to receive the payment for their work, while in the case of theft, for example, the earnings are immediate, but also the fact that they consider certain jobs as being humiliating represent further motives for which they don't stay employed long periods of time.

Another obstacle faced by the ex-inmates who are returning to the community is the drug addiction. Most of the interviewed recidivists with a history of drug use admit with sorrow that their chances of recovery are much reduced because drug dependence is a chronic illness. For this reason, the probability of relapse even after a period of 2 or 3 years is very high.

Regarding the family, except two interviewed inmates who were abandoned by their parents and brothers due to their repeated incarcerations, for all others, the family was close to them and supported them, sometimes with huge sacrifices. Interestingly, some respondents admit that one of the reasons for not given up criminal activities is, perhaps paradoxically, the support offered by the family both during the incarceration periods and after the releases from prison. As they said, they *didn't feel the burden*.

A difficult obstacle for most of the interviewed detainees is the reunion with their friends involved in criminal activities. Although some of them have stated that they want to give up of these entourages, they believe that because they have been to prison, it will be very difficult for them to enter into a new group of non-offenders friends.

Another barrier to successful reintegration into community of former prisoners is, in the opinion of the interviewed recidivists, the way in which prison prepares them for the release time. Thus, they have argued that the prison system is not focused on the idea of rehabilitation, but rather is one that *gets people away from the human things*.

3.2. How prison prepares the inmates for the release time? The answer to this question has been obtained through the interviews carried out with practitioners from Giurgiu prison. As they have highlighted, the detainees have the opportunity to participate in prison in a wide range of psychosocial interventions and educational activities. This includes, inter alia, the following programs:

- **Adaptation to institutionalized life**, focused on activities of information and support for those inmates who are at the beginning of detention period, in order to take note and comply with the institutional norms of everyday program;
- **Educational programs**, such as: education for a good citizen; legal education; education for human rights; education for family life; education for a healthy life;
- **Primary, secondary and high school education** according to the rules of the public education law and the conditions established in the collaboration protocol signed by the Ministry of Education and Research and the Ministry of Justice [3]. For illiterate prisoners are organized courses in order to promote the first four classes, through the „Second Chance" program;
- **Training and qualification courses** consistent with the interests and individual skills of the offenders, but also with the labor market demand [3]. These courses are organized in collaboration with A.J.O.F.M., and are offered to the inmates who have to serve up to 9 months of the sentence;
- Depending on the detention regime, the detainees can **work** according to their qualifications and skills, age, health, work capacity etc. There are two types of activities in which the prisoners can participate: the paid work, for which they can earn both money and days and the unpaid work for which they obtain only the so-called earning-days. The latter ones are those provided in the interest of the detention units;
- **Recreational activities,** which consist in practicing sports and games in accordance with the prisoners' health, their skills, age and preferences.
- **Pre-release programs** whose objectives are to preserve and strength the relationships of the inmates with their families and communities (friends, neighbors). Some of the persons interviewed have pointed out that the training for release is more an informational program than a practical one, especially for the inmates who are detained at maximum security or closed regime, who don't have the legal possibility to go out in the community to seek employment or even to work. For these prisoners, the programs of this type teach them how to write a postcard, how to write a resume or how to apply for a job.
- **The social assistance programs** are primarily intended to mediate the relationships between incarcerated persons and their families. It must be said that being workers within the penal system, the social workers are not allowed to visit the prisoners home to see the familial environment in which they lived before imprisonment and to which they will return after release. Thus, the only way in which they can mediate the relationships between prisoners and their families is in the visit sector, or, if the inmates are not visited through official requirements submitted to local authorities to provide the necessary information about the prisoner family situation;
- **Therapeutically interventions** aimed to prevent violent behaviors, reduce aggressive conducts, reduce depression, increase self esteem and self image, develop positive thinking, reduce the anxiety level etc.

Although as previously noted, there is a wide range of educational and psychosocial programs designed to reform the criminal behavior, their effectiveness is limited by: a) the small number of the staff of the education an psychosocial assistance service; b) the high level of bureaucracy; c) the lack of material and financial resources; d) the so-called phenomenon of *prison tourism*; e) the lack of viable work opportunities offered to prisoners held at maximum security and closed regime;

f) the lack of appropriate treatment programs for drug users (the Giurgiu unit does not have a therapeutic community, although according to those mentioned by the prison director, almost half of all prisoners is related with trafficking or drug use; g) the lack of post detention assistance.

3.3. What is the role of other institutions from community in the social reintegration process of former inmates?

The main findings of the interviews conducted with the representatives of the public institutions have reveled that at present, there is no coherent legal and institutional framework regarding the community reintegration of persons who are released from prison. Only in the new Penal Code is stipulated the responsibility of the Probation Service to supervise the way in which some prisoners who have been conditional released comply with the measures imposed by the court. Although such regulation is very useful, to be applied it is necessary to allocate to the Probation Service proper human, material and financial resources. In this context, it should be mentioned that at the time of the study, in Giurgiu, the institution had only three probation officers.

None of the public bodies whose representatives were interviewed have a record of people who are released from prison. In particular, the local authorities where the detention units are, should establish a special office or department whose main responsibility should be the maintenance of the relationships with the prison and which, inter alia, to keep records of those who are released from detention. Neither the A.J.O.F.M. keeps records of the inmates who have participated in training and vocational courses to see whether after being released from prison, they have employed in the jobs that they were trained. Such statistics will allow the objective assessment of the efficiency of these courses carried out in prison.

The persons who leave prison do not receive any social benefits or subventions other than those of which can benefit all other people from the community. There is no special financial support for this category of individuals. For this reason, some of the interviewed subjects have recommended the providing of an allowance to former inmates on a period of maximum three months until they succeed to get employ or under the obligation to hold a job. Such benefit would help those who have no financial possibility to pay the transport or the medical investigations required by any employer.

The inmates demand for information and professional counseling programs and also, for vocational courses is high during the detention period. After release, the number of those who contact the A.J.O.F.M. is very much reduced. The interviewed ones consider therefore that the development of certain individual plans for finding jobs for the prisoners who have to serve up to 2-3 months of detention can compensate, to some extent, the lack of support they would benefit if they would be addressing the Agency. Such an initiative would be particularly welcome given that many of those who return to the community after release from prison come from other counties and although the Agency specialists refer them to the territorial structure of the institution, most of them are not going.

Another measure that would help all those who are released from prison to reintegrate of the labor market would be the provision of the prison director of a certificate of good behavior, which to attest the inmates' participation at programs and activities carried out in prison, work performed, the rewards received etc. Also, to increase the chances for employment of the ex-inmates, some respondents believe that it should be introduced the mandatory participation of the prisoners at vocational and training courses. After completing the courses, the organization of caravans in the community from which the offenders come could further contribute to the social reintegration process of ex-detainees.

In Giurgiu, there are no NGOs focused on social reintegration of former convicts or on helping families of those incarcerated. There is only one NGO in whose status is mentioned the providing of professional counseling and guidance, but not for ex-inmates. Also, there are no prevention and treatment services for alcohol and drug addicts, from which come a high percentage of former detainees.

4. CONCLUSIONS

Society must understand that the community reintegration of the ex-convicts is not only the problem of Ministry of Justice, but of the entire government and that by giving the opportunity for social reentry of those persons released from prison, the communities become safer.

We consider that in the first place, it should be allocated sufficient financial resources to stimulate the employment of prison staff specialized in psychology, sociology, social work and pedagogy. The personnel deficit impedes the conducting of the most basic educational and psychosocial programs and interventions and compromises the chance of inmates to reform their conduct and turn to a pro-social lifestyle.

Reintegration of ex-prisoners does not have to stop at the prison gate. An essential role in this context should be played by the local authorities, which should manage the flow of releases from detention. It should be realized that without a network of social and institutional support, these individuals cannot overcome the barriers they confront with, being therefore prevented to follow the conventional routes in life.

REFERENCES

1. Altschuler D. M., Brash R. Adolescent and Teenage Offenders Confronting the Challenges and Opportunities of Reentry. *Youth Violence and Juvenile Justice*. Vol. 2: 72-87 (2004).
2. Visher, C. A., Travis J. Transition from Prison to Community: Understanding the Individual Pathways. *Annual Review of Sociology*. Vol. 29: 89-113 (2003).
3. Law no. 275/2006 regarding the execution of punishments and measures taken by the judicial bodies during the criminal trial, published in Official Monitor, First Part, no. 627.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

TRUST - AN INSTRUMENT FOR IMPROVEING HIERARCHIC COMMUNICATION

Viorela BUCUR

Institute for Public Order Studies, Bucharest, Romania

Abstract: *The complex and competitive economic and social contexts are increasingly stimulating companies towards performance. An organization's success and positioning depend on a few parameters: its capacity to organize, the quality of its internal and external relations and the human resource creating this reality. The people's involvement encourages the taking on of responsibilities and it allows for building resources that bring optimum results and generate trust. Considering the quality of intra-organizational as essential to the organization's effectiveness, we may assert that trust is the source for their functioning and for consolidating cohesion, an indispensable element in a hierarchical relation.*

Keywords: *trust, credibility, trust capital, vulnerability, risk*

1. INTRODUCTION

Trust, as a polysemous and multidimensional concept, is defined through a person's intentions and expectations in a given exchange situation (communicational or relational), a person's positive anticipation of a third party's capacity and intention to carry out a given activity, the anticipation being accompanied by a presumed risk (Krieger, 2001). Trust is having faith that the other person will behave in a predictable manner and will respect their promises, and it starts with self-confidence that can be perceived and related to by others. Trust is a rational choice, it is a rational analysis made from a prescribed perspective, and it also is authentication (Prax, 2003).

Studies on the distribution of trust in relation to authority, carried out by Breton and Wintrobe (1986) are displaying two types of trust: *vertical trust* (which includes ascending *trust* - from the subordinate to the hierarchical superior and *descending trust* - from the hierarchical superior to the subordinate) and *horizontal trust*. The first type is met between persons that are on different hierarchical levels, while the second one addresses the same hierarchical level and it refers to persons that are found on similar positions. According to the authors, trust is a source of efficiency for the organization. When inappropriately managed, the distribution of trust creates organizational contexts where an increase in horizontal trust contributes to the weakening or deterioration of vertical trust (Bornarel, 2004). It seems that the absence or weak presence of reciprocity brings difficulties in relations and it redirects the vertical trust capital to horizontal trust.

2. THE DYNAMICS OF TRUST

Van den Bulke (2003) considers that, for subordinates, trust is equivalent to freedom of action, it is very validating. To trust is to leave a bit of authority behind. A temporary and controlled abandon of formal authority (that comes with statute) or of functional authority

(given by competence) have effects that increase reciprocity. It is a risk assumed with the other party. The hierarchical superior must be credible, must have the capacity to inspire trust. Their credibility, a success factor, is dependent on the impact they have on subordinates. The trust that they are generating is undertaken and it influences future interactions.

Various literature dedicated to aspects related to trust emphasizes significant differences in the means by which trust is born, the contents and the role it plays in the stability of relationships. Trust is created through an emotional component - self esteem, emotional involvement in an activity, involvement/motivation and a social component: recognition, reputation, support (Prax, 2003). It requires reliability, communication, and coherence between speech, action and decision making. It is a developing process and its evolution depends largely on the communication aspect of the decision-making process:

- involving the people in the process of taking decisions that refer to them (Zara, 2005),
- explaining the decision from the perspective of organizational welfare;
- explaining the effects and new rules that follow the decision.

Trusting the hierarchical superior is based either on expertise or perceived competence (the technical aspect) and the perception on the nature of intentions (the moral aspect) (Giffin, 1967). Therefore, there are two sources that may or may not grant trust: technical competence and ethical competence (Landowski, 1989). Trust exists when moral values are present, when the hierarchical superior shows a certain moral profile, certain moral qualities. In other words, „a person's character ensures people's trust" and trust ensures the leadership position, according to Maxwell (2005). The perceived quality brings forth an amount of trust that the subordinates attribute to the hierarchical superior, and, according to its degree, they involve themselves in the activity. The hierarchical superior may ensure an amount of trust as a manager or by demonstrating expertise in the field of competence. Trust is partial, limited when the subordinate trusts management capacities without trusting the manager's moral quality, his professional competence, or vice versa. It depends on the presence or absence of moral values and competences that bring the feeling of reliability. Credibility in one of these aspects may determine a transfer of trust to the other (the trust given to the expert shifts towards the manager). This shift will be verified, and the actual contexts will ensure the maintaining and strengthening of the trust capital in the hierarchical superior or the other way round. A hierarchical superior that doesn't have credibility allows the subordinates to turn towards a person they trust, thus losing ground in relations and image.

Offering and inspiring trust is a delicate process for the hierarchical superior and it depends on a series of factors and variables required for establishing trust: the accordance between intention and action, personality traits, the source of control, degree of similarity, assumed role behaviors, self assertion and feed-back, adaptability to circumstances, interdependence, organizational politics, staff coordination and the working environment within the organization (Rusaw, 2001). If the hierarchical superior offers trust, the subordinates feel obligated to return it. The principle of reciprocity ensues: the subordinates give credit that has to be returned. Offering mistrust affects the relationship. If the manager doesn't trust his collaborators with anything other than operational tasks, they will trust the collaborators if they accomplish the tasks successfully, according to Van den Bulke (2003). The level of trust rises when future plans are declared. Other degrees of trust between the manager and the managed exist between these two extremes, the writer states.

A trust relationship is built through cognition, proximity and interaction. It is „independent interaction" (Orléan, 1994), that depends on the time factor, it is a balance between proximity and quality. Interacting produces communicational behaviors and both the subordinate and the hierarchical superior become sources of interaction. Trust has

different grounds to be built on and it favors the paths of relationships in a different manner. Producing the trust relationship is associated to a context that can influence the path of the relationship. Often, trust is determined by uncertainty. Uncertainty brings vulnerability, thus generating a particular form of solidarity, which helps overcoming the uncertainty. The hierarchical superior doesn't order to be trusted, he earns it. Involvement, attention offered to the others and openness towards them, coherence, a fair behavior, acknowledging the others' value and frequent communication are only a few elements that ensure the investment of trust in the hierarchical superior. Competence, results, the solutions brought by the subordinate participate in the hierarchical superior's trust being born and maintained. This investment is done over time and it is periodically evaluated, in various contexts. As hard as it is to gain trust, as easy it is to lose it. The absence of trust is manifested through fear, relationship tension, stress, cynical behavior etc. When subordinates are disappointed by the hierarchical superior, they withdraw, they avoid communication, they stop offering their support, they become indifferent, are superficial or they stop being involved. Loss of trust gives way to conflictual tendencies and to the refusal of authority.

Research in the field of knowledge management (Rolland & Chauvel, 2000, Davenport & Prusak, 1998) is showing that trust is the most important condition in the exchange of knowledge. A person doesn't share his knowledge with another person unless they trust them (Connelly & Kelloway, 2000). The processes of transmitting and sharing knowledge follow a set of formal and informal rules and procedures that include the communicational aspects and they result in trust. The elements that constitute trust (Servet, 1997): faith, which is determined by the legitimization of rules, the faith in others and transparency (a minimum amount of shared knowledge between those involved); elements of trial and validation; memory, which is involved in the learning process of trust and which is based on common experiences and routine - all enrich the contents of the hierarchical relation as it offers the circumstances for securing and optimizing the environment within the organization.

Vertical trust favors hierarchical communication. Trust is credit that may be awarded for the other person's words. Trusting the words of the hierarchical superior (respecting things that were said, clarity, fairness, the quality of listening) is the ground for a durable professional relationship. When communication is frequent, when the roles, tasks and responsibilities are well defined and where there is positive feedback and permanent encouragement and mutual trust, when the same degree of involvement is shared, trust is consolidated (Prax 2003).

3. CONCLUSIONS

Trust gets built, tested and updated. It is contagious, interactive; it brings forth and maintains hierarchical communication. Or, in De Rochefocauld terms, "trust offers more conversation material than intelligence". Trust makes the difference in a working environment and it is an important motivational feature. If its presence in intra-organizational relationships secures, optimizes and brings benefits, its absence produces disruptions and instability. When consolidated and exploited, it is a powerful aspect in the success of the organization.

REFERENCES

1. Bornarel, Fr., „La confiance contrainte", in *13è Conférence de l'Association Internationale de Management Stratégique*, Normandie, Vallée de Seine, 2-4 juin (2004)

2. Breton A., Wintrobe R., „Organizational Structure and Productivity", in *The American Economic Review*, vol. 766, nr. 3 (1986)

3. Davenport T. H. & Prusak L., *Working knowledge: how organizations manage that they know*, Haravard Business School Press (1998)

4. Giffin K., „The contribution of studies of source credibility to a theory interpersonal trust in the communication process", in *Psychological Bulletin*, n° 68 (1967)

5. Krieger E., *L'influence respective de la confiance et des approches instrumentals dans l'évaluation des nouvelles entreprises. Une application aux professionnels du capitalinvestissement,* Thèse de doctoratès Sciences de Gestion, Université Paris IX-Dauphine (2001)

6. Landowski, E., *La société réflechié*, Seuil, Paris (1989)

7. Maxwell, J., *Totul despre lideri, atitudine, echipă, relații*, Editura Amalteea, Bucureşti (2005 [2003])

8. Mc Allister, D. J., „Affect-and cognition-based trust as foundations for interpersonal cooperation in organizations", in *Academy of Management Journal*, nº 38 (1995)

9. Orléan, A., „Sur le rôle respectif de confiance et de l'interêt dans la constitution de l'ordre marchand, in *Revue du MAUSS*, nº 4

10. Prax, J.-Y., *Le Manuel du Knowledge Management – une approche de 2ème génération*, Dunod, Paris (2003)

11. Rolland N. & Chauvel D., „Knowledge transfer in strategic alliances", in Despres C. & Chauvel D. (Eds*.), Knowledge Horizons: The Present and the Promise of Knowledge Management*, Butterworth Heinemann, Boston, MA (2000)

12. Rusaw, A. C., *Leading Public Organizations. An Interactive Approach*, Hartcourt College Publishers, Orlando (2001)

13. Servet, J.-M, „Le chapeau", in Bernoux, Ph., Servet, J.-M. (ed.), *La construction sociale de la confiance*, Montchretien, Paris (1997)

14. Van den Bulke, Ph., Monème, I., Doublet, L., Comte-Sponville, A., Le *Management relationnel: Manager et Managé sont dans un bateau...*, Dunod, Paris (2003)

15. Zara, O., *Le management de l'intelligence collective. Vers une nouvelle gouvernance*, M2, Paris (2005)

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

THE CULTURAL AWARENESS-A FANCY MILITARY TERM, OR A CRITICAL NECESSITY IN COUNTERINSURGENCY OPERATIONS?

Ecaterina Elena CEPOI

Department of International Relations and European Integration, National School Of Political And Administrative Studies, Bucharest, Romania

Abstract: *History had taught the U.S.A. hard lessons especially in Vietnam, about fighting in a foreign environment in a seemingly endless conflict. After almost 40 years the same army it is involved in its second long term, counterinsurgency operation in Afghanistan, a country which is plagued with a vast landscape of inhospitable terrain, poor ground transportation network and a rampant insecurity. Of course that in the last four decades, the American Army and its allied militaries have struggled to change and to adapt the doctrine, and its technology to counter an elusive enemy. But it wasn't enough as it was proved by the war in Iraq, especially by the Abu-Ghraib prison's episode in the sense of winning a war not only at the technological level, but at the human level, too. Also, the shift of conflicts from the conventional warfare to counterinsurgency almost imposed to the U.S. military to devote substantial resources to research and education. Thus, appeared in the 1990's the Military Operations other than War, or as it is popularized by its acronym –MOOTW. At the core of MOOTW is cultural awareness, because these operations often require the military interaction on the ground with local population. But what is cultural awareness? Is it the key to success in counterinsurgency operations, or just a new concept used by U.S. foreign policy makers to control at a certain level the main enemy of it, which actually defeated the Americans in Vietnam, the media? By trying to find an objective answer to the questions mentioned above, the research in this article will be focused on the importance given by the U.S. military forces to the cultural side of war in Vietnam, Iraq and Afghanistan, especially to their similarities and differences.*

Key words*: Vietnam, conventional warfare, counterinsurgency; MOOTW, Iraq, cultural awareness, Human Terrain Team, Afghan culture;*

1. BACKGROUND

„Guerillas never win wars but their adversaries often lose them"
Charles W. Thayer

Without any doubt, the 20th century as well as the beginning of the 21st was dominated, and is still dominated, from the military point of view, by the U.S.A, despite the huge efforts made by the former U.S.S.R. during the Cold War period, Russian Federation, and the Republic of China in the aftermath of it. The figures of the military budget allocated by the countries mentioned above are talking, in this respect. A simple comparison for the fiscal year 2010 for example, shows that the U.S.A. official figures allocated for the military budget, released by DoD,(*Fiscal 2010 Budget Proposal*, May 2009) were of $663.84 billion, the Republic of China, of U.S.$ 150 billion(Annual Report for the Congress, 2010), while the Russian Federation allocated

only U.S.$ 58,7 billion according to the SIPRI Yearbook 2011 (2011:163).

Even so, despite the above data, it is known that the same U.S. military forces which were defeated in the Vietnam war, left behind the state of Iraq at the end of 2011, after eight years of war, an almost full sovereign one-indeed- but also a place where a minimal level of security is hardly to be achieved, while the deployed forces in the Islamic Republic of Afghanistan since 2001, and starting with October, 2006, under the umbrella of ISAF, are facing serious difficulties in accomplishing their mission. And it is not about only the recent events such as the Qurā'n burning, or the massacre of those 16 Afghan civilians, done by an American sergeant from the base located in Panjwai, from the district of Kandahar, but about the costs of lives for all parties implied, as long as the time is passing and the situation in Afghanistan instead of being stabilized, is getting worse.

All of these having as a background the context in which the U.S. Army has learned already, a tough lesson during the war in Vietnam regarding the difference between the *"war of necessity and the war of choice"*, and where it learned that wars, are no longer fought in the traditional old form and that the shift from the conventional warfare to counterinsurgency requires not only having financial resources or the most advanced military technology in the world, but also a different approach of the warfare itself, whose only characteristic that remains unchanged, is, its dynamic. As a result, having the best capabilities is not anymore equal with getting quick victory, with few causalities.

Also, as a part of the lessons learned, or at least, which had to be learned, is the appeal in October, 2004, of Major General Robert H. Scales Jr. who called for "a shift in operations and trainings towards a greater cultural awareness as an essential component of counter-insurgency operations"(L. Bond, 2010:69), while the Lieutenant General David H. Petraeus(2006:2) admitted that the war in Afghanistan and Iraq were not the wars for which the U.S. military forces were prepared to fight in 2001, but the wars which the American forces must to master. Moreover, the same well-known general in the same article, pointed out that the overwhelming conventional military superiority such as the firepower, manoeuver, technology of the U.S. army will make it unlikely to be confronted directly; rather the asymmetric attacks, will be preferred, which requires to remember and to learn from the previous experiences.

As a result to all these, suggestions, comments, perceived shortcomings, or recommendations, the U.S. military has poured millions of dollars in the development of an improved cultural understandings of the Muslim world, and had established human terrain teams(HTT) which are mostly composed of academics and cultural anthropologists, who have to accompany troops on operations and who provide cultural advice to unit commanders when required(Bond, 2010:69). Thus, the cultural awareness term has started to be researched, mentioned and heard more often within the military journals, and from commanders, even it is/was often met with rolled eyes from those who execute the orders, because soldiers often think that the cultural awareness is a weakness according to Major Mark S. Leslie (2007:4).

But what is cultural awareness? Why suddenly, is a such an important term for the U.S. military forces, in the aftermath of war in Vietnam, and these days, of that from Iraq? This question is genuine, as long as, during the war in Vietnam, did exist a pacification programme called CORDS which was the acronym for Civil Operations and Revolutionary Development Support, which aimed to provide to the S. Vietnam with access to vast human, financial and organizational resources in implementing an integrated program at the provincial, district, hamlet, and village level(Stewart, 2010). Also, it did existed and still exist MOOTW(Military Operations Other Than War), which was more popularized during the 90's, whose main objective was/is to focus on deterring war and

to promote peace, according with its Joint Doctrine issued on June, 1995.

1. CULTURAL AWARENESS, IN THE HISTORY OF THE U.S. ARMY

" If you know the enemy and know yourself, you need not fear the result of a hundred battles." Sun Tzu

The U.S. Army and Marine Corps COIN Manual, quoted by Colonel Hershel L. Holiday(2008:2) defines cultures as being a „web of meaning" shared by members of a particular society or a group within a society. Therefore it is a system of shared believes, values, customs, behaviours, and artefacts, that members of a society use to cope with their world and with another. It can be learned, shared by the members of a society, patterned, changeable, internalized and very important for a modern soldier, arbitrary; meaning that the soldier should make no assumptions regarding what a society considers right or wrong, good or bad. Also, culture can be seen as an "operational code" that is valid for each member of the group, and includes under what circumstances the rules shift or change(Holiday, 2008). Coming back to U.S. Army's meaning of culture, DoD, also consider/added the realities of racial and ethnic groups, stereotypes and tensions within the cultures to the characteristics mentioned above.

Even there are huge pitfalls in modern military strategy approach when considering culture as an organizing concept within military process, alongside with the Six Joint Operating Systems, in order to become the seventh operating system pending future operations involving stability and transition/reconstruction operations(Holiday, 2008), the use of cultural knowledge during conflicts it is an old practice, which leads to the conclusion that the cultural knowledge and warfare are inseparable. To know the enemy in order to improve military prowess has been sought since Herodotus studied his opponents' conduct during the Persian Wars (490–479 BC) as the well-known anthropologist McFate stressed in 2005. Also, as it can be seen from the quote above, Sun Tzu advises the soldiers to know themselves and the enemy. An example in this respect, for the Arabic part of the world is that of the Lieutenant Colonel T.E. Lawrence (of Arabia) from the British Army who documented his military cultural background while living among the Arabic people, in order to improve his military expertise(McFate, 2004).

As a recorded history within the U.S. Army's operations, the concept of cultural awareness, surely, it is not a new one. As it is already mentioned above in this article, there were/are projects established by the U.S. Army which had/have at their heart the cultural awareness at least, partially. RAND Corporation quoted in Human Terrain Study Guide by Derian Der James and Camilla Hawthorne(2011:2) is mentioning that between1916-1996 there were 846 MOOTW-type engagements in which the American Air Forces played a central role. MOOTW involves using military capabilities for purposes that do not include traditional warfare, such as: peacekeeping, arms control, assisting in response to domestic crises, while the cultural awareness is the core of MOOTW, because these type of operations frequently involve interaction of soldiers on the ground with locals(Derian Der James and Camilla Hawthorne, 2011). Also, the existence of CORDS which as a program implemented by South Vietnamese government and the Military Assistance Command which was

meant to undermine communist guerrillas from N. Vietnam, in large part by winning the local villagers from South Vietnam, is a prove of the fact that the cultural awareness was taking into account by the U.S. Army at a certain moment during a war where the conventional war shifted into counterinsurgency. Also, in 1970 DoD budget included $115,000 for the development of cultural awareness, while the counterinsurgency operations through the Cold War, frequently involved the "applied military anthropology"((Derian Der James and Camilla Hawthorne, 2011).

Later on, in the aftermath of 9/11 events, during the war in Iraq, the U.S. Army realised that sometimes, the cultural awareness incorporated into operations, is much more important than other conventional weapons in their inventory. In this respect, Lieutenant General D. Petraeus underlined "the cultural terrain can be as important as, and, sometimes, much more important than the geographic terrain", remark that stands at the base of his own definition of cultural awareness which is in his opinion" a force multiplier"(Petraeus, 2006). That is why, it is considered that the soldiers that are culturally aware and know how to apply the cultural awareness on the battle field, are the 21st century warriors(Leslie, 2007).

Because in an asymmetric environment as it is that of the today's conflicts, which proves on daily basis that the fundamental nature of war has changed-(Derian Der James and Camilla Hawthorne, 2011), the modern fighter -has to know and understand what is behind a possible "target", which might have a sum of features which may change the course of conflict in which the soldier is involved. The target may have the quality of a friend, of an ally, or it may be a representative of a non-governmental organisation, as well a civilian, each one of them with a different cultural background, meaning that in the modern warfare the soldiers are dealing with much more than a simple target. But to be able as a soldier, to make the difference between and among them, there is necessary cultural training, which can be acquired in time, in specific conditions. Thus, appeared the idea to embed at the formal level, social scientists, such as anthropologists, with troops in Afghanistan and Iraq, as long as officers began to complain of their lack of adequate knowledge of local cultures. As a result Pentagon recruited Montogomery McFate a well-known anthropologist, then a program started by a retired S.O.F. namely Steve Fondacaro which aimed at embedding social scientists with combat brigades. The funds authorised by the Secretary of Defence Robert Gates in amount of $41 million in 2007, were in order to expand the program and to give it consistency for the tax-payers. And due to the importance given at the formal level to the cultural awareness by senior military and elected officials, such as Scales, Petraeus, Gates or Ike Skelton, and under pressure of the development of conflict in Iraq, it was made a significant change in how the United States Government approaches warfare. Thus, appeared and developed Human Terrain System project. But why it was necessary, that the most powerful country in the world, to change its warfare strategy? What is the difference between the conventional warfare and COIN operations?

2. THE ROLE OF HUMAN TERRAIN SYSTEM WITHIN COIN OPERATIONS

"The guerrilla must swim in the people as the fish swims in the sea."
Mao Zedong

Perhaps the best description of COIN operations is given by the following definition: *"In counterinsurgency, military forces are a delivery system for civilian activity: their role is to afford sufficient protection and stability to allow the government to work safely with its population and for economic revival and political reconciliation to occur."(Coin Manual, 2008:28).* This means that counterinsurgency is a much more complicated war, as long as, it comprises military, paramilitary, political, economic, psychological and civic actions. Its

success is not defined solely by eliminating the insurgents; actually, a success is impossible without the application of a much more complex approach, thinking of all the actions mentioned above.

And, without any doubt, the cultural awareness term has gained an important place within military operations, especially in the aftermath of 9/11; but this only inside the COIN operations, due to HTS. In order to understand the importance of HTS, is essential to differentiate between the conventional war and COIN, because in a conventional war the key ongoing objectives is to obtain and retain the terrain, while in COIN the terrain has already been obtained and military forces often operate in the same AO(area of operations) for several months at a time. (L. Bond, 2010). The military forces often patrol in the same area, on a daily basis, which means that COIN operatives inevitably interact with the locals of the country in which the operations that place, and very important do the insurgent factions. So, it has been generally accepted that in COIN operations, it is imperative to gain the support of the population, as they are the centre of gravity for both sides of the conflict, according to Captain L. Bond.

The importance of gaining the trust of the local population, it is clearly stated also in the Canadian National Defence, within its COIN doctrine : "many insurgencies will develop in failed of failing states where governments have failed to address or satisfy their basic needs of their populace. These needs will differ, depending upon the region or culture involved, but in general will include de basic essentials of a stabile life, a responsible government, religious freedom, and economic viability".(L. Bond, 2010). Keeping in mind the quote above, about states, where governments have failed to keep the level of security at a minimal level such as Iraq was, in the first years after the second Gulf war, the need for cultural awareness within COIN operations, was seen as a must after the raise to public prominence of Lieutenant General David H. Petraeus, and his redirection of COIN in Iraq. As a result, the American government, started to implement Scales's recommendations and Petraeus's ideas, and have established the HTS program, as largely composed of academics and cultural anthropologists, that are meant to provide with cultural information to unit commanders, at their request.

The HTS combines the best of both military and civilian cultural experts to assist in planning and executing the reconstruction operation in post-conflict environment conflicts. HTS program is composed of HTT(human terrain teams), RRC(research reachback cell) and SMEnet(subject matter expert network), each one of them having an important role in fulfilling the objectives of the HTS.

HTS teams were created to provide a knowledge on the local population to the military commanders, by assisting them in understanding the people within their area of operations, to reduce the chance of negative effect responses, such as improvised explosive device events, direct at American soldiers and to enable the commanders to make better informed decisions. This type of teams fill the social-cultural knowledge gap in the commander's AO. Another role of HTS teams is to assist in building relations with the local community. HTT are regionally focused, and modular, they deploy as trained and organized teams and are attached to army brigade combat teams, division-level headquarters, and higher command echelons. Also, very

important to note is the role of HTT which integrates into a unit's staff, the unclassified open sources and field research and provides focused and operational relevant human terrain information. (Leslie, 2007).

As well as CORDS, the HTS program is highly controversial and has many critics; one year before the first HTT was deployed, the American Anthropological Associations, started an investigation into the ethics of its members involvement with the military intelligence. The AAA is opposing the HT project, by stating that their code of ethics is violated, which stipulates as a requirement that anthropologists do not harm the people they are studying, while the scientists involved in HTT are often accused of gathering intelligence. (Derian Der James and Camilla Hawthorne, 2011). Even so, the role of the HTT seems to be of help in fulfilling the aim of the COIN operations: that of an adequately protection of the civilian population and of exerting a maximum pressure on the enemy's freedom to act and influence, even the idea of implementation of such type of teams came too late for the American troops during the war in Vietnam, and partially for the Iraqi people-as long as the label of a failed/failing state, is far away of their borders, but, hopefully not for the Afghans.

3. INSTEAD OF CONCLUSION

The acknowledge at the formal level by the American policy makers of the concept of cultural awareness and the implementation of HTS project, came at a moment when the U.S.A, as a state, within the Middle East area, and among the Muslim in general, and not only, started to lose its credibility. Because it came with a military operations' history full of mistrust not only from the outsiders, but also from their own citizens. In this respect, it needs to be mentioned the Gulf Tonkin's episode which is strong connected with the war in Vietnam(motivated later on, as a containment policy, without any doubt, too late for H. Johnson as the President of the U.S.A); the Nayrah testimony about an inexistent act of atrocity done by the Iraqi soldiers in a hospital from Kuwait(related to the Persian Gulf War in 1991); the non-existent W.M.D. in Iraq(which was the basis for the intervention in this country in 2003), according to the final report of C.I.A., and the use of a P.R. war for the last two mentioned wars, are the facts that lead to the question whether or not, the cultural awareness term is just a tool used by the U.S military forces to control the way, how their behaviour toward the local population in AO, is perceived. On the other hand, the question whether the cultural awareness is a fancy military word, or a critical necessity within the COIN operations, (un)fortunately, the answer maybe affirmative for both assumptions. Because it can be perceived as a fancy military word, as long as not all the soldiers, who are patrolling within the AO, and have to interact with villagers, have the ability to assimilate in a short period of time the cultural background needed it in a such situation. Moreover, a soldier can be prepared for an area of operation, such as Iraq, was, but the same soldier, is useless for the operations in Afghanistan, thinking of the cultural complexity of Afghanistan. And the costs are too high even for the military budget of the U.S.A, thinking of its new offshore balancing strategy. On the other hand, if the costs with trainings needed to acquire the cultural background necessary in AO, is overcome, the cultural awareness maybe seen as a critical necessity within the COIN operations as long as it is aimed at reducing the cost of lives for both sides, and it doesn't imply ethical problems for the social scientists embedded within the HTT.

REFERENCES:

1. ANNUAL REPORT TO CONGRESS.*Military and Security Developments Involving the People's Republic of China,* 2010. *Available online at* http://www.defense.gov/pubs/pdfs/2010_CMPR_Final.pdf
2. Bond. L. *Speaking the language: cultural and linguistic fluency in counter-*

insurgency operations. Canadian Army Journal Vol. 12.3(winter 2010)69-84. Available online at: http://www.army.forces.gc.ca/caj/documents/vol_12/iss_3/CAJ_Vol12.3_10_e.pdf

3. Counterinsurgency Operations Manual. 5 October, 2009. Available online at: www.fas.org/irp/doddir/army/fmi3-07-22.pdf
4. CIA's final report: No WMD found in Iraq. Online at: http://www.msnbc.msn.com/id/7634313/ns/world_news-mideast_n_africa/t/cias-final-report-no-wmd-found-iraq/. Derian Der James with Camilla Hawthorne *Study Guide. Human Terrain: A study Guide.* August 2011.The Watson Institute for International Studies, Brown University Available online at: http://www.bullfrogfilms.com/guides/humtguide.pdf
5. DoD. Press release. *Fiscal 2010 Budget Proposal*; available at*:* *http://www.defense.gov/releases/release.aspx?releaseid=12652*
6. Holiday L. Hershel, *Improving cultural awareness in the U.S. Military*. U.S. Army College, Carlisle Barracks, PA 17013-5050. Available online at: http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA482217
7. Kimbrough, M. James. *EXAMINING U.S. IRREGULAR WARFARE DOCTRINE, DEPARTMENT OF THE AIR FORCE AIR UNIVERSITY; AIR FORCE INSTITUTE OF TECHNOLOGY Wright-Patterson Air Force Base, Ohio.June, 2008. Available online at: http://www.dtic.mil/dtic/tr/fulltext/u2/a488263.pdf*
8. Leslie, S. Mark. *Integrating Cultural Sensitivity into Combat Operations*. Armor magazine. January-February 2007
9. Montgomerry McFate. *The Military Utility of Understanding Adversary Culture*. Available online at: http://www.dtic.mil/doctrine/jel/jfq_pubs/1038.pdf
10. Petraeus, H. David. *Learning Counterinsurgency: Observations from soldiering in Iraq.* Available online at: *http://www.army.mil/professionalWriting/volumes/volume4/april_2006/4_06_2.html*
11. Quote of Ch. W. Thayer available online at: http://www.utefans.net/message.php?id=466931&filter=
12. *SIPRI Yearbook 2011: Armaments, Disarmament and International Security.* Sam Perlo-Freeman, Julian Cooper, Olawale Ismail,Elisabeth Sköns ,Carina Solmirano. *Military Expenditure*. Page 130. Avalaible online at: http://www.sipri.org/yearbook/2011/files/SIPRIYB1104-04A-04B.pdf
13. Stewart W.Richard. *CORDS and the Vietnam Experience*. Center of Military History. Available online at: http://www.pnsr.org/web/page/652/sectionid/579/pagelevel/2/interior.asp

.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

THE DEVELOPMENT OF THE HUMAN RESOURCES ABOARD SHIPS

Carmen Luminița COJOCARU, Naie Gilles OPRISAN

Civilian Naval Faculty, Naval Academy ,,Mircea cel Bătrân" Constanța, Romania

Abstract: *The main target of a prudent sailor and also, his moral and professional obligation is to ensure he the ship reaches its destination safe and secured and with maximum of its efficiency. As well as the whole human knowledge the skills of the sailors suppose a lot of practice, support and materialized confirmation in recognizing this, professionally.*

Aboard maritime ships, this problem involves mainly the manner to prepare a navigation process in deep security conditins, realised by training, preparation and exercising in order to support the team aboard.

Keywords: *professional skills, specific attributes, adjusting answer. Self-complacency, maladjustement, ship security, etc.*

I. INTRODUCTION [1]

The selection, the training and the improving quality of the training in the civilian and military navy are some outstanding kind of activities. They are permanently searching to improve the specificity of the professional activities aboard ships on the sea as well as on the rivers, the level they consciously get the meaning of the deck life at the highest level ever, of the members of the crew, in good or tempest moments.

We are looking every moment to form physical and specific psycho-motional crew qualities, in order to successfully respond all the requests, no matter the weather conditions. This way a human fail material and human as well could be avoided.

[1] Mention the contribution in achieving this work of mr. col. (rs.), psiholog ***Dan NICOLAU***.

II. GENERAL FACTORS LEADING TO A HUMAN FAIL IN THE NAVIGATION ACIVITY

Nowadays, the equipments and the technology reached an apex, never met, being involved in here, the commercial s, the trading activities aboard ships, that means an important increasing of the tasks, according to the new technologies aboard, for the personnel.

The statistics in the field of maritime accidents, represent:

- 71% from the accidents	- the missing of the planning;
	- charging the crew with wrong missions;
	- the missing of the watchman service;
	- asleeping cause of too long service, because of an illness or fatigue, not having the requested capability for the variable normal requests.

- 10% from the accidents	- missing skill, no technical skills, no physical and psychical qualities to use the intervention and saving means;
	- general missing of competence, no way of understanding the way of the professional activity.
- 19% of the accidents	- some other causes, techical falls, bad luck, unforseen situations, etc.

III. MAIN CAUSES AFFECTING THE HUMAN FACTOR PERFORMANCE COULD BE THE FOLLOWING:

1. The Stress

The work aboard a ship is a most stressing one in the world. The specific stress in this professional activity, is coming from the specific isolation for long periods, and last but not least, a result of the immense pressure of the harbor activities. It could be the same as a result of the small crew number: inside small crews the same jobs are done with less people. The more are the commercial jobs of the crew, the more are the professional stress signals of the crew.

Now, the stress is marked as an universal phenomenon, and a result of the excess psychological, physical and social requests of a modern man.

Another reality could be the one the stress is an adaptative answer neglected by individual differences, and as well as a consequence of a situation, an action or an external event pressing over some psychological or physical excessive requests on the individual.

The stress is well known as an „human adaptation" to a a situation generating non-satisfactions and fulfillments of the primary needs, sometimes considered as a „burden", most of the times, non social, according to the best moments of the life. The understanding and the evaluation of the stress is a specific phenomenon specific for every individual.

Different environments and situations could affect the individuals in different ways and the stress level perception of the same event could be different to different individuals.

The way each one learned (had a capability) to answer the natural and professional environment, as ell as some other factors(physical status, health, personality, age) influences the stress level each one has facing an efficient activity. Generally speaking the stress affects: attitudes, behaviors, the performance and the decisional process.

2. The missing of the skills, knowledge or adequate specific training

These causes could affect the performance and answer level in different situations. It is good to know the level of the missings of all kind and the way they could affect the security of the actions.

3. The ilness (physical or mental)

This could become from a simple misunderstanding in some common activities, mostly tose in the relation with the security of the ship and the ship's performances.

4. The physical and psychical self complacency

This one, mentioned just as self satisfaction induced to the individual and aiming to the confidence in his own way of acting. We could mention that this self complacency shows like a mental status, a moment when the individual has the necessary capability, the resources and knowledge to act responsibly but for some reasons these capabilities are not activated.

5. The technological self complacency

The modern technologies put the individual in an increasing dependency position to them. The knowledge of the real technological capabilities and the feeling the system can never fail induces another kind of self complacency.

6. The leading self complacency

Especially in the position of the leading team, the self complacency is produced by the bad communication of the commandant himself, an extreme authority, by the damaged relationship he has with the crew. The crew members can refuse to communicate and to act

the moment the leader refuses to use all resources, giving birth to a situation of self complacency and self evaluation.

7. The managerial self complacency

It also acts in a poor communication situation between the individual and the system, In this case, the capabilities, the skills and the knowledge of the crew are not reasonably evaluated, the people accept the management the way it is. This situation develops in time a bad hostile attitude initiating to all crew's members a self complacency and slackness status.

8. The self induced self complacency

This situation appears the moment the individual is too strictly controlled, watched or scolded by his superior or feels like nobody listen to him. This creates an inferiority feeling causing an abnormal behavior.

IV. PARTIAL CONCLUSIONS

The capability to work aboard a ship depends somehow on everyone training in every way. As a learning process, the socialization starts from the early childhood, this way the maturation of the individual appears at 18-20.

Everyone's need to self actualize or self passing the own limits requests training or coaching the more the work has some particularities aboard the ship.

A special development of some special and specific skills is requested, as to work in a team, in a group to develop a professional cooperation relationship in order to fulfill the commercial tasks as well as the security of the voyage of the ship and of the crew.

This way the training in the Navy means the learning of the individuals to execute various tasks or procedures at a highest level, as the coaching supposes the development of some already created specialized skills educating them from a psycho attitudinal point of view in this job.

V. BIBLIOGRAPHY

1. Bridge Team Management, Capt., AJSwift, Nautical Institute, 2000;

2. Bridge Resource Management, A. Cowbron and E. Wabren, SAS Academy, 2004-2005;

3. COJOCARU, Carmen, Luminița - *,,The incidence of the emotional intelligence in building the person profile"* - The Technical-Publishing House of the Army, Bucharest, 2008.

4. GANCIAR, I. L., KOROVIN, D., G. - *The experimental programme to train the students in the naval high schools. Methodical recommendations*, Odessa, 1994.

5. HORGHIDAN, V. - *The psycho mobility problems*, Globus Publishing House, Bucharest, 2000.

6. Human Resources Management, Gh., Iosif, Ed., Victor, 2000;

7. Life Resource Management, CRM and Human Factors, Gunnar Falgren, Creatine Book, 2004;

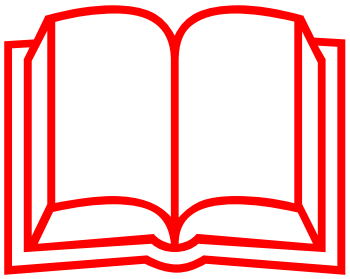
8. OPRISAN, N., VOINESCU, D., SINTION, F., and partners. - *Ways and modalities to recover the psycho-mobility capabilities*, Bucharest, *„The Physycal training and sports magazine",* No. 11/1987, page 29-34.

9. OPRISAN, N. - *Physical and psycho-motional training of the future navigators*, Bucgharest, Education Ministry Publishing House and the Editorial Staff for foreigners „Romania", in Forum Magazine, No. 11-12/1993, pages 19-23.

10. TÜÜÖS, Ştefan - *,,Basic psychological concepts"* – A genetic and functional perspective, Globus Publishing House, 2001;

11. VASILESCU, P., I. - *The risk psychology,* Military Publishing House, Bucharest, 1986.

---------- ///// ----------



"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

NEW CONCEPT OF SECURITY AND GENDER PERSPECTIVE

Mária MARTINSKÁ*, Dušan MALÍK *

* Departnment of Social Sciences and Languages, The Armed Forces Academy of General Milan Rastislav Štefánik, Liptovský Mikuláš

ABSTRACT: *New trends in the society development are restructuring the traditional relation between women and war, and require a more comprehensive analysis of the change in the social status of women and men in the context of history. From the gender vantage point the objective of the reorganisation processes of complex systems, such as human society, is not to achieve gender parity, but to take advantage of a unique and powerful way women along with men can provide in war conflict prevention and elimination, thus enhancing peace efforts and security of individuals in common life. Traditional limitations in gender determination bring about the question of further integration of women into armed forces, but also the need to innovate the understanding of social care ethics and social welfare in order to promote peace and security.*

KEY WORDS: *Women, men, war conflict, human security, gender equality principles.*

1. INTRODUCTION

Humanity and dignity represent the core of the common good and the highest values a human being as an individual or a society as such should strive for. [4] The development and the implementation of the social values can only be possible in coexistence, a person´s dignity and human rights have a social and institutional form. From the ethical point of view, human dignity is the basic and fundamental value of providing quality life in a society. The basic values include the institution of marriage and family and political order which can provide fundamental values of common good, namely social justice, freedom and peace.

These values have been questioned over the time due to war conflicts and there have been changes in the traditional social positions and roles of women and men. Currently, the increasing need for appreciation of equality of women´s and men´s rights and their equal participation in all areas , as well as the opportunity to cooperate in providing peace and security, have an impact on these values. These trends necessitate the need to innovate the approach to understanding social care of complex systems, such as the human society, by means of applying the principles of gender equality.

2. HISTORICAL CHANGES IN GENDER STEREOPTYPES AS THE AFTERMATH OF WAR CONFLICTS

Antropological researches describe and prove the effort to protect women who symbolize life as an important imperative of human race. That means that there are good evolution reasons to keep women away from the centres of war danger. The texts on the history of women in modern war describe their roles in a more comprehensive way, adopting the roles of unifying symbols of a nation, mothers, victims, non combatants, or those we notice as combatant exceptions.

Their social status and position cannot be fully grasped in its complexity, the most dominant model is represented by the so called "military women" motivated to survive the war period and, more or less on voluntary basis, to provide care for soldiers,

provisions, clean water, sanitary facilities, quarters, spiritual but physical support as well, education, medical care.

If the understanding of masculinity and femininity is connected with the notion of unpassable border between the two, this leads to making a barrier and the expected models of behaviour become overruling. Then, any nonconformity is punished by mockery, oppression, rejection, exclusion from society, in some cultures even death. This unpassable division line between the sexes is the basic prerequisite of gender "stereotypes". [7] An integral part of the development of modern nations is the notion of women as a non combatant unity. Another part of the stereotype is the difference in the attitude of men and women to violence. At the end of the 18th century male violence could be justified in war only, female violence was not acceptable beyond any scope of expectations. [5] Female violence was consindered evil and individual. Male violence in war time could be regulated and controlled by rules. Also sharp differences between personal and public life arose, the ones between the family and the nation. Women were the guardians of families, men were defenders of a nation. From this vantage point men´s heroic deeds were seen as the stories of bravery, courage, morale and fame. Women adopted the role of generosity, sacrifice, service, immortality. [11]

War is the the main reason of the "family crisis" characterised by the seperation of male family members, the change in the demographic development, the shift in the traditional role of women in a family, loosening social ties and the „loss of morale" (showing itself in corruption, sexual promiscuity, adultery, homosexuality). [1] The absence of men in families made women do men´s work, take over decision making and the responsibility for providing the family with money. It was not easy, as during wartime the effort to provide the basic needs was in a conflict with higher needs of, for example,a municipality, government. The departure of men into war represented the loss of the breadwinner. Not even war bonuses for families and other social-political measures to keep stability could make up for a considerable decrease in the standard of living.

From the gender point of view it is interesting to note, that not only women, but also men fall victims of gender stereotypes. Once a war broke out, men had no choice.The conscription, ethical and moral ideals ruled over social ties and the dread of death paralysed them, resulting in dodging the conscription. The gender stereotype was also followed by women supporting anti–pacifist ideas in WWI. Those women mocked young men not wearing a uniform by wearing white feathers, the symbols of cowardice. The ways to dodge conscription were almost unlimited, ranging from requests, appeals to corruption. Desertion, escapes to being taken hostage, faking being sick, self-harm were also ways to avoid the battlefield. An interesting option was getting disqualified because of the importance for the economy.

A long-term absence of men in families, their losses or reunions marked with mental trauma or physical handicap resulted in socio-economic and mental problems and the change in social roles, which could not be easily reversed in post-war periods.

3. NEW SECURITY CONCEPT AND GENDER PERSPECTIVE

Modern armies face new challenges in international peace deployment , the objective of their effort is no longer "combat" , or "victory", but conflict prevention, peace settlement and peace enforcement. A military mission of the 21st century can be characterised by activieties such as "protection" , "aid", " rescue". It does not involve just the protection of the country, but assisting in the settlement of conflicts in other countries. [12] The concept of the so called " human security" and the legisaltive need to provide security of an individual is promoted by the UN. "Human security...must be focused on an individual, not only a country or a nation. The security concept must change from beiing the concept of the national security to a concept focused on individual security. It must change from the security provided by arms to security concerning the issues of food supply, job security and healthy environment". [3] These objectives are in line with the traditional female qualities of care,[9] protection, moreover, they enhance their application from the family level to society and require both male and female experience,, skills, education. Female blue helmets, so called "observers", in the area of human rights and other women deployed in missions, offer new possibilities and options for the area of ongoing development of peace keeping . Women often find it easier to socialise with locals and gather information, communicate with local women, can provide the sense of security for children, seniors, victims of violence or natural disasters. The fact that women

are an integral part of army units in appointments of female soldiers, policewomen, mediators, doctors, social workers, enhances security conditions for victims, but also initiates the processes of post-conflict reconstruction not only in official peace talks, but also the enhancement of their roles in the reconstruction of citizen society and the basic infrastructure. It also enhances the need to integrate the gender point of wiev into planning, developing and implementing humanitarian aid and allocating relevant assets in this area.

Conclusion

The paticipation of women in peace support processes is essential. [6] It is an appeal for women to join peace negotiations, as combat war conflics have a differetnt impact on men and women. One of the indicators of a shift to post-military society is the enhancing of the civil principles and civil and political rights of military personnel. That is why the enhanced military role of women can be understood as promoting civil and political rights and the indicator of a broader historical shift from o society with a predetermined status to the one aimed at performance. The principle of their „equal participation and full integration into all activities to support peace and security" in line with the UN resolution number 1325 of 2000 is not followed and the decisions concerning conflict prevention and settlement are often made without any involvement of women. [10] The objective is not for women to replace male appointments, but to enhance the opportunities, take advantage of a unique and powerful way women and men can inspire, complement one another and participate in providing peace and security.

REFERENCES

1. DUDEKOVÁ,G.: *Stratégie prežitia v mimoriadnej situácii*.Vplyv veľkej vojny na rodinu na území Slovenska. In Forum Historiae,2009, vol.3.n.1.p. 2/online/
2. HAMAJ, P. – MARTINSKÁ, M. – MATIS, J.: *Vybrané problémy zo všeobecnej sociológie.* L. Mikuláš: AOS. 2005. ISBN80-8040-266-3
3. Human Development report 1993. *In: Waisová Š.: Řešení konfliktú v mezinárodních vztazích*. p. 68.
4. GLUCHMAN, V. (ed.). *Reflexie o humánnosti a etike*. Prešov: L.I.M., 1999. p. 55.
5. JANATA, J.: *Agrese, tolerance a intolerance*. Praha: Grada Publishing 1999. ISBN 80-7169-889-X.
6. KEYSER, V.: *Správa o postavení žien v ozbrojených konfliktoch a ich úlohe pri rekonštrukcii a demokratickom procese v krajine po skončení ozbrojeného konfliktu from 3.5.2006*.
7. KICZKOVÁ, Z: *O štruktúre a funkcii rodových stereotypov*. In: Zborník príspevkov z vedeckej konferencie s medzinárodnou účasťou „Kvalita života a ľudské práva v kontextoch sociálnej práce a vzdelávania dospelých. Prešov: FF 2002. p. 313. ISBN 80-8068-088-4.
8. KMOŠENA, M.: Vybrané problémy vedenia a vodcovstva v jednotkách v teórii a praxi. In: *Zborník z medzinárodnej vojensko-vedeckej konferencie „Aktuálne problémy vedenia a vodcovstva vo vojenských jednotkách"* L. Mikuláš: Akadémia ozbrojených síl gen. M. R. Štefánika. 2004. ISBN 80-8040-249-3
9. SEVENHUIJSEN ,S.: *Starostlivosť bez hierarchie*.ASPEKT,1999,n. 2.pp.118-120.
10. Report on following the human rights in the Slovak Republic in 2007. Slovak National Centre for Human Rights, Bratislava: 2008. http: //www.snslp.sk .
11. TOWNSHEND Ch.: *História moderní války* . – Jean Bethke Elshtain Ženy a válka , pp 314-327. Oxford University press 2005 Mladá fronta 2007. ISBN 978-80-204-1540-0)
12. www.genderandpeacekeeping.org

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

THE SOLDIER OF THE ARMED FORCES OF THE SLOVAK REPUBLIC FOR THE 21st CENTURY

Jozef MATIS* , **Dušan MALÍK****

*the head of The Department of Social Sciences and Languages at the Armed Forces Academy of general M. R. Štefánik in Liptovskom Mikuláši, Liptovský Mikuláš, The Slovak Republic, **the lecturer at The Department of Social Sciences and Languages at the Armed Forces Academy of general M. R. Štefánik in L. Mikuláši, L. Mikuláš, The Slovak Republic .

ABSTRACT: *The authors of the article handle an interesting and very up-to-date problem related to characterizing a new perspective of training professional soldiers for the tasks of the armed forces in the 21st century. The keystone for this step are the qualitative changes of security situation in the world and in Europe and their influence on the rise of new, qualitatively different, national and international professional armed forces.*

KEY WORDS: *limiting factors of the new security situation, professionalization of the army, national and international armed forces, professional soldier.*

1. INTRODUCTION

In order to characterise the new view on the training of the 21st century soldier it is necessary to take into consideration the fact that the Armed Forces of the Slovak Republic and the whole society will gradually have to come to terms with the impact of both qualitative and quantitative changes in the security situation in Europe and the world after the year 1989. The change in the implementation of the external mission of the armed forces can be seen as a crucial influence.

Up to 1989, armed forces were designed as the means of deterring the clearly defined and identified enemy and were rarely deployed in reality (except for the USA and SU armed forces). Since 1989, armed forces have been designed as the means of combat deployment against asymmetric, and to a greater extent, not clearly identified enemy.

The service in such armed forces will be performed in two phases:

- *the phase outside the combat deployment* (the time prior to deployment - the training for deployment and the time after deployment - rest and recuperation),
- *the phase in combat deployment* (direct combat deployment and recuperation, but in the area of deployment)

2. THE SECURITY AREA AND THE ARMED FORCES OF THE SLOVAK REPUBLIC

The struggle of an individual to meet the basic human need - hunger (survival), has always made a man subjugate the nature. Unless this struggle develops into the coexistence of a man and nature, the mankind will face a kind of *fate of the endangered*, [4, p.54] which a man gets born into, but has no control of.

The coexistence of a man and nature necessitates the shift from one way (a man - an initiator) to *a complex understanding of the interaction.* [13, p.23; 14; 15]

The process which results in the new global threat to mankind is called globalisation [7], the integral part of which, apart from integration, unification and balancing, also combines spatial and social segregation, separation and exclusion (so called time-spatial compression) [1, p.9; 2; 5; 6;]. It can be argued that it is a set of problems of a major transition implemented by current global society.

It involves the understanding of the adaptation of mankind (individual, social group and society) to constant and complex changes with a high level of uncertainty. The complexity of this transition stems from mutually connected issues of current society, namely: 1. disarmament, 2. energy shortage, 3. global warming, 4. growing poverty of the third world countries and 5. unbalanced wealth distribution in the current world. [17; 18] The idea of creating one super civilisation has proved unreal. One ethnocentricity may not be substituted by a different one and thus create a balanced global world. Each culture and civilisation must be viewed as a unique value which must take an adequate place in the new globalised world order. This approach makes the world we live in a system of subsystems, in which the new synthesis must stem from identifying and developing common values [7].

The antipole of globalisation is localisation, which can be simply understood as the process of introducing law and order. If it is to succeed set against globalisation, it must gradually outgrow the current national boundaries (locality). The process which is aimed at preventing chaos, which develops in line with the gradual diminishing of communication between more global and extra-territorial elites and the more "localised" majority is known as the process of introducing new order [16, p.109]. Arranging a part of the world has always meant founding a state. Only a global and extraterritorial - a multinational state, can compete successfully with global and extraterritorial elite in the future. The local elite (local leaders) must gradually develop into new local elite - multinational elite, which will be able to implement local ideas and manipulate the newly born disorder. The global management and its part, the new local elite, faces demanding intellectual, moral, political, economic and security challenges, concerning the mankind not missing the global ethical challenge and not getting drifted by the whirl of global (world) revolution. The global revolution comprising conflicts in different parts of the world is developing spontaneously, uncontrolled, as if having no internal connections and the resulting ideological basis.

Founding a state (sovereign or multinational) necessitates supressing state forming ambitions of a wide range of smaller nations and nationalities, or, handing over a portion of sovereignty for the benefit of the whole. The global scene is changing. It is no longer the theatre of international politics, focused on setting and securing borders dividing and providing the territory of legislative and executive sovereignty of each state, but is changing into global politics. That will eventually lead to global democracy providing the share and responsibility of national states, making up multinational social system, for the creation of new norms, traditions and culture, not supressing national norms, traditions or culture. It must be said that it also applies to the forming of EU - implementing the new order in Europe.

3. THE TRAINING OF THE SOLDIER OF THE SLOVAK REPUBLIC FOR THE 21ST CENTURY

The qualitative change in the security situation in Europe and the world and the process of full professionalization of armed forces will require from both armed forces and society the transformation of current military training, education from military activities only to the training of a soldier taking part in dealing with global problems.

We assume that the change of European security environment will have probably been

undermining the change of national armed forces up to 2020, when two crucial factors will have to be taken into consideration:

a) *The European Constitution*, which, since 1.12.2009, has been initiating the creation of EU institutions, as well as European armed forces. Their formation will not be instant, but will follow the gradual process of several phases:
   - the first phase, which, in fact, has already started and is marked by forming battle groups (2 to 3 countries) following quota principle (selection of agreed number of soldiers from the number of national armed forces),
   - the second phase will probably be marked by quota principle of contribution of individual EU member countries into European armed forces as well, but it will involve individuals whose appointment will be set and trained by EU,
   - the third phase will most likely be marked by doing away with the quota principle and the contribution into European armed forces will be conducted by recruitment of „Euro citizens" who will meet the given admission conditions for joining European armed forces and will be funded by the EU (national countries will contribute into security by set percentage of GDP).

b) *The existence of national countries with limited sovereignty* (voluntary handover of the portion of national sovereignty to the EU), which will have a substantial impact upon the quality and the totals of national armed forces. Those can be formed on:
   - professional basis, when the need of the integration of these forces with the police force, immigration and highway police as well as rescue and fire squads will arise. Such an integration of national armed forces will lead to the need to establish an integrated type of ministry – which might be the ministry of defence and security,
   - militia basis, established as militia or national guard,
   - the basis of active reserves.

Therefore, it will be necessary, at least until 2020, for the managements of EU member armed forces, as well as the management of the Armed Forces of the Slovak Republic, to develop and design a qualitatively new, compatible system of comprehensive, but also differentiated training of professional personnel of the following possible categories:

- *a professional soldier of European armed forces* (but not international), who will evolve from a national force soldier, but will not be trained or funded by a national state (funding of the training will be provided by means of EU member country contributions to defence),
- *a professional soldier of integrated national armed forces*, who will be trained and funded by the national state and will serve and be deployed to defence only within the territory of the national state,
- *a voluntary soldier* (a militia or national guard member, not active reserves), who will only enjoy the benefits of a national state and whose service and training will be unpaid and limited to the territory of a national state,
- *a member of active reserves*, who will be recruited from all the above mentioned categories of soldiers, especially from the category of professional personnel after having completed active service and been dismissed as reserves.

This system of comprehensive training of soldiers, being divided into particular categories, will necessitate further subdividing according to particular socio-professional groups, namely into the ones of training: *professional staff and NCOs, warrant officers, COs and generals.*

It is necessary to bear in mind the fact that providing the training of professional personnel should follow the individual phases of professionalism of an individual (preparation and development phase), as well as the phases of military unit life cycle (combat deployment training, combat deployment and rest and recuperation).

The newly created system of training of soldiers will have to be focused on two basic categories of soldiers in particular: *contracted professional soldiers* – so called military semi-professionals (military service up to 6 years), comprising the staff and NCOs and only exceptionally COs-specialists and *military professionals* (military service of over 10 years, which can be considered military career), comprising mainly career officers (military managers – commanders). Only in exceptional cases this category will comprise warrant officers and NCOs – highly specialised experts. This differentiation of armed forces personnel corresponds with the differentiation of armed forces into: the so called *professional core* (military professionals) and the *periphery* or *networks* (contract staff or outsourced services). [10]

The newly created system of soldier training for the 21st century is an integral part of military reform and the transfer of military education. It is aimed at improving the training of professional commander staff in particular (career officers) for the 21st century. The training of military professional personnel must therefore be in line with the growing complexity of conditions of military activity conduct, and the combat readiness of troops, as well. Apart from this, it must stem from the new understanding of the position and role of soldier training in the process of lifelong education of a citizen, not only in general, but also in a given society. It is based on the shift from traditional encyclopaedic, memorising and directive-matter education to the education providing creative humane education focusing on activity and personal responsibility and the power to create one´s own progressive and creative way of being in the new millennium.

The professionalism of armed forces [12] has involved and will involve higher demands on the quality of the training of military professionals, namely career officers. Military education facilities provide the most comprehensive and focused and the highest quality training. The high military authorities therefore are paying great attention to the transformation of military education currently. The new concept of training is being developed, capable of responding to challenges the armed forces face. [11 It must be in line with the concept of the reform and modernisation effort. Its objective is to promote the changes which will provide putting the training of military professionals in line with the trends in the development of military science and modern military thinking, and promote the process of the preparation of the EU armed forces to join NATO and the merge of national forces with the EU armed forces.

Military education [8], must provide the entry level training of military professionals, their lifelong education and also the training of citizens working in public and government administration in the areas of security, defence of the state. Great attention must be paid to the transformation of military education that will provide military-specialist training and general education of military personnel, which would be part of their lifelong education and would also make the core of socio-scientific research in the areas of military, security and defence.

The process of lifelong education in the information (learning) society is according to the international documents based on four fundamental pillars: 1. learning to learn, 2. learning to act, 3. learning to co-exist, and 4. learning to exist (to be). Lifelong education covers all areas of society and military. The views identifying with the education and value structure represent great danger of slowing the process of lifelong education in the military down. These views seriously hamper the career of military personnel and bear a strong

demotivation value. Ideally, education must be linked with an appointment, and a rank with the echelon of leadership.

Forming of military professionals must provide and develop not only their military-specialist skills, but also their general skills, unique for each member of a given society. Thus, two extremes must be avoided. *The first one* is a very narrow specialisation of military professionals to combat deployment (the example of units trained for mission deployment). *The second one* is the general training of military professionals just for a potential deterrence (so called peace service only). The most ideal model of a professional soldier in peace time would be a „uniformed citizen", who would be ready to meet the deterrence function immediately, and, having completed a short-term intensive specialised training, would be capable of combat deployment (mission). That applies to armed forces only. A professional soldier capable of combat deployment must be considered for multinational and international armed forces .

The main objective of comprehensive training of professional military personnel for the 21st century is developing effective subsystem of lifelong education, which alongside with the subsystem of military education will provide quality performance of military service of all categories of soldiers of both national and multinational forces and enable smooth and troublefree integration of a former soldier into society.

The implementation of the changes is not going to be easy, as it will lead to military education representing a modern educational, learning and training system, based on relatively independent, yet closely connected three echelons of soldier training. The three-echelon differentiation of military education is determined by its mission, objectives and the following set of tasks:

- *the primary area* will comprise training units aimed at training a professional soldier at the echelon of staff and NCOs (their entry and specialised training),
- *the secondary area* will comprise specialised NCO schools aimed at development training and the basic training of warrant officers and recruited COs ,
- *the tertiary area* will comprise a military college(university) aimed at implementing higher and career education of COs and warrant officers (exceptionally NCOs-experts), of mostly national armed forces.

It follows from the echelon based system of military education that the training of a soldier at particular echelons will be provided by the subjects of military education. Each of them will provide the education of the specific target group of specific area of study, education and training.

Experience has proved that the given innovation process in the area of training of professional soldiers is the process of constant and dynamic changes, that is why the main strategic concepts, objectives and the principles of the development of comprehensive professional military personnel (soldiers and staff) training must be developed. That means it is necessary to pay great attention to some social aspects of junior military professional training.

4. CONCLUSION

It follows from the above mentioned, that such an important change, as the transfer to fully professional armed forces is and which to a great extent alters the way of meeting the objective of defence function, brings about in all specific national armed forces, as well as the society itself, the change

in relation to a newly-created category of its members, professional soldiers

We draw from the fact that a military professional gets developed throughout the whole period of professional military service. But only the preparation phase offers the basic conditions to acquire the necessary qualities and skills of the military professional for the 21st century, which include the following:

- the ability of analytical and swift thinking, logical evaluation of the given combat situation., drawing justified conclusions and creative decision making,
- the ability to fulfil the tasks within crisis management and peace operations,
- good language skills,
- the ability to control one´s own activities and everyday activities of troops,
- readiness for managerial, personnel, educational and social work.

The fore-mentioned qualities make up only the basic conditions to create the potential necessary for armed forces to be able to face new security challenges (both military and non military) and be capable of common cooperation at national (armed forces along with other segments of security area), international (national armed forces along with other national armed forces or cooperation within a coalition) and also at the fore-mentioned multinational levels. In the transition of armed forces to fully professional ones, the symmetric efficiency of deployment of professional soldiers must be taken into account in every category. The system of military education, being the part of armed forces of the country in question, plays the crucial role in meeting this objective (providing the quality of human potential). Only the military education system understood in this way will provide not only the entry level training of a professional soldier, but also personal development into a military professional, as well as the reintegration into common life. It will provide the training and development of not only the military sector staff, but also civil and government administration personnel, dealing with national security, protection and defence issues.

REFERENCES

1. BAUMAN, Z.: *Globalizace. Důsledky pro člověka.* Praha: Mladá Fronta. 2000. ISBN 80-204-0817-7
2. BAUMAN, Z.: *Individualizovaná společnost.* Praha: Mladá Fronta. 2004. ISBN 80-204-1195-X
3. BECK, Urlich: *Riziková společnost.* Praha: SLON. 2002. ISBN 80-86429-32-6
4. BRZEZINSKI Zbigniew: *Volba – globální nadvláda nebo globální vedení*. Praha: Mladá Fronta. 2004.ISBN 80-204-1179-8
5. FRIEDMAN, G.: Nasledujúce desaťročie. Bratislava: IKAR a.s. 2011. ISBN 978-551-2625-8
6. GIDDENS, A.: Třetí cesta. Praha: Mladá fronta. 2011. ISBN 80-204-0906-8
7. IVANIČKA, K.: *Globalistika.* (Poznávanie a riešenie problémov súčasného sveta). Bratislava: Ekonómia. 2006. ISBN 80-8078-028-5
8. JANEČEK, V.; POLONSKÝ, D.; MATIS, J.; KMOŠENA, M.; TOMÍČEK, F. a KORČOKOVÁ, Z.: *Výkladový slovník základných pojmov z pedagogiky, psychológie a sociológie (pre potreby príslušníkov OS SR).* Bratislava: GŠ OS SR. 2007. ISBN 978-80-969362-1-2; KING, A. – SCHNEIDER, B.: *První globální revoluce.*. Bratislava: Československá asociace Římskeho klubu. Bradlo. 1991. ISBN 80-7127-048-2
9. MATIS, J.: Teoreticko-empirická analýza vybraných problémov sociálneho zabezpeč. profesionálnych vojakov Ozbrojených síl Slovenskej republiky. In: *Komplexné sociálne zabezpečenie vojenského profesionála (el. forma)*. L. Mikuláš: AOS, 2010 pp. 10 – 40. ISBN 978-80-8040-406-2
10. MATIS, J. – HAMAJ, P – MARTINSKÁ. M.: *Sociológia armády.* 1. vyd. L. Mikuláš: AOS, 2008. ISBN 978-80-8040-361-4
11. POLONSKÝ, D. a MATIS, J.: Profesionalizácia armády a príprava vojenských profesionálov. Liptovský Mikuláš. VA SNP. 1994
12. SOROS, G.: *Kríza globáneho kapitalizmu*. Bratislava: Kaligram. 1999. ISBN 80-7149-270-1
13. TOKÁROVÁ, A.: Globalizácia a jej sociálny rozmer. In: *Zborník referátov z vedeckej konferencie z medzinárodnou účasťou.* „Sociálna práca – ľudské práva – vzdelávanie dospelých“ Prešov: FF PU. 1998. ISBN 80-88885-49-3

14. TOKÁROVÁ, A.: Globalizovaný svet, kvalita života a vzdelanie. In: *Zborník z príspevkov z vedeckej konferencie z medzinárodnou účasťou.* „Kvalita ľudského života a ľudské práva v kontextoch sociálnej práce a vzdelávania dospelých" Prešov: FF PU. 2002. pp. 22 – 25. ISBN 80-8068-088-4
15. VOLNER, Š.: *Problémy bezpečnosti v 21. storočí.* B. Bystrica: Euroatlantické centrum. 2005. ISBN 80-969306-1-3
16. VOLNER, Š.: *Európska únia geopolitický aktér 21. storočia.* Hlohovec: Efekt Copy spol. s.r.o. 2006. ISBN 80-969573-9-2
17. ŠKVRNDA, F.: *Terorizmus najvýznamnejšia nevojenská bezpečnostná hrozba súčasnosti.* Bratislava: MO SR. 2002. ISBN 80-968855-2-9

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

PSYCHO-MOTIVATIONAL ASPECTS OF INMATES WITH A HISTORY OF DRUG USE

Ana Maria MUCIONIU, Florin Marian ANTONESCU

Giurgiu Prison, Romania

Abstract: *Drug use represents an important and complex problem for all of us. It signifies a hope or a challenge for youth, a serious problem for the family and an alarm signal for the society. Drug use takes often the form of an experience that brings together: curiosity, the desire to try something new or to experience everything, the desire to increase the intellectual performances, but many times this experience is associated with delinquent behaviors and criminal acts that lead to convictions. This theme tries to demonstrate that the specific activities carried out in prison under a careful guidance and observation have an important contribution to improve the self-esteem of the inmates with a history of drug abuse and to increase their motivation for change.*

Keywords: *drug addicts personality, inmates, motivation, social reintegration, prison*

1. PSYHCO-MOTIVATIONAL ASPECTS OF INMATES WITH A HISTORY OF DRUG USE

Drug addiction is a psycho-somatic state that results from the interaction of the individual with a specific psychoactive product, having as consequences behavior disorders and other reactions involving an invincible, permanent, continuous or periodic desire to use drugs to achieve certain psychological effects; it is a morbid habit of using repeated and increased doses of toxic substances; it is a pathological habit of consuming toxic substances (cocaine, morphine, opium etc.) that cause physical and mental degradation of the individual [5].

Drug addicts are often considered delinquents and some of them end up in prison for their criminal behavior. Without a specialized intervention throughout the entire period of sentence, the problems of these persons may exacerbate, having direct consequences on their subsequent evolution after their released from prison.

Among the predisposing factors of drug use are: the lack of parental attachment and affection; the loss of a parent at an early age; emotional and personality disorders; immaturity and psychological instability; alcohol consumption; a disorderly life; peer groups and drug using friends.

Although there is no well established personality profile of the drug addicts, however, it can be identified some common characteristics for this category of persons: emotional dependence; separation anxiety; isolation and anxiety felt in the relationships with others; intolerance on frustrations; depression; the need for love, approval, valorization; immediate satisfaction of desires; the lack of self-confidence and passivity; shyness and hyper-sensibility.

The feelings felt by the drug users are: shame towards the civil society and family; frustration; lack of hope; lack of motivation; fear of withdrawal; fear of refusing drug

dealers; insecurity; anxiety; panic; resignation in the face of imminent death (heroin users).

Behind the drug use are presented other evidence of psychological and mental deterioration: tattoos on different parts of the body, criminal record (often due to the theft), repeated failure or school dropout and run away from home, combined with serious health problems - hepatitis C or tuberculosis. These drug users are considered to be incurably sick people, weak of character, who create many problems to themselves, their families and to the society. They commit crimes and are sanctioned with prison.

From a psychological point of view, detention causes the modification of the characteristics of each element of personality.

In terms of typological approach, the offenders with a history of drug addiction can be classified in the group of difficult offenders [2] – they have difficulties in adapting to the rigors and deprivations of imprisonment, especially because of their personality in a strictly delineated physical environment but also, because of their mental problems caused by substance abuse.

In addition to the problem of adaptation to prison life (shock of first entrance in prison; perception of punishment and detention; prisonization phenomenon; prison hierarchy and social status; aggression and violence; territoriality; frustration; stress; self-mutilations; denial of food; tattoos; suicide; homosexuality etc.), the inmates with a history of drug use may develop other psychiatric disorders due to the withdrawal symptoms: violent anxiety crises; fever; tremors; impaired perceptions; psycho-motor agitation; hallucinations; insomnia etc. All these problems require special examinations and specialized interventions.

The programs provided to the inmates with a history of drug use consist in activities of information, education, communication, awareness, skills developing etc.

The prevention measures are disposed according to the specificity of the place of detention and are carried out by the prison staff in collaboration with C.P.E.C.A, services of victim protection and social reintegration of offenders, other public services, associations, NGOs, international organizations.

The programs offered to drug users are conducted by the personnel who provide medical, psychological and social assistance in prison, with initial or continuous training in the drug field.

The period of time spent in detention is not a “break” in the evolution of the individual. It is and must be a preparation stage for returning to the society of these persons who have committed crimes. It is focused on forming and developing those skills, attitudes and abilities that will facilitate the ex-inmates social reintegration after they are released from prison.

Education represents the most important means by which can be limited the negative consequences of isolation from community and can be encouraged all those persons who want to change their behavior and to abandon their criminal career, by providing utility to the time spent in prison, by identifying and stimulating the positive potential and by raising awareness about the new opportunities that they can benefit.

The activities carried out by the specialists from the Educational and Psychosocial Assistance Service – educators, psychologists, social workers, orthodox priest – are significant and varied, including both the activities carried out inside prison and the educational activities conducted in the community.

1. **School activity** – is integrated into the national educational system, so that after release from prison, the persons with a low educational level can perform their studies without any difficulty.

2. **Vocational training courses** – organized in collaboration with AJOFM in jobs required on the labor market, according to the collaboration protocol signed by A.N.O.F.M. and A.N.P.

3. **Educational programs and of social competences development** – literacy, education for a healthy life, preparation for release, education for a democratic society, civic education, human and child rights, forming the abilities for everyday life, improving the level of general culture,

literature circles, courses of foreign languages, moral-religious education, introduction to computer use.

4. **Programs for psycho-behavior balancing and optimizing** – the management of conflicts, the reduction of aggressive behavior, the optimization of communication and interpersonal relationships skills, support therapies for those with a history of drug addiction.

5. **Programs and artistic and sport-recreational activities** – music, poetry, dance, theatre, mime, circles of painting, graphics and drawing, occupational workshops, sports (football, basketball, athletics, fitness, table tennis, chess, rummy, sport competitions).

6. **Activities carried out in the community –** viewing films and theatre spectacles, performing theatre, music and poetry spectacles, visiting locations with cultural, historical and religious significance, visiting institutions that provide social assistance to persons who are in difficulty.

7. **Educational and institutional partnerships** signed with institutions, NGOs, foundations, humanitarian associations involved in informal and formal education of youth.

8. **Ongoing educational projects, externally, non-reimbursable financed,** having as main objective the facilitation of social reintegration of inmates.

9. **Educational and psychosocial interventions carried out with the community participation** – interaction and communication of inmates with outside world consists in programs of maintenance, improvement, encouragement and development of social relationships.

Also, **wor**k is one of the most important activities during the time spent in prison to which the detainees with a history of drug use and abuse can participate.

These activities that were mentioned before can be considered as being a powerful motivator because they produce changes at different levels of personality: behavioral, attitudinal, cognitive, volitional and social.

Motivation for change is seen as a crucial factor in any form of therapy. The motivational interview is a technique that allows the subject to recognize the problems that he/she has and to determine him/her to enter into a certain form of treatment, to continue the treatment and to be compliant with it.

The therapy of motivational increase is based on the principles of motivational psychology and it was built to induce a motivational change so that the person can abandon the drug use model, using the necessary strategies to mobilize his/she resources.

Another root of the therapy of motivational increase is the study of natural or spontaneous recovery process, knowing the fact that there are cases in which the drug addicts become abstinent for a long time without any therapy or external intervention. Prochaska and DiClemente [6] have showed that at the base of this process is a chain of changes in the motivation of the subject for change. They have described **6 different stages of change**:

1. subjects who did not take into account anything to change at themselves are in the **pre-contemplation stage**;

2. while those who are thinking that they should change, that they have a problem and how easy it will be or how much it will cost them this change are in the **contemplation stage**;

3. when these latter individuals decide to change, they are in the **determination stage**;

4. and when they start to change their behavior, they go through the **action stage**, where there are many negotiations with themselves and the environment;

5. if they succeed, they enter into the **maintenance stage** of behavior change or of the support of this new behavior;

6. if these efforts have failed, the subjects enter into the **relapse stage** and they can restart a new cycle, a new process of change.

Although many subjects leave this cycle in different phases or relapse, it is important to know that many of them repeat the cycle and some succeed to end it without relapse. As Prochaska and DiClemente have mentioned, the therapy of motivational increase aims to move the client from the pre-contemplation stage, by passing him/her through the ambivalence of the contemplation stage and bring him/her in the stage of decision and commitment for change.

The main objectives of the therapy of motivational increase are:

- the subject to realize how serious is the problem of addiction for him/her and how it affects him/her, both positive and negative; this balance is essential for the subject to pass from contemplation to determination;

- determining the subject being in the contemplation stage to assess the possibilities and the cost/benefit balance of change. This means that he/she must evaluate if he/she is able to change himself/herself and how this change will reflect upon his/her further life.

2. CONCLUSIONS

After correlation the theoretical data and the practical ones obtained through the direct observation and anamnesis interview, can be outline several concluding findings:

1. the inmates with a history of drug use, incarcerated for the first time have problems of adapting at the beginning of the execution of punishment, problems reflected at behavioral level (misbehaviors) and at their personality profile (psycho-affective disorders). These problems may increase if the detainees did not participate or have not been included in different activities carried out in prison, this fact being achieved only after a rigorous assessment from an educational, social, psychological and medical point of view and after drawing an individualized plan of education and specific intervention that will be fulfilled throughout the entire time spent in prison;

2. in many cases the motivational structure is affected: due to consumption and due to the status of convicted person, and this fact cannot be treated from itself, but only with the involvement and the participation of the inmates to the activities carried out in prison (educational, psychosocial, school, vocational training, work, recreational) and under the supervision of the specialists involved in the social reintegration process (educators, psychologists, social workers, doctors).

3. it has been observed an improvement of self-image and an increase of motivational level of those inmates who have a history of drug addiction, who are included and participate to activities. This supports the conclusion that the specialized intervention carried out in prison is necessary for this category of inmates, because the detainees with a history of drug addiction are labeled twice in comparison with other detainees – once as drug addicts and once as convicted persons. Thus, working with these persons during their sentence is double – once to reduce the effects of addictive behavior and to prevent relapse after the detainees are released from prison and once to identify, develop and use those skills, competences and abilities to prevent recidivism;

4. to undertake an appropriate individualized plan of evaluation and educational and therapeutically intervention is desirable to consider not only the personality structure of the persons with a history of drug abuse, but also three aspects related to the motivational level of these persons: offending motivation, motivation for change and motivation or willingness of being involved in the activities carried out in prison;

5. it has been observed that the primary or physiological needs and the security ones are considered as necessary both for prisoners with a history of drug use who are at the beginning at their sentence and for those who have already served a fraction of their

punishment and who have participated to different activities, the latter ones offering more importance to the social needs. When it comes to the needs that are in the top of the Maslow pyramid – higher needs – the inmates with a history of drug use who have participated to different activities in prison pay special attention to self-esteem and consideration;

6. regarding the motivation for participation to the activities conducted in prison, the detainees with a history of drug addiction who have attended such activities have quite high level of intrinsic motivation (the desire to participate to reintegration activities/work in order to learn/to feel useful, to have a positive opinion about themselves, the desire for social contacts, status within the group, communication with others), while the detainees with a history of drug addiction who are in the observation-quarantine period confer a particular importance to the extrinsic motivation (earning days, rewards etc.) and to the economic motivation (pay for the work done in prison);

7. also, it has been observed an improvement of the personality structure of those persons with a history of drug addiction who were included and participated to the activities conducted in prison.

In conclusion, the motivational level of the inmates with a history of drug dependence who participate to different social reintegration or working activities during the time spent in prison is considerably improved and through the increase of their motivational level, their self-image improves, the recidivism chances are diminished and the chances of not relapsing into drug abuse after they are released from prison are increasing.

But all these measures and specialized interventions conducted in prison should be supported and continued by other psychosocial measures, provided to the inmates after they are released from prison by different institutions and organizations involved in the social reintegration process of persons with a history of drug addiction who have served a custodial penalty.

REFERENCES

1. Abraham, P. – *Capcana drogurilor*, Ed. Detectiv, Bucharest, 2005;
2. Butoi, T. şi I.T. – *Tratat universitar de psihologie judiciară – teorie şi practică,* Ed. PHOBOS, Bucharest, 2003;
3. Dragomirescu, V. – *Psihosociologia comportamentului deviant,* Ed. Ştiinţă şi Tehnică, Bucharest, 1976;
4. Florian, Ghe. – *Psihologie penitenciară,* Ed. OSCAR PRINT, Bucureşti, 1996;
5. Predescu, V. – *Psihiatrie,* Ed. Medicală, volumul I şi II, Bucharest, 1989-1997;
6. Prochaska J.O., DiClemente C.C. – *Toward a comprehensive model of change, in WR Miller & N Heather (Eds.) Treating Addictive Behaviors: Process of Change*, Plenum Press, New York 1986.

Panel 2. Educational Psychology, Counselling and Vocational School
Clinical Psychology and psychotherapy
Communication sciences

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

TOWARDS POSITIVE INTERPERSONAL RELATIONSHIPS IN THE CLASSROOM

Adina BABONEA*, Ana MUNTEANU*

*Faculty of Legal and Administrative Sciences, Brasov, 'Spiru Haret' University, Romania

Abstract: *Our paper looks at the basis of every interpersonal relationship: communication. It is an important form of interpersonal interaction and its forms can really help teachers improve their teaching style, strengthening the bound between them and their students. A positive interaction is essential for a good teacher-student(s) relationship. And, last but not least, the goal of our paper is to help teachers become acquainted with the importance of establishing and maintaining a positive professional interpersonal relationship in their classrooms with the help of verbal, para-verbal and non-verbal communication.*

Keywords: *communication, interpersonal relationship, interaction, teaching*

1. INTRODUCTION

A person can be approached scientifically in two ways: substantially and relationally. The former approach looks at the person from a structural point of view; the latter tries to answer such questions as: 'How does a person behave in a certain social situation?', 'Can a person influence the people around him?' and 'Can that person be influenced by the people around him?' There is a considerable body of research literature that answers these questions so we will just underline some important aspects related to the art of teaching.

In the environment of the classroom the interpersonal relationship between teacher and students is an important element contributing to the students' learning process. We look at communication as the most important form of interpersonal interaction. Communicating, through all its forms, teachers can improve their teaching styles, thing that will help create a positive interaction.

The establishment of common ground between teachers and students is a fundamental component for a good and, why not, a lasting interpersonal relationship. Trust and transparency are essential in any relationship, so all the individuals found together in a classroom, sharing similar interests, i.e. learning, passing an exam, acquiring new things, should try trusting and respecting each other in order to avoid misunderstandings and conflicts, aiming at having a nice, relaxed atmosphere during their classes. Teachers are extremely important in this process, as a significant body of research indicates that academic achievement and students' behavior are influenced by the quality of the teacher-student relationship. It is said that students prefer teachers who are warm and friendly. But do teachers (who are human beings living in a more and more demanding and stressful society) know how to be warm in the classroom?

2. POSITIVE INTERPERSONAL RELATIONSHIPS THROUGH EFFECTIVE COMMUNICATION

2.1 The interpersonal relationship. Pantelimon Golu defined interpersonal relationship as a 'conscious, direct, psychic union, based on a complex reverse connection – union comprising at least two people' [3]. Moreover, interpersonal relationship refers to a strong association between people sharing common interests and goals. Constantin Noica [4] noted that the interpersonal act is not limited to the emotional attraction-repulsion dimension. It is always a mixture of perceptions, sympathetic and communicative acts.

2.2 Communication, a form of interpersonal interaction. Interpersonal relationship is a process mediated by communication. Communication is the main manifestation of the psychosocial interaction, because all the interpersonal effects (perceptive, sympathetic or functional) are transmitted through communication. The essential element of the message is attracting the receiver's attention to the reference object and its characteristics.

Teachers communicate during their classes. They need a good preparation in order to send correct, up-to-date messages. This would be intentional communication. But the preparation should be doubled by an adequate way of expressing ideas, thoughts, and feelings. Non-verbal and sometimes non-intentional communication is also important, although the message is received unconsciously. The presentation skills should be continually improved as we think of them as a key medium through which learning occurs. Teachers must learn to be aware of not only *what* content they are delivering, but also *how* they are delivering it.

2.2.1 Verbal communication. To enhance communication of materials, teachers must skilfully incorporate a variety of delivery skills, both verbal and nonverbal.

Verbal communication refers to the use of sounds and language to relay a message. It serves as a vehicle for expressing wishes, ideas and concepts and it is vital to the processes of learning and teaching. Interpersonal communication refers to a two-way exchange that involves both talking and listening. It is essential to help forming bonds and building relationships between teachers and their students.

Through verbal language, individuals draw attention to themselves, influence and get influenced. Interinfluencing vary according to the degree of intensity. Taking into account this report, P. Golu states the existence of three forms of communication: simple verbal communication, persuasion and suggestion [3]. All of them should be used by teachers during their classes in order to establish a good interpersonal relationship and influence positively the students' academic achievements.

2.2.2 Para-verbal communication. In this case the message is not transmitted through words, but could not get to the listeners without speaking. According to some authors, the 'para-verbal subsystem' consists of the following elements: the intonation, the volume of voice; the intensity of voice; the tone of voice; the speech rate [1].

A really important element of the verbal communication and one of teachers' greatest tools is the voice. An effective speaking voice has the following characteristics: pleasant, natural, dynamic, expressive, and easily heard.

A pleasant voice is easy to listen to over extended periods of time. It is very important while teaching one-on-one or in small groups.

A natural voice reflects your true personality and sincerity. Combined with a natural rhythm – not too fast, not too slow – it becomes an important commodity.

A dynamic voice is helpful for speaking in front of large groups. It gives the impression of force and strength, even when it is not especially loud.

An expressive voice never sounds monotonous or emotionless.

An easily heard voice projects the proper volume for the size of the group to whom you are speaking.

An effective speaking voice can be obtained by practice (again, practice makes perfect) and should be one of the main goals of any teacher who wants to establish a good

relationship with his/her students. A 'new voice', more resistant, melodic and convincing is a tool that facilitates communication between human beings as it is derived from a better self-control [2].

2.2.3 Non-verbal communication. Although verbal communication is a primary means of expression, non-verbal actions such as body language can greatly affect the way a message is perceived.

Non-verbal communication uses as tools physical appearance, facial expression and gesture, which give nuances to the message and helps people to express themselves.

Teachers cannot prevent sending nonverbal messages during their classes, but they certainly can learn to manage and control them. Nonverbal delivery skills can be further described as: posture, hand gestures, body movements, facial expressions, and eye contact.

The posture reflects people's attitude. It lets the listeners know if those persons, the teachers in our case, are confident, alert, enthusiastic, and in command of themselves and their course.

A hand gesture is a specific movement that reinforces a verbal message or conveys a particular thought or emotion. Teachers should not use too many hand gestures, but if they use them, they should make sure that their gestures are pleasing and convincing, smooth and well timed.

Body movements should be treated with care because changing the position or physical location while presenting information communicates a message, whether one likes it or not. Teachers have to consider the impact of their movements if they are used to moving all around the room or juggling their weight from one foot to the other. Students may be watching their movements instead of listening to their words, so it may be better for the teachers to make a concentrated effort to change their habit.

Students usually watch their teacher's face during the course, waiting for a confident, friendly and sincere facial expression. This would help them feeling better, wanting to establish a rapport.

What teachers say can create (or destroy) rapport, but that is only about seven percent of communication. Body language and tone of voice are more important. People who are in rapport tend to mirror and match each other in posture, gesture and eye contact. The deeper the rapport, the closer the match will tend to be, meaning the interpersonal relationships will be better.

Eye contact helps teachers establish rapport with their students. Effective eye contact means focusing your eyes for a few seconds on individual participants throughout the course, building person-to-person relationships with them. Monitoring the visual feedback, teachers can gauge the group's reactions to what they say and adjust their presentation accordingly.

If people have rapport with each other, they have a relationship in which they have a special ability to understand each other's feelings and points of view. To create rapport, teachers should join their students' 'dance' by matching their body language sensitively and with respect. This builds a bridge between them and their model of the world. But this matching should be mimicry. A teacher can very well match his students' arm movements by small hand movements and their body movements by head movements.

A satisfactory rapport means good communication and a positive relationship. Earlier studies investigating the associations between interpersonal relationships and students' results have shown that positive, enjoyable and pleasant teacher-student relationships are more effective for students'

achievement and attitudes than indifference or bad relationships. Ryan and Grolnick found that students who perceived their teachers as personally positive and supportive were more likely to feel a greater sense of competence and to be more intrinsically motivated [5].

3. CONCLUSIONS

The conscious union, the interpersonal relationship based on common interests and goals between teachers and their students is an important element really contributing to the students' process of acquisition and their ability to pass examinations.

Successful teachers create rapport and rapport creates trust, which is a key element to having good interpersonal relationships in the classroom.

Communication is an important form of interpersonal interaction and its forms can really help teachers improve their teaching style, strengthening the bound between them and their students. A positive interaction is essential for a good teacher-student relationship, which facilitates students' efficient work and their good academic results.

REFERENCES

1. Andrei, P., Alexandrescu F. *Personalitate şi comunicare. Tactici de influenţă interpersonală.* Bucureşti: Licorna Publishing House (1999).
2. Cegolea, G. *Vox Mentis. Ghid practic pentru cântat şi vorbit.* Bucureşti: Europa Nova Publishing House and Armonia Publishing House (1995).
3. Golu, P. *Psihologie socială*. Bucureşti: Didactic and Pedagogic Publishing House (1974).
4. Noica, C. Interpretare la *Lysis*. In Platon, *Opere*, vol. II, Bucureşti: Scientific and Encyclopedic Publishing House (1976), p. 165-212.
5. Ryan, R. M., Grolnick, W. S. Origin and pawns in the classroom: Self-report and projective assessments of individual differences in children's perceptions. *Journal of Personality and Social Psychology*. 50 (1986), p. 550-558.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

THE EFFICIENCY OF A TRAINING PROGRAM ON REDUCING CAREER DECISION-MAKING DIFFICULTIES

Delia BIRLE*, Elena BONCHIS*, Daniela ROMAN*, Daniela CRISAN*

*Psychology Department, University of Oradea, Oradea, Romania

Abstract: *This study's objective is to analyze the effect of career development training on career decision-making difficulties. 138 participants (high-school students, XII grade) were included, thus: 63 within the control group, 51 within the experimental group, and 24 within the placebo group. The training took place during a 10-week period, and it intended to increase the decision-making capacity regarding future career. The level of difficulties was assessed with the CDDQ – Career Decision-Making Difficulties Questionnaire (Gati & Osipow, 2000, 2002) – which was validated on Romanian population. Results show there are significant differences in posttest between the three samples, as follows: for global difficulties regarding career decision (f=.405), for difficulties caused by the lack of information (f=.405), and for difficulties caused by inconsistent information (f=.405). As the results have shown, the global level of difficulties regarding career decision-making had dropped significantly from pretest to posttest within the experimental group, and it maintained constant in follow-up. The results obtained within this study point out the importance of modular interventions in career development on high-school students. It has been ascertained that interventions of this kind are likely to have an indirect impact on reducing perceived difficulties related to the process of future career decision.*

Keywords: *career decision-making difficulties, training efficiency, career development*

1. INTRODUCTION

Career counseling is a lifelong, complex, and sinuous process. Career counseling activities, in its direct, organized and planned form, are implemented in schools, centers, private practices or within public institutions that work with adolescents looking for a career, with fresh graduates who are looking for a job, with individuals wanting professional reconversion, with unemployed individuals who want to re-enter the labor market, or with retired individuals who wish to remain professionally active. Among reform measures implemented in Romania in the past few years, career counseling and orientation was constantly taken into consideration by educational policies, and was introduced in the national education plan as a distinct curricular area, starting with the school year 1998-1999. The information is based on the M.E.N. Law no. 3207 from 02.03.1999 regarding the implementation of the new educational plan for the primary, secondary, and high-school cycles, starting with the school year 1999-2000. There is a series of legal documents that confirm the preoccupation for implementing in the educational area of objectives related to school guidance for children and young adults, before 1998.

The necessity for career guidance is due to the following factors:

- the increased complexity of society's occupational and organizational structure, which makes it more difficult to gather,

assimilate, and organize information necessary for career decision-making;
- rapid technological development, which requires adaptability, flexibility, and open-mindedness;
- the nation-wide increased interest in the improvement and using of every individual's potential;
- the keen seeking for values which give life a meaning;
- the need for special training in order to obtain a better job;
- the disillusion lived by some young individuals with educational difficulties, and by adults forced to adapt to the new conditions dictated by a changing society (Jigau, 2001)

2. Career decision-making difficulties

2.1 The interest in the research of career decision-making difficulties issue. The large number of individuals confronted with a variety of difficulties in their struggle to choose a profession, emphasizes the utility of studying the decision and the factors of indecision regarding the choice of future profession or career. The words "career indecision" are used to express the problems that may occur during career decision-making process.

The decision regarding future career is a complex process. Some theorists include it in the "situations of crucial importance" category. It represents the process of choosing one alternative from the multitude of alternatives available at a given moment.

Gati and his colleagues (1996) have developed and studied empirically a theory-based taxonomy of the career decision-making difficulties. This category of difficulties has been defined as a set of deviations, deflections from what could be called "the ideal career decision", that a person who is aware of the necessity of a decision on this matter, has the willingness to proceed with it, and is capable of choosing the right alternative (based on an adequate process, compatible with individual's interests and resources) could make. Any variation from this ideal model is seen as a potential difficulty that could affect the decision process regarding future career in one or two ways: the individual backs off from making any decision at the given moment, or he/she fails to make the optimum decision.

The classification includes three main categories, each category consisting of other difficulties, and thus, totalizing 10 specific categories (Gati and colab., 1996). The first main category, *difficulties regarding the lack of readiness*, includes three specific categories of difficulties that may occur before the actual decision process: (a) the lack of motivation for career decision, (b) general indecision that affects all kinds of decisions, and (c) dysfunctional beliefs, including irrational expectancies regarding career decision-making process.

The other two main categories of difficulties, *lack of information* and *inconsistent information*, include categories of difficulties that may occur along the actual decision process. The *lack of information* includes four specific categories: (a) the absence of knowledge about the steps involved in the process, (b) the lack of information about oneself, (c) the lack of information regarding possible alternatives, and (d) the absence of knowledge about additional sources of information. The third main category, *inconsistent information*, includes three specific categories of difficulties concerning the exploitation of information: (a) uncertain information (difficulties involving uncertain or contradictory information), (b) internal conflicts (struggles due to contradictory preferences or to the need for compromise), and (c) external conflicts (concerning the influence of significant others).

Regarding the differences due to participants' gender (Gati and Saka, 2001, in Tien, 2005), they indicated that high-school boys have greater difficulties than girls on *external conflicts* and *dysfunctional beliefs*. Tien (2005), obtained, on a Taiwanese sample (188 boys and 329 girls), significant differences between boys and girls for *lack of motivation* ($F(10, 468)=5.83$, $p<.05$, within the *difficulties caused by lack of readiness* subscale), but he didn't find any significant differences for the other subscales.

Singaravelu and his colleagues (2005) have also shown that there are no significant differences between girls and boys regarding the level of career difficulties. Literature (Leong, 1995 in Singaravelu and collab., 2005) indicates that traditional female role characteristics are constantly changing, meaning that graduating from school becomes important not only for males, but for females, too.

Creed, Patton, and Prideaux (2006) haven't obtained statistically significant differences by gender for career indecision, either. Within another study, Lapan, R. T., Hinkelma, J. M., Adams, A., Turner, S. (1999) have examined the latent factors that narrow down the career options for adolescents with rural provenience. They have shown that parental support regarding the choice of occupations within the realistic and investigative areas is perceived differently by boys and girls. Tien (2005) has obtained, in his study, statistically significant differences by factor "level of education" (or the decision stage), for four out of ten subscales within the original version of Career Decision-making Difficulties Questionnaire (CDDQ): dysfunctional thoughts, internal conflicts, external conflicts, and ways of gathering additional information. These results indicate that career decision-making difficulties caused by dysfunctional thoughts, conflicting conditions, and means of gathering information are several concerns for individuals both of different age groups or on different stages of career decision-making process. Kleiman, T., Gati, I., Peterson, G., Sampson, J., Reardon, R., Lenz, J. (2004) are citing Gati's, Saka's and Krausz's (2001) study by which individuals on early stages show higher levels of difficulties regarding future career, compared to individuals on the final stages of decision process. Analogue, those with higher level of decision difficulties regarding future career also show a higher degree of dysfunctional thinking related to choosing a career.

Tinsley, H. E. A., Tinsley, D. J., Rushing, J. (2002) state, as an outcome of the analysis of results from studies conducted by Fretz, 1981; Kivlighan, 1990; Lunneborg, 1983; Oliver & Spokane, 1988; Phillips, 1992; Rounds & Tinsley, 1984; Spokane & Oliver, 1983; Tinsley, Benton, & Rollins, 1984; Tinsley, Tokar, & Helwig, 1994, that a series of research studies backs up the idea that both individual and group career counseling are efficient. Oliver and Spokane (1988, in Tinsley, H. E. A., Tinsley, D. J., Rushing, J. 2002) have performed a meta-analysis regarding the efficiency of career counseling, and obtained an effect size of 2.05 for group career counseling, of 0.76 for test interpretations for groups of subjects, of 0.75 for career workshops, and of 0.74 for the individual career counseling.

Some theorists have postulated the idea that individuals with different decision styles (or different psychological typology) would respond differently to career counseling interventions (Harren, 1979; Johnson, 1978; Myers & McCaulley, 1985, in Tinsley, H. E. A., Tinsley, D. J., Rushing, J. 2002), but no researcher has yet approached this matter.

3. Method

3.1 Participants. In the study were included 138 participants, high-school senior year, age 18 to 19 years old, distributed within three groups: the control group, consisting of 63 students, the experimental group, with 51 students, and the placebo group, of 24 students. The students came from three different high-school from Bihor county, and

they took part in the study on a voluntary basis.

3.2 Instruments. *Career Decision-Making Difficulties Questionnaire* is a relatively new instrument, and it is based on the taxonomy of career decision-making difficulties.

It consists of 34 items, plus 3 additional items; the first additional item requires the participant to specify if he/she has already made a decision regarding future career, the second additional item regards participant's certainty that he/she has made the right decision (these two additional items are presented before the 34 items of the actual questionnaire), and the third additional item, which is presented at the end of the actual questionnaire, assesses participant's perceived level of difficulties regarding future career decision process.

Each of the 34 items refers to a certain difficulty regarding career decision-making process (ex. *I find it hard to make a decision regarding my future career, because I'm not aware of the steps involved*); the answer is given on a 9 point Likert-type scale, going from 1 (not at all like me) to 9 (very much like me).

The scale was adapted on Romanian population in a research study conducted by Birle (PhD thesis, in press).

3.3. Procedure. The instruments were applied in the classroom, anonymously, and based on an informed consent. During a period of 10 weeks, the students took part in a career development training program that aimed areas like self-evaluation, occupational information, career goals, and problem planning and solving, areas chosen based on career maturity theory and career decision-making self-efficacy theory (Betz and Taylor, 2001). Two activities were allocated to each topic. The placebo group also participated on a 10-week training program, on *Conflicts and communication*. Same questionnaire was applied in posttest and follow-up, in order to verify intervention's efficiency for the three groups within the study.

4. Results and discussion

The scoring for CDDQ items was made according to the results from the validation on Romanian population study, being preferred, as a result of CFA, the three subscales version, thus: difficulties caused by lack of information subscale, difficulties caused by inconsistent information subscale, and difficulties caused by lack of readiness subscale.

In pretest, all three groups presented homogeneous scores for all CDDQ subscales and for the global score, when compared with one-way ANOVA.

In posttest, the following results were obtained:

Table 1. Means and standard deviations for CDDQ scores in posttest

Scale	Group	N	Mean	S.D.
CDDQ (global score)	control	63	137.42	43.62
	experimental	51	102.27	31.93
	placebo	24	135.04	47.74
	Total	138	124.02	43.54
CDDQ inconsistent information	control	63	46.41	17.74
	experimental	51	31.86	14.01
	placebo	24	47.25	21.33
	Total	138	41.18	18.49
CDDQ lack of information	control	63	61.30	24.22
	experimental	51	40.90	16.45
	placebo	24	56.45	28.97
	Total	138	52.92	24.36
CDDQ lack of readiness	control	63	23.47	8.43
	experimental	51	22.47	8.21
	placebo	24	23.12	8.37
	Total	138	23.04	8.29

The one-way analysis of variance indicates significant differences between samples in posttest, for *global difficulties regarding career decision-making*, for *difficulties caused by lack of information*, and for *difficulties caused by inconsistent information*. The three statistical analyses show medium effect sizes (for global score, f=.405, for inconsistent information and for lack of information f=.403). Although there are no significant differences between the three samples for *difficulties caused by lack of readiness* in posttest, for the experimental group, the mean has dropped with approximately 3 point from pretest.

Games-Howell post hoc test indicates significantly more difficulties for the control group compared to the experimental group for CDDQ global score (d=0.944), and the placebo group has significantly more difficulties in posttest than the experimental group (d=0.545); Hochberg GT2 post hoc test indicates statistically significant differences between the control and experimental groups, for *inconsistent information* (d=0.928). Likewise, the placebo group has significantly more difficulties caused by *inconsistent information* (d=0.577), compared to the experimental group. The values of Hochberg GT2 post hoc test for *difficulties caused by lack of information* faced by subjects in posttest, has associated a significance value of p=0.001 and an effect size d=1.033, for the comparison of experimental and control groups. The differences between the three samples remain strongly significant in follow-up, with medium effect sizes for CDDQ global score (f=.468), for difficulties caused by inconsistent information (f=.426), and for difficulties caused by lack of information (f=.486). There are no statistically significant differences for difficulties caused by lack of readiness.

On ANOVA repeated measures, intra-group comparisons, important size effects were obtained for the experimental group, thus: for CDDQ global score part η^2= .670, for difficulties caused by inconsistent information part η^2= .637, for difficulties caused by lack of information part η^2= .516, and for difficulties caused by lack of readiness part η^2= .401.

As the results indicate, the global level of career decision-making difficulties has reduced significantly from pretest to posttest within the experimental group, and it maintained constant in follow up. The same pattern is observed for CDDQ subscales, meaning for difficulties caused by lack of readiness, by lack of information, or by inconsistent information.

The difficulties caused by lack of readiness were significantly fewer within the experimental group, and they kept constant in follow-up. The most important effect size (part η^2=.704) has been found for the first contrast, between pretest and posttest to be exact, for difficulties caused by inconsistent information. The difficulties caused by lack of information have reduced significantly within the experimental group, as a result of the intervention, and they kept at the same level in follow-up. Regarding the placebo and the control groups, there are no significant changes in the level of difficulties caused by lack of information.

5. CONCLUSIONS

This study puts forward an intervention model that hopes to increase senior year high-school students' confidence in their capacity of making the right decisions regarding their future profession, and to reduce the level of difficulties associated to the same decision process, as well.

Results sustain the efficiency of this training program, on the condition of a thorough experimental control – experimental group, placebo group, and control group, with three evaluation moments – pretesting, post-testing, and follow-up; because we wanted to generalize the efficiency of the training, we used classes of students with multiple educational profiles. Living in the century of speed and information, we consider the transposing of the training in a computerized, more interactive version, as future research heading, to be practical and of use to students, teachers, school counselors, and parents.

Acknowledgements
This study was conducted with the support of CNCSIS, by the research grant PN II Idei 666/2009

REFERENCES

1. Betz, N., E., Taylor, K., M., (2001). *Manual for the Career Decision Self-Efficacy Scale – Short Form,* Dep. Of Psychology, The Ohio State University.
2. Creed, P., Patton, W., Prideaux, L. (2006). Causal Relationship Between Career Indecision and Career Decision-Making Self-Efficacy: A Longitudinal Cross-Lagged Analysis. *Journal of Career Development, 33,* 47-65.
3. Gati, I., Krausz, M., Osipow, S., (1996). A taxonomy of difficulties in career decision making. *Journal of Counseling Psychology, 43,* 510-526.
4. Jigău, M., (2001). *Consilierea carierei.* Sigma, Bucureşti.
5. Kleiman, T., Gati, I., Peterson, G., Sampson, J., Reardon, R., Lenz, J., (2004). Dysfunctional Thinking and Difficulties in Career Decision Making. *Journal of Career Assessment. 12*, 312-333.
6. Lapan, R. T., Hinkelman, J, M., Adams, A., Turner S. (1999). Understanding Rural Adolescents' Interests, Values, and Efficacy Expectations. *Journal of Career Development, 26,* 107-136.
7. Singaravelu, H., White, L., Bringaze, T. (2005). Factors influencing international students' career choice: a comparative study, *Journal of Career Development*, 32, 46-59.
8. Tien, S. H., (2001). Career Decision-Making Difficulties perceived by college students in Taiwan. *Bulletin of Educational Psychology*, *33*(1), 87-98.
9. Tinsley, H. E. A., Tinsley, D. J., Rushing, J. (2002). Psychological Type, Decision-Making Style, and Reactions to Structured Career Interventions. *Journal of Career Assessment. 10,* 258-282.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

MILITARY PSYCHOLOGICAL STUDIES IN ROMANIA IN THE EARLY TWENTIETH CENTURY: THE MAIN MOMENTS

Eugenia BÎRLEA

Library of the Romanian Academy, Cluj-Napoca Branch

Abstract: Psychology made its official entry into the curriculum of the Superior School of War only in 1909, and on the level of Officer and Sub-Officer Schools, the role of these sciences of education was even more modest, concerns of military psychology are precursory to this stage. In 1902 the Romanian army doctor Marcu Câmpeanu published in Paris a work entitled *Essai de psychologie militaire individuelle et colective*, with a glorious preface by Théodule Ribot. The book knew several translations: in the USA, Bulgaria, Serbia, Russia, Italy etc. and was awarded a prize from the Romanian Academy.

In 1922 Dumitru Caracostea, an important teacher of literature, critic and folklorist during the Interbellum, published *The Psychological Aspect of War*, as a result of his teaching activity at the Superior School of War, between 1919-1922. While Marcu Câmpeanu's work was an application to the military environment of the theories enunciated by the famous theorist of crowd psychology, Gustave Le Bon, Dumitru Caracostea elaborated his study from an obvious interdisciplinary perspective of a rural world and country folklore connoisseur, integrating the dramatic experience of war, which his students at the School of War made available for him under the form of war memoirs written at his request.

Key words: *military psychology, Romania, the beginning of the 20th century, Marcu Câmpeanu, Dumitru Caracostea*

We believe we can talk about quite an early interest displayed by Romanians towards psychology in general and social psychology, considering the publishing period of the first studies. Already in 1895 Nicolae D. Xenopol, brother of historian A. D. Xenopol, published in the series *Conferences of the Romanian Athenaeum* the study called *Crowd psychology*. Frankly speaking, N. Xenopol was doing not much more than spreading the ideas of the Italian school of criminology, which was attributing to the crowds criminal only instincts. In the year 1900 the posthumous work of Nicolae Vaschide, a former collaborator of Alfred Binet, about imitation as a social phenomenon, added to the studies done in the same field by Professor Constantin Dimitrescu-Iași, published during the same period (Chelcea 2002: 38-39). Only a few years had passed since the publication of Gustave Le Bon's *Psychologie des foules*, in 1895, until a young Romanian doctor, Marcu Câmpeanu, was applying these ideas to the concrete case of an army, publishing in Paris, in 1902, the *Essai de psychologie militaire individuelle et collective*. The book became remarkably popular among army officials in Europe and not only. The story of this success is worth being rediscovered, even if there are a lot of unclear aspects.

The French edition of his book was accompanied by a eulogistic foreword written by psychologist Theodule Ribot. He was noting that the first systematic approach of army psychology was due to M. Câmpeanu;

even if a lot of servicemen made valuable remarks about the capital importance of moral and intellectual dispositions to the formation of armies, it is to M. Câmpeanu that comes the merit of being a path opener (Câmpeanu 1902: 7). The French edition enjoyed a warm welcome within the military milieux, according to the author, and specialised magazines in the European countries, America and Japan publishing "flattering reviews". In Norway, a military magazine dedicated nearly an entire issue to the book. The book had simultaneously caught the attention of the Russian General Staff, which ordered its translation, in 1903. During the same year two Bulgarian translations were issued, one by Major Futacov, in Razgrad, the other one by Major Tricikow, in Sofia, the latter being published by the Ministry of War Printing House. In the USA it was partially translated and published by Captain Dr. Jarivis in a New York magazine. The German translation was made by Romanian captain Strişca, the author making his choice between his compatriot and a translator from Germany, and was released in Bucharest, in 1904. In 1904 appeared in Belgrad the Serbian translation (Câmpeanu 1907: Prefaţă). The Romanian edition ended with a chapter signed by Alexandru Sturdza, the son of politician D. A Sturdza, directed against parade training, apparently excessively practiced in our country to the detriment of training for war. The success of the book was rewarded by the Romanian Academy, which bestowed on it the Adamachi award in the session of 1907, so the author had a reason to be content. Even though, after nearly two decades, Dumitru Caracostea was excessively critical to him, he couldn't help but note that "ever since Cantemir's *History of the Ottoman Empire* hardly was there greater demand among foreigners for any book issued from under a Romanian's quill." (Caracostea 1922: 6-7)

In our attempt at getting out of oblivion the biography of a character so famous for a while within the military societies, few sources are available. He was born in 1872 and studied at the Faculty of Medicine in Bucharest, after which he was, for five years, an army doctor in Roman. At the time his book was published in France in 1902, the author had already renounced his career of an army doctor for the Romanian army, preferring to work as a civil doctor in Focşani. He published, beside the book on military psychology, over 50 medical articles, a booklet dealing with the anti-Semitic problem, published in France, and two novels (Câmpeanu 1935: 49-53). The novel *Căpitanul Cordea [Captain Cordea]*, inspired „from the military life", according to the subtitle, released in Focşani, was inspired by the French naturalism, but unfortunately had a non-realistic intrigue and conventional characters that do not manage to liven up the story.

Marcu Câmpeanu was a Jew; his name was on the list of forbidden Jewish writers published by Antonescu's regime in November, and lived until 1948 (Contribution of Jews 2004: 252). Practically, after the success recorded at the beginning of his carrier, this author became a plain provincial doctor.

How can we explain the success of his book of military psychology? Without the pretence of originality, Marcu Câmpeanu was ready, based on Le Bon's theory and few other French and Italian works about the expression of crowds, to apply these theories to the concrete case of a human group – the army – and yield a practical work, full of commonsense remarks. Most of them were not even his own remarks, he did nothing but synthesize articles scattered throughout the military press of the time. The unexpected success of his book is explained by the fact that it came to meet a need. Historian and General Radu R. Rosetti remembered the early years of his career as an officer, at the beginning of the 20th century, when, feeling completely unprepared to train soldiers, Doctor Câmpeanu's book on military psychology was a real help. (Rosetti 1940/I: 128)

After an introductory part on general psychology, M. Câmpeanu reiterates G. Le Bon's fundamental ideas on crowds, their special irrational character and the special relationship between a crowd and its leader. Parts III and IV enjoyed real appreciation in

military environment, being dedicated to the psychology of armies, the military leader, and troop psychology respectively, according to their different weapons: infantry, cavalry, artillery.

Even though he did no more than resuming and systemising older remarks, his merit was no small. The few passages are worth noticing draw attention on soldiers recruited amongst peasants, usually considered stupid because of their shyness. Reaching an environment they were completely unfamiliar with, they were intimidated by the novelty of a soldier's life and behaved awkwardly, being hard to train and considered idiots by their training officers and sub-officers. (Câmpeanu 1904: 62-64) Officers must avoid excessive harshness, which is harmful to these shy soldiers. (Câmpeanu 1904: 64)

One must note that, when his book was released, soldier battering was still practiced in the Romanian army, although being forbidden as early as 1868 by Charles I ("The Army Gazette" 1868/15); in 1910 it was it was again forbidden, but this time it imposed itself, despite the opposition of some officers. (Rosetti 1940/II: 44-45)

The remarks of young doctor M. Câmpeanu are noticeable when referring to the military spirit specific to Germans at the end of the 19th century and the beginning of the following century, propped, among others, by the quasi-military organisation of student associations practising duel on a daily basis. The prestige of great victories as those in Napoleon's time or German victories against French in 1870/71 contribute to supporting the military spirit of a people. (Câmpeanu 1904: 82-83)

In the chapter referring to military leaders and their relations to subordinates he is also inspired from Le Bon's opinions about crowd leaders, but brings a few remarkable personal notes, as well: the importance of military eloquence, quality difference of an army that submits to its leader out of sympathy as compared to an army that submits only for fear, the prestige of the leader and the factors determining it. He insists on different types of officers, frequently met, having negative repercussions on troops. "One could object that subordinates should love their boss. Normally such subordinates are happy when they are able to love the one they should fear. If a boss does nothing to inspire that feeling, commits injustice, treats his men meanly, it is impossible even for the most disciplined individual to nurture a feeling for which there is no interest, to possess a quality that is stifled to him." (Câmpeanu 1904: 108) The first condition an army leader should fulfil is to know the feelings of the troop he leads. (Câmpeanu 1904: 110) Officers who use their position to satisfy their desire of power and believe to make a good impression on their superiors by behaving like tyrants to their inferiors will destroy everything around and the soldiers would become a gang of discouraged, unsatisfied, unconfident men.

In the last part of his book, M. Câmpeanu refers to the psychology of troops according to the weapon they fight with: infantry, cavalry, artillery. The pertinence of remarks referring to cavalrymen's psychology was noted by the French General Canonge, in the preface of the French edition. (Câmpeanu 1902: 11-12)

In his conclusions, young doctor Câmpeanu insists on repeating what he had underlined throughout the book: the decisive factor in battle is the moral factor. Causes of defeats are not as much the number of military fatalities as the panic invading following tactic or strategic surprises or even an overnight enemy attack. (Câmpeanu 1904: 152-154)

We do not believe that in the Romanian army the influence of the book was considerable. It was rather known and appreciated in certain General Staff milieu. Radu Rosetti, who was very interested in reading M. Câmpeanu, was part of the elite of Romanian officer body, being a passionate reader. He confesses having read the works of G. Le Bon, A. Comte, Nietzsche, Marx etc. (Rosetti 1940/II: 19) but, generally speaking, officers did not read much. During the first years of his carrier he had been entrusted the library of a Bucharest regiment to which he had been assigned and found that the greatest part of books' pages were not cut; except for his commander, almost nobody asked him for a book, although his regiment's library was quite well furnished.(Rosetti 1940/I: 128-129) In the Superior School of War in Bucharest, psychology was introduced only in 1909, at the same time with logics and Romanian literature (*The History* 1939: 168), and in the schools of officers and sub-officers, the status of sciences like pedagogy and psychology was marginal throughout the Interbellum (Buricescu & Stoka, 1931: V).

Things were no different in the German army that, along the French one, was the indisputable model of the Romanian army. After the last change of the curriculum at the War Academy in Potsdam, in 1912, along the military subjects there were only subjects such as History and Law, Mathematics (7 hours weekly) upon choice, with a foreign language; as early as 1904 Japanese was introduced in schools (10 hours during the first year, 6 hours in the second and third years). (Schwertfeger 1940: 58) There was no longer place for subjects such as History of literature or Philosophy, which had been studied all along the 19th century. (Scharfenort 1910: 118-121, 308-312)

From 1909 until World War I the psychology course at the Superior School of War in Bucharest put at the disposal of future General Staff officers only some knowledge of general psychology. Suspended during the war, the courses were resumed in 1919, when the school management entrusted the course, surprisingly, to Dumitru Caracostea, a high-school teacher (1914 – 1923), graduate *magna cum laude* of his studies in Vienna with the most famous Romanist of the time, Wilhelm Meyer-Lübke, and, for the next few decades, an important teacher of literature and author of fundamental books about Eminescu and the Romanian folklore. Caracostea had made himself noticed by 1919 by publishing a consistent study about the Mioriţa in Moldavia (1916) and by the 1915 debate with critic Eugen Lovinescu, where he was warmly defending the beauty of the folklore creation against the latter's irony. Caracostea's task was to elaborate a course that should synthesize the experience of war as well as his knowledge about popular culture and mentality, as he confesses in the book.

After setting about to achieve the task, he had to notice that there was very little material. Both foreign and Romanian works did little to satisfy him, the only one he admits as a starting point being Dr. Marcu Câmpeanu's work. "Where there was psychological and philosophical training one would not find material on the military experience, and where there was such a material, one would not find a true psychological interpretation." (Caracostea 1922: 6) It is more worthy to reveal the way in which he created the documentary basis of his study. Not having at hand documents and methods allowing him to draw conclusions on manifestations related to the collective life of soldiers, a rather unusual idea struck him: his students, all former fighting officers, should describe the barely ended war under its psychological aspect. He was emphasising that he acted like a folklorist appealing to field investigation (Caracostea 1922: 7-8), but we cannot help not noticing the aspect of the real experiment created by war, at the country level. Starting from the dominant social theories of the time, Caracostea made a far more complex study of social psychology, which was not limited to one subject only. The hope of subsequent perfection was not fulfilled.

The book retains nowadays researcher's attention by its interdisciplinary approach, methodological and theoretical openness, but mainly by the attempt to offer a display of the individual and group psychic

reactions during war. Even if the effects of being hastily written are felt, and given the absence of foregoing studies, and the author not having reviewed the book, as he used to, leaving the School of War after just three years, and preoccupations of the kind, his work is unique within the Romanian body of research. Caracostea had to create both the sources and the methods of a research conceived from its very beginning as interdisciplinary. In spite of having started from Wilhelm Wundt's school of thought, with an overwhelming prestige within the Romanian science at that time (Rădulescu-Motru 1990: 68), and Gustave Le Bon's ideas of crowd psychology, his study is intended as an original approach, even critical mainly toward the interpretation of Le Bon's ideas within some military societies. Peasants, hostile to military service, may become very good fighters if their mindset and system of values is known, and the author did his best to give as many example of bravery as possible of soldiers recruited amongst peasants.

A chapter in Caracostea's book is called *Crowd psychology* and starts, inevitably, from Le Bon's writings. He is critical towards vulgarisation of his ideas in Dr. Marcu Câmpeanu's book of military psychology. The very work of Gustave Le Bon is not spared from Caracostea's criticism: "conceived in a dilettante manner" it brings forth an interesting material and satisfies readers' penchant for hastily uttered generality." Very similarly, Serge Moscovici was saying about his books: "Most of them are written from one day to another, with the intention to like, to strike the reader's imagination, to tell them exactly what they want to hear." (Moscovici 2001: 73)

Interdisciplinary interpretation between Wilhelm Wundt's etnopsychology and crowd psychology represented by Gustave La Bon, his vision as a fine knower of linguistics and Romanian folk creation creates from the very start the premises of an interesting book.

This unique book had, to say the least, a strange destiny in the Romanian intellectual environment. The few works of military psychology during the Interbellum done by Preda (1926 and 1933), Coman (1929), Buricescu and Stoka (1931) are, generally, ready to summarize G. Le Bon and Marcu Câmpeanu's ideas, without having the concrete and interdisciplinary character of Caracostea's book, which results from personal and collective experiences told by its students. Some of them do not even mention Caracostea's book, as brochures that do not even rise to the level of Marcu Câmpeanu's book. A special mention deserves only C-tin Cleanoveanu's book, *The Psychology of Fighters*, published in T. Severin, in 1940. Its special quality as related to the other works during the Interbellum is given by the fact that it synthesises remarks pertaining to soldiers' psychology that are included in regulations, works of tactics and other military works. It is, however, regrettable that he ignored the efforts of his forerunners, namely M. Câmpeanu and D. Caracostea, thus missing the chance to systemise these previous efforts.

BIBLIOGRAPHY

Buricescu, Ion. Stoka, Ion. 1931. *Elemente de psihologie şi pedagogie militară.* Bucureşti: Tipografia Şcoalei Militare de Infanterie nr. 1. (Elements of Military Psychology and Pedagogy)

Caracostea, Dumitru. 1922. *Aspectul psihologic al războiului*, Bucureşti: Editura Cartea Românească (The Psychological Aspect of the War)

Câmpeanu, Marcu.1902. *Essai de psychologie militaire individuelle et collective*. Paris
Câmpeanu, Marcu. 1907. *Încercare de psicologie militară individuală şi colectivă*. Focşani (An essay of Indivudual and Collective Military Psychology)
Câmpeanu, Marcu. 1904. *Versuch einer Militärpsychologie*. Bukarest
Câmpeanu, Marcu. 1935. *28 de ani de serviciu medico-sanitar la oraşul Focşani, 1907-1935*, Focşani: Tipografia şi legatoria ziarului „Sentinela". (28 Years of Medical Service in the City of Focşani)
Coman, Simion, 1929. *Contribuţie la psihologia militară*. Sibiu: Tipografia Şcoalei Militare (A Contribution to the Military Psychology)
Chelcea, Septimiu. 2002. *Un secol de cercetări psihosociologice.* Iaşi: Editura Polirom (A Century of Psychophysiological Research)
Contribuţia evreilor din România la cultură şi civilizaţie. 2004. Bucureşti: Editura Hasefer (The Contribution of the Jews in Romania to Culture and Civilisation)
Istoricul Şcoalei Superioare de Război 1889-1939, 1939. Bucureşti (History of the Superior School of War)
Moscovici, Serge. 2001[1981]. *Epoca maselor*. Iaşi: Institutul European (The Age of the Crowd: A Historical Treatise on Mass Psychology)
Preda, Gh..1926. *Noţiuni de psihologie generală şi militară aranjate după programul Şcoalei Militare de Infanterie nr. 2, Sibiu*. Sibiu (General and Military Psychology Elements organized according to the Infantery Military School no. 2 curriculum)
Preda, Gh.. 1933. *Contribuţie la psihologia şi pedagogia militară. Pentru uzul ofiţerilor Şcoalei de Aplicaţie a Infanteriei*. Sibiu (A Contribution to the Military Psycology and Pedagogy)
Rosetti, Radu R.. 1940. *Mărturisiri*, volumul I-II. Bucureşti (Confessions)
Rădulecu-Motru, C-tin. 1990. *Mărturisiri.* Bucureşti: Editura Minerva (Confessions)
Scharfenort, Louis von. 1910. *Die Koeniglich Preussische Kriegsakademie 1810-1910*, Berlin
Schwertfeger, Bernhard. 1940. *Die großen Erzieher des deutschen Heeres. Aus der Geschichte der Kriegsakademie*. Postdam: Rütten &Loening Verlag

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

ASSESSING SELF REGULATED LEARNING: QUALITATIVE VS QUANTITATIVE RESEARCH METHODS

Ana-Maria CAZAN*

*Faculty of Psychology and Education Sciences, Transilvania University, Brasov, Romania

Abstract: *Recent investigations revealed many facets of self regulated learning, highlighting the necessity to study this phenomenon in real contexts and real time, in events rather than as aptitudes. These two perspectives propose two types of methods which can be used to assess self regulation. The most common methods for measuring self regulated learning as an aptitude are quantitative methods such as questionnaires, although structured interviews and teacher ratings are also used. Qualitative measures assess mostly self regulated learning as an event, the data being collected during learning. The methods analyzed in this study are think aloud protocols, learning journals, and observations of performance. The advantages and the disadvantages of both quantitative and qualitative measures are discussed. Assessing self-regulated learning is a fundamental element of research in this field, new methods are developed allowing self-regulated learning to be assessed as a dynamic, continuous process which unfolds over time and in a specific context.*

Keywords: *quantitative methods, qualitative methods, learning journals, self regulation, think aloud protocols*

1. INTRODUCTION – ACADEMIC SELF REGULATED LEARNING

Self-regulated learning is a proactive process that students use to acquire academic skills, such as setting goals, selecting and deploying strategies, and self-monitoring one's effectiveness [24]. Recent investigations in this field revealed many facets of self regulated learning, highlighting the necessity to study this phenomenon in real contexts and real time, in events rather than as aptitudes [21].

An aptitude is a relatively enduring trait of an individual, and measurement of this trait can be used to predict future behavior. Thus, an individual's self-perception of his or her metacognitive and/or cognitive processes is an accurate measurement of self regulated learning. Self regulated learning as an aptitude can be assessed through responses to questionnaires. Often self regulated learning as an aptitude is measured through quantitative methods such as self-report questionnaires [21].

Self-regulated learning as an event is viewed within particular contexts [5,14]. Self-regulatory processes should be examined in real time because learning is an ongoing process that unfolds within particular contexts. As an event, self regulated learning can be assessed mostly through qualitative methods such as think aloud protocols, error detection tasks, observations of performance, structured interviews, and learning journals.

As an aptitude, most of the assessment of learning is focused as an outcome, while as an event, learning is focused on the process. Traditionally, most of the assessment of self

regulated learning was focused on ability as a construct and not on certain cognitive and strategic processes of students thinking [11].

Despite the limitations of each of the two perspectives, researches reveal the complexity of learning, having implications for how we study phenomena such as self regulated learning and prompting reconsideration of traditional distinctions between aptitudes for self regulated learning in and across events [21].

2. ASSESSSING SELF REGULATED LEARNNG THROUGH QUANTITATIVE METHODS

The most common methods for measuring self regulated learning as an aptitude are quantitative methods such as questionnaires, although structured interviews and teacher ratings are also used.

2.1 Self report questionnaires. Self report questionnaires are widely used because they are relatively easy to design, administer, and score. The fact that the items ask respondents to generalize their actions across situations, self-report questionnaires measure self regulated learning as an aptitude. Some of the most utilized questionnaires are: The Motivated Strategies for Learning Questionnaire [15], Inventory of Learning Styles [18], The Five-Component Scale of Self Regulation [12], The Learning and Study Strategies Inventory [20], Approaches to Learning and Studying Inventory [10]. Although, the most used questionnaires in the recent researches are those developed by Pintrich and by Vermunt [15,18].

The Motivated Strategies for Learning Questionnaire [15] was designed to measure students' motivation and self-regulated learning as they relate to a specific course, in the frame of socio-cognitive model of learning. The course is seen as the unit of measure, with the idea that the course is ideally situated between the very general level of "all learning activities" and the very specific and unworkable level of "every learning situation within the course" [9].

The Motivated Strategies for Learning Questionnaire comprises several scales and measures learners' motivational beliefs and use of self regulated learning strategies (cognitive, metacognitive, motivational and behavioral self regulation strategies) from a socio-cognitive perspective. MSLQ has two sections: a motivation section and a learning strategy section. The Motivational Section consists of three sections: value, expectancy, and test anxiety. The Learning Strategy Section contains three types of scales: cognitive, metacognitive and behavioral strategies. Other researchers added another scales, such as motivational self regulation [22].

Scores from the MSLQ have been used extensively by investigators doing empirical research in the areas of motivation and self-regulated learning. Through MSLQ, teachers are able to identify students who may be having trouble and provide additional study skills assistance [2].

The Inventory of Learning Styles [18] is developed in the frame of information processing model of learning. While MSLQ focuses on specific domains of learning, ILS measures self regulated learning in a general context.

ILS consists of 120 statements that cover 4 learning components: cognitive processing strategies, metacognitive regulation strategies, conceptions of learning, and learning orientations. The questionnaire consists of 20 scales: five processing strategies, five regulation strategies, five conceptions of learning, and five learning orientations. The five processing strategies are: deep processing comprising relating and structuring, and critical processing, stepwise processing comprising memorizing and rehearsing, and analyzing, and concrete processing. The regulation strategies are: self regulation comprising self regulation of learning process and results, self regulation of learning content, external regulation of learning process and external regulation of learning results and lack of regulation. The five conceptions of learning are the following: construction of knowledge, intake of knowledge, use of knowledge, stimulating education, and co-operative

learning. Finally, the five learning orientations are the following: personally interested, certificate oriented, self-test oriented, vocation oriented, and ambivalent.

Both analyzed questionnaires can be used at the university level. Studies reported a high stability of results over time and good internal consistency coefficients for all scales. Also, the translated Romanian versions of the questionnaires confirmed the factorial structure of the original versions and good psychometric properties, comparable with those reported by the authors of the instruments [6,7].

2.2 Advantages and disadvantages regarding the use of quantitative methods. Questionnaires offer a stable perspective of the behavior in most situations, making possible the generalizations.

The scores obtained form questionnaires are stable and show moderate convergent validity with the scores obtained from other measures, and moderate predictive validity.

Despite the fact that the questionnaires are easy to use and the complexity of the information revealed, the quantitative methods have also many limitations. Some authors [14,17] argues that when completing a questionnaire, the subject must draw from memory, more a process of reconstruction than recovery, thus overall assessment of strategic processing through self-reports has limited validity and usefulness. There is also a high probability that the subjects confuse their desires or intentions with their real actions. Assessment using self reports only allows us to ascertain a learner's predisposition to use self regulated learning strategies [16].

Another limitation concerns the fact that students are not always aware of the strategies they use, so they may not report them even when they have made use of them. When assessing, it is assumed that the subject is aware of his or her cognitive activity (thoughts, feelings, etc.) and that he or she can establish relationships between these and the final results. However, research shows that our cognitive system only has limited access to the processing and establishing of causal relationships for the behavior being assessed [8].

3. ASSESSSING SELF REGULATED LEARNNG THROUGH QUALITATIVE METHODS

Qualitative measures assess mostly self regulated learning as an event, the data being collected during learning. The methods analyzed in this study are think aloud protocols, learning journals, and observations of performance.

3.1 The think aloud protocols. The think aloud protocol offers a process methodology that measures cognitive and metacognitive SRL processes during learning, because the student reports about thoughts and cognitive processes while performing a task [3]. The think aloud protocol can be as unstructured ("Explain your work") as that or it can follow a formal, conditional script that dynamically adjusts which questions or comments an observer makes depending on how the student behaves or whether the student mentions particular information [5].

The think aloud methodology is used to examine how self regulated learning fosters conceptual understanding of complex systems, or to examine how students plan, monitor, use strategies, and handle task difficulties while learning about a challenging science topic. Research using this method proved the capacity of the think-aloud protocol to capture self regulation processes in a dynamic learning situation.

An advantage of the think-aloud methodology is that it is open-ended, and the students' responses are coded into self-regulatory process categories by trained observers at a later point in time. The disadvantages of the method regard the fact that verbalizing thoughts during learning can disrupt the learning process.

3.2 Learning journals. Learning journals are useful in research on self-regulated learning due to their application as an instrument for recording learning processes and for evaluating the results. Learning journals are a self guided way of writing that allows for elaboration and reflection on learning content. In a learning protocol, learners apply cognitive and metacognitive strategies while writing down their reflections on previously presented learning contents. They are instructed to ask themselves what they do not understand and what can be done to bridge the gap in understanding [4].

Journal-writing has been associated with improved capacities for metacognition and self regulation. Other authors imply that journals enable relationships between the self-regulation cycle and the learning goals of the students [19]. Although, research revealed that learning journals usage affected the metacognitive strategies of the students positively while it had no significant effect on cognitive strategies such as rehearsal, elaboration and organization [1].

Diary measures of self regulated learning have been used both with elementary school children and with students, showing SRL trained students displayed significant increases in homework effectiveness, time-management skills, a broad array of self-reflection measures, and academic performance skills. Also, learning journals provide us with time-series data, which offer the possibility of conducting analyses with more sophisticated methods.

Although the results obtained through learning journals are promising, there are also some limitations, referring to the way self regulation processes are assessed. It is possible that the students elicit more comprehension monitoring than they actually document in the learning protocol or their reflections may be biased. Another issue is the fact that some students invariably write more and more openly than others. Learning journals is a method which requires effort from the learner, as well as the think aloud protocol method.

3.3 Observations of performance. Observations are used in research as measurements methods of self regulated learning. The demarche for using observations for the assessment of self regulated learning includes the necessity to decide which categories of self regulation strategy use and processes will be observed. The observation can focus on individual students or on interactions between students. Often, they are complemented with interviews.

The advantages of observations are that this is an objective measure of what the learners are doing instead of what they remember or they think that they do. The observations reflect what learners do versus what they recall or believe they do. Observations also allow associations between learners' behaviors to task conditions, especially those where feedback is available within the boundaries of a task. Observations can ameliorate difficulties such as positive response bias or limited language for describing cognitive processes [5]. However, observations are limited to examination of behaviors and provide limited insight into how individuals make sense of events [21].

3.4 Advantages and disadvantages regarding the use of qualitative methods. An optimal time to use qualitative methods is when it is not possible to separate a phenomenon from its context [23]. This is the case for self regulated learning. The qualitative methods allow the assessment of the process rather than the outcome of learning, and enable the researchers to challenge self regulated learning theories using other methods than those traditionally used.

The disadvantages concern the fact that there are no standardized measures for assessing self regulation.

Qualitative methods are particularly well-suited for examining self-regulated learning as events because they involve rich, holistic descriptions, emphasize the social settings in which the phenomena are embedded, do not

make assumptions about intra-individual stability, and are oriented to revealing complexity. Qualitative measures also enable researchers to take a grounded, inductive approach to understanding students' thoughts and behaviors [13].

4. CONCLUSIONS

Assessing self-regulated learning is a fundamental element of research in this field. A greater number of methods both quantitative and qualitative measuring instruments should be created and validated in the future, allowing self-regulated learning to be assessed as a dynamic, continuous process which unfolds over time and in a specific context [21].

New trends in the field of self regulated learning assessment concern collecting information during the space and time that a task is under way. From this perspective, recent research promotes learning in hypermedia contexts. The computer is viewed as a powerful tool for promoting, recording and interpreting actions indicative of self-regulated learning. New methods are proposed, such as graphic analysis, analysis using conceptual maps, analysis through neural networks [8].

REFERENCES

1. Arsal, Z. The effects of diaries on self-regulation strategies of preservice science teachers. *International Journal of Environmental & Science Education*, 5(1) (2009).
2. Artino, A.R., Stephens, J.M. Academic motivation and self-regulation: A comparative analysis of undergraduate and graduate students learning online. *Internet and Higher Education*, 12 (2009).
3. Azevedo, R. Computer environment as metacogntive tools for enhancing learning. *Educational Psychologist*, 40(4) (2005).
4. Berthold, K., Nuckles, M., & Renkl, A. Do learning protocols support learning strategies and outcomes? The role of cognitive and metacognitive prompts. *Learning and Instruction*, 17 (2007).
5. Boekaerts, M., Pintrich, P., Zeidner, M. (Eds.) *Handbook of self-regulation.* San Diego, CA: Academic Press. (2000).
6. Cazan, A.-M. Self regulated learning strategies – predictors of academic adjustment. – Social and Behavioral Sciences. *Proceedinds of 2nd the International Conference "Psychology and the Realities of the Contemporary World"*-PSIWORLD 2011 (2011, in press).
7. Cazan, A.M., Aniței, M. Motivation, learning strategies and acadmic adjustement. *Romanian Journal of Experimental Applied Psychology*, 1(1) (2010).
8. De la Fuente Arias, J., Diaz, A. Z. Assessing self-regulated learning in early childhood education: Difficulties, needs, and prospects. *Psicothema*, 22 (2010).
9. Duncan, T.G., McKeachie, W. J. The Making of the Motivated Strategies forLearning Questionnaire. Educational Psychologist, 40 (2005).
10. Entwistle, N.J., McCune, V. The Conceptual Bases of Study Strategy Inventories. *Educational Psychology Review,* 16(4) (2004).
11. Magno, C. Developing and Assessing Self-Regulated Learning. The Assessment Handbook: Continuing Education Program, 1 (2009).
12. Martinez-Pons, M. *The psychology of teaching and learning*. London: Continuum (2001).

13. Patrick, H., Middleton, M.J. Turning the Kaleidoscope: What We See When Self-Regulated Learning is Viewed with a Qualitative Lens. *Educational Psychologist*, 37(1) (2002).
14. Perry, N.E., VandeKamp, K.O., Mercer, L.K. Investigating teacher-student interactions that foster self-regulated learning. *Educational Psychologist*, 37(1) (2002).
15. Pintrich, P., Smith, D.A., Garcia, T., McKeachie, W.J. *A manual for the Use of the Motivated Strategies for Learning Questionnaire (MSLQ).* Michigan: The University of Michigan (1991).
16. Pintrich, P.R. A conceptual framework for assessing motivational and self-regulated learning in college students. Educational Psychology Review, 16(4) (2004).
17. Samuelstuen, M.S., Braten, I. Examining the validity of self-reports on scales measuring students' strategic processing. *British Journal of Educational Psychology*, 77(2) (2007).
18. Vermunt, J.D. Relations between Student Learning Patterns and Personal and Contextual Factors and Academic Performance. *Higher Education*, 49(3), 205-234 (2005).
19. Webber, J., Scheuermann, B., McCall, C., Coleman, M. Research on self-monitoring as a behavior management technique in special education classrooms: A descriptive review. *Remedial and Special Education*, 14(3) (1993).
20. Weinstein, C.E., Schulte, A., Palmer, D. *LASSI: Learning and Study Strategies Inventory.* Clearwater, FL: H & H Publishing. (1987).
21. Winne, P. H., Perry, N. E. Measuring self-regulated learning. In P. Pintrich, M. Boekaerts, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 531–566), Orlando, FL: Academic Press (2000).
22. Wolters, C. A., Understanding and Predicting the Self-regulation of Motivation in College Students Assessing Academic Self- Regulated Learning. Paper presented at the *International Conference on Education Research*, Seoul National University, Korea (2010).
23. Yin, R. K. Case study research: Design and methods. Thousand Oaks, CA: Sage (1994).
24. Zimmerman, B.J. (2008). Investigating Self-Regulation and Motivation: Historical Background, Methodological Developments, and Future Prospects. *American Educational Research Journal*, 45 (1) (2008).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

I.T.C. TRAINING PROGRAM – CASE STUDY

Teodora Daniela CHICIOREANU*, **Nicoleta LITOIU****

* Lecturer & PhD candidate eng., Teacher Training Department, University Politehnica of Bucharest
** Associate Professor PhD Nicoleta Litoiu, Director– Career Counselling and Orientation Centre, Polytechnic University of Bucharest

Abstract: *The purpose of the* ***Informative Techniques and Computer-based Communication Training Program*** *is the initiation of the academic personnel, those with didactic, guidance, control or leading functions, in using ,development or involving a set of particular computer skills.*

This continuous training program also covers one of the objectives of the educational and professional training systems specified by The European Council and The European Commission, namely The access' insurance to ITC for all, taking account of a group of generic professional standards. Within this continuous training program, the differentiation of the practical and theoretical applications will be taking into account the level of vacational training on the student.

This program consists of only 110 classes performed in the methodology day of the engineers (on Wednesday) and on Saturday. The trainers have different specializations covering the entire speciality.

The included disciplines in this training program are defined by valid scientific and cultural contents; the subjects are well circumscribed, challenging and related to the target objectives.

Reuse of this module in the same program or transferring it into other programs can increase the effectiveness of educational programms.

Keywords: ICT, web 2.0, education

1. The Description of the Program

The "Informative Techniques and Computer-based Communication" Training Program ITC adds in "The Training of the Professors Engineers Program"which included only two modules (The Adjudication CNFP no. 220/19.12.2007):

Module 1: Setting, organization and valuation of the didactic activities - 30 credit points

IMPERATIVE DISCIPLINES : Curriculum training and valuation (IOb1); The speciality's didactics (IOb1a);Speciality disciplines (IOb2a)

FACULTATIVE DISCIPLINES :

Pack A: Teaching/Learning strategies and models; recent development (IOp1A1); Knowing the students and the school group personality (IOp1A2)

Pack B: Modern working instruments (Web2.0 correlated to technological curriculum areas (IOp1B1); Technological training (modular curriculum approach) (IOp1B2); Methods of research in education (IOp2.1.); Recent development about the teacher's evaluation competence (IOp 2.2.)

Module 2: Management and communication - 30 credit points

IMPERATIVE DISCIPLINES: Psychopedagogy of Communication (IIOb1); Management of the classroom (IIOb2) **FACULTATIVE DISCIPLINES** :Quality management in education (IIOp1.1); Professional development and career management (IIOp1.2); Project management (IIOp1.3); Creativity through/in the learning process (IIOp2.1); The leader's behavior and decisions and the adoption process (IIOp2.2)

To ensure that the continuity of The Training Program addressed to the dons, senior staff and guidance personnel will be complete and also, to make possible the issue of the 90 points certificate transferable by CNFP, it was accredited **The "Informative Techniques and Computer-based Communication" Training Program** representing Module 3-TIC, a first class program, short type (within the meaning of article 33, first paragraph, Law 128/1997).

Module 3: T.I.C. - 30 credit points
- Decision CNFP no. 72/28.05.2008
- Affinity Program with The Post and Telecomunication Technical College "Gheorghe Airinei"

The purpose of the **Informative Techniques and Computer-based Communication Training Program** is the initiation of the academic personnel, those with didactic, guidance, control or leading functions, in using ,development or involving a set of particular computer skills through 7 thematic categories: Basic concepts in Information and Communication Technologies; Using the computer and managing files; Ability to edit texts and image processing; Creating presentations; Spreadsheets; Database; Internet – communication and documentation

Who participates at the program?

Teachers – engineers and dons from the undergraduate education with didactic, guidance, control or leading functions.

How long doar it takes the programl?

At the moment a third series completed in June 2009 Module III –ITC. The first series completed in June 2008 and the second in February 2009.

The justification and the utility of the program

- The agreement with the national politics and with the learning development strategies

The continuous training programs may have numerous purposes and may address to a wide range of needs from those which are pursued by the educational priorities at national level to the needs of the schools, professors, individuals or local communities.

All approuved CNFP programs are being designed according to "CNFP Methodology" which forcast the reporting to the national priorities in this domain.

This continuous training program also covers one of the objectives of the educational and professional training systems specified by The European Council and The European Commission, namely: *The access' insurance to ITC for all*

- The numerical growth of the equipment and educational software so that ITC will be implemented successfully in teaching and training practices;
- The adaptation of the teaching methodes and the role of the teachers and educators in using up the "real" and "virtual" teaching techniques.

It promotes the professional standards of the didactic occupation according to MECT, CNFP purviews and other official documents.

Nowadays, the continuous training programs are elaborated and evaluated interrelated with a group of generic professional standards which don't discriminate between the initial professional training, the training of the beginner professors or of those that already have different professional distinctions expected in career development.

Within this continuous training program, the differentiation of the practical and theoretical applications will be taking into account the level of vacational training on the student (begginer/advanced). For the students with high level knowledge of TIC will be suggested to participate at The Informative Techniques and Computer-based Communication Training Program – "advanced level" (25 credit proffesional transferable points), the second category program, approuved by Decision CNFP no. 65/28.05.2008 (89 classes)

The Informative Techniques and Computer-based Communication Training Program – "advanced level" is addressed to the dons, senior staff and guidance personnel, proffesors which already have TIC knowledge (beginner level, ECDL certificate, faculty diploma/post academic course in the field).

What resources (human, material, time) are spent in using the program?

This is a short program with only 110 classes according to the following curriculum. These classes are performed only in the methodology day of the engineers (on Wednesday) and on Saturday. The trainers have different specializations covering the entire speciality.

CURRICULUM
for THE INFORMATIVE TECHNIQUES AND COMPUTER BASED COMMUNICATION

	Discipline	No of classes assigned				No. CPT
		Basic training course	Tutorial	Ev.	Total	
Module .I.T.C.	Base concepts in in Information and Communication Technologies	4	4	1	9	3
	Using the computer and managing files	5	6	1	12	3
	Ability to edit texts and image processing	6	10	1	17	5
	Creating presentations	6	10	1	17	5
	Spreadsheets	6	10	1	17	4
	Database	6	10	1	17	5
	Internet – Communication and Documentation	6	10	1	17	5
EVALUATION DURING THE CLASSES				**7**		
FINAL EVALUATION					**4**	
TOTAL CLASSES (NO)					**110**	**30**

2. The Clarification of Evaluation Objectives

The basic training course complies with the contents of the curriculum for passing the ECDL (European License for Driving the Computer) exam (according to Annex 13-Magazine CNFP no 3-4), but follows it in another matter, into a collaborative medium, so that after taking the course, the student must be acquainted in using the computer and its offered possibilities for different interacting types, know how to integrate multimedia materials in didactical projects without any difficulties.

Tutorials contribute to:

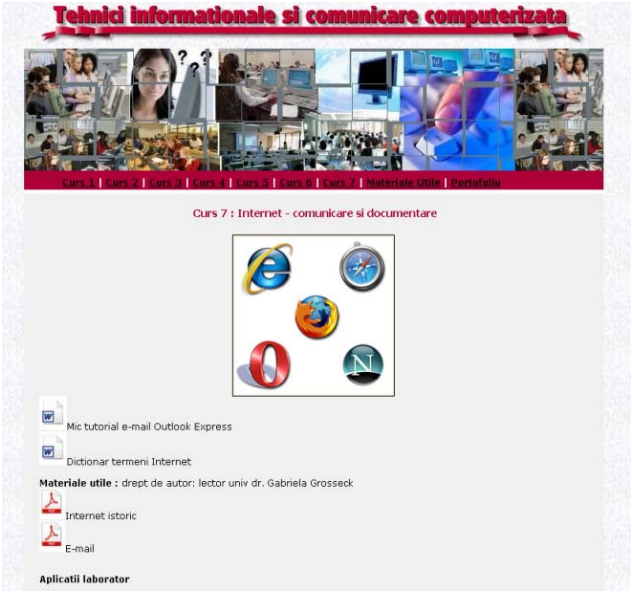
- the attainment of knowledge and skills in using ITC and a positive attitude regarding this matter;
- the training in using the ITC/ the familiarization with the operating system (the proffesors must be able to use the computerised equipment in a critical and structural manner, as instruments used in fulfilling the tasks.
- the identification of the using posibilities of the computer;
- the discrimination between hard and soft components of the computer;
- the training for familiarization with the operating system regarding hardware and software equipment, communication through computer network (local database or remote access);
- the development of the competences in using different software (MS OFFICE, Open Office for example);
- the development of the communication and cooperation in interactive contexts;
- the implementing of the ergonomics rules and legislation regarding computer use / computer network;
- daily use of the computer;
- the development in individual working/ training the students in collective works;
- the development of Information culture.

The scientific, pedagogical and cultural relevancy of the content

The included disciplines in this training program are defined by valid scientific and cultural contents; also, they are updated and judiciouslly structured; the subjects are well circumscribed, challenging and related to the target objectives.

The proportion between theory and practice in favour of applivative activities;

The proportion between theory and practice in favour of applivative activities is established by *The Trust Methodology Regarding the Continuous Training Programs*. It forcasts various shares of the theoretical, practical and valuation on modules activities. As you can see in Figure 1, to each



module corresponds a web page. Within those web pages, the students have the possibility to access tutorials, to read support courses as well as practical applications (including tutorials for solving the tasks). Each module is completed with a certain applicative homework which must be included in the final portfolio. This homework is graded along the course.

Figure 1

The logical and pedagogical distribution of the training

Concerning the number of didactical activity classes, scheduled per week, it is oversized at 8-9 hours a day.

The program provider offers feed back related to the training program, through the Moodle, so that many proffesors can run some of their practical activities from school or home, without being necessary their presence in the laboratory (Figure 2).

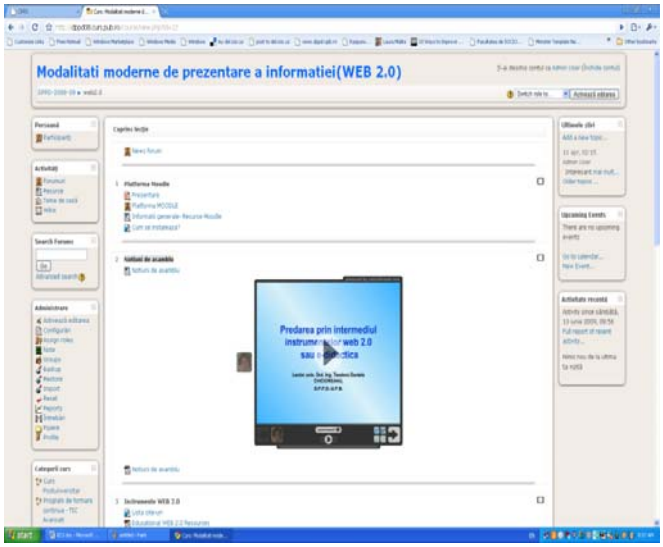


Figure 2

3. The Assesment of Information Resources (the research of the available data relevancy)

Using the modern teaching equipment

The integration of the new information and communication practices in the continuous training program led to:

- the valorization of the new information and communication technologies by including them in the learning process;
- providing examples of combining traditional methods with those based on e-learning in working with students; training professors to guide students in using web-sites useful in studying of a discipline or to use smart-phones and digital cameras in teaching and learning (creating new materials, adapting to their personal learning styles, exercises in the acquisition and use of digital images);

- developing competent teachers in view of elaboration teaching materials with didactic nature.

The development and use of complementary curricular materials

Course support, educational software, tutorials, Internet services and literature are the main sources of documentation and learning. All these materials and information are provided by the platform program. Full bibliography is organized in two sections:

- required references – with a reasonable number of new works, active links, tutorials addresses on levels of competence;
- optional references allowing those interested in deepening the study individually.

Organizational Details

The program also offers a web site dedicated to issues of organization: time, ads, study formations associated with each module. Through this page, students were able to highlight some organizational problems, which are solved in due time by the program provider.

What changes have occurred in the level of the training provider as a result of the unfolding program?

After each set of students, following analysis of questionnaires, it was inserted and adjusted a whole series of practical applications for each level:beginner/advanced; tutorials were created for students, etc…

4. The Design Evaluation by establishing methods, selection of comparison groups

The choice of methodology depends on:

- what we want to evaluate;
- the available time;
- financial constraints;
- implementation capacity

The project offers a variety of assessment methods, able to cover all the skills and expected developments.

The requested feedback from students is one of the main sources of improvements without stopping of the program.

Setting the comparison groups

The impact assessment has considered making significant comparisons between:

- the situation before and after intervention implementation (practical tests at the beginning and in the end of the activity)
- the effects of intervention on a group against any similar group (work teams)
- a group on whom you spoke and a "control" group (what happened and what could have happened without that intervention; we compared the e-portfolios of the students with those of participants in teaching degrees, who have not followed this module)
- effects of intervention on similar groups in different parts of the country (this criterion was achieved by group 1 and group 2 actually formed of professors from Bucharest, while the group 3 consisted in professors from Ilfov.

Data collection was carried out by making use of methodologies:

- quantitative
- qualitative
- participatory

The data subjected to processing were:

- questionnaires
- analysis of written documents
- analysis of practical works
- focus groups
- case study

The results are given in the report of assessment.

5. The Training Team of Evaluators

Assessment activity requires specific competences.

Quality impact assessment increases considerably in terms of external coordination between:

- the members of the research team;
- the initiators of the program.

The first team includes the evaluation manager, analysts in the social sciences, sampling expert, field team, those who process and structure the data.

The Evaluation Manager is responsible with:

- the determination of the information needs and the identification of indicators
- shaping the terms of reference for the other members of the team
- the selection of evaluating methodologies
- the composition of the team

The Analysts in the social sciences

- contribute to the writing assessment report

The Sampling Expert

- guides the selection process of the sample
- calculates appropiate sample sizes for the indicators set
- selects the sample
- reviews the outcome of the current sample compared to the default and incorporates all in analysis
- selects sites and groups for pilot tests

The Design Research Team

- projects the data collection tools, brochures User Manuals and codes
- ensures along with the Team Manager that data collection tools are valid and correctly applied

The Field Team

- is responsible for the whole approach of collecting data
- plans routes for collecting data
- establishes the compozition of the team: operators, researchers

Those who process and structure the data

- design programs for entering data
- store data
- check the validity of such data
- produce primary results
- provide necessary documentation with regards to data

2. The Assessment Report

After the three series of students, the graduated percentage was:

Series 1: Students : 120 people (17 executives/school inspectors); No. of students who completed the module: 106 people - 56 with "exceptional" grade, 38 with "very good" grade, 12 with "good" grade)

Series 2: Students : 107 people (5 executives/school inspectors); No. of students who completed the module: 94 people - 37 with "exceptional" grade, 53 with "very good" grade, 4 with "good" grade)

Series 3: Students : 75 people (7 executives/school inspectors); No. of students who completed the module: 66 people - 46 with "exceptional" grade, 18 with "very good" grade, 2 with "good" grade)

After the data were collected, were processed the following[9]:

 # To what extent the current themes and applications activities contributed to the clarification of some current issues that you may face in your class activity?

	Specified Aspect	***Very much***	***Much***	***Satisfactory***	***Insufficient***
a.	Basic concepts in Information and Communication Technologies	**56,25%**	27,5%	2,5%	0%
b.	Using the computer and managing files	**53,75%**	31,25%	1,25%	0%
c.	Ability to edit texts and image processing	**60%**	25%	2,5%	0%
d.	Creating presentations	**55%**	32,5%	0%	0%
e.	Spreadsheets	**58,75%**	20%	6,25%	1,25%
f.	Database	**48,75%**	23,75%	10%	1,25%
g.	Internet – Communication and Documentation	**53,75%**	27,5%	1,25%	0%

 # Which topics you think you would like to be addressed in the future training sessions?

Selected topics (written in italics) - *Database deepening;Presentation of educational software and ways of working with them*; Mechatronics;AutoCAD 2D and 3D; *Multimedia Applications;*AEL;Using educational software in AEL;*Paint Applications;*CATIA;*Lessons solved Interactive*; Inventor; LabVIEW; FluidSIM; The Computer and PLC set in schedule of mechatronics, Class XII and XIII;Corel Draw - were introduced in the classes of practical applications and thus developed for the following series of students. Applications of AutoCAD, CATIA Module were included in advanced ICT and mechatronics information (courses and applications) were included in Modele 1, Specialized Disciplines. Unfortunatelly, curriculum imposed by the ministry does not allow us to develop Modeule 3 ICT and other applications then in other educational programs accredited by CNFP.

 # How far the methodical approach of topics/courses covered in Module III was effective against objectives?

	Specified Aspect	***Very much***	***Much***	***Satisfactory***	***Insufficient***
a.	Accesibility of specialized language and terminology	65%	18,75%	1,25%	0%
b.	Used Methodology	58,75%	23,75%	1,25%	0%
c.	Interactive nature of the activities	58,75%	25%	1,25%	0%
d.	Access to ongoing support	65%	16,25%	1,25%	0%

 # What suggestions and recommendations you have for improving the used methodology in courses and applications made?

- Transmition of information at a pace more alert for more practical applications in the second part of the lesson;
- Existence of several materials listed/printed for exercises (practical work);
- More time for individual applications;
- Sessions dedicated to a single type of application, to deepen;
- Course support less dense;
- A larger course for not being necessary to exercise and practice outside the topics ;

 # How do you assess the final evaluation of educational activities within the Module III in terms of:

	Specified Aspect	***Very much***	***Much***	***Satisfactory***	***Insufficient***
a.	Evaluation tools used	56,25%	25%	1,25%	0%
b.	Relevance of the documents requested by portfolio	47,5%	33,75%	2,5%	0%
c.	Assessment efficiency for future teaching activities	47,5%	31,25%	2,5%	0%

 # What suggestions and recommendations you have to improve methods and final evaluatio tools used in Modulule III?

- Division on multiple preparing levels of the students;
- To work in smaller groups;

- A greater number of classes for Excel and Database Modules;
- Less topics and applications;

 # What recommendations andgeneral feedback you addressed to the trainers team?

General appreciation:

- Professionalism;
- Patience;
- Flexibility;
- Excellent team, very well prepered.

Recommendations:

- One trainer to work with fewer students;
- Course has less hours;
- Portfoliu with fewer topics;

Reuse of this module in the same program or transferring it into other programs can increase the effectiveness of educational programms offered by DPPD-SSU.

Exemple : ICT Module has a mandatory status when it is part of a prgram from category 1, « every 5 years » and non-binding, when the supplier presents it as a thematic program, from cathegory 2.

6. BIBLIOGRAPHIC REFERENCES

1. ******* Education Law no. 84/1995, amended and republished.
2. *** Ministry of Education and Research, CNFP – Online continuing educational provider of pre-university education staff
3. ******* Ministry of Education and Research (2005), The Methodology for accreditation of training programs for staff in pre-university education, OM nr.4611/ 19.07.2005.
4. Potolea, D.,(2001) Standards for training teachers; a reference framewok and some problems, the National Seminar ”Initial and ongoing staff , Sinaia.
5. Potolea, D.,(coord), Toma, S., Zlate,M., Crețu,T.,Verza, E., Iucu, R.,Tacea, F., Velea,S., Bercu,N., (2002), Curriculum for vocational pathway- profile of teaching, Național CouncilCurriculum, Bucharest.
6. Potolea D., Toma, S.,(2007), Country Report – ROMANIA, Bucharest, WYG International, Phare Project
7. Noveanu E, Potolea D – Computerization of the education – SEI Program, Evaluative Research Report, Ed Adata 2008
8. http://www.edu.ro/cnfp/
9. Sorina Barboiu – Analysis of DPPD questionnaires-continuous training

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

INTERPERSONAL COMMUNICATION ABOARD SHIPS

Carmen Luminița COJOCARU, Naie Gilles OPRISAN

Civilian Naval Faculty, Naval Academy ,,Mircea cel Bătrân" Constanța, Romania

Abstract: *Concerning the team aboard,* ***the interpersonal communication aboard ships*** *tries to understand the manner of the sailors ton understand each other in order to do safe manoeuvers and that means communication between the members and also an efficient way to talk to the commanders.*

Aboard maritime ships the issue refers to the maim methods of communication, of the perception mode and of the psychological influence formed by ***the interpersonal communication****, significant at different levels, considering the different nations the sailors belong. Their cultures, ethnics, needing a clear communication in order to do the most appropriate and safe manoeuvers aboard ships, in any moment !*

Keywords: *interpersonal communication, psychological perspective, social-professional influence, information changing, understanding skills, subconscious communication.*

I. INTRODUCTION [1]

Life is a dynamic product, as well as all human activities, in which the communication has a huge role to play. From a psychological perspective, the communication processes are definitely social, are always based on interaction phenomenon and are determined by these.

Therefore, any kind of communication is an interaction, meaning a dynamic phenomenon involving a transformation, as a following act of a social mutual influencing process between many social actors.

II. SOME DATA CONCERNING THE DEFINITION OF INTERPERSONAL COMMUNICATION INSIDE THE MULTINATIONAL NAVAL CREW

In order to define the communication we agree with that idea of J. C. Aleric who considers: "*the communication represents a sum of many processes aiming towards a change of information and significations between persons in a given situation*".

Basing on this idea we can easily assert that the act of communicating is not just a simple process of transmitting, based on interaction, but a social conscious transactional act, deliberate or involuntary, conscious or not, located at the very base of the social link.

The quality of the communication is an important factor of the "construction" of the naval crew; a special factor of the unity and familiarity between the crew members, which could supply security and efficiency.

In order to better develop the personal relations between the members of the crew, a lot of communication availabilities and the understanding skills.

III. POSSIBILITIES AND WAYS TO COMMUNICATE ABOARD SHIP

The participation together with the naval students and the professional members of the

[1] Mention the contribution in achieving this work of mr. col. (rs.), psiholog ***Dan NICOLAU***.

ships crews in the practical activities aboard ships, was a remarkable method to directly observe all impersonal forms of acting.

Getting aboard ships, the participation to the practical training voyages offered a best opportunity to test al kinds of acting forms.

Because our study, made aboard ships is much larger, in order to have room enough to express we'll present only in short some of the impersonal communication forms and possibilities to succeed in reaching the professional targets aboard and also able to mean security, to protect the crew members and the ship cargo.

We'll present now some of our study's conclusions:

- the first and the most clear communication form is that one we use to transmit our needs and ideals;
- the second one refers to the signification of the others tem mates from the crew needs and aspirations;
- the third level uses the subconscious communication, meaning the voice tone and the action, able to send discreet messages able to low or to raise the barriers in interpersonal and group communication.

Inside the multinational naval communities we must consider not only the transmission of the message, but to ensure the receiver decoded the message correctly. That's why the message will have to be transmitted as possible in the receiver's mother tongue. If not possible, we have to use the international language of the navigators: the English.

That involves the forming to the multinational crew of a mental representation or a common mental pattern in order to avoid any misunderstanding or confusion.

In this context, the perception is the psychological mechanism every person uses to compare himself, understanding the environement he belongs.

Every information is, this way, included in a perceptive process meaning:

- the perceptual organization, involving the prerception, the perceptual defense and the perceptual functions;
- the perceptual sensitivity is a showing process, permitting to the individual to select and to mentally process just some details. From the selectivity point of view, we can see some kind of a defense owed to the perceptual functions, by, what we call perceptual organization ("screening out") and a settlement, a personal perceptual consolidation of every individual ("screening in").

III. INTERPERSONAL COMMUNICATION

To communicate is not a skill you were born with. W have to learn to improve our communication, learning the communications skills, improving them, developing them.

Anyway the personal communicationcan affect the interpersonal communication as follows:

- the most of the communication is an oral one (including the speaking) by messages(as much as 70% from the whole communication process);
- communication is limitating itself as the people can refuse any kind of communication;
- the communication is not always objective as long as it is a conscious activity, connected but to the personal desires and intentions;
- the communication cannot always be controlled.

IV. A COMMUNICATION MODEL

Sound: the source-coding-transmission-reception-decoding- destination and feedback.

We define the sound as any barrier interfered in our communication trend. We have, from this point of view: physical barriers, semantic barriers, psychological barriers, all of them deeply involved.

The understanding should be ensured by a correct way of the coding/decoding process means, as the mutual linguistic understanding or the non verbal communication. The message should be established in a shape of a "pack" that could be read as a whole, once it was received.

Feedback is a very important part of the communication in order to organize a successful cooperation. A leader has to know the way to feedback and to receive and accept feedback as well because this one is acting two different ways as:

- a positive feedback – it helps the person to understand what the receiver is continuing to do;

- a negative feedback – permitting to person to stop discovering what has t be stopped or what has to be changed; The negative feedback is not a punishment it has to have a critical constructive feature and most of all not to be made in public.

In another easier representation we refer to this as at a "closed communication curl" meaning a process where two or more minds meet – at the moment all agree on solving a problem "like this", the result is mentally shared "as a model for the others", an image of an independent process, no matter the nationality or the culture.

Settling the communication forms we should think the following:

- the number of the persons we are speaking to (individuals or groups);

- the communication instruments (speaking/oral/non verbal);

- the goal of the message (incidental, emotional, utility, of common interest, of group, etc);

- the cultures variety -all differences of nationality, material and spiritual very specific to each ethnic group. To build up moral valuesmeans a long, very long process starting from the very childhood and always influenced by some factors as: the religion, the language, the education, the family, the national customs and traditions.

The language. The misunderstanding can start from the language. Many a time some individuals aboard a ship, belonging to many nations are not good English speakers and they may cause misunderstandings starting from here. It usually happens from the need to ,,colour" the dialogue, missing the sense, giving a wrong way to understand.

V. CONCLUSIONS

The success in ensuring an efficient communication in an inter cultural area of the shipping depends of the knowledge in communicating art, the opinions of every ethnic group in relationship with the main interpersonal liaisons and supposes the interest to avoid confusions and misunderstandings supporting a deeply secured voyage.

VI. BIBLIOGRAPHY

1. Bridge Team Management, Capt., AJSwift, Nautical Institute, 2000;

2. Bridge Resource Management, A. Cowbron and E. Wabren, SAS Academy, 2004-2005;

3. COJOCARU, Carmen, Luminița - *,,The incidence of the emotional intelligence in building the person profile"* - The Technical-Publishing House of the Army, Bucharest, 2008.

4. GANCIAR, I. L., KOROVIN, D., G. - *The experimental programme to train the students in the naval high schools. Methodical recommendations*, Odessa, 1994.

5. HORGHIDAN, V. - *The psycho mobility problems*, Globus Publishing House, Bucharest, 2000.

6. Human Resources Management, Gh., Iosif, Ed., Victor, 2000;

7. Life Resource Management, CRM and Human Factors, Gunnar Falgren, Creatine Book, 2004;

8. OPRISAN, N., VOINESCU, D., SINTION, F., and partners. - *Ways and modalities to recover the psycho-mobility capabilities*, Bucharest, „*The Physycal training and sports magazine",* No. 11/1987, page 29-34.

10. OPRISAN, N. - *Physical and psycho-motional training of the future navigators*, Bucgharest, Education Ministry

Publishing House and the Editorial Staff for foreigners „Romania”, in Forum Magazine, No. 11-12/1993, pages 19-23.

11. TÜUÖS, Ştefan - *„Basic psychological concepts”* – A genetic and functional perspective, Globus Publishing House, 2001;

12. VASILESCU, P., I. - *The risk psychology,* Military Publishing House, Bucharest, 1986.

---------- ///// ----------

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

DYNAMICS OF PERSONALITY IN CAREER CHOICES

Georgiana CORCACI

Department of Psychology, University "Petre Andrei" of Iasi, Romania

Abstract: *The overall aim of the research is to verify the link between certain personality traits - important to guide students in the training plan - and insert the professional field. We assume that the individual is required to achieve performance matching lifestyle with the professional environment, but also consider important and vocational counseling in the choice of study, reinforced by training (Chircev, A., Salade, D., 1996). We therefore propose the following objectives: 1. analysis of personality traits outlined by ICC Inventory (capacity for status, self-acceptance, responsibility, communality, achievement through independent, flexible) 2. probing the link between the 7 personality traits relevant to personal success and preference for certain types of professional activities, 3. analysis of significant differences in the experimental groups in the sample analysis described by personality traits, professional interests, field of study, gender differences analyzed by category, 4. predict professional success of students in the sample analyzed by categories of gender. Research methodology: the goals were used two standardized tests: California Personality Inventory (CPI) which proved relevant to 7 scale and Inventory J. L. Holland's professional interests, tools were applied to a total of 100 subjects, students from different faculties of four universities in Iasi.*

Keywords: *personality traits, career interests, career.*

INTRODUCTION

The overall aim of the research is to verify the link between certain personality traits - important to guide students in the training plan - and insert the professional field. (Jigău, M., 2007). Start from the premise that the individual is required to achieve performance matching lifestyle with the professional environment, but also consider important and vocational counseling in the choice of study, reinforced by training.

RESEARCH OBJECTIVES

1. Analysis of personality traits outlined by ICC Inventory (capacity for status, self-acceptance, responsibility, communality, achievement through independent, flexible) 2. Probing the link between the 7 personality traits relevant to personal success and preference for certain types of professional activities, 3. Analysis of significant differences in the experimental groups in the sample analysis described by personality traits, professional interests, field of study, gender differences analyzed by category, 4. Predict professional success of students in the sample analyzed by categories of gender.

RESEARCH METHODOLOGY

To achieve the objectives we used two standardized tests: California Personality Inventory (CPI) which proved relevant to 7 scale (achievement through independence, intellectual efficiency, capacity status, self-

acceptance, responsibility, communality, flexibility) and Inventory JLHolland's professional interests (Holland, J.L., 1999).

RESEARCH HYPOTHESES

Hypothesis 1: Suppose that between the professional interests of students presented in terms of behaviors and vocational counseling, there is a strong correlation. *Null hypothesis:* there is no correlation between the professional interests of students presented in terms of behaviors and vocational counseling.

Hypothesis 2: Suppose that among the 100 students there are significant differences in distribution of the 11 combinations of professional interests, the categories of gender and field of study. *Null hypothesis:* no significant differences between the 100 students on the distribution of the 11 combinations of professional interests, the categories of gender and preference for the study operationalized as faculty studying choice.

Hypothesis 3: There are significant differences between analyzed groups of students based on career interests, personality traits, faculty and gender category membership. *Null hypothesis:* there are significant differences between groups of students analyzed based on career interests, personality traits, faculty and gender category membership.

Hypothesis 4: Suppose that the success of students in the labor market is dependent on membership in the category of gender, vocational counseling and professional interests. *Null hypothesis:* the success of students in the labor market success can not be predicted by gender category membership, vocational counseling and professional interests.

SAMPLE OF

For the present research were applied two tools on a total of 100 subjects (51 man and 49 female), students from different faculties of four universities in Iasi as shown in Table 1:

Nr.	Universities – Colleges	Woman	Man	Total
1.	Asachi - Energy Management	0	2	2
2.	Asachi – Construction Survey	0	2	2
3.	Asachi – Construction Installations	0	2	2
4.	Asachi – Construction Hydrology	0	4	4
5.	Asachi – Civil Engeneering	1	3	4
6.	Asachi - Economic Engeneering	0	4	4
7.	Asachi - Engeneering Energy	0	2	2
8.	Asachi – Electrical Thermal	0	4	4
9.	Asachi - Electrical Telecommunications	2	3	5
10.	Cuza – Medical Physics	6	0	6
11.	Cuza - FEEA – Finance, Banks	0	6	6
12.	Cuza - FEEA – International Relations	1	5	6
13.	Cuza - Geography	0	1	1
14.	Cuza - Philosophy	7	1	8
15.	Cuza - Engeneering Geological	2	3	5
16.	Cuza – The Arts School	2	1	3
17.	U.M.F. - General Medicine	5	0	5
18.	U.M.F. – Medical Bioengeneering	5	0	5
19.	Petre Andrei - Psychology	13	13	26
total	**4 Universities – 19 Colleges**	**49**	**51**	**100**

Table 1 - Distribution of subjects in sample analysis by field of study

DATA ANALYSIS AND INTERPRETATION OF RESULTS

Hypothesis 1: Suppose that between the professional interests of students presented in terms of behaviors and vocational counseling, a close correlation. Null hypothesis: there is no correlation between the professional

interests of students presented in terms of behaviors and vocational counseling.

Hypothesis was partially confirmed: the multiple correlation analysis of the results we observed significant correlations between average and weak personality traits revealed by ICC and between professional interests and personality traits. This means that: 1. there is a significant medium between established and ownership model, that intellectual efficiency for personal success, 2. there is a weakly significant between accountability, self-acceptance and intellectual efficiency, 3. there is a weakly significant between accountability and flexibility (low to high flexibility and taking responsibility) 4. there is a significant environment, the attainment of independent, intellectual efficiency, 5. there is a weak significant negative variation between professional interests and match the accepted model and intellectual efficiency. In conclusion we can say that at age student, in the present context of professionalization accountability is so strongly linked to the model induced by parents, counselors, all being able to mentor and counsel towards becoming professional, according to their intellectual efficiency

Hypothesis 2: Suppose that among the 100 students there are significant differences in distribution of the 11 combinations of professional interests, the categories of gender and field of study. Null hypothesis: no significant differences between the 100 students on the distribution of the 11 combinations of professional interests, gender differences and preference for the study (operationalized as choice of faculty who are students).

Hypothesis was confirmed: we find that a rate of 63% of students prefer the sciences with a high share for construction (24%), finance (12%) and medicine (10%), medical physics (6%) to equal to the geography and geological engineering (6%), telecommunications (5%) while 37% of subjects preferred the social and human sciences (philosophy, psychology, literature).

After calculating the raw scores, according to election activities students have posted 11 combinations of professional activities of interest, which operationalization personality types as follows: RIA (intellectual realist art), R.I.Î. (realistic intellectual entrepreneur), R.I.S. (realistic intellectual capital), R.A.Î. (realistic artistic entrepreneur), R.Î.S. (realistic social entrepreneur), R.Î.C. (realistic conventional business), I.A.S. (artistic social entrepreneur), I.S.C. (intellectual social convention), I.Î.C. (intellectual entrepreneur conventional), ASI. (artistic social entrepreneur), S.Î.C. (conventional social entrepreneur). High frequency of choice lies types RIA (intellectually realistic art) tied with type S.Î.C. (conventional social entrepreneur) but with a lower frequency of choice than IAS (entrepreneurial social art) with the same frequency of occurrence that ISC (intellectual social convention), R.I.Î. (realistic intellectual entrepreneur), I.Î.C. (intellectual entrepreneur conventional) and ASI. (artistic social entrepreneur).

Finally, descriptive statistics show differences in the distribution of preferences for professional activities and field study on gender criterion which emphasizes ownership and mature identity and gender role imposed by society. This is due to a personal guidelines for various types of activities proving a more realistic than artistic personality with different shades.

Hypothesis 3: There are significant differences between analyzed groups of students based on career interests, personality

traits, faculty and gender category membership. Null hypothesis: there are significant differences between groups of students analyzed based on career interests, personality traits, faculty and gender category membership.

The hypothesis was partially confirmed: To analyze differences between groups of students analyzed based on career interests, personality traits, faculty and gender category membership were compared five experimental groups. Following analysis of variance (F (4.95) = 0, 667 at a significance level p = 0.616), no significant differences were found among the 100 students overall, which induces the idea that personality traits are important personal and professional success but at this age is modeled under the impact of professional conduct requirements of professional, organizational and process maturity was in full swing.

To analyze differences between the professional interests of subjects analyzed, the criterion of belonging to the category of gender, were compared two experimental groups. Following analysis of variance (F (1.98) = 2, 947 at a significance level p = 0.089), there were no significant differences overall between the 100 students that make up the sample for analysis. There is a slight male orientation of the subjects for professional environments such S.Î.C. (conventional social entrepreneur), Î.A.S. (artistic social entrepreneur), R.I.S. (realistic intellectual capital), R.Î.S. (realistic social entrepreneur), R.I.A. (intellectual realist art), R.I.Î. (realistic intellectual entrepreneur), while female subjects are easily oriented professional environments such I.Î.C. (intellectual entrepreneur conventional), ASI. (artistic social entrepreneur), I.S.C. (intellectual social convention), I.Î.C. (intellectual entrepreneur conventional), Î.AS (artistic social entrepreneur), S.Î.C. (social entrepreneur conventional) and less R.Î.C. (realistic conventional business).

These slight differences can be understood in the context of current professional affected by the change of EU integration, and recent economic crisis, causing uncertainty practice events in an activity enjoyed, desired and for which specific skills can be proved: both subjects females and males are oriented according to financial situation which may facilitate their choice of field of work where the time to find spiritual and material rewards be based on the ease of admission and graduation of a university not too demanding (Muchinscky, P.M., 1990).

Analysis of personality traits, belonging to a category of gender and field of study to choose the type of personality that fit with their colleagues, has shown that personality traits are important for personal and professional success but age makes professional conduct (young people more easily shape under the impact of professional requirements, organizational). Because they are during the rearing, the choice of learning environment differ significantly between the 100 subjects. Current professional context - affected by the changes inherent in EU integration and economic crisis - support a practice uncertainty in an industry liked and wanted to prove that specific skills (Zlate, M., 2008).

People have to be flexible, to move into an area where they can obtain material rewards. Expression influences the choice of study and develop the trainees' professional interests of students, causing maturity matching with the professional environment.

Hypothesis 4: Suppose that the success of students in the labor market is dependent on membership in the category of gender, vocational counseling and professional interests. *Null hypothesis:* the success of students in the labor market success can not be predicted by gender category membership, vocational counseling and professional interests.

The hypothesis was partially confirmed: for making this prediction was used to analyze relationships between predictor and criterion variables separately for the two gender categories. You notice a significant positive correlation between average achievement independent, field of study (r = 0.315), independent, effective intellectual achievement (r = 0.357), capacity status and professional interests (r = 0.462), capacity

status and acceptance self (r = 0.482), responsibility and capacity status (r = 0.337), responsibility and communality (r = .478), field of study and flexibility (r = 0.495) and significant negative environmental correlation between accountability and flexibility (r = - 0, 355). This means that the choice of study requires a high flexibility, motivation and strength need to be conducted independently of social context, the presence or absence of family to the support, state capacity, intellectual efficiency, matching the pattern induced by society, family, counselors and responsibility to support capacity status, matching the professional environment, achieving the independence and less flexibility.

You notice a significant positive correlation between the average self-acceptance and field of study (r = 0.307), communality (r = 0.465), capacity status (r = 0.346), responsibility (r = 0.315), interest (r = 0.330) , flexibility (r = 0.346), significant positive correlations between environmental responsibility and intellectual efficiency (r = 0.373), achievement via independence (r = 0.447), flexibility (r = 0.391) and negatively with professional interests (r = -0.332), significant positive correlations between average intellectual flexibility and efficiency (r = 0.446), communality (r = 0.360), significant negative environmental correlation between professional interests and communality (r = - .314) and positive between capacity and communality status (r = 0.351) , significant positive correlations between the environmental field of study and intellectual efficiency (r = 0.325), communality (r = 0.315) and flexibility (r = 0.414).

CONCLUSIONS

The problem of school counselors as they complex vocational counseling, considered important for developing young generation implies an interdisciplinary effort and a good knowledge of the student's personality traits that they grow specialist tomorrow and survey of all elements which contribute to ensuring professional success.

Present research aims to identify personality traits that would support efforts to achieve a fit young professional circle, analysis focusing on areas of study that would motivate the emergence and maturing skills, professional preferences.

Vocational counseling proved to be stronger in historical and social context currently possible because the job market with a crisis, leading to the reconsideration stage of education as an investment in professional future.

Important to solve the crisis through proactive approach to school problems and prevent failures of graduates, vocational counseling requires reconsideration of the role specialist school and professional orientation through evaluations, career assistance, placement, although the decision is the responsibility of the student or professional school, expression analysis all conditions, awareness of their professional future and the consequences of the decision, a stage of maturation.

Present research highlights this aspect of accountability training environment and negatively correlated with the ability to adapt as required by field of study as preparation for future professional.

Personal success predicted by the 7 personality traits chosen field of study and professional interests takes different forms depending on gender category membership largely due to the influence of gender

stereotypes, building personal and personal history of each.

REFERENCES

1. Chircev, A., Salade, D., (coord.), *Orientarea şcolară şi preorientarea profesională*. Bucureşti: Editura Didactică şi Pedagogică (1996).
2. Holland, J.L., *Making vocational choices*. Englewood Cliffs, NJ: Prentice Hall Inc. (1999).
3. Jigău, M., *Consilierea carierei*. Bucureşti: Editura Sigma (2007).
4. Muchinscky, P.M., *Psychology applied to work*. Pacific Grove, CA: Books/Cole Publishing Company (1990).
5. Zlate, M., *Eul şi personalitatea*, Bucureşti: Editura Trei (2008).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

THE LIFE LONG LEARNING IN ROMANIA SCHOOL COUNSELOR. NEEDS AND PRIORITIES

Anice Gabriela DRAGOI

Centrul Municipiului Bucuresti de Resurse si Asistenta Educationala,Bucuresti, Romania

Abstract: *Relatively new to the world of school attendance, school counselors is one of the key figures in education and student development because of the role and tasks that meet their. Taking a proactive character, activity not only helps students but also their parents and teachers. Being the,, day, the news industry is not only a requirement but a necessity. A good counselor is a counselor who is working continually to training and continued professional development*

Keywords: *communication training, counseling, personal development*

European Union's strategic objective set by the Lisbon European Council (23-24 martie2000) and the European Council reaffirmed Stckholm (23 to 24 March 2001) is that the European Union to become the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more jobs and greater social cohesion,

Stockholm European Council ratified the report on the objectives of education and training, adopted by the Board of Education of 12 February 2001 and reaffirmed the importance of education and training: ,, Improving basic skills, especially those on ICT and digital, is a priority of the European Union to make the European economy the most dynamic and competitive knowledge-based economy in the world. This priority includes education policies for lifelong learning and to prevent decrease in the number of scientific and technical staff "

In Romania, school counselor activities is characterized by great diversity: consulting, prevention, intervention, evaluation, research. Research shows that job satisfaction of those involved in various activities is higher than those carrying only evaluation activities (Proctor & Steadman, 2003, cited Drugaş et al., 2010). There is also a desire to reduce the time devoted to the evaluation and increase the time devoted to intervention, consultation (Curtis et al., 2002, cited Drugaş et al., 2010).

School counselor needs are different from the needs of space and materials and ending with training needs and training. Training and development activities are essential to ensure quality school counselor.

The International School Psychologists Association (ISPA) suggests that we should consider the following aspects of training and professional development needs of school psychologists (school counselors) (Drugaş et. Al., 2010):

• recognition of the need to participate in continuous professional development training;

• seeking supervision and collaboration in information poor situations;
• keeping abreast of scientific and professional news of recent studies in this field, participation in conferences, workshops, active participation in associations / organizations in the field.

The Teaching and Learning International Survey (TALIS) coordinated by the OECD in 2007/2008 reached the following conclusions on teacher training and professional development in several countries, especially Europe:
- Training should be done in accordance with the initial training, with support for career and professional development;
- Fostering professional values that encourage innovative practices and performance;
- Providing support for career both began and during his career, formal and informal support on various issues (eg learning opportunities for formal / informal);
- Providing a higher education teachers and professional development programs offered by institutions, it meets the needs of schools, teachers, society.

All these aspects are applicable to the school counselor teacher performing specific activities. Both teachers and school counselors say we need effective feedback on their work to take full advantage of training opportunities. This says a report published by OECD and the European Commission entitled 'Professional development of teachers, a comparison between Europe and the world" (TALIS, 2009). The report also shows that diversity training experience and a better climate to work in schools are, in turn, the key to successful professional development.

We believe that such studies continue training needs to be done periodically as changes in society inevitably causes changes in training in any field, especially in socio-human.

REFERENCES

1. Herr, E., Cramer, S. – *Controversies in the mental Health Professions.* Accelerated Development Inc., (1987)

2. Myers, J.E.; Sweeny, T.J. – *Specialties in counseling*, in D.C. Locke, J.E. Myers, E.L. Herr (Eds.) – The Handbook Of *counseling* (p. 43-54), Thousand Oaks, CA: Sage,(2001)

3. Neukrug, Ed – *The world of the counselor*– An Introduction To The Counseling Profession, Brooks/Cole Publishing Co., USA, (1999)

4. Szilagyi, A. – *The Status Of Counseling Profession In Romania* in *Career Counseling and the global labor market,* "Petru Maior" University Publishing House, (2005).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

TEACHERS' LEADERSHIP STYLE IN THE CLASSROOM AND THEIR IMPACT UPON HIGH SCHOOL STUDENTS

Loredana DROBOT*, Monica ROŞU**

*Faculty of Theology, Social and Educational Sciences, University "Eftimie Murgu" of Reşiţa, Romania
** Faculty of Economics, University "Eftimie Murgu" of Reşiţa, Romania

Abstract: *The teacher, in the educational process, plans, organises and controls students' activity and thus he / she appears in the leader's position. Irrespective of the concrete content of the manager teacher's activity his / her work falls within one of the following activities; information processing, engaging in interpersonal relations and decision making.*
Research purpose: investigating students' perceptions about the impact of teachers' leadership styles in the classroom upon their psychosocial development.
Research objectives: 1. Analysis of the teacher-student relationship in relation with the way the students feel these interactions; 3. Exploration of the pupils' opinions regarding the characteristics of the desired teacher.
Research hypotheses: 1. If teacher-students relations are based on co-operation and involvement then the students' level of satisfaction towards the activity performed; 2. If teacher-students relations are based on encouragement in participation, students get the feeling they are in control of the activities they are bout to deploy; 3. If the teacher exhibits communication and relationing skills, and has also vocation, in the vision of pupils he / she is the "ideal" teacher.
Methodology: The method of research was the opinion poll inquiry. The sample was made of 300 high school students.
Conclusions: The way in which a teacher organises his / her relations with the students is the most important ingredient for the subject assimilation; suggesting lifelong training programmes for the teachers with modules of pupil-focused learning; training teachers in pupil-focused counselling, modules of personal development destined to teachers.

Keywords: *leadership style, teacher-student relationship, student-focused learning.*

1. INTRODUCTION

The teacher, in the educational process, plans, organises and controls the students' activity and consequently appears in the position of leader [2]. Studies conducted in the field of class management present the teacher's authoritative, democratic and *laissez-faire* leadership styles.

The authoritative leadership style means that the leader (teacher) makes all the decisions about the organisation of the group and the activities performed in the group. He or she does not share with the students the overall plan of activities, nor the criteria for assessing individual or group performances. His / her evolution supposes keeping outside the group's concrete activities and exercising a strict control.

The democratic leadership style. The democratic leader does not participate either too much in the activities. Nevertheless, he / she avoids to make decisions alone, and invites the group to participate in setting the organisation manner. The students are offered the opportunity to choose every time, their advice is sought regarding the task fulfilment: the leader suggests at least two alternatives, letting them decide themselves. The leader presents the common criteria of assessment and criticism he or she observes together with the students; he or she acts, in a way, like a member of the group.

The laissez-faire leadership style means a passive role of the leader, who limits his or her participation as much as possible, leaving the students to take all initiatives. He / she exhibits a friendly attitude but by all he or she does suggests indifference and non-involvement: he / she hesitates when put in the situation of offering suggestions and constantly avoids any evaluation of participants ideas or behaviours.

Irrespective of the concrete content of the manager teacher's work, his or her *actions* fall within one of the following: processing information, engaging interpersonal relations and decision making [1].

The educator's roles are associated with the personal values and attitudes incorporated in the structure of each student's personality. The students address to teachers to get advice only if the latter are close enough to students, if the former trust to be understood and well advised. When they do it, students do not address to any teachers but only to those who *understand them*. Students wish to have closer relations with teachers in order to find in the latter moral support whenever they need it [3].

The purpose of the research is to investigate the students' perceptions related to the impact of teachers' leadership styles in the classroom upon their psychosocial development. The objectives are, on the one hand, to analyse the teacher-student relationship in relation with the way students feel these interactions, and on the other hand to explore the students' opinions on the characteristics of the desired teacher.

2. RESEARCH HYPOTHESES AND METHODOLOGY

2.1 Research hypotheses.

1. If teacher-student relations are based on co-operation and involvement, the students' satisfaction level towards the activities increases.
2. If teacher-student relations are based on participation encouragement, the students get the feeling they are in control of the activities they are to perform.
3. If the teacher exhibits and proves communication and relationing skills and also has vocation, he / she is the "ideal" teacher.

2.2 Methodology. The research was conducted by a study of the teachers' leadership styles in the classroom, performed from the perspective of the analyses of teacher-student relation and teachers' characteristics, monitoring the way these interactions influence students' attitudes and behaviours [4].

For formulating hypotheses, the following criteria were set for the two first hypotheses, the level of satisfaction and the degree of control, whereas for the third hypothesis the empathic capacity and the pedagogic talent.

The research method was the opinion poll inquiry. The Questionnaire "***Teachers' leadership style in the classroom***" comprises *6 items* for which there are 3 answering options: a) to high extent; b) to medium extent; c) to low extent; and 1 item with free answer asking the students to list three essential characteristics of the "ideal teacher". The subjects who answered the questionnaire were *300 high school students*, enrolled in technical training in an industrial high school of Reşiţa.

2.3 Questionnaire structure. For the first 6 questions there are 3 answering variants. Choose the answer that best corresponds to your opinion: a) to high extent; b) to medium extent; c) to low extent.

Questions:

1. Do you appreciate that the activity carried on in the classroom under the teacher's co-ordination offer you satisfactions?
2. Are there co-operation relations among the classmates, between them and the teachers in the fulfilment of the tasks?

3. During the activities performed in the classroom, are students encouraged and objectively appreciated by their classmates and teachers?
4. Are the class students mutually integrated and accepted in order to solve learning tasks together?
5. Do classmates prove to be capable of interpersonal awareness and communication?
6. Are you allowed to express your own opinions and to take initiative?

Question no.7 asks you to list three essential characteristics defining, in your opinion, the portrait of the "ideal teacher". Please select form among the following: to be talkative, friendly and close to students, to be sympathetic and indulgent with students, to be fair, to be patient and calm; to be a good teacher, to teach well; to be well trained and qualified; to be kind; to give good marks, other: to be dignified, to be demanding and strict.

7. What should an "ideal teacher" be like?

3. PRESENTATION AND INTERPRETATION OF THE RESEARCH RESULTS

3.1 Presentation of results

- Question no.1: the students appreciate that the activities of school learning deployed in the classroom under the teachers' co-ordination create satisfactions as follows: a) to high extent 10%; b) to medium extent 76.66%; c) to low extent 13.34%.

- Question no.2: the students appreciate there are co-operation relations for fulfilling the work tasks among the students, between them and the teachers: a) to high extent 40%; b) to medium extent 56.66%; c) to low extent 3.34%.

- Question no.3: during the work activities realised in the classroom, students are encouraged and appreciated objectively by their colleagues and teachers: a) to high extent 16.66%; b) to medium extent 63.33%; c) to low extent 20.01%.

- Question no.4: the classmates are mutually integrated and accepted in order to solve learning tasks: a) to high extent 30%; b) to medium extent 30%; c) to low extent 40%.

- Question no.5: the classmates prove to be capable of interpersonal awareness and communication: a) to high extent 13.33%; b) to medium extent 60%; c) to low extent 26.67%.

- Question no.6: the students are allowed to express their own opinions and to take initiative: a) to high extent 33.33%; b) to medium extent 30%; c) to low extent 36.67%.

We remark that in questions 1,2,3,5 the weight of the answers "to medium extent" is above 50%. In questions 4 and 6 the percentages of the answers "to high extent", "to medium extent" and "to low extent" are close.

The answers to question 7 "What should an ideal teacher be?" describe the students' perception as regards the portrait of the "ideal teacher".

According to the criterion "empathic capacity" the appreciation of answers is the following; 18.88% - to be talkative, friendly and close to students; 15.55% - to be sympathetic and indulgent with students

According to the criterion "pedagogic talent": 13.33% - to be a good teacher, to teach well; 7.77% - to be well trained and qualified.

3.2 Interpretation of results.

3.2.1. If we analyse the teacher-students relationship, according to the criteria students' "satisfaction level" toward the classroom activities under the teacher's guidance, considering the answers to questions 1,2,3,5 the following interpretations result:

1. It is encouraging that the students exhibit opening for awareness and communication at the level of the class to a 60% extent, which grants them satisfaction in their work (over 70%). We may say that the students are aware "to medium extent" of the necessity to know each other and to communicate and appreciate that their personal needs can be satisfied by the activities carried on in the classroom under the guidance of teachers.
2. We should also appreciate that the students consider in a percentage of over 50%, that their relations with the teachers are relations of co-operation in the fulfilment of task and not relations of imposing under the dominance of teachers' power. Moreover, we found that at the level of the class group there are co-operation relations among the members.
3. What is to be praised it that teachers use techniques of student motivation and the latter feel encouraged and appreciated to a "medium extent" of over 60%.

3.2.2. When we analyse the teacher-student relations according to the criterion "students' degree of control" over the activities they are to deploy, we may identify the following appreciations:

1. In Question 4 "Are the classmates mutually integrated and accepted in order to solve learning tasks together?" the percentages of appreciations are close, but answer c) stands out, which leads us to the following interpretations:

- We may say that the cohesion of the teacher-student group is not fully reached, either because there are teachers who don't show interest and don't get involved in the group dynamics, do not grant importance to becoming aware of the group and individual psychology, and at the level of the students' group, they do not accept one another; or there are authoritative teachers whose work style is to impose themselves and not to co-operate with students, or there are teachers who refuse or are reluctant to adopt the new work strategies aiming at integrating and involving all students in the activities, new teaching work (in small groups) and relation-setting at the group level;
- Students do not feel integrated and responsible, thus motivated, which would offer them the possibility to be more persevering and consequently to master certain aspects of the classroom activities.

2. In Question 6 "Are you allowed to express your own opinions and take initiative?" we remark a closeness of answers' weight, which leads us to the following interpretation:

- If we consider the weight of each individual answer, we may remark that the answer with the most important weight (36.67%) is that stating that students are not allowed to express their opinions and to take initiative. Students appreciate in fact that they are not understood by teachers and in fact their suggestions would not count; they are not aware that they actually express their individual satisfactions and not their objective needs, teachers mediate between the group needs and the goals to reach; teachers attempt at keeping a rigorous control, teachers who are reluctant to other people's opinions, including those of students, are teachers resisting change who do not adopt a consulting, democratic style.

3.2.3. What is really important for students is that teachers first of all communicate with them, understand them, but also that they understand the teachers' explanations grace to the latter's pedagogic talent they prove in the classroom.

3. CONCLUSIONS & ACKNOWLEDGMENT

At the level of the class, we witness, in different contexts, different manifestations of the authoritative, democratic and *lasisez-faire* teachers' leadership styles. We may not claim that one style is predominant in all aspects, because after the analysis of the teacher-student relations, when it comes to the criterion "degree of control" we may draw the following conclusion: by choosing answer c) to questions 4 and 6 the students show they feel constrained by teachers' authority (the authoritative style), and they would wish to feel the cohesion of the teacher-students group, to feel encouraged and motivated to participate in future actions, to have some

control over their actions. We may affirm that this perception, at the level of students' personality, is found also at the level of individuals and groups of any social organisation.

As regards the criterion "level of satisfaction" towards the activity performed, the conclusion is that the answers to questions 1,2,3,5 definitely, but also answers to questions 4 and 6 to a medium extent lead us to conclude that teachers adopt a democratic style by co-operating with students, by objective assessment, communication developed, students' involvement. At the same time, if we analyse the answers to questions 4 and 6, i.e. that to a low extent they feel integrated in activity and to high extent they express their opinions, we may draw the conclusion that there are teachers who do not get involved, are not interested in changing anything, are indifferent to everything, are content to be left to do their job teaching, the style adopted by them being "*laissez-faire*".

As for the identification of students' perceptions about teacher-student relations developed in the classroom, on the whole we found that students manifest the tendency to appreciate the relations developed so far.

The analysis of the characteristics of the "ideal teacher" in students' opinion lead us to the following conclusion: the way a teacher conduct his or her relations with them is the most important element, as the most relevant attributes of the ideal teacher are in their perspective communication, indulgence, friendly attitude, fairness or patience in the teacher/student relationship. Thus, the portrait of the ideal teacher in the students' vision is focused on the teachers' communication and relationing skills, on his or her attitude (patience, calmness) but also on the quality of explanations and teaching (pedagogic talent).

REFERENCES

1. Boboc, I., *Psychosociology of school organisations and educational management,* Bucharest: E.D.P.-R.A. Publishing House (2002).
2. Păun, E., *The school in sociopedagogic approach,* Iaşi: Polirom Publishing House (1999).
3. Spătaru, L, Cădariu, L., *Introduction to educational research,* Bucharest: Economic Publishing House (2003).
4. Cristea, S., *Management of the school organisation,* Bucharest: E.D.P Publishing House, (2003).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

PREMISES FOR AN EFFICIENT SCHOOL ORIENTATION AND CAREER COUNSELLING

Loredana DROBOT*, Monica ROŞU**

*Faculty of Theology, Social and Educational Sciences, University "Eftimie Murgu" of Reşiţa, Romania
** Faculty of Economics, University "Eftimie Murgu" of Reşiţa, Romania

Abstract: *School orientation and career counselling refer to the set of educational-training activities by which people get support, help and guidance in choosing studies and professions that are the most appropriate to the structure of their personality and meet society's requirements. The main research objective is the need for taking certain measures able to lead to the shaping of the clearest picture possible as regards the awareness about the school network in the county and school pupils' and students' counselling.*
The research hypotheses are the following: if all pupils got enrolled in high school or vocational studies, we may affirm they are aware of their abilities and interests, and thus they succeeded, and the activity of counselling about school and career orientation to which the well-known factors have contributed was satisfactory. The research sample was made of 120 high school students. The method used was a 16-item questionnaire.
From the data analysis and interpretation we consider that the presence in school of an organisational psychologist is absolutely necessary. In Romania the school organisational psychologist has not found his place in school yet, it is considered that the educational psychologist has as task the pupils' and students' professional orientation and counselling. However, the students' answers have not mentioned the presence of the educational psychologist.
The conclusions and recommendations are that in the lifelong learning system there should be training modules in career counselling, training modules for teachers in counselling and modules of personal development, of professional supervision.

Keywords: *school orientation, career counselling, school counselling*

1. INTRODUCTION

Counselling for school and career orientation is a field of psycho-pedagogic counselling which includes specific activities destined to school pupils' and students' education and training, enabling them to adopt the best decisions regarding professional studies, occupations that may be embraced by each of them during their entire life [2]. Career is built by each person. It is successful and brings satisfaction if it is shaped as realistically as possible.

Our study aims at highlighting the necessity to take measures leading to the shaping of the clearest picture possible as regards the awareness about the county school network to the counselling of school pupils and students who have chosen a school that is not fit for them, does not match their potential and knowledge.

2. RESEARCH METHODOLOGY

2.1 Study hypothesis. The study hypotheses are the following:

- If all pupils got enrolled in high school or vocational studies, we may affirm that they are aware of their capacities and interests, and thus they have succeeded, and the activity of counselling regarding school and vocational orientation, to which the well-known factors have contributed, was satisfactory.
- If not all school pupils continue their studies, then the activity of orientation was not adequate, and it should be improved the following school year,

2.2 Research sample. For the verification of the above hypotheses we applied a questionnaire to a number of 120 nine-graders from a college (high school) distributed as follows: 52.5% M and 46.6% F.

2.3 Questionnaire. The method used was a 16-item questionnaire, presented below:

1. Have you made a final option as regards the faculty / post-graduate school you wish to attend when you graduate from high school?
   Possible answers: yes or no.
2. What type of school did you want to attend when you graduated from the 8th grade?
   Possible answers: high school; vocational school; apprenticeship school; other: describe …
3. Where did you get the information related to the main high schools in your town, about their educational profile, their curriculum supply?
   Possible answers: from form teachers; from teachers; from the school counsellor; from parents; from acquaintances, friends and colleagues, other sources: describe …
4. Who should offer you information regarding your future career?
   Open question ……
5. Which were the criteria having oriented you to chose that type of studies?
   Open question …….
6. Did you talk with your form teacher in educational classes about topics related to your career, about what you are to do in the future?
   Possible answers: yes or no.
7. If the above answer was yes, please elaborate on some of these themes debated.
   Open question ……..
8. Which were the greatest difficulties you encountered in finalising your options?
   Open question ……
9. What topics you think should have been discussed in school?
   Open question ……
10. What were the results following the educational classes with your form teacher related to your school orientation?
    Open question ……..
11. Do you think that your school orientation plays an important part in your evolution as school pupils and students?
    Possible answers: yes or no.
12. Is there a reason that could motivate the selection of your future studies?
    Open question …
13. What is the weight of your parents' involvement in your orientation for the future?
    Open question ….
14. Did the information you received related to high schools and vocational schools, with their laborious offers, influence you in any way?
    Possible answers: yes or no.
15. If you answered yes to the above question, which were the most important offers?
    Open question ……..
16. Do you think that you will overcome the future obstacles with success and that the choice of your career in the near future will be successful?

Please state your reasons. Open question …

In the end please state your grade, age and gender.

3. DATA PRESENTATION AND INTERPRETATION

3.1 Presentation and interpretation of answers item by item. The data collected from the answers to the questionnaire are the following (item by item).

Item 1.

Most school pupils are decided since middle school what type of high school they wish to attend. Consequently 94.16% of them have finalised their option and are rather self-confident, whereas 5% have certain difficulties in choosing.

Item 2.

The pupils' preference for high schools is the highest (94.16%), whereas only 4.16% chose vocational schools and even less, 0.83% opted for apprenticeship schools.

Item 3.

The answers to question 3 regarding the school network show that pupils received information from their form teachers (60%), teachers (13%), parents (8%), school counsellors (8%), schoolmates and friends (7%). It results that school was the main source of information (81%).

Item 4.

When we analyse this item, we find that pupils consider that the highest weight in receiving information about career comes from form teachers (44 answers), and parents (22 answers). Hence the conclusion that pupils prefer to be informed about their future by school and family.

Item 5.

This item showed the criteria underlying the pupils' options and the following situation resulted: "mark at the national examination" – 15 pupils, "inclinations and talents – 28 pupils; "parents' advice" – 27 pupils. We remark that 7 pupils chose as criterion "the conditions provided by the school" and "it should be a good school".

Item 6.

In this item we find that most students answered they have discussed with the form teacher, during educational classes, topics about career, about their future, and they gave affirmative answers in 80% of the cases, which is a rather satisfactory situation.

Item 7.

This item asked for examples of debate topics. 37 students mentioned the topic "the school we wish to choose", 23 of them – "Where do I orient my career?", another 23 students mentioned the topic "profession – most valuable jewel in life". From this item it results that they talked rather little about the examination they were about to take and how to fill in the option chart.

Item 8.

The item was meant to highlight the difficulties encountered in expressing options. For 35 pupils they were represented by "grades", 15 pupils said "there are no difficulties", 13 pupils were afraid of low marks at the examination. We remark that in general the students are aware of the difficulties they may encounter. There were two cases in which the difficulty was "convincing parents to let them attend a certain high school":

Item 9.

Here students were asked what further topics should be discussed. 37 pupils affirmed to have discussed them all, 15 students are sufficiently informed, 15 pupils wish information about the professions required the most on the labour market, and the rest desire information about the school network and their offer.

Item 10.

As for the results of educational classes with the form teacher related to school orientation, the situation is the following: very good results (30%), good results (38%), "I am better oriented" (15%), "more informed" (13%), "none (4%). Hence the conclusion that educational classes with the form teacher were efficient on these themes.

Item 11.

The answers to the question if school orientation plays an important part in their evolution as school pupils and students were 98% affirmative and 2% negative.

Item 12.

When motivating the choice of future studies, 25 students affirmed "there are no reasons, 30 students said "there are certain reasons, 15 of them chose "money"! as motivation, 25 motivate "I like the profession of …", while 5 students express their desire to have "a decent job".

Item 13.

As for the weight of parents' involvement in their orientation for the future, the situation is the following: 51% answered that parents have a hundred percent importance, 13% of them assessed this intention as advice "they said it would be better", and the other students mentioned that the parents' involvement weight is moderate, little or even minimal.

Item 14.

When asked if the information they received from high schools or vocational schools influenced then. 62% of them answered yes, and the other said no.

Item 15.

They consider that the most relevant and comprehensive offers are those of "Traian Vuia" High School (40 students), School Groups (20), "Mircea Eliade" High School (10 students), "Traian Lalescu" High School (8 students). A number of 30 students affirm there were no offers, and thus we conclude that they do not consider important the passage from middle school to high school, or the educational factors did not do enough to convince them.

Item 16.

Very many students, more precisely 91, are sure of their success in overcoming future obstacles, 13 students "think and hope so", 8 students "are not sure" and the rest do not believe they will be successful.

3.2 Overall interpretation. From the analysis of all items, we remark that pupils are mostly sure they will choose a high school and not a vocational school. In some cases form teachers have not insisted enough upon certain debate topics related to career, or pupils were not interested enough. We remark a high importance of parents' involvement in pupils' orientation. In selecting their options, a determining role is played by the marks obtained in school and obviously the score at the "national tests". The orientation toward a good high school from the part of parents is beneficial, but this should not be imposed without the child'' agreement [3].

3. CONCLUSIONS & ACKNOWLEDGMENT

The educational ideal of Romanian school consists in free, whole and balanced development of human personalities. In view of reaching this ideal, an important role is played by school pupils' and students' psycho-pedagogic awareness in view of building and supporting the capacity of self-awareness, getting information about the world of professions and school network and the optimum modalities to acquire them, as well as awakening and developing pupils' interests / aspiration in view of the appropriate structuring of social motivation specific to the labour market [1].

The means used before in school as regards school orientation and career counselling are not at all obsolete, but they have to undergo a process of adaptation, of matching with reality, they should be modernised, updated and integrated in the new contents of education provided in the national curriculum.

So that the act of school - professional choice be actually justified, school pupils and students should be offered knowledge , information and data about several professions, domains of activity, trades, social positions etc. and thus they will be put in the real situation of choosing from among

alternatives, of actual selection and comparison , and consequently they will be free to choose.

The first elements of school orientation and career counselling will be simple information and knowledge from the environment known to the pupils: neighbouring schools in the locality and nearby towns, and in the county, professions and jobs specific to the region, with the extension similar to the previous situation. The details will be provided at the express request of certain pupils and students, at the pressure of new schooling stages or on graduation from the chosen schools.

REFERENCES

1. Cucoş, C., *Pedagogy,* Iaşi: Polirom Publishing House (1996).
2. Dumitriu, Al.I., *Psycho-pedagogic counselling. Theoretic grounds and suggestions of practical action,* Timişoara: Eurostampa Publishing House (2004).
3. Jigău, M., *Career counselling,* Bucharest: Sigma Publishing House (2001).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

PROFESSIONAL DEVELOPMENT OF ACADEMICS TEACHERS – REFLECTIONS ON PARTICIPATION IN TRAINING PROGRAMS

Nicoleta Verginica DUTA

Faculty of Psychology and Educational Sciences, Teacher Training Department,
University of Bucharest, Bucharest, Romania

Abstract: *The objective of this article is to identify the degree of participation of academics teachers in the training programs. Research method corresponds to a descriptive study that used quantitative and qualitative analysis techniques. The sample included academics teachers participating in a questionnaire survey of four public universities in Romania and Spain, with a total of 240 people in Romania and 240 in Spain. Variables selection of teachers were home country higher education institution that teaches; faculty to which it belongs, sex, age in higher education, professional category. For analysis and interpretation of data we used SPSS 17.0 program. The results obtained through question 4, not to generalize the entire population, there is a low level of participation in training programs to teachers of our country (22,86%), compared with teachers in Spain (65,83%). Academic life allows us to think of a project on short, medium and long term, including professional development. Finally, we propose to have training programs for university staff as a result of reflection and individual and collective responsibility.*

Keywords: *development professional, lifelong learning, training of teachers*

1. INTRODUCTION

The professional development of teachers is studied and presented in the relevant literature in many different ways. But always at the core of such endeavors is the understanding that professional development is about teachers learning, learning how to learn, and transforming their knowledge into practice for the benefit of their students' growth [1].

The paper is organized as follows. The theoretic considerations regarding the definition of teachers training and development professional are presented in Section 2. The research methodology it developed in Section 3. The results research is presented in Section 4. Finally, conclusions are provided in Section 5.

2. THEORETICAL PERSPECTIVES

2.1 Definition of teachers training

Fullan (1993) considered to teacher training is having the honor of being simultaneously the worst problem and the best solution in education. Teacher education still has the honor of being simultaneously the worst problem and the best solution in education.

For the concept of "training" are used and other concepts using similar or partly similar meanings, as we found in the literature: staff development, professional development, personal development, career development, etc.

As considered Iucu (2004), training means "all activities aimed at updating regularly the initial training, to adapt it to new demands of

conducting educational processes, and to assimilate knowledge and skills".

2.2. Definition of development professional

In a previous paper [3] we have presented the current literature review of the development professional (Iucu, 2007; Benedito, 2007; Potolea & Toma, 2008) elaborated some of the starting points of our communication with regard the professional development of the university teacher. We present a synthesis of the definitions of professional development (Marcelo, 2009):

- The concept of professional development is understood as synonymous with other concepts, considering the various theoretical frameworks underlying the different strategies of action undertaken trainer undoubtedly bring with teacher various positions at the class, the curriculum changes and life cycles career.
- Work opportunities that encourage creative and reflective skills in the teachers, thus, enabling them to improve their practices (Bredeson, 2002).
- The professional development of teachers is the professional growth the teacher acquires as a result of his/her experience and systematic analysis of his/her own practice.

3. RESEARCH METHODOLOGY

Research undertaken lies in education, opting for an integrated strategy, which correlates with the quality quantitative research. Frequently, the research conducted, the two types of paradigms, quantitative and qualitative, and have, and have supported each other and become complementary. The research was conducted between November 2008 - July 2009 in four institutions of higher education in Spain, was quoted as institutions representative units in the country. Also, for a comparative study we resumed the investigation and in our country between September 2009 - July 2010, comprising a total of four institutions of higher education in Romania.

a) Participants

Universe: population analyzed
the teachers of public universities in Romania and Spain, divided into areas of knowledge the humanities and experimental.

Sample: intentional, as any sampling according to two variables (type of university study), four universities decided to select different features: large universities with a long history, universities belonging to different territorial areas. A total of 245 university teachers from Romania and 240 from Spain were sampled, to whom the questionnaire was provided.

b) Design

Approach: Descriptive, pilot study.

Technique: to know the views that teachers may have about possible participation in a training program, we designed a questionnaire for training needs and technical college teachers to collect information through a survey and were asked among others, the following question: Does participation in an appropriate training program in university education?

Variables selection of teachers were: country of origin (Romania, Spain); institution delivering higher education, faculty to which it belongs, sex (male/female), age in higher education, professional category (junior, assistant, lecturer, associate professor, associate professor, consultant).

The questionnaire was constructed in the first phase of 16 items, which was applied on a pilot sample of 22 teachers, male and female within an institution of higher education in Spain. Also, after the initial questionnaire consisting of 16 items, of which five open-response items, was applied to a pilot sample of 25 subjects formed within an institution of higher education in our country. At the time of application, the final questionnaire included a white sheet for subjects to express their views and suggestions as it deems appropriate, both on the instrument in general and regarding description categories and items in particular.

Following this pilot application we wanted to examine: (a) the teacher on the instrument, (b) use of evaluation categories, (c) understanding the terminology used in the questionnaire, (d) overall assessment of the instrument.

Final version questionnaire was developed based on the results of the pilot study, consisting of 14 items. The procedure for obtaining the data was the questionnaire in writing. In so doing the analysis and interpretation of data, we used SPSS 17.0 (Statistical Package for the Social Sciences - Statistical processing program for Social and Human Sciences).

c) Procedure

The procedure for obtaining the application data was written questionnaire sent to teachers by internal mail and email.

4. RESULTS

Teacher participation in training programs in Romania is regulated by national legislation and community expectations defined.

As a general objective of training is considered supporting the improvement of the national training system. Spain made in education, a shift towards a new paradigm, which reflects a constructivist conception of learning**.**

The results obtained through question 4, not to generalize the entire population, there is a low level of participation in training programs to teachers of our country (22,86%), compared with teachers in Spain (65,83%). The situation presented in detail in the following:

Table 1.

Subjects / Participation in training programs	Teachers Romania No. -245		Teachers Spain No. -240	
	Frequency	Percentage	Frequency	Percentage
Yes	56	**22,86%**	**158**	**65,83%**
Not	**174**	**71,02%**	72	**30%**
Non-response (NR)	15	6,12%	10	4,17%

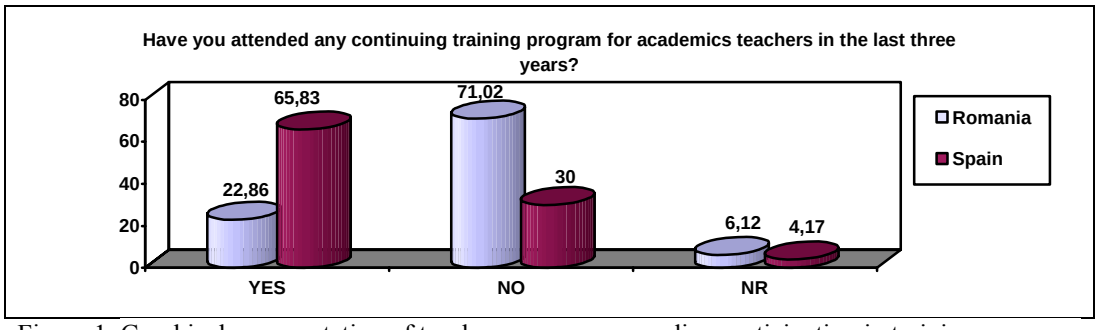


Figure 1. Graphical representation of teacher responses regarding participation in training programs

As can be seen, a percent of 71,02% teachers in our country have participated in training programs in the past three years, compared with only 30% teachers in Spain. Also, notable that a small percentage of subjects responded (6,12% -Romania; 4,17%-

Spain), which shows that this question has an insignificant number of subjects who did not respond.

Teacher training is an ongoing process that is based on the concept of lifelong learning.

An important contribution to development lies in the teaching career of lifelong learning; especially through the results we determine the level of education, for the purposes of this efficiency.

Analyzing the answers given by university teachers in the institutions of both countries of the point (b) in the question 4, we can see that most of the subjects interviewed in both countries (80% subjects in Romania and 85,83% subjects in Spain) considers appropriate pedagogical training for participation in higher education, significant fact in favor of building the training programs at university level.

Distribution of answers is reflected in Table 2 and graphic below:

Table 2. Distribution of answers regarding the importance participating in training programs of academics teachers

Subjects / Importance the participation in training programs	Teachers Romania No. -245		Teachers Spain No. -240	
	Frequency	Percentage	Frequency	Percentage
Yes	**196**	**80%**	**206**	**85,83%**
Not	33	**13,47%**	23	**9,58%**
Non-response (NR)	16	6,53%	11	4,59%

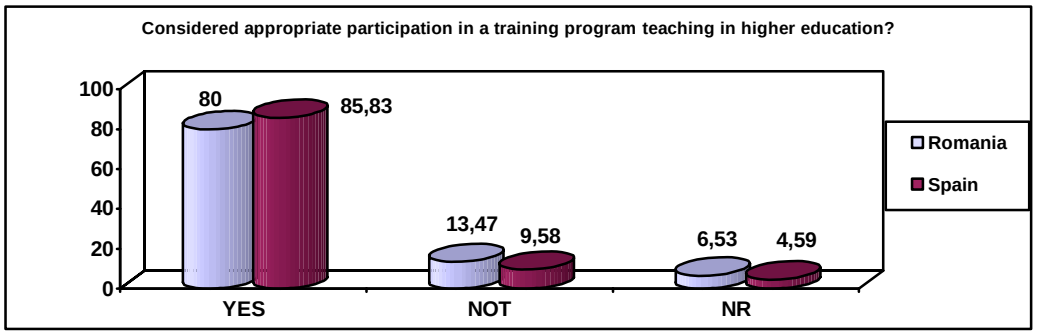


Figure 2. Graphical representation of answers regarding the importance participating in training programs of academics teachers

Observed that only a percentage of 13,47% subjects in Romania considered appropriate pedagogical training, for which university staff believes that pedagogical training programs are important, especially early career, but not decisive, and in Spain only percentage of 9,58% subjects.

We can say that in this category we find two kinds of people: some who do not feel the need for training, because it possible considered they have a certain level of training (appears effect prestige) and people do not realize they have this need (not it aware importance of the psycho-pedagogical professional development, but in fact have this need). Also, notable that a small percentage of subjects in Romania (6,53%) and Spain (4,59%) did not answer this item.

5. CONCLUSIONS & ACKNOWLEDGMENT

Conclude the most important data obtained from the collection; highlight some ideas and conclusions that could guide the reflection and debate around issues of training.

In summary, the results allow us to observe that the data show similarities and differences between the teachers surveyed in both countries.

Interestingly, both teachers in Romania as those of Spain considered it necessary to participate in training program (80% subjects of Romania and 85,83% in Spain).

It stands out from the results that teacher training is an essential factor in improving the quality of university education.

It highlights the need for training and updates the idea of a permanent training of professor. We are talking about updating scientific knowledge and pedagogical knowledge. Need to be updated as scientific knowledge, their specialized fields is due to constant change and new knowledge is generated and is given to knowledge through basic and applied research and dissemination of scientific discoveries. Academic life permits us to thinking a project of life on the short, medium and long term, including the professional development.

As suggestions that we need some key to the success of teacher education: creating training programs, dynamic reflective target, transparent ethics, modernizing experiential, empathic psychosocial climate. Also establish educational systems technical support and evaluation for teaching performance, based on a holistic, systemic, thoughtful, critical and continuous professional development.

Author thanks the organizing committee for The 14th International Conference "Scientific Research and Education in the Air Force".

REFERENCES

1. Avalos, B. Teacher professional development in Teaching and Teacher Education over ten years. *Teaching and Teacher Education,* 27 (1), 10-20 (2011).
2. Benedito, V. *Ser profesor en la Universidad del XXI.* Investiture Speech Honoris Causa. University of Bucharest, Romania (2007).
3. Du□ă, V. N. Professional development of the university teacher – inventory of methods necessary for continuing training. *Procedia - Social and Behavioral Sciences.* Issue 33 1003–1007 (2012).
4. Fullan, M. *Change Forces: Probing the Depths of Educational Reform*. London: Falmer Press (1993).
5. Iucu, R. B. *Formarea cadrelor didactice: sisteme, politici, strategii.* Bucuresti: Humanitas Educational (2004).
6. Iucu, R. B. *Dezvoltarea profesională a cadrelor didactice din învă□ământul superior*, course support (2007).
7. Marcelo, C. Professional Development of Teachers: past and future. *Sísifo. Educational Sciences Journal,* No. 8, pp. 5-2. [online]. Available: http://sisifo.fpce.ul.pt/pdfs/S8_CarlosMarcelo(1).pdf (Jan/Apr., 2009).
8. Potolea, D. & Toma S., *Dezvoltarea profesională a cadrelor didactice. O perspectivă evaluativă. Experien□e □i realizări în context românesc*. Bucure□ti, (2008).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

THE PROFESSIONAL INSERTION OF SOCIO-ECONOMIC MARGINALIZED GROUPS A SPECIFIC ROLE FOR THE CAREER COUNSELOR

Simona Magdalena HAINAGIU *

*Teacher Training and Social Sciences Department, POLITEHNICA University, Bucharest, Romania

Abstract: *Career counseling is a new and continuously growing field in Romania. It promotes concepts and patterns of intervention previously used under the name of professional integration counseling. This paper proposes a new perspective on the career counseling process, switching the optics towards a new target group, the socially marginalized people. The intervention in these special cases has its own characteristics which propose themselves as challenges for the career counseling process as previously conceived. This specific group of people asking for career counseling could be common clients for every career counselor. Therefore, the career counselor should be ready in dealing with their specific issues.*

Keywords: *career, counselor, marginalization, insertion, disadvantage people*

1. INTRODUCTION

The professional activity is conceived as a personal identity component in many cultures. For many people the meaning of their work contribute to the quality of their lives and also fulfill their need for self development. Therefore, the unemployment period in every working person life is a difficult one and sometimes specific intervention or psychological support is needed. From this point of view, the unemployment period is a social exclusion one. Only in this context we understand why people exposed to socio-economic exclusion for different reasons, undergoing a long period of unemployment, have multiple reasons to feel excluded from society.

The intervention programs addressing the issues of this target groups focus on social categories like:

- disabled people
- teenagers leaving the protection system
- teenagers in the probation system
- ethnic minorities
- sexual minorities
- females
- homeless people
- people recently released from prison

The common career counseling process approach stresses the multicultural issues mostly in an international context [2]. If we consider each of these social groups as a mini specific culture, we better understand the meaning of multicultural sensitivity as a prerequisite of performing as a career counselor.

The main purposes of any professional integration support process addressing the issues of such groups are double: the professional insertion on one hand, and empowerment of these persons, on the other hand.

2. STAGES TO BE FOLLOWED IN THE INTERVENTION PROCESS

Any career counseling process is structured on some specific steps that are to be followed in approaching the client's needs.

We list and discuss below these steps, focusing on the specific intervention for the social marginalized clients.

1. Getting in contact with the client. This first step should clarify the career counselor about the client's motivation to participate in such a support process and the ways he/she took this decision. In many cases, this is the first time the client speaks with the career counselor. In supporting the persons from marginalized groups, this stage could be specific for an initial discussion between an institutional representative and the career counselor. In the majority of cases, people from marginalized groups are referred for counseling by a social care service or institution. It is mandatory for the career counselor to assess in such situation the motivation for employment of the referred clients. Moreover, the counseling process has to take into consideration the conditions imposed or assured by the social care institution addressing the client form a marginalized group. Significantly related to this situation is the quality of the counselor-client relation to be build during the counseling process.
2. Assessment of the personal and professional potential of the client. According with the needs for counseling identified by the counselor in accord with the client, the assessment uses formal and nonformal evaluation tools. Sometimes, the purpose of this stage is to support the client to know himself/herself better, to become more aware of his/her own abilities, interests, competencies. This is an important gain for the client helping him/her better orientate in his/her professionals search. In some cases, this stage is focused on specific professional competencies that are to be investigated in order to better orientate the client toward a field of activity or another, or toward a job or another.
3. Setting the objectives for intervention. The immediate result of the assessment stage is providing the counselor and the client with a lot of information about the resources the client has in order to conceive the objectives of intervention that would meet the client's needs, either identified by the counselor or declared by the client. Specific for people coming from marginalized groups are objectives like: personal acceptance, developing social and communication skills in relation with other people or institutions, independent life skills, time or personal budget management skills. More common for any career counseling process are objectives like training for the employment interview, development of the ability to write a CV or a motivation letter, or to identity the job announcements.
4. Once the agreement upon the objectives is established, the next natural step is to conceive an action plan including the objectives previously established, the timeline for fulfilling them, the obstacles envisaged and the resources allocated. It is important to establish the action together with the client and thus being assured about the involvement of the client in an action plan that he/she have designed for his/herself.

5. Implementation of the action plan. This is the process in which the client is guided by the counselor to fulfill the objectives established. In this stage, the relation between the two partners, the counselor and the client, is important in order to ensure the support necessary for the client to undergo this stage. One specific step for the intervention with the marginalized groups is the monitoring post insertion.

In each and every stage of the support process, the career counselor uses specific instruments and documents in order to gather and store information about the client.
Some specific characteristics of this group of people focusing on the differences among common clients and people from socially marginalized groups are to be mentioned:

1. The clients coming from socially marginalized groups are referred to the career counselor by a care organization, private or public. In the majority of cases, there is a specialist responsible with the case management of the intervention process for that person. In these cases, the sending organization pays for the counseling services.

2. The career counselor collaborates in an intervention network with the case manager from the sending organization, and also with other specialists in professional integration from partners' organization. This is a context influencing the conception of the action plan, as it should take into consideration the situation of the client as a person benefitting from a free social care service at the "sending" organization.

3. In the case of career counseling with marginalized people, the career counselor acts sometime as an employment negotiator with the potential employer and sometimes, as a mediator and an agent of mentality changes. Unlike the common career counseling process, in the support process for marginalized persons, the career counselor contacts and meets the employer with every occasion. The purpose of the meeting is to present the employer the candidates, to explain their situation, to make sure that the employer would make efforts to support the insertion of the new employee at the work place. This is a significant role for the career counselor as he/she has to build a partnership with the employer in the benefit of the candidate. This is, in most of the cases, a condition for the new employee to succeed in maintaining the newly obtain job placement. For instance, the counselor has to be sure that the employer will make efforts to control the other employees' reaction when they are facing the possibility to work with a motor disabled person. This professional insertion also request specific access transformation in terms of adapted bathrooms and platforms for the wheelchairs.

4. In this specific case of intervention, the post placement monitoring stage is very important. The difficulty of these peoples is not only to obtain a job, but also to maintain it and to adapt to its requests.

5. The client is always in the center of the support process. The process is always an individual approach, considering the client past, specific difficulties, personal and professional history, professional and personal interests.
6. Each decision regarding the support process is taken by the career counselor considering in the first place the client benefit.

7. The evaluation process focuses on the resources and the potential of the person, not on the deficits.
8. The support process is conducted by the counselor activating in an interdisciplinary team. The specialists working in team could be: social workers, psychologists, vocational instructors, soft skills educators.
9. Probably more than in a common counseling process, in the support process with socio-economic marginalized persons, the unconditional acceptance principle is more significant [1]. This is an attitude that helps the career counselors to build the counseling relation and to genuinely support this type of client to find and maintain a workplace.

3. CONCLUSIONS

This specific intervention model results from our practices in the field of professional insertion of multiple socio-economic disadvantaged groups, as we have mentioned above. Our approach in this paper is to reframe the career counseling process as it is described and understood by professional associations and by the business field, in the light of the characteristics of professional insertion services for disadvantaged people. This is a particular approach that finds its roots in the same set of principles that guide the support services. Moreover, career counselor are to be preoccupied by being able to address whenever necessary the specific issues of these disadvantaged people looking for a job.

REFERENCES

1. Mearns, D., Thorne, B. Counseling focused on the person in action, Trei Publishing, (2010).
2. Nelson-Jones, R., Counseling handbook, Trei Publishing, (2009).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

THE INFLUENCE OF SELF EFFICACY IN MANAGING DEPRESSION IN HEMODIALYTIC PATIENTS A PROPOSITION OF AN ALTERNATIVE INTERVENTION MODEL

Simona Magdalena HAINAGIU *

*Teacher Training and Social Sciences Department, POLITEHNICA University, Bucharest, Romania

Abstract: *Depression in patients diagnosed with end stage renal disease and undergoing hemodialytic treatment is a psychological condition significantly related with mortality rate among this group of patients. The common intervention procedures focus on psychiatric assessment and medication. This situation is even more specific for a country like Romania, where the psychological assistance is not a common service for every health care institution. In this context, the alternative intervention model that we propose in this paper is based on the self efficacy theory and social persuasion as a source of increasing self efficacy. Based on previous research in the field, the model propose to increase the level of self efficacy in order to diminish the depressive symptoms using social persuasion as a source of self efficacy improvement. Further implementation of the model will validate this theoretical model.*

Keywords: *self efficacy, depression, hemodialytic patients, quality of life, social persuasion*

1. INTRODUCTION

Patients diagnosed with end stage renal disease (ERSD) undergoing hemodialytic treatment procedure have a significant impaired quality of life. This type of treatment exposes the patients to several significant constraints regarding the medical procedure, but also the personal lifestyle. The ESRD patients must undergo three - four treatment sessions per week, each of them lasting three –four hours. In addition to the length of time spent in the hospital for the hemodyalitic treatment, the patients must submit themselves to a severe life style regarding the food consumed and the quantity of liquid ingered. The only justification for these privations is to maintain the body weight as constant as possible. At the end of each dialytic session the patients' weight is measured and it stands for a comparative indicator for the next measure, at the beginning of the next treatment session. The difference between the two measures should be the smallest possible. In addition to these constraints, the quality of life of these patients is affected by some other factors: the loss of the kidney's hormonal functions, neurological and digestive disorders, and the decrease of cognitive and physical functions. To all these aspects, we may add the difficulty in maintaining the social, professional and family roles [4].Only reading these lines, it is enough to understand why the depressive symptoms among the hemodialytic patients are so common [5].

As in the case of other depressive patients, the most fearful correlate of the depression is the suicide danger. Nevertheless, the direct connection between the depressive symptoms and the mortality rate among the hemodialytic patients is still a subject for discussion. The rate of depressive psychiatric diagnosed symptoms in the hemodialytic population is still unsufficient documented, but specialists place it in the range of 5-10 % [5]. In this

framework, we can imagine that the depressive symptoms are even more frequent.

As for Romania there are no statistics, we will consider the data availabe for the United States population. These data document that more than 470.000 persons living with the ESRD diagnosis. Each year, more than 100.000 persons are diagnosed with ESRD, according to the data offerd by United States Renal Data System, în 2008 [2].

2. SELF EFFICACY-CONCEPT AND CONNECTIONS

Self efficacy is a concept first introduced in the scientific literature by Albert Bandura, in 1977. This describes the trust that a person has in his/her own ability to manage the difficult tasks or obstacles or, as Bandura himself defined it, is the individ's belief in his own capacity of successfully fulfilling a task [1]. Self efficacy is a complex construct. Motivation is a principal component of self-efficacy construct, but it has to be differently understood in different context. In an academic setting for instance, motivation is connected to competition and performance while one person's motivation to improve his/her own health is probably conected to the fear of death or some other internal similar fears and cannot be connected to competition or performance [6]. Therefore, when considering the effect of self-efficacy upon people's performance, we have to consider some other moderating variables like the level of optimism, locus of control, level of self esteem, copying styles, learning styles, or some demographic variables like gender, race, culture, age, level of education [6].

Another important aspect in disscussing about self-efficacy is the distinction between *specific self-efficacy* and *general self-efficacy*. General self-efficacy can be defined as the general confidence of one person in his/her own capacity to deal with different situations encountered. Investigating self-efficacy is more precise if it aims to consider specific self-efficacy, focusing on the performance in specific tasks and specific activities. Moreover, there cand be significant differences between the levels of general self-efficacy and specific self-efficacy measures for the same individ. For instance, a person with a high level of general self-efficacy, very confident that he/she can deal with life chalenges, may have significant difficulties in adapting to a new or specific behaviour, like developing specific skills in public speaking.

A very important variable in influencing the treatment compliance, self-efficacy has four indentified sources for its development: vicarious experience, mastery experience, social persuasion and physical and emotional states.

Vicarious experience uses social modeling and sharing of experience. If people see others similar to themselves succeed through persistent effort, they may come to believe they, too, can succeed in similar activities [1]. **Mastery experience** is the most efficient source in developing the self-efficacy. It refers to the previous personal experiences that give the person the sense of expertise and a succes feeling. Succeding in overcoming succesive tasks, people reach a certain level of expertise. This is the most authentic proof that the person has the resources to do whatever is necessary to succeed. Succes experience help in constructing self-efficacy while failure, minimizes it.

Social Persuasion is the third source for developing a strong sense of efficacy. People can convince others, through suggestion, to believe they have the ability to do what is necessary to accomplish a certain outcome. While social persuasion is not as effective as mastery or vicarious experiences, often people can be verbally persuaded that they possess the ability to master certain activities. People who are persuaded in this manner are more likely to sustain effort and try harder when faced with obstacles.

Physical and Emotional States is the fourth **s**ource for developing a strong sense of efficacy. It refers to reducing stress and depression while increasing physical state of

wellbeing. People use their physical and emotional states to judge their capabilities. An elevated mood can enhance self-efficacy, while a negative mood may diminish it. People tend to associate stress, tension, and other unpleasant physiological signs with poor performance and perceived incompetence.

3. SELF EFFICACY IN HEMODILAYTIC PATIENTS

A common consequence in the depresive states of hemodialytic patients is the decrease of treatment adherence. This concept is defined as «the measure in which one's behavior meets the medical advise or the health prescriptions » [3].The treatment compliance is essential for the dialysed patients due to its connection to mortality [7]. Studies in the scientific literature have documented a significant corelation between self-efficacy and treatment adherence or depression in the sense that a high level of self-efficacy is associated with high levels of compliance and low levels of depression.

4. ALTERNATIVE MODEL OF INTERVENTION IN DECREASING THE INTENSITY OF DEPRESSIVE SYMPTOMS – A PROPOSAL

The usual procedure in adressing depresive symptoms in hemodialytic patients specifies the role of the psychiatric intervention. Rarely, the patients are refered for a psychological assessment and intervention. But, the legal framework in Romania doesn't specify the obligation for the hospitals or private hemodialytic centers to offer psychological support to the patients. In this context, our model of intervention ignores the usual procedure of treating depression and focuses on increasing the levels of self efficacy, using one of the self-efficacy sources: social persuasion.

Stages in implementing the proposed model :

1. Selecting the hemodialytic patients participating in the study.

Selection criteria consider inclusion, but also exclusion characteristics.

Inclusion criteria :

- over 18 years old
- undergo dialysis for three-four times a week
- undergo treatment for at least six months
- able to eat and walk alone
- live in a family setting
- are willing to participate in the study

Exclusion criteria:

- hospitalised patients
- patients with psychiatric disorders and cognitive impairement,
- assisted in self care

2. Identifying the patients with high levels of self-efficacy and low intensity of depressive symptoms. In this stage, specific assessment instruments are used.
3. Selection of the patients with high levels of self-efficacy levels.
4. The patients with high level of self-efficacy levels participate in a videotyped interview focusing on the resources used in managing the life and treatment constraints. They are encouraged to say how they succeed in managing a privative life style as exemples to be folowed.
5. While undergoing hemodialytic therapy, the pacients with lower levels of self efficacy see the filmed interviews.
6. The interviews are reviewed by the same patients with lower levels of self efficacy once a week for three weeks.
7. After the intervention procedure, the participants in the study undergo the same assessment stage, for assessing the levels of depression and self-efficacy.

8. The expected results are that the intervention procedure has lowered the levels of depression as compared with the initial measures (before the intervention) and has also increased the level of self-efficacy as compared with the initial stage, (before the intervention).

5. CONCLUSIONS

The model is a theoretical one and is based on the data revealed by the previous literature. Further research is needed in order to validate the model proposed. The implementation of such a model in every health care institution providing hemodialytic treatment in Romania is motivated by the lack of resources available for patients in their process of adapting to the disease constraints. The health care system doesn't provide for these patients psychological assistance in addressing the depressive symptoms. The only procedure used in such cases is the psychiatric treatment. For chronic patients like those with ESRD with a significant impairment of quality of life, the additional medication and its side effects would further contribute to the perceived increase of stress. Furthermore, we believe that depressive symptoms would be better managed through psychological assistance than by medication.

The benefits for implementing such a model are clear at theoretical level, but they need to be validated through specific intervention and subsequent scientific research.

REFERENCES

1. Bandura, A. *Self-efficacy:Toward a unifying theory of behavioral behavioral change. Psychological Review*, 84, 191-215 (1977a).
2. Daria L Kring, Patricia B Crane "*Factors Affecting Quality of Life In Persons on Hemodialysis*" Nephrology Nursing Journal. Pitman:Jan/Feb 2009. Vol. 36, Iss. 1, p. 15-24, 55 (11 pp.)
3. Kaveh K, Kimmel PL. *Compliance in hemodialysis patients: multidimensional measures in search of a gold standard. American Journal of Kidney Disease,* 2001; 37:244-266.
4. Kimmel PL, *Psychosocial factors in adult end-stage renal disease patients treated with hemodialysis: correlates and outcomes*. American Journal of Kidney Disease 2000; 35:S132– 40.
5. Kimmel PL, Peterson RA: *Depression in end-stage renal disease patients treated with hemodialysis: Tools, Correlates, Outcomes and Needs*, *Seminars in Dialysis*,vol.18,no.2, 91-97, 2005
6. O′Sullivan, D., Strauser, D., (2009). Operationalizing self-efficacy, related social cognitive variables, and moderating effects, Implications for rehabilitation research and practice, Rehabilitation Counselling Bulletin, Volume 52, Number 4, 251-258
7. Saran R, Bragg-Gresham JL, Rayner HC, et al. Nonadherence in hemodialysis: associations with mortality, hospitalization, and practice patterns in the DOPPS. Kidney International 2003: 64: 254-262

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

METACONITIVE TRAINING FOR AWARENESS OF READING STRATEGIES

Ramona HENTER*

*Faculty of Psychology and Educational Sciences, "Transilvania" University of Brasov, Brasov, Romania

Abstract: *Metacognition, defined as knowledge about one's cognitive states, processes and knowledge and as the ability to consciously monitor and adjust these cognitive states, processes and knowledge (Papaleontiou –Louca, 2008), may be „the missing link in school learning" (Nicholls, 2003), the thing that differentiates individuals as concerning their performance. The metacognitive skills during reading are oriented towards better understanding and memorizing of the text being read (Cubukcu, 2008), the main strategies for cognitive adjustment including planning, monitoring, applying, revising, and assessing.*

The present case study is part of a more extended research, this being an exploratory session, performed in order to analyze the benefits and drawbacks of a metacognitive training focused on the metacognitive skills used while reading a text in a foreign language that is being learned (in this case, English). The metacognitive awareness was measured before and after the metacognitive training with MARSI (Metacognitive Awareness of Reading Strategies Inventory, version 1.0), developed by Kouider Mokhtari şi Carla A. Reichard (Mokhtari&Reichard, 2002).

This training, aiming at increasing the student's awareness during reading, improves the efficiency of reading in terms of better understanding and summarizing the text, better retention of new words. This improvement is achieved by using certain strategies which can be grouped in global reading strategies, problem solving strategies, and support reading strategies. However, the most important finding is that these strategies can be learned outside the language class, during a special training and that these strategies can be transferred.

Keywords: *metacognition, metacognitive reading strategies, metacognitive methods*

1. THEORETICAL BACKGROUND

Metacognition refers to what people know about cognition in general and about their own cognitive processes and retrieval, in particular, as well as how they use this knowledge to adjust their informational processes and behaviour [9].

At the basis of a metacognitive training is the concept of metacognition, introduced by John Flavell in 1976 to define awareness of thinking process: what we think, how we think when we face a certain task or situation and why we think in a certain way. Metacognition also includes the ability to monitor these processes [5].

Papaleontiou-Louca [14] considered important to stress the fact that between metacognition, on one hand, and learning and development, on the other hand, we can not put an equal sign, metacognition meaning learning and development regulation.

The huge potential of metacognition in obtaining performance in language learning was first detected by Wenden [5] in 1987 and many different interpretations of

metacognition and metacognitive models have since appeared, models that have attempted to explain the link between metacognition and language learning. Those who perform in learning a foreign language are those who are aware of learning and use learning strategies (including metacognition) flexibly and effectively [6].

Research has shown that the strategies used during reading are directed both to a better understanding and memorising (Cubukcu, 2008). Also, even those who have good reading skills can improve them if they are trained in the use of effective strategies and are taught to monitor their activity while reading [1]. These strategies include: use of strong personal points (exploiting the abilities best mastered by those who read - if you are good at interpreting graphs, rely on information obtained from them, for example), deduction of meaning of unknown words, use of personal information about topic, search for information relevant to the objective pursued, began returning to the questions to find the answers. Also, use of prior knowledge on the subject in question can improve understanding of the read [3].

2. GOALS AND RESEARCH METHODOLOGY

2.1 Goals. My case study is an exploratory one. Its aim was to identify efficient methods of teching and learning metacognitive reading strategies.

2.2 Hypotheses. I started from the hypotheses that if a student learning a foreign language uses metacognitive reading strategies, the efficiency of reading will increase. The criteria for defining efficiency are a better understanding of a text read (reflected in higher scores at exercises which presume answering questions from the text) and a better recall of the texts (reflected in a more fluent and detailed summary of the text).

2.3 Sample. The subject of this study was a 14 years old pupil, atteding the 8th grade. She has been studying English as a foreign language since the 4th grade, being an average student.

2.4 Instruments used. I used the Metacognitive Awareness of Reading Strategies Inventory (MARSI version 1.0), in the original language as the subject's knowledge of English permitted this. This inventory was designed by Kouider Mokhtar and Carla A. Reichard [10] starting from Flavell's theory on metacognition, shown above. It is a tool that can be used to identify metacognitive strategies used while reading in academic text for understanding it. It has three subscales or factors: 1. global reading strategies (it has 13 items and aims at strategies for a global analysis of text), 2. problem solving strategies (with 8 items on strategies used when the text is too difficult to understand) and 3. functional strategies, supportive for reading (it contains nine items relating to the use of reference materials, taking notes, other practical strategies). The three types of strategies are in interaction and have a great influence on understanding the text. The Cronbach Alpha internal consistency coefficient is .89 for full scale. The questionnaire can be administered individually or in groups, from teenagers to adult students. Responses are recorded on a Likert scale with values from 1 (never do this) and 5 (always do this). The administration has no time limit and generally lasts 10-12 minutes. Interpretation of scale determines the respondents' place into one of three classes of users of learning strategies: high (over 3.5), medium (between 2.5 and 3.4) and low (below 2.4).

There were also used language tests, provided in the school textbook, only the reading exercises being used.

As concerning the metacognitive strategies taught, the following were presented to the subject, during individual sessions, off-school: questioning the thought process, generating questions, strategic questions, think aloud protocols, identifying the problem to be solved, walking through pictures.

2.5. Intervention. At the beginning of the school year 2011-2012, the subject was given an English test, provided by her textbook. She scored 76 points out of 100. Then, she filled in the Metacognitive Awareness of Reading Strategies Inventory. She had an overall score of 3.16 (medium level). The Global Reading Strategies category was of 3.46 (high level), Problem – Solving Strategies had 3.12

(medium level) and the last category, Support Reading Strategies totalized 2.77 (medium level). This indicated that she had to work on the last two categories, so the methods chosen for her respected this.

During the first semester of the school year, over 10 sessions of individual preparations, the subject was gradually presented the metacognitve methods that can be used while reading for a better understanding and memorising of the text. She was asked to use them as often as possible during reading an English text. These methods are:

Thinking about the activity performed can be made in order to extract students' implicit knowledge to about what they are learning, which will become the basis for new learning. It is not limited to activities already carried out, it helps to plan the following ones 5].

A similar method is that of *questioning the thought process* [13], made at the end of an activity in order to acknowledge the metacognitive strategies used. The method follows three steps: 1. retrospection on the activities, collection of data on thinking processes and their association with feelings, 2. classification of shared ideas and identifying of the strategies used, 3. assessment of each strategy, the elimination of the unproductive ones and the identification of successful one, to be used on other occasions.

Generating questions [13], by definition, involves a high level of metacognition as the learner is actively involved in monitoring and regulating his own independent activities of understanding of what is heard or read.

Strategic questions [2] are those questions asked by the student to inform himself on the strategy for information, indicating awareness of learning context and student intention to control the situation.

Identifying the problem to be solved [13] refers to identifying what you know and what you do not know, as a starting point in developing a strategy that will identify the information sought.

Think aloud protocols [3, 7, 8, 13, 16] mean recording students' thoughts as they perform a task and say aloud whatever crosses mind during this time. The interviewer can stay with students until they complete the task, asking questions such as: "What are you thinking?", "Why have you decided to do this?" [12]. Protocols are subsequently analyzed and students are free to use the native language or the one being taught. These protocols can offer data on the use of strategies.

Walking through pictures involves throwing a look over the images that accompany the text to be read to infer the meaning of the text and discussions on the participants' opinions.

At the end of the semester, she was tested again. In English, the subject obtained 85 points out of 100. Her MARSI scores improved: the overall score was 3.56 (high level), the Global Reading Strategies category was of 3.76 (high level), Problem – Solving Strategies had 3.62 (high level) and the last category, Support Reading Strategies totalized 3.22 (medium level).

3. RESULTS

The subject's overall MARSI score increased with 9%, which is sufficient for undergoing a metacognitive training, in terms of its pragmatic results. These results also show that metacognitive strategies can be taught and outside the language class,

The subject's results also improved in English, too. In a short debriefing interview,

she also reported using these strategies in other subjects, such as Romanian and History.

I must underlie the fact that, to a certain extent, which was not the aim of this study, these results can appear due to genuine learning of the foreign language or to pure sensibility in such matters.

4. CONCLUSIONS

As it is a descriptive exploratory study, it is only the first step in a much larger research. This study's findings will guide its replication with similar subjects in order to identify the metacognitive strategies preferred by most learners. Then, these strategies will be included in a course dedicated to young learners of English.

REFERENCES

1. Cubukcu, F., Enhancing Vocabulary Development and Reading Comprehension through Metacognitive Strategies. ***Issues in Educational Research,*** 18 (1) (2008).
2. Deed, C., Strategic Questions: A Means of Building Metacognitive Language. ***International Journal of Teaching and Learning in Higher Education.*** 20 (3), 481 – 487(2009).
3. El-Koumy, A. S. A. K., ***Metacognition and Reading Comprehension.*** Anglo Egyptian Bookshop, Cairo (2004).
4. Goh, C., ***Metacognitive Awarenedd and Second Language Listeners***. ELT Journal. 51 (4) (1997).
5. Goh, C., Metacognitive Instruction for Second Language Listening Development: Theory, Practice and Research Implications. ***RELC Journal.*** 39 (2), 188 – 213(2008).
6. Huang, J., Metacognition training in the Chinese University Classroom: An Action Research Study. ***Educational Action Research.*** 13 (3), 413 – 434 (2005).
7. Imtiaz, S., Metacognitive Strategies of Reading among ESL Leaners. ***South Asian Language Review,*** 14 (1&2), 34 – 43(2004).
8. Jimenez, V., Puente, A., Alvarado, J. M., Arrebillaga, L., Measuring metacognitive Strategies Using the Reading Awareness Scale ESCOLA. ***Electronic Journal of Research in Educational Psychology.*** 7(2), 779 – 804(2009).
9. Koriat, A., Metacognition and Consciousness, 289 – 327. In P. D. Zelazo, M. Moscovitch & E. Thompson (Eds.), ***Cambreidge Book of Consciousness.*** New York, USA: Cambridge University Press. (2007).
10. Mokhtari, K., Reichard, C. A., Assessing Students` Metacognitive Awareness of Reading Strategies. ***Journal of Educational Psychology***. 94 (2), 249 – 259 (2002).
11. Nicholls, H., Cultivating 'The Seventh Sense' : metacognitive strategising in a New Zealand secondary classroom. Available at http://www.aare.edu.au/03pap/nic03186.pdf (September, 2011) (2003).
12. O'Bryan, A., Hegelheimer**, V.,** Using a mixed methods approach to explore strategies, metacognitive awareness and the effects of task design on listening development. ***Revue canadienne de linguistique appliquée/Canadian Journal of Applied Linguistics.*** 12 (1), 9-38 **(2009).**
13. Papaleontiou – Louca, E., The Concept and Instruction of Metacognition**.** ***Teacher Development.*** 7(1), 9 – 30 (2003).
14. Papaleontiou – Louca, E., ***Metacognition and Theory of Mind.*** Cambridge Scholars Publishing(2008).
15. Schraw, G., Moshman, D.. Metacognitive Theories. ***Education Psychology Review,*** 7 (14), 351 – 371 (1995).
16. Singhal, M., Reading Profeiciency, Reading Strategies, Metacognitve Awareness and L2 Readers. ***The Reading Matrix.*** 1 (1) (2001).
17. Singhal, M., Reading Proficiency, Reading Strategies, Metacognitve Awareness and L2 Readers. ***The Reading Matrix.*** 1 (1) (2001).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

MANAGEMENT INFORMATION AND DIRECTIONS FOR SCHOOL DEVELOPMENT

Felicia IUROAIA

Associate Proffessor, PhD
University "Petre Andrei" of Iasi, ROMANIA

Abstract: *Information management issues and learning was the subject of many studies and researches conducted by specialists in psychology and pedagogy. Of renowned authors who have contributed to understanding the aspects of information management concepts and management of learning may be mentioned H. Gardner, JL Holland, H. Siebert, I. Jinga, I. Negreț, I.T. Radu, M. Jigau, M. Golu, I. Al. Davies, Adriana Baban, etc..*

Information management covers the identification, evaluation and appropriate use of the information available to us at a time to solve problems and make optimal decisions. Management information and learning has direct implications in educational area, but acquisitions in this area can be transferred and used successfully in other contexts.

Key words: information management, learning style, decision, problem

Introduction

This paper is an attempt to highlight the importance of information management skills and learning for personal, social and professional students. Information management issues and learning was the subject of many studies and researches conducted by specialists in psychology and pedagogy. Of renowned authors who have contributed to understanding the aspects of information management concepts and management of learning may be mentioned H. Gardner, JL Holland, H. Siebert, I. Jinga, I. Negreț, I.T. Radu, M. Jigau, M. Golu, I. Al. Davies, Adriana Baban, etc..

Information management covers the identification, evaluation and appropriate use of the information available to us at a time to solve problems and make optimal decisions. Management information and learning has direct implications in educational area, but acquisitions in this area can be transferred and used successfully in other contexts.

The explosive development of new technologies based on advances in computer science, propose a relevant general education in Romania. The center reconfiguration of scientific knowledge, the information is considered part of knowledge, power and potential for social change and education. Information involves înțelegrea data symbols, which sometimes have no significance between them. Meanings appear in the instruction and training, research and education process, by processing and distributing them to the understanding of students. "The information underlying the judgments, experiments imagined by the human mind, in order to obtain new knowledge." (Păunescu, F., Badea Dincă, N., 1985, pp. 46)

Information management and learning is one of five thematic modules that are grouped according to learning contents: 1. Self development, 2. Communication and social skills, 3. Information management and learning, 4. Career Planning 5. Quality lifestyle. The curriculum for counseling and guidance curriculum proposed in this respect, offer education for teachers and school counselors. Conținurile presented is characterized by continuity, accessibility gradual and practical utility. Thus, from class I, introduce a series of learning activities during each school year until twelfth grade, are becoming increasingly complex, depending on age-specific pedagogical features.

All these behaviors are aimed at training, called the communication behaviors, their counterparts, in the words of Pierre Bourdieu, in some groups of objectives: objectives identity, territorial objectives, relational goals, objectives conative. Information becomes thus focus our role in forming attitudes to convince, involved in finding solutions to service problems, couple or family with an important role in finding a job.Management of information focuses on personal, social and professional students, helping them to understand the connection between what they learn and useful for real life skills and knowledge acquired.

Thematic framework objectives corresponding to these modules are aimed at developing the capacity of self-discovery and positive attitude towards themselves, develop networking skills in different contexts, develop skills to use information for learning, acquiring skills for career exploration and planning; practice management skills of a quality lifestyle.

Benchmarks and custom learning content in each thematic module form a coherent structure, built on the principle of spiral learning, each year strengthening the aspects previously accumulated, gradually adding new issues specific to each age level.

Thus, throughout the school, through learning and information values and attitudes are promoted following: respect and confidence in others, recognizing each person's uniqueness, responsiveness to the emotions of others, valuing interpersonal relations, critical and selective exploitation of information, adaptation and openness to new learning, motivation and flexibility in developing their educational and professional path, responsibility and availability for decisions and actions on your career, interest in lifelong learning in a changing world and the knowledge society, quality oriented life now and in the future.

A good manangement of information leads to the acquisition of knowledge and skills that will help students become responsible actors and contribute to school life, community, family, group of friends, to transform the learning in an ongoing process.

Management information and assistance on career

We propose below, the presentation of sessions that can form an intervention program on career choice, specifically the eighth grade.

a. The importance of literacy and information

The first meeting is the self-made (by the way classical and atypical forms), to examine how the selection of subjects, the arguments underlying the intervention plan, expectations of each participant, the following general themes have meetings, proposals are and suggestions.

Objectives: to practice different ways of the self, to know the objectives of the intervention participants; to accept the differences caused by the uniqueness of each individual, to express their expectations about these activities, to show an interest in involvement in the program.

Exercises of the self and intercunoaştere:

- Today I want to be perceived as ... for that ...! - Students are invited to submit through symbols / metaphors and justify your choice (eg "Today I want to be perceived as a sun because I feel I have more căldură and light to give those around me!") ;
- If I were ... I would! - Another version of the first year: "If I were flower / animal /

color / toy / actor / star / musical instrument / sport would be ... . "

- How do I see? How do others see? How I wish I? - This exercise can be done verbally or graphically, individually or in pairs;
- photo gallery - children are known by presenting photographs of significant events for them (the first day of school, participation in certain activities) or that appear to some people, it may propose implementation of an exhibition of photographs in the space following meeting to take place all the program;
- What we share with others? What sets us apart? - To give students a set of questions and notes for each question children who have common answers and who have different answers;
- favorite activities - each student will achieve a colored paper a "card" that reveal their preferences original his leisure, all cards are exposed on a panel and then, in turn, presents and identify that person;
- What do we get and what we offer? - Each child receives a petal divided into two notes on their answers, then all petals glued on a poster to get a flower in the center of which says "We are so alike yet so different."

b. Style of learning and information processing

The purpose of this meeting is to identify their learning style, so that students know their advantages and disadvantages as their learning strategies. Thus they will be able to optimize actions to achieve school success.

Objective: to know the specific aspects of learning style, to self-assess learning style, to explain the relationship of complementarity between learning styles, to argue the ease / difficulty experienced in acquisition and retention of certain information, to identify their strengths, but and limits their learning style, to learn strategies specific to each learning style, to improve their learning style to achieve school success.

Activities:

- learning style - brainstorming exercise;
- description of each learning style (visual, auditory, tactile-kinesthetic) and emphasizing strengths;
- or use of specific questionnaires to identify the learning style of each student;
- Pyramid learning style: I am unique (a) and perfect (a)! - Are discussed on a poster representing a pyramid of learning styles;
- reflect on their learning experiences - "Analysis of the most effective learning experience to date" - it starts from the description of the objects of study or training in one of the themes to which the student was successful. Sharing their learning experiences and discussing the strategies they use, with colleagues, children become aware of the effectiveness they have different methods for different cases, and the various materials;
- identify learning style based on descriptions provided as support, children can identify from existing descriptions, to what extent techniques utilizează visual, auditory or kinesthetic processing information, reaching a higher level of conceptualization of their learning style;
- experience different learning styles, from performances and efficiency in terms of time and effort
- promoting learning strategies for each learning style part.

C. *Information Management and direction of education and professional development*

During two sessions, students will be advised in the information management problem, with specific reference to how to select and use information for a better educational and vocational guidance, since they are in eighth grade, class in which they will have to take very important decisions for the future.

Objectives: to investigate the personal characteristics (interests, values, personality characteristics, skills and abilities) for use as a future profession evaluation grid, to use information that meet several criteria of validity and fidelity (accuracy, timeliness , relevance, specificity, clarity, degree of tension, lack of biases, comparability), to identify sources of information for educational and vocational guidance, to argue the advantages and disadvantages of using ICT for information on future options; to perform applied activities (essays , posters, role play, CVs, case studies).

Activities:

- exercises to investigate their interests through systematic reflection on previous elections, the inventories of interest - eg. Questionnaire of interest based on Holland's theory or on-line version of the same questionnaire;
- exercises to investigate personal values through the hierarchy of values listed in a list, by analyzing the previous elections, using discretionary time (eg if you only have one hour per day to which you choose to do?)
- analysis exercises personality characteristics;
- exercises establishing correspondence between personality characteristics and certain occupations;
- Identification stocktaking exercises and skills in certain questionnaire;
- exercises to explore different areas and strict selection criteria useful information (accuracy, timeliness, relevance, specificity, clarity, degree of tension, lack of biases, comparability) (see http://www.Self-directedSearch.com);
- Identify sources of information on pathways, profiles and specializations of the day in high school / arts and crafts school, family, media (television and print media); guides, magazines, presentation folders, books, posters ; monographs professional profiles occupational group of friends, the reference group, discussions with people up; visits to various public or private employment fairs, internet - web pages, sites containing information useful educational and vocational guidance, mailing, video conferencing, search engines, computer simulation, application software self-tests, questionnaires.
- exercises benefit analysis, identification and disadvantages of counseling services through the Internet;
- discuss case studies;
- role play - simulating a situation-focused employment, career choice, etc..;
- exercises preparing a CV;
- practice occasioned real job interview;
- implementation of suggestive posters on "profession that suits me!"

Evaluation of the whole intervention program

In this meeting is to analyze the overall counseling program involving students. It is an update of those made at each meeting of the portfolios based on the materials. Give the types of activities that students have been very receptive, but also activities in which their interest was lower. It noted the progress made by some students during activities, but without criticizing those who were not particularly emphasized.

Activity is the front into a discussion where students express their own views on the program they were involved. It addresses questions such as the following: What tasks have you enjoyed most? What you get bored during these activities? We were happy to participate in this program? What did you learn in addition to what you already know? Consider that now collaborate better with colleagues? If the school will also organize

such programs will want to participate or not? Why? What do you think would make the program more attractive to students? How lessons will help you what you have done this program? But in life? What is your parents' opinion on this program? But the teachers?

Also, some students distributed the recording sheets in a comparative manner, aspects of personal learning style approach in the past (before attending the counseling program) and now (after participating in the program). Are discussed, then students answers.

Views of students shape representation of how the program was appreciated by students, their parents and teachers. Of course, during activities, students' attitude is a clear indicator of the involvement, interest and their openness to novelty. The views expressed in the end serve to confirm or refute the school counselor observed during the program.

Also, the views expressed by students, their parents and teachers can be considered when running a new program management information and learning.

Analysis results of the intervention plan

Analyzing the results of this contingency plan in an integrated manner, it may indicate some conclusions. Thus, during the program students have been very interested and active, eager to continue beyond the time allowed. Besides acquired skills and independent learning skills necessary for independent students have "benefited" the positive influence of the group advised, to increase social awareness, personal development and optimal adaptation to reality. The activities have confirmed the effectiveness of cooperation and acceptance of others opinions.

Through this program, students have acquired self-control over their learning, they become able: to set realistic goals, in accordance with its capacity for learning, to plan their study time, to monitor systematically in terms of involvement in pregnancy, to eliminate / control the fun factors (external or internal - thoughts emotions and fun) to control the learning process, thus ensuring self-regulation, to select / use appropriate strategies for processing and updating of learning material, to evaluate the outcome of learning; to be self-motivated in learning achievement.

With regard to information management counseling sessions, they have proven by the fact that students have mastered a set of knowledge needed to plan a possible educational and vocational routes.

The positive effects of counseling programs are proven to increase school performance of students participating (to obtain higher marks after completion of the program, compared with the grades obtained before counseling), the "testimonies" of their parents and teachers who teach certain subjects those students. Of course, increasing capacity to overcome learning difficulties and progress in the correct use of information were seen during the counseling program activities / exercises conducted applied.

Students were advised regarding information management and learning, but for best results on short and long term, they must practice the strategies learned to fix them permanently and use them when necessary. "We believe that one of the most useful things that a teacher can make to his students is to equip them with tools to independent learning and teaching strategies are effective only if it empowers students to take their own way of to learn "(Dumitru, I., 2009, p28).

Bibliography

1. Băban, Adriana (coord.), 2009, Consiliere educațională - Ghid metodologic pentru orele de dirigenție şi consiliere, Editura ASCR& Cognitrom, Cluj - Napoca.
2. Cabin, Philippe, Dortier, JF, 2010, *Comunicarea, Editura Polirom, Iaşi.*
3. Dimitriu - Tiron, Elena, 2005, *Consiliere educațională,* Editura Institutul European, Iaşi.
4. Dumitru, I. Al, 2008, *Consiliere psihopedagogică - Baze teoretice şi sugestii practice*, Editura Polirom, Iaşi.
5. Gherguț, A., 2007,*Management general şi strategic în educație - Ghid practic*, Editura Polirom, Iaşi.
6. Jinga, I.; Negreț,I., 1999, *Învățarea eficientă,* Editura Aladin, Bucureşti.
7. Pânişoară, Georgeta; Pânişoară, Ion - Ovidiu, 2005, *Motivarea eficientă - Ghid practic,* Editura Polirom, Iaşi.
8. Păunescu, F., Badea Dincă, N., 1985, *Informatizarea societății – un fenomen inevitabil, Editura Ştiințifică şi Enciclopedică, Bucureşti.*
9. Vrăsmaş, Ecaterina, 2007, *Dificultățile de învățare în şcoală - domeniu nou de studiu şi aplicație,* Editura V&I Integral, Bucureşti.
10. *www.creativelearningcentre.com*
11. *http://www.Self-directedSearch.com*
12. *http://europass.cedefop.europa.eu/*

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

THE NEED OF CAREER COUNSELLING IN UNIVERSITIES: A COMPETENCIES – BASED APPROACH

Nicoleta LITOIU *, Carmen Gabriela OPROIU **

* Associated Professor PhD., Teacher Training Department, Director of Career Counseling and Guidance Center, University Politehnica of Bucharest, Romania
** Associated Professor PhD., Teacher Training Department, University Politehnica of Bucharest, Romania

Abstract: *Studies of the characteristics of universities students suggest a diversity of needs for career counseling and guidance programs. Research has consistently shown that almost one-half or more of university students' desire help with educational and vocational planning. University affects students' career choices and development by providing career mobility and advancement and by increasing career aspirations. The benefits of higher education can also lead to a fulfilling lifestyle and the capacity to make appropriate judgments over the lifespan. This paper is aimed to focus on the status of career counseling approach as is perceived by the academic strategies and educational policies at the universities level, in order to improve and facilitate the successful universities graduates' insertion on the job market.*

Keywords: *career counseling, competencies, graduates, job market, career planning, soft skills*

1. INTRODUCTION

Studies of the characteristics of universities' students suggest a diversity of needs for career guidance programs. Formal research shown that almost one half or more of students investigated in seven of the most prestigious Romanian universities (from Bucharest, Brasov, Sibiu, Cluj, Iasi) recognizes the need of help with educational and vocational planning. On the other hand, the reality reveals a different face of the coin, confusing and contradictory, in terms of students' interest and desire to benefit from specialized services about career choices and development. A few little students, probably one out of five students comes, at least once during the university studies, in a career counseling or planning center.

There is a huge discrepancy between the formal answer to a questionnaire exploring what the students would like to have or benefit from, in terms of learning facilities or specialized services, like counseling and guidance for a job or career, and the real situation in universities, in terms of students' determination and motivation to attend a career guidance program/session, for instance. We are all, experts in education or counseling, teachers in higher education system, employers, used to explain this lack of students' interest for anything else, but

academic performance, by saying that career counseling/planning/guidance has no longer tradition in Romanian education system. The truth is that students themselves, and the society at a large, have no culture of supporting professions like psychologist, counselor, etc., they are not customized to go easily to a counselor for specialized help. One of the explanations of this situation is closely related to the understanding of cultural influences on career development in Romania, during the former communist regime.

According to the U.S. Library of Congress Study of Romania (Bachman, 1989), the Romanian academic system was highly competitive, with very restricted numbers for admissions to university. Choosing a college was equivalent to choosing a career with that decision completed by the end of high school at the age of 18. "Despite an impressive network of universities, technical colleges, academies and conservatories, only 8 percent of those eligible for higher education were permitted to enroll. The central government allocated slots based on predicted demand for given occupations". With this restricted opportunity for admissions, competition became very intense at an early age. Because entrance exam scores were the sole criterion used for acceptance into higher education programs, students began planning their area of specialization as early as the eighth grade, so they would be able to devote a significant portion of their high school education to this academic focus. This practice required career choice and decisions to be pushed to the age of 16, or sometimes even as early as 14.

With this early age for career decisions, it is not surprising that family had a strong influence on career orientation. Families acquired private tutoring for their children many years prior to the highly selective and demanding entrance exams. These families were attempting to ensure success in the chosen career arena. The cost of a private tutor was prohibitive for many workers and peasant families, and rural-urban differences in education exacerbated their differences. For students who gained successful admission to the competitive and selective university programs, the Romanian state provided generous financial support, including low-cost housing and meals, free tuition, book subsidies, and monthly stipends. The financial package awarded depended on various factors, like socioeconomic background and area of specialization.

From this socio-cultural and political perspective, it is easier to understand why the tradition in counseling field is so vague and inconsistent for the period before 1990, and why it is a still slowly on-going process with small developments in the years after.

Trying to analyze the reality existing now into the universities environment, over the couple of past years from where the legal framework for Career counseling and guidance Centers functioning has been legitimated through a ministerial ordinance (2005), we can realize that some efforts have been done and few organizations have been involved in specific activities in the field, but not systemic and significant enough to impose an educational policy, at the national level. In order to have a better understanding of this issue, we need to start with the year 1991, when the Ministry of Education established the Psycho-pedagogical Guidance Centers for teachers, students and parents, at the pre-university education level. This action was followed by the common regulations elaborated in 1998 by the Ministry of Education in cooperation with the Ministry of Labor and Social Protection, referring to the establishment of the Information and Vocational Counseling Centers, at the counties' level for pre-university education level. We can't deny the important steps towards, but they have taken too long, in a slowly process, sometimes without any strategically systemic view in order for this counseling approach, at the school or university levels, to produce the expected results.

Nowadays, we have established the career counseling and guidance centers in universities, but only few of them are really implementing specific activities they are meant to do, supporting students, graduates and interested employers. The Career Guidance and Counseling Center from University Politehnica of Bucharest is one of many other universities' centers which, at five years from establishment, is still working on promoting their services in counseling field in the largest technical Romanian university,

trying to convince more and more students to participate in specific activities, according to the mission statement the center is aimed to put in place. Needless to say that is a difficult process, in small steps, a long way involving different levels of development among students and graduates.

2. THEORETICAL DETAILS ABOUT CAREER COUNSELING

Career counseling is a systematic approach to analyzing a worker's skills, abilities and work habits, using information obtained on their education, work experience and general interests. This information is then organized into general categories of people, data and things, and further analyzed to fit into the occupational requirements of other jobs. Career counselors should have specialized training in career counseling and career development. They may also have additional training in personal counseling as well as in group counseling. They may facilitate career development groups for students or counsel students individually. Counselors can assist students in various areas. Some examples include increasing self-awareness, decision-making, goal-setting and establishing a plan of action.

Over a 20-years-period, Pascal and Terenzi (1991) conducted a comprehensive study of research findings on how college/university affects students. The following conclusions were relevant (4):

- students frequently change their plans;
- significant occupational status differences between high school and college graduates are sustained over the life span;
- individuals with a bachelor's degree are more likely to obtain high-status managerial, technical, and professional jobs;
- college graduates are less likely to be unemployed than are high school graduates;
- employers see college graduates as possessing requisite skills and values that make them more desirable for employment and advancement;
- college graduates enjoy significantly higher levels of career mobility and advancement;
- maturity of career thinking and planning can be modestly improved through various career development courses, increasing student occupational aspirations.

The results of this study suggest that benefits of a college/university education are quite significant in the world of work. This conclusion comes as no surprise but does give credence to recommendations counselors have made for years about the influence of higher education on lifestyle and future opportunities for career development. Not only does the college experience provide for career mobility and advancement, but it also increases occupational aspirations. In essence, the benefits of higher education improve the quality of life and the capacity to make appropriate judgments over the life span.

From a theoretical point of view, it is known that career counseling policies are developed and focused on three main directions:

- lifelong guidance, complementary to lifelong learning;
- a professional model, more open, providing a wide range of interventions;
- the active role of individual, as a part involved in career counseling services.

In 1992, National Occupational Information Coordinating Committee (NOICC -USA) established appropriate competencies and indicators for adults to underscore the necessity of preparing students for the work world and for integrating life roles into a future lifestyle. These competencies and indicators present a significant challenge to institutions of higher learning and point out the importance of and need for an effective career guidance program. Not only is the importance of educational and occupational exploration suggested by these competencies and indicators, but also the importance of work as it affects values and lifestyle. To accomplish these goals will require a comprehensive program and commitment on the part of the college or university.

Such an example is presented below (3):

Adult: Competencies and indicators

Self-knowledge

Competency 1: Skills needed to maintain a positive self concept;

Competency 2: Skills needed to maintain effective behaviors;

Competency3: Understanding develop-mental changes and transitions;

Educational and occupational exploration

Competency 4: Skills needed to enter and participate in education and training;

Competency 5: Skills needed to participate in work and lifelong learning;

Competency 6: Skills needed to locate, evaluate, and interpret information;

Competency 7: Skills needed to prepare to seek, obtain, maintain, and change jobs;

Competency 8: Understanding how the needs and functions of society influence the nature and structure of work.

Career planning

Competency 9: Skills needed to make decisions;

Competency 10: Understanding the impact of work on individual and family life;

Competency 11: Understanding the continuing changes in male/female roles;

Competency 12: Skills needed to make career transitions.

Based on these competencies, career guidance must meet the needs of students at various stages of career development and from this point of view, understanding the relationships between career choice and educational requirements is essential, as well as career planning and decision-making.

Career guidance activities in institutions of higher education must provide assistance in helping each student understand that career development is a lifelong process based on a sequential series of educational and occupational choices (6).

Moreover, to carry out the specific counseling activities require a comprehensive program and commitment on the part of the university, which refers to the following issues, corresponding to different groups of competencies and indicators (3):

- identify skills, abilities, interests, experiences, values, and personalities traits and their influence on career decision;
- demonstrate skills to manage financial resources; describe how personal motivations and aspirations may change over time; describe short- and long-range plans to achieve career goals through appropriate educational paths; identify information that describes educational opportunities (e.g., job training programs, graduate and professional study etc.);
- describe community and organizational resources to support education and training; demonstrate confidence in the ability to achieve learning activities; identify and use current career information resources;
- describe information related to self-assessment, career planning, occupations, prospective employers, organizational structures, and employer expectations;
- demonstrate skills in preparing a resume and completing job applications;
- demonstrate skills and attitudes essential to prepare for and participate in successful job interview;
- describe how society’s needs and functions affect occupational supply and demand;
- describe occupational, and technological trends as they relate to training programs and employment opportunities;

- describe personal criteria for making decisions about education, training, and career goals;
- describe skills to assess occupational opportunities in terms of advancement, management styles, work environment, benefits, and other conditions of employment;
- develop an individual career plan, updating information from earlier plans and including short- and long-range career decisions.

As a consequence of listed issues above to take into consideration in a career guidance program at the university level, career planning must meet the needs of students at various stages of career development. Understanding the relationships between career choice and educational requirements is essential. University's students must learn to relate their personal characteristics to occupational requirements. Career planning and decision-making skills play an important role, and students need assistance in choosing between career opportunities.

3. CONCLUSIONS

Career guidance activities in institutions of higher education must provide assistance in helping each student understand that career development is a lifelong learning process based on a sequential series of educational and occupational choices (6). Each student should be given the opportunity to identify and use a wide variety of resources to maximize his or her career development potential.

Typical programs offered by career counseling centers in universities include career search strategies, interview skills training, and instructions on writing resume. But the demand for work- and experienced-based programs is increasing. The mobility on international job market is expected to grow. In this respect, students will need to plan early their career to meet job requirements in the international marketplace.

The career counseling in Romanian education system has no long tradition or experience in developing and conducting specific counseling activities, but we learn by doing! Collaborative working environment and international perspective help us to set up appropriately the general framework for action. New opportunities and approaches in career counseling field are under development and implementation in Romanian educational system.

REFERENCES

1. Gysbers, N.C. and Associates (Eds.), "*Designing careers, counseling to enhance education, work and leisure*", San Francisco: Ed. Jossey – Bass, (1984);
2. Mauer, E. B., Gysbers, N.C., "*Identifying career concerns of entering university freshmen*", Madison, University of Wisconsin, Wisconsin Vocational Studies Center, (1990);
3. National Occupational Information Coordinating Committee (NOICC), U.S. Department of Labor, "*The national career development guidelines project*", Washington D.C.: US Department of Labor, (1992);
4. Pascarel, E.T., Terenzi, P.T., "*How college affects students: Findings and insights from twenty years of research*", San Francisco: Jossey–Bass, (1991);
5. Sampson, J. P., Jr.; Reardon, R. C., Peterson; G. W., & Lenz, J. G., "*Career*

Counseling And Services: A Cognitive Information Processing Approach", Pacific Grove, CA: Brooks/Cole, (2004);

6. Vernon, G.Z., "*Career counseling. Applied concepts of Life Planning*", Southwest Texas State University, Brooks/Cole Publishing Company, pp. 252-279, (1998).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

WAYS OF DEVELOPING THE COMMUNICATION COMPETENCE IN THE INITIAL TEACHER TRAINING PROGRAM

Flavia MALUREANU*, Luiza ENACHI-VASLUIANU*

*The Department for Teachers' Training, the Focşani Branch, Faculty of Psychology and Educational Studies, University of Bucharest, Focşani, Romania

Abstract: *Activating the communicative competence is a prerequisite for an efficient activity of the future teacher. Its formation and development on students involves a level of performance which is based on knowledge, skills, attitudes and motivation. The competence of communication is acquired through learning which can be of various nature and can be gradually polished up. On the one hand, we may speak of a rationally guided learning of the type „how to do", on the other hand, we may speak of learning through direct involvement in the action.*
The programme of initial formation conducted in the Department for Teachers' Training, the Focsani Branch, is based on the idea according to which the competence of communication concerns the students in their dual capacity: educated and future educators and focuses on its development through the utilization of strategies centred on interaction. During the seminars we lay emphasis on modern interactive methods that enable intercommunication sequences. The purpose of these strategies / methods is not only to improve cognitive acquisitions, but to develop competences which underpin the construction of a harmonious professional personality prepared according to specialization, but, at the same time, endowed with a large horizon of general knowledge, with an attitude open towards novelty, with personal and professional equilibrium.

Keywords: *communicative competence, initial teacher training program, effective teaching*

The skills that ensure the correct premises for a personality to achieve effective teaching are professional (scientific), pedagogical, methodological, psychological, social, managerial and communicative [3]. The importance of communication for the effectiveness of education is revealed by its inclusion in the annual evaluation files of the teaching staff.

In a generalist approach, De Vito [4] refers to the communicative competence which he considers to be composed of "one's own knowledge of several social aspects of communication". By increasing the scope of the term, Sălăvăstru [11] states that the ability to communicate effectively in any situation is called communicative competence. According to the author, this competence includes:

- the knowledge of communication rules and the skills to implement these rules;
- the knowledge of the contextual influence on the content and on the form of communication and, on this basis, the adequacy of the "behaviour" of communication to the context in which it occurs;
- the knowledge of the individual psychology, the experience of the

interpersonal relationships and a certain social skill to avoid pitfalls and dangers;

- the awareness and the knowledge of the culture of the interlocutor because the principles of the effective communication will vary from one culture to another.

J. Habermas [9] has stated that every act of communication is linked to the presentation of the relevant language that can be understood, to the correct determination of the social relations, to the revelation of the speaker's experience. The communicative competence, according to Jablin [9], is characterized by a set of skills, primary resources that the communicator uses for the communication: strategic knowledge (rules and norms about the appropriate communication) and capabilities (features and abilities).

The communication skills, as described by Păuş [8] in accordance with the recent recommendations of the Council of Europe in terms of language learning include: language skills, sociolinguistic competence and pragmatic competence:

- language skills include lexico-semantic competences, grammatical competences, phonological competences;

- sociolinguistic skills require the knowledge of the elements that indicate social relationships (status of the interlocutors, relationship closeness, record speech), the knowledge of the rules of courtesy, language registers etc.

- pragmatic skills include discursive competences (organization of the sentences, speech planning, information structure, argument construction etc.), functional competences (functional use for precise discourse: description, commentary, exposition, argumentation, persuasion etc.) and competences of power schemes of interaction (verbal exchange models, cooperation, negotiations, recognizing patterns of dominance and subsequent inferiority schemes etc.).

Each component consists of knowledge, attitudes, skills and abilities. Among these components an interdependence relationship is established which is done in practice through the production, the reception, the interaction and the mediation of the message.

Shockley-Zalabak [12] presents the communicative competence through the four forms that it can take:

- knowledge competence (the ability to understand organizational and communicative environment);

- sensitivity competence (the ability to feel / infer the correct meanings and feelings of other members of the organization);

- skill competence (the ability to correctly analyze organizational situations, to initiate and effectively use organizational messages);

- value competence (the ability to assume responsibility for effective communication).

Effective communication in the educational activities involves the activation of the communicative competence, perceived in its double condition, innate and acquired, and expressed simultaneously at three levels: verbal, nonverbal, and paraverbal. The communicative competence is an imperative for the teachers and a requirement for the students as educated and future educators. For the teachers, communication is one of the means of exercising their teaching profession. To do it successfully, they should prove highly communicative competence, meaning: the ability to use language skills in order to say something, to explain, to clarify, to ask etc.; the ability to provide correct grammatical structures and use them effectively in teaching communication; the ability to integrate communication in the context of the cognitive, affective, volitional factors; the knowledge of the development, the construction and the operation of the logical type of oral communication and written arguments; the knowledge of the role of gestures, mimicry, silence etc (nonverbal behaviour) [2]. Teachers should try to meet all these requirements, to promote and to cultivate them in their students.

With respect to the oral and written teacher's language, Charlotte Danielson [10] sets out a scale of reference for the performance:

Unsatisfactory level: the teacher`s speech is at an inaudible level or the writing is unintelligible. The language (oral or written) may contain many grammatical errors; the vocabulary may be inadequate, vague, or used

improperly, inducing a state of confusion to the students.

Basic level: the teacher's verbal language is audible and the written language is intelligible. Both are used correctly. Vocabulary is also correct, but limited, or it is not appropriate to the age or to the experience (cognitive, affective etc.) of the pupils.

Competent level: the speech and the writing of the teacher are clear and correct. The vocabulary used is appropriate to the age and interests of the students.

Outstanding level: the speech and the writing of the teacher are correct and expressive, with well-chosen vocabulary that enriches the lesson.

In the context created by this scale it is desirable that all teachers reach the highest level, but it is known that not all are located on the same level of performance with the oral or the written language. To develop and to sustain an optimization approach of the educational communication, teachers have a multitude of possibilities: books and magazines, profile courses etc. But all these requirements are necessary to be known not only by teachers but also by students in order to be able to improve performance of the oral or the written language and to integrate them into communication as an effective approach.

Training and developing the students' communicative competence is one of the purposes of the initial teacher training program. Research in education has shown that the communication objectives are best achieved by focusing on the pragmatic language, the use of language in different contexts, the fluency in speech, the authentic contexts. The training of the communicative competence involves a level of performance based on knowledge, skills and attitudes and an optimal motivation that determines the efficiency of a subject in an activity.

In the initial training programme for primary and preschool teachers we use the modern interactive methods of instruction as a framework for forming and developing the communication skills. In this respect, the methods that have proven their efficiency in lecture and seminar activities are the brainstorming, Philips 6/6, the method of division, the role-playing, the Socratic seminar, the mosaic, the aquarium method, the panel discussion, the creative controversy. We shall not dwell on the detailed presentation of each method as the focus of our activity is on the pragmatic formation of the competence of communication in the conversational context created by these methods. Based on the teaching experience in the university field we have noticed that the general advantages of using them are the following: they motivate students to learn, they incite to dialogue, to reflection, they involve the formation of new ideas, opinions and arguments, they create situations of learning centred on intercommunication and, as a result, they become means of personal development. Of course, the series of advantages is much more complex, but we have tried to bring forth only the conclusive aspects in terms of communicative competence.

In the beginning of the academic year, the students are familiarized with a number of indicators which underpin the formation and the development of the competence of communication of an effective teacher. In order to determine the students to realize the importance of the indicators as well as their level of accomplishment, we have formulated the requirement that they be followed in the activities that use preponderantly the interactive methods. The indicators we have proposed are:

1. *adapting the message to the audience;*

2. *using the support-elements to understand the message;*
3. *the technique of asking questions;*
4. *expressiveness;*
5. *the ethics of communication.*

Adapting the message to the audience means that the teacher should use a language appropriate to the level of knowledge of the pupils (s)he addresses to so that the message should be correctly and completely understood. The educational message must be as attractive as possible, understandable, accessible, without being charged of redundant elements. The sentences should be simple, not too intricate and the connection between the ideas should be clear and logic.

Using the support-elements to understand the message enables the easy and complete reception of the educational message. The teacher's speech must contain data, facts, observations, experiences from daily life alongside with explanations, interpretations, arguments, examples which should allow the pupil to distinguish between the gross fact and the scientific fact. At the same time, there should be used plans of ideas, tables, drawings, images to make the message more intelligible and believable.

The technique of asking questions is valuable as it is a means of stirring the students' intellectual activity and of involving them in the communication process. Underpinning the dialogue and the intercommunication, the questions' role is to lead the discussion on a certain path, to enrich the information, to remove ambiguities, misunderstandings and gaps in the informational process, and, most of all, to deepen understanding. As such, the questions must be clear and precise. Their choice depends on the objective proposed, the subject they can be used at, and on the students the questions are addressed to. In order to optimize intercommunication the teacher must use different types of questions (*factual*, *empirical*, *productive* – which do not require one correct answer, *evaluative*). Moreover, they should constitute a crescendo, a scale that the students will climb as they move inside a field of science.

Expressiveness refers to the nuanced formulation of ideas and feelings the teacher intends to convey to his pupils. The importance of expressiveness in the educational communication comes from the fact that the form of the teacher's discourse is the first element the pupil has contact with in the educational process. Before understanding the ideas the teacher conveys, the pupil notices the beauty of his speech.

The ethics of communication is about the "morally" correct behaviour of the communication act. Language, as primary tool of communication, is not easy to deal with. It is a social construct as much as it is a mental ability. It is important for students to be aware of this and they should choose their words and phrases on the basis of a number of variables such as purpose, appropriacy, and language in discourse.

One of the basic rules of efficient intercommunication is that we select language for its denotational (or surface) meaning with a purpose in mind which we wish to achieve. Students must understand that the purposes we propose have a profound impact upon the design of the teaching materials. In order to achieve a communicative purpose we have to choose the most appropriate language forms to use and our choice is governed by a series of variables such as setting (informal and spontaneous language at home, formal pre-planned speech in a work environment), participants (the people involved in an exchange determine the choice of degree of (in)formality of discourse), gender (research has shown that men and women typically use language differently when addressing either members of the same or opposite sex), channel (face to face interaction, telephone conversation, speaking through a microphone to an unseen audience, standing up in a lecture hall in front of a crowd etc will generate different uses of language), topic (affects our lexical and grammatical choices).

Language as discourse is language in use. Thus, the communicational act is described in terms of speed, rhythm regulation, and interaction dominance (involving the three main types of strong initiatives: directing, controlling and inhibiting moves)**,** turn-taking

(how people take turns to speak in a conversation), and the patterns and routes which many typical conversations follow. Moreover, in order to ensure the efficiency of the communicational act the students must be educated to "listen actively" when they are not speaking, to transmit their message in a way that does not cause misinterpretation, and be prepared to make inferences from the context, whenever required, to formulate replies and questions in connection to the topic of discussion, to give the correct information, to give the required amount of information, to be brief, orderly, unambiguous and not obscure in their speech acts.

Paralinguistic features such as facial expression, tone of voice, gesture and posture are all part of the way we communicate with each other in face-to-face encounters. When teaching we can draw our students' attention to these as they may send powerful messages about how we feel or what we mean. From the most common facial expression smiling should be used to a great extent. However, according to the context, the student should make plenty use of other signs as well: raising eyebrows to suggest surprise or interest, biting one's lip to indicate thought or uncertainty, compressing the lips to show indecision or obstinacy etc. The gestures should accompany appropriately the facial expression. Thus, crossing one's arms may indicate relaxation, scratching one's head may indicate puzzlement, shrugging shoulders may show lack of specific knowledge, hand-clapping may indicate call for order or congratulations on a good answer etc. Posture can convey meaning too. For instance direct eye contact maintains the channel of communication open and shows interest in what is being said.

All in all, communication is also a matter of linguistic and paralinguistic factors. Students should be made aware of the importance and the necessity of all these (para)linguistic features in the development of good intercommunication. This could be easily done using video-material to observe other teachers (more or less experienced) or in peer evaluation activities. In seminars, when we have our students study the way language is used in speaking or writing, we will want to draw their attention to these issues. We may ask why a speaker uses particular words or expressions. We may have our students prepare for a speaking activity by assembling the necessary topic words and phrases. We may discuss what sort of (para)language is appropriate in a certain situation etc.

As a result of this approach, the communicative competence accumulates the full set of personal skills: to know, to know what to do, to know to be, to know to become. In order to form the communicative skills to students, the educators themselves must also possess these skills. Therefore, the problem of communication skills concerns the educators and the educated, whether it's training for the first, or it's training and development for the others. Gille [6] stressed that an important educational task is to teach students to communicate, exchange ideas, opinions, to understand, to externalize, because the dialogue means to assume that the interlocutors can learn something from each other. Therefore, in order to communicate effectively and have communicative competence is not enough that students should know the grammatical aspects of the language system or to use a rich vocabulary, but they also need to produce, to develop ideas, to start a conversation, to analyze, to persuade, to argue.

From the above we understand that communicative competence consists of cognitive-theoretical structures and practice, through which communication can be done.

The teachers' task is to provide opportunities for open communication and to form communicative competence to their students through their own example and by providing ongoing guidance to acquire the qualities associated with this type of competence. On the other hand, students have the duty to get actively involved in intercommunication, to follow examples and listen to their teacher's explanations and to improve their activities step by step.

In conclusion, the pedagogical approach we initiated to form and develop the competence of communication has started from the idea that the competences can be learned and polished progressively. In other words, nobody is naturally competent for a particular task, but one becomes competent. The competences, as A. M. Marhan [7] stated are acquired through rationally guided learning of the type „how to do", with emphasis on "to do" through direct involvement in the action. More precisely, the competence of learning is learned through observing the others, through instructions offered explicitly, through trial and error.

REFERENCES

1. Cabin, P., Dortier, J.F. (coord.). *Comunicarea. Perspective actuale*. Iaşi: Polirom (2010).
2. Cerghit, I.. *Sisteme de instruire alternative şi complementare. Structuri, stiluri şi strategii*. Iaşi: Polirom (2008).
3. Cristea, G.. *Psihologia educaţiei*. Bucureşti: Coresi (2002).
4. De Vito, J.. *The Interpersonal Communication Book*. New York: Harper, Row Publishers (1988).
5. Harmer, J.. *The Practice of English Language Teaching*. Edinburgh: Longman (2001).
6. Leroy, G.. *Dialogul în educaţie*. Bucureşti: Editura Didactică şi Pedagogică (1974).
7. Marhan, A. M.. *Psihologia utilizării noilor tehnologii*. Iaşi: Institutul European (2007).
8. Păuş, V.A.. *Comunicare şi resurse umane*. Iaşi: Polirom (2006).
9. Pânişoară, I. O.. *Comunicarea eficientă*. Iaşi: Polirom (2004).
10. Pânişoară, I., O.. *Comunicarea eficientă. Metode de interacţiune educaţională*. Iaşi: Polirom (2003).
11. Sălăvăstru, D.. *Psihologia educaţiei*. Iaşi: Polirom (2004).
12. Zlate, M.. *Tratat de psihologie organizaţional-managerială*. Iaşi: Polirom (2008).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

ROMGLEZA – IN THE NAME OF GLOBALIZATION

Ana MUNTEANU*, Dorina LUPAN**

*Faculty of Legal and Administrative Sciences, Brasov, 'Spiru Haret' University, Romania

Abstract: *Our paper looks at how far the Romanian language has changed under the influence of English, one of the most spoken international languages. We totally agree with the statement that a language is a living organism, the lexicon of a language being the most mobile part. Nowadays we think that all languages are particularly altered by English borrowings, showing that, with and especially without people's conscious will and awareness, globalization really touches one of the most durable symbols of a nation: their language. No matter how bad it seems, we think that the positives far outweigh the negatives. Not to mention the fact that, from time to time, a 'global' language influences the other languages. It is not without problems, but on the whole we think that it is better not to greatly exaggerate the whole process.*

Keywords: *romgleza, globalization, lexical innovation, linguistic evolution*

1. INTRODUCTION

The European motto 'unity in diversity' seems to have altered its content. Globalization, with good and bad things, touches, slowly but surely, one of the most durable symbols of a nation: language. Obviously we are not close to the 1948's, when the lexical borrowings, especially those from French, were endless subjects and maybe the most interesting topics of wide debates. Everybody remembers that some of the professionals' concerns knew apocalyptic dimensions, some being really hilarious. However, some contemporary linguistic 'metamorphosis' remind us that history repeats itself, including the history of language.

The fact that a nation's language is a living organism has become a common place. And it would be a pity not to be so. If we do not accept this reality, we admit that a language does not evolve; still neologisms are irrefutable evidence that any language is alive. How far can this trend be accepted? It is a good subject for reflection for everybody, not only for specialists. The pessimists would say, 'Up to torturing the language! In the name of globalization!'

We propose, in the lines below, a reflection on this development, with or without quotes.

2. *ROMGLEZA*

2.1 A new language? *Romgleza* was 'born' from the union of two languages: Romanian and English, following the great mixture of more and more English words and Romanian words.

The truth is that English has spread across the world relatively fast due to the British and especially American economy and the fast-growing developments in technology, to mention just two of the most important causes. Today about eighty percent of the data stored in the world's computers is in English. The entertainment industry has a say in this, too. Many people are familiar with English because of Hollywood and pop music. At least five out of ten songs in the pop charts in most countries at any given time are sung in English.

Coming back to Romania and the language spoken on this land, we would like to imagine

an ordinary day in an average Romanian person's life. Please, note that the underlined words are English.

The Romanian manager, a top corporate executive, the CEO type, welcomes everybody with a shiny 'hello!' while opening the door with a 'Push' sign on it, and wishes a good day (i.e. a kind of "Buna ziua" (good afternoon) translated into a transatlantic language), when there is a sign saying 'Closed'. The job itself is not very complicated: s/he has a computer, a usual browser, so s/he logs in, chooses a user name from a big folder where s/he stored her/his passwords. Then s/he clicks enter, then OK; if the case, s/he scans; if s/he happens to make a mistake, s/he presses on the delete button or cancels the activity.

For team building it is a bit different. All information should be updated and one should download everything they think is relevant, hot, the main topics being trend, dumping and the necessary inputs. Outdoor it's ... cool; one can see or have tuned cars, the latest gadgets, tablets, of course, the 'must have' type, or 'must see'; the latest hits, the news in prime time, the latest CDs, VIP's life, shopping at mall or at the nearest supermarket.

In this continuous stress, one can survive eating a hot dog in the morning, at a fast food at lunch, perhaps a pizza; at dinner one can choose something special, a full menu from a catering company, leader on the market.

And this imaginary day could go on, fueled by the language that bombards us daily, especially from mass-media. This perception is, of course, at the common user's level. The specialists, those who would handle such a profound phenomenon thoroughly, will find reasons, explanations, being able to classify the new words into different groups, belonging to various areas (art, cinema, techniques, information technology, etc.).

2.2 Looking backwards. If we confine ourselves to just a quick ascertaining observation, we will note that the phenomenon is not new, just that the pace of innovations in a language got amazing speeds. A quick review of the development of vocabulary in other languages such as Greek, English or French is meant to eliminate any concern.

While conquering the world, Alexander the Great carried the kind of Greek spoken then into the Near East where it became the standard language of commerce and government, existing along side many local languages. Greek was adopted as a second language by the native people of these regions and was ultimately transformed into what has come to be called the common Greek [2]. It brought significant changes in vocabulary, pronunciation, and grammar and some of these changes have persisted into Modern Greek. The time of rapid change initiated by Alexander, though, lasted around 600 years.

In his research, Palmer found out an 'amazing' thing: during the Hellenistic period some purists reacted strongly against common Greek. They developed a movement called Atticism, which treated classical Attic as the only acceptable standard for prose writing. This movement would continue to influence Greek writing well into the modern era by constraining the production of literature in the normal idiom of actual daily speech [2].

Ancient Greek had an amazingly rich vocabulary and had a heavy influence on the English speaking civilization. Its vocabulary influenced and contributed to modern English; more than twenty percent of English vocabulary is derived from the vocabulary of ancient Greece. According to the *Webster International Dictionary* the total of the word stock of the English language is 166,724 words, out of which 41,214 are Greek [5].

Some of the most known English words of Greek origin are: analysis, antithesis, criterion, diagnosis, dogma, method, phenomenon, synthesis, therapy.

During the last century Italian and then French influenced other languages, according to the period when they were 'global'. In the same period, in Romanian many words were introduced from the neo-Latin languages, especially Italian and French. Much of the Italian words from the Romanian language belong to music and banking terminology. But the strongest influence of the last century until the late 1980s was, of course, the French influence. French was taught and known by many Romanians.

The French language influenced Romanian throughout the eighteenth century. At first, the Phanariote principles brought French culture in the Romanian countries.

The Greeks from Constantinople were officials of the Ottoman Empire due to their higher level of education (compared to the average Ottoman population). Many members of the Phanariote families occupied high political and administrative posts for the Sublime Porte for relations with Western Europe because they were multilingual. The spread of the French culture in the Middle East led to the adoption of French as the language of diplomacy and shortly it became the language of the cultivated, well-mannered class of society. And if they did not know French, the Phanariote Principles came in Romania accompanied by their secretaries who spoke French, those times' international language. As a result, landowners and people from the 'aristocracy' brought French people to Romania, people who taught French to their Romanian children and to the court [3].

As opposed to the above mentioned influences that happened because of the countries' educated elites, the recent English influence has happened due to ordinary people. At the end of the last century and the beginning of this century, the majority of loans are from English. They have appeared and still appear in different fields: sports, business, economy, banking, finance, IT, fashion, music, transportation, psychology, art, construction, film, medicine (and we are aware that our list did not include all areas). For example, a person who has an average level of knowledge of English and works in the economic field uses 'willy-nilly' specific terms in English, because, internationally, English is now recognized as the global language of business (there is a specialized language: English for business).

2.3 Looking at our Latin relatives. European clichés consider French to be proud of their traditions, cuisine and fashion, monuments, literature and art, culture and civilization in general, but also arrogant, conservative, and reluctant to multiculturalism.

Beyond clichés, however, the French are bizarre and spontaneous, charming and unpredictable, ironic and well-mannered, knowing how to behave and what to speak.

Like any other language, French has known and still knows internal and external influences which, due to their strength can not be ignored, regardless of the causes which concur in this process.

The French Academy – conservative forum par excellence – in many occasions rejected any attempt to authorize any innovation in language, such as lifting or reducing the accents or accepting neologisms, mainly Anglicisms (English words).

More tolerant, in fact more flexible and realistic proved to be the French lexicologists who update with commendable consistency and monthly frequency each edition of Larousse and Robert dictionaries.

Innovations in current French deserve to be treated under different chapters, depending on their nature and in the context of external pressures at an orto-phonetic and orthographic level, as well as a social level. For example, the pronunciation of foreign proper names, in accordance with the French norms, is the foreigners' delight and even the Francophones': Mozart [Moza], Michael Jackson [miʃɛl Jaksõ], Venise, Milan, Florance; sandwich, weekend, tramway and other old Anglicisms have 'suffered' a more phonetic treatment than an orthographic one. In French recent neologisms have experienced different treatments, strange, or maybe normal if judged according to the 'purist' Frenchmen

and / or the import of technology together with the word that it defines.

The Ministerial decision from January 1973, for example, requires or recommends the use of French terms for realities borrowed from English: 'cadreur' instead of cameraman, 'retour en arriere' instead of flash back, 'classe' for standing, 'salle de sejour' for living room, 'savoir faire' for know-how, 'banque de données' instead of data bank, [4].

Toubon's famous law of 1994 (dubbed, by the way, Monsieur Allgood) also attacks the 'cut' words, the abbreviations, in this case, which can give rise to confusion and would rather approach slang; but abbreviations are common in spoken French and tend to generalize influencing slowly, selectively, even the neat French: ado(lescent), aglo(mération), bio(logie), compta(ble), déca(feiné), démo(nstration), écolo(giste), impro(visation), instit(uteur), labo(ratoire), météo(rologie), prépa(ratoire).

2.4 Other aspects. The language of a people is an element of stability in its life, but, considered in terms of its functionality, it appears to be a dynamic phenomenon, capable of evolving and changing. Language is a very complex phenomenon that involves an extremely rich system of morphological, syntactic, orthographic or orthoepic rules and regulations. Once these rules are set they must be complied with by all the speakers or writers to keep the unity and stability of the language. These rules are contained in treaties, handbooks, textbooks, dictionaries, of which we understand what it is allowed or not in a language. But, due to the evolution of the language, now and then such rules become uncomfortable because they change the relationship between what is right or wrong. E. Coşeriu states that 'change in a language, linguistic change, means the dissemination or generalization of an innovation, involving some necessary and subsequent adoptions' [1]. That is why we think we should accept linguistic changes, adopting necessary things up to altering the existing language as known by our grandparents. We believe that Romanian would not become *Romgleza*, but a more developed language, capable of helping people communicate better.

3. CONCLUSIONS

For a long time, people have felt the need for a global language in order to communicate faster and better. Esperanto, the most successful artificial language, was thought to become the global language. It did not succeed. Instead, English has spread across the world.

While more and more people learn English and speak it for different reasons, one could notice the effect it has on the other languages: a great variety of words and expressions are used in English while speaking their native language. We think it is 'OK' :) in principle, and, without being a huge fan of the new language some people speak (*Romgleza*), we are optimist. This living creature called language will grow nicely, changing just as much as needed, if we do not exaggerate while bringing it up. In fact, it happened before, as we have mentioned above: Greek, Latin, Italian, French influences, to mention just some of the most powerful – and Romanian is still unique, special and different from all other languages.

REFERENCES

1. Coşeriu, E. *Diacronie, sincronie şi istorie*. Bucureşti: Encyclopedic Publishing House, (1997), p. 70.
2. Palmer L., R., *The Greek Language*. Duckworth Publishing House (1996).
3. Rosetti, Al., *Schiță de istorie a limbii române de la origini până în zilele noastre*, Bucureşti: Albatros Publishing House (1976), p. 81.
4. *** *Dictionnaire des néologismes*, 5-e édition, Paris : PUF (1988).
5. *** *Webster International Dictionary* Available: http://unabridged.merriam-webster.com (April, 2012)

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

SCHOOL TRAINING OF THE FUTURE UNIVERSITY PROFESSOR

Simona Nicoleta NIȚĂ

Teacher Training Department and Socio-Human Sciences, Politehnica University of Bucharest, Bucharest, Romania

Abstract: *Educational training of the future professor addresses three issues: the need for psychological training of the future professor - necessity deriving from the duties and obligations that satisfy the educational plan, optimizing practical professional training of future teachers - just observing and then practicing it himself the learned in this way, the student acquires certain skills and pedagogical skills, attending seminars - the seminars' activities should be based on understanding, challenges and hypothetical or real problem solving, passing then to develop creative and independent research skills for topics of professional interest. At the end of the study there are identified factors that block student participation in discussions.*

Keywords: *university professor, teacher training, qualifications, teaching technique.*

1. INTRODUCTION

Improvement of the education quality also depends on the improvement in its selection process and the enhancement of training, social status and work conditions the professors' benefit from. They should have appropriate knowledge and abilities and certain individual characteristics proper to this profession and they should be given the adequate professional motivation and prospects if the hopes invested therefore are wanted to become real and the „product" i.e. the graduate stores a certain savoir and savoir-faire.

There is a need for reconsidering the education of the professor, generally of the university professor because such reconsideration is especially meant to prepare, in the future, professors having those intellectual and human qualities which are required to facilitate a new approach of the teaching technique.

2. THE NECESITY OF UNIVERSITY TEACHER EDUCATION

2.1 Psychological education of the future university professor. The necessity of the psychological education of "the student of today, the professor of tomorrow" as shown by Maximilian Boroș (1994, pp. 97-118), derives from the obligations and the tasks the latter is to carry out in the instructive- educational field. On one hand, forming and modeling the students conduct and their entire personality are taken into account and on the other hand, the teaching of a subject itself meaning much more than a mere transmission of the specific information.

Boroș stated that the professors, lacking a proper psychological education, are those who face the most difficulties related to the prevention and solving of the problems and the events in a class. Such difficulties are more frequently experienced and manifested in "a

wrong assessment of the students behavior and consequently an unfair sanction of the same, a tough behavior launching, willingly or unwillingly, conflicts inter-individuals, incapacity to discover and identify, in due time, of the difficulties the pupils/students face in understanding and assimilating knowledge and information and henceforth the inability to give them the necessary support" as the author mentioned.

Thus one can find that without a comprehensive psychological, theoretical and practical education of the teacher, the school is unable to successfully achieve either its current instructive-educational tasks or the one of forming the citizen and the specialist of tomorrow.

The professor psychologically trained is acquainted with the physical, moral and intellectual possibilities of the students he teaches, including the individual ones, and he possesses the ability of engaging the student up to the level where these availabilities are changed in real abilities and performances and he knows the conditions in which a certain information can be better learnt and also the type of motivation involved.

2.2 Optimization of the practical professional education of the future university professors. The practical professional education of the students draws lately more and more the attention to the „execution factor and raise the interest and concern of the specialists" Boroş (1994). Particularly, the concern of the educators is focused on the educational application. Starting from the necessity of its „resettlement" on a scientific basis the educators are concerned to:

a) Find forms of organizing and developing the practical training;

b) Formulate concepts and generalize positive experience and simultaneously to identify the conditions and the means of their improvement.

The educational application of the students starts with the observance of the way the educational process in the school is organized and carried out, a special importance being attributed to the work system the professor practices with his/her pupils in the class. The more the student makes progress within his/her training the more the student is entrusted the organization and the control over some activities specific to the specialty professor, especially the techniques inciting and guiding the pupils towards learning the knowledge taught in the class. In this way, observing and applying by himself what he/she learns through this method, the student finally acquires some teaching skills and abilities. The appropriate acquirement of such skills is to a great extent ensured by a critical (self critical) analysis and appreciation of the teaching results, situations and facts. Thus the, student learns from his/her own remarks and from those made by the members of the group he/she belongs to, remarks and comments certified by the leader of the teaching practical course whose advices and suggestions represent, on their turn, a significant source of learning … The level and quality of the practical teaching education depend to a great extent on the nature of the teaching facts observed and on the advices deriving from their examination.

The above mentioned raise the following questions:

1. What do students practitioners expect from the specialty professor and to what extent their expectations are satisfied?

2. What is the nature and, closely related to, the instructive value of the facts observed and examined?

3. Does the present education of the student provide the competent exercise of his/her future professional role? (Boroş, 1994).

The author of this research makes clear that it is necessary before anything else, „a judicious selection of the teaching personnel leading the pedagogic practice. In addition to the thorough specialty education it is necessary for the teaching personnel to have a good psych-pedagogic education. Further, it should be required for the students to involve much more in practical activity, while simultaneously they are granted the requested assistance and guidance" (M. Boroş, 1994, pp. 97-118).

2.3 Attendance seminars. The active participation in the seminars have „ beneficial effects on the students education", wrote

Boroş (1994). However, the number of the students taking directly part in the debates at the seminars is generally, quite small. This can probably, be explained by the „ predominant traditional character of the seminar, by the practice of „resumption, in the same order or in a different order the information taught at the course, with a view to explaining or completing the same" (ditto). Yet, the seminar, unlike the course, is meant to transmit and acquire information, and its main purpose is to „make the student able to use the acquired information" (Boroş, 1994).

Reaching the goals of the seminars implies in the highest degree application and use of the knowledge the students previously acquired either by hearing the courses and/or individual study. There are more than one type of activities that can be used for this purpose So, to check and increase the degree of understanding the knowledge presented at the course by the students, the person leading the seminar may ask such knowledge be reformulated and translated in one's own language, he may put questions or initiate and lead discussions about the related topic. He may also request the students to demonstrate an assertion or offer arguments thereto asking for this purpose questions like: „Who believes he/she could settle this dilemma?", „How do you think one could act?", „Who engage himself/herself to contribute to...?", „What is this grounded on?" wrote the author (1994). Beyond their general character such questions have the value of stimulating both the thought and the ambition of the students. And more important is that the students, on their turn, be allowed to ask questions, to look for solutions, to issue hypothesis, to experiment and to evaluate.

The activity at seminars should start from the understanding, debating and solving the hypothetical or real problems and then pass to the development of the creative abilities and of individual research of topics of professional interest.

3. CONCLUSIONS & ACKNOWLEDGMENT

The person leading the seminars should simultaneously with his/her teaching technique development be equally concerned about:

- Provision with an environment in which students be free to express their ideas without the fear of being ridiculous or unsuccessfully;
- Instruction of the students so that they perceive the activity at seminars as a learning event the mistake being an organic part thereof;
- Persuasion of the students so that they get used, that to talk" is a complex ability and can not be learned without making mistakes;
- Awareness that from making a mistake one can learn how not to repeat it and that besides a positive learning there is a negative learning that is one through which we learn how we should not do any longer;
- Warning the students that various controversies and conceptual conflicts are not conflicts between individuals but between opinions and ideas, a very normal fact and equally beneficial for one's own formation;
- Ensuring the student through word and fact that he/she is a sincere partner in finding the truth and that he/she is only one of those who have got an extra responsibility on the path of finding the truth.

If encouragement and cooperation the participation is larger and more fruitful, trust is developed as well as the need to help a colleague by offering details, rectifications. Conversely, „under competitive conditions discussions turn contradictory opposition ones even without a proper argumentation" (M. Boroş 1994, pp. 97-118)

The author proposes himself to identify factors hindering the tend of the students to participate in the discussion. For this purpose, an inventory of 6 items was drawn up and 81 students were inquired:

- Impression that others are better trained;
- I fail to express myself easily;
- Impression that I am followed with too much critical spirit;
- I can not say anything;
- I learn more hearing the others;
- Fear of making a fool of myself.

The most inquired students (52,2%) motivate their refusal of a direct and willingly discussion, though previously prepared, on the reason that they do not want to say anything (26,7%) or that They can not express themselves easily (25,3%). It is worthy mentioning the number of those whose tend to participate is inhibited by the impression that they are listening with too much critical spirit (18, 3%).

The reasons the author referred to, have a common aspect that is the fact that it unleashes, sustain and direct the behavior of avoiding the failure. But just because they „serve the defense of the Ego, they may be easily construed as mere justifications. Consequently, the professor leading the seminars should explicitly propose himself/herself as a target the attraction in the discussions of a large as possible number of students and, if possible, all the students of the related group.

REFERENCES

1. Boros, M., *Teacher and students*, Pedagogy Collection, Baia Mare: Gutin Publisher (1994).
2. Iucu, R., Păcurari, O. *Initial and continuous teacher training*, Bucharest: Humanitas Educational (2001).
3. Iucu, R., *Four exercises of education policy in Romania*, (2005) *Source.* [online]. Available: www.cedu.ro/programe/exercitii/pdf/oct/modul02.
4. Iucu, R., *Teacher training. Systems, policies, strategies*, Bucharest: Humanitas Educational (2007).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

UNIVERSITY TEACHING POSITION VIEWED ON THE PAST-PRESENT AXIS

Simona Nicoleta NIȚĂ

Teacher Training Department and Socio-Human Sciences, Politehnica University of Bucharest, Bucharest, Romania

Abstract: *University professor has according to his professional status the duty and the possibility to fully utilize the entire potential of young generation. But it can only be achieved when the teacher has the capacity, skills that allow performance of teaching positions, the roles that need to be performed under his status. Given this, we mention that, until 2011, to enter the university system was required bachelor's degree and completion of courses organized by the Teacher Training Department. After entry into force of the new Law on Education to hold a university teaching position, you must have at least the quality of PhD student or doctor's degree without having to follow a program of psychological and educational studies. So, we propose an analysis of how to access a function in university system in terms of past-present axis.*

Keywords: *university system, teacher position, quality of education, levels of training*

1. PROFESSORS IN SEARCH OF NEW PROSPECTS

Education is seen as an ambitious task for the development of individual and society. Each individual is encouraged and helped to make use of his/her abilities and opportunities of learning throughout his/her entire life. Therefore the university professors are expected and required to offer very much; to turn this vision into reality depends to a large extent on such professors (Jacques Delors, 2000, p. 119). Professors play a determinant role in training the youth taking into account that the former have to teach the latter not only how to trustfully view the future but also how to build that future with responsibility and awareness.

Necessity of instruction, generally, and quality of education, especially, depend on the personal qualities of the professor and on his/her relationship with the class and with each and every pupil/student separately and also on his/her capacity of organizing and guiding the activities in the class and on the ability to motivate his/her students in the learning process.

In this respect we propose a thorough analysis of the manner one can attain a teaching position in the university education as viewed on the past-present axis.

2. MODALITIES OF ATTAINING A UNIVERSITY INSTRUCTIVE POSITION: PAST-PRESENT

Teaching positions in the university education can be occupied, by the time the

new Law of Education enters into force (January, 2011) as follows:

- Requirements for the position university tutor, university assistant – to have graduated, holding a licence diploma, a higher educational institute or holding an equivalent diploma or of a postuniversity academic institute as well as to have graduated the courses conducted by the Department for the Teaching Personnel Training (as for the university assistant minimum criteria of seniority are also applied);
- Requirements for the position of *university lecturer* or chief of works – to have graduated, holding a license diploma, a higher university institute or holding an equivalent diploma or of a postuniversity academic institute as well as to have graduated the courses conducted by the Department for the Teaching Personnel Training or to be a trainer for a doctor's degree or to have been conferred the Doctor's Degree/Ph.D (minimum criteria of seniority are also applied);
- Requirements for the position of *university conferee* and *university professor* - to have graduated, holding a license diploma, a higher university institute or holding an equivalent diploma or of a postuniversity academic institute as well as to have graduated the courses conducted by the Department for the Teaching Personnel Training or to have been conferred the Doctor's Degree/Ph.D (minimum criteria of seniority are also applied).

We can notice that all the teaching positions require both academic instruction and the graduation of the courses conducted by the Department for the Teaching Personnel Training (DPPD) within the higher educational institutions. The professional training offered by the said courses is certified at graduation in a certificate of graduation issued by the related higher educational institute.

As an alternative the graduates choosing a didactic profession are given the possibility to attend the courses of DPPD in a period of maximum 3 years from the date of employment (Law of National Education, 2007-2008).

As soon as the Law of National Education (10th of January, 2011) enters into force the teaching positions can be occupied as follows:

- Requirements for the position of *university assistant*: to have got the status of student-trainer for doctor's degree or diploma of doctor's degree and to have met the standards for occupying the teaching positions, standards specific to the related position as approved by the University Senate without any provisions for seniority according to the law;
- The minimum conditions for occupying the position of university *lecturer/chief of works* are the followings: to be the holder of a diploma of doctor's degree, to meet the standards for occupying a teaching position, standards specific to the related position and approved by the University Senate without any seniority conditions according to the law;
- To occupy the teaching position of a *university conferee* one is required to hold a diploma of doctor's degree, to meet the minimum standards for occupying the position of a university lecturer (standards approved under art. 219 (1) lit. a), satisfying the standards for occupying teaching positions, standards specific to the related position and approved by the University Senate without any seniority restrictions in accordance with the law;
- To occupy the teaching position of a *university professor* one is required: to hold a diploma of doctor's degree, to hold a certificate of qualification, to meet the minimum standards for occupying the position of a university professor (standards approved under art. 219 (1) lit. a), satisfying the standards for occupying teaching positions, standards specific to the related position and approved by the University Senate without any seniority restrictions in accordance with the law;

Having into consideration the above said we have to mention that, by 2011, one could have access to the university educational system if having hold a licence diploma and graduated the courses conducted by the Department for the Teaching Personnel Training while the status of a student/trainer of the doctor's degree or the diploma of the

doctor's degree was required to occupy a teaching position at a higher university level.

Since 10.01.2011 (when the new Law of National Education entered in effect) to occupy a university teaching position one has been required to have at least the capacity of student/trainer for the doctor's degree or to hold a diploma of doctor's degree (that means implicitly to have graduated higher studies and hold a diploma of licence and a master's degree). We observe that, at present, there is no longer any obligation to attending the program of psycho-pedagogic studies conducted by DPPD.

With regard to the occupancy of a teaching position at university level we observe that the model proposed by the new law is conditioned as follows – the candidate must hold all the three diplomas: licence, master's and doctor's.

Lately reforms regarding the training systems for university personnel have been made in the other European countries too.

Examining the Eurydice Data Base with regard to the training level of the university teaching personnel in Europe (20 countries surveyed),we have subsequently synthesized the information in the following table:

Table no. 1. Levels of training for the European University Teaching Personnel

Levels of training for those willing to teach in the university educational system	**European countries**
Minimum requirements for employment in the university education:	
Diploma of licence	Belgium – Flemish area, Holland, Norway
Diploma of master's degree	Check Republic , Estonia, Iceland, Letonia, Luxemburg, Poland, Slovenia, Great Britain
Diploma of master's degree in teaching + diploma of doctor's degree	France
Diploma of doctor's degree	Austria, Romania, Bulgaria, Cyprus, Finland, Germany, Greece, France, Spain, Sweden
Obligation to attend a program of initial training for professors	Estonia, Iceland, Norway, Slovakia, Slovenia, Great Britain
Universities impose the graduation of a program of training for their own teaching personnel, a *Postgraduate Certificate for training and teaching in the higher education is conferred*	Great Britain
No obligation to attend a program of initial training for professors.	Austria, Belgium – French community, Romania, Cyprus, Republic Check, Spain, Sweden, Malta, Netherland, Finland, Italy

3. CONCLUSIONS & ACKNOWLEDGMENT

It can be seen that in a limited number of European countries, the minimum requirement for someone teaching in an university is to have graduated the licence studies while in other countries a diploma of master's or doctor's degree is required with or without the obligation to attend a program of training for the teaching profession.

In Romania, starting from year 2011, the diploma of master's degree as well as the diploma of doctor's degree, represents significant prerequisites for a debut/start in a university career. There is no longer any compulsory program of psycho-pedagogic studies. Moreover, the modulus for training in the teaching profession, offered by the Departments for the Teaching Personnel Training, is about to cease beginning with the university year 2011-2012, it means that the students can no longer attend, during their studies for licence, the program of qualifying as teaching personnel. They may attend a teaching master course instead having accordingly the possibility of pursuing doctorate studies, or they may choose a scientific master course in which case there is practically no specialty training for the university teaching profession.

It is worth mentioning that the curriculum of DPPD was modified by the Ministry of Education and Research beginning with university year 2008-2009, with intent to make a difference between the professional training routes of the following categories of teaching personnel: those who are to teach in the primary and secondary schools (graduates of licence studies and of the program of psych-pedagogic studies level I) and those who are allowed to teach in the high schools and universities (graduates of master's degree studies and of the program of psycho-pedagogic in-depth studies level II).

In this formula, the pedagogic competences were ensured and achieved by a curriculum structured as follows: psychology of education, fundamentals of education, theory and methodology of curriculum, theory and methodology of instruction, theory and methodology of assessment, management of the class, didactics of specialty, pedagogic practice, optional subjects, summing up classes of theoretical training, methodology and practical applications, scheduled along the years of academic study. The following questions are raised: how shall the pedagogic competences be induced to the future university teaching personnel especially if they are no longer obliged to attend a teaching master course? Is it sufficient for the students to get only a theoretical knowledge about a distinctive methodology and thereto the certainty of its being applied efficiently in the class? How shall the pedagogic practice be provided, a practice that makes the future professor be better prepared for such profession and brings about an extra experience which of he can benefit to easily adjust himself/herself to various situations? It is of a great importance that the following general abilities be developed and/or acquired:

a. abilities for relationship:

- confidence, independence and responsibility in getting in touch with other persons;
- ability to communicate;
- ability to work in a team;
- ability to efficiently solve conflicts.

b. efficient teaching:

- time planning and management;
- knowledge of personality and qualities of students;
- development of learning abilities throughout the life time;

c. steady professional development (a life time learning):

- ability to critically consider and assess the students activity;
- ability to develop and generate knowledge.

d. organizational and managerial abilities.

The Curriculum of DPPD for levels I and II was conceived so that students could learn the subjects in such a succession and in such a number of hours that made possible the acquiring of the abilities under the standards of teaching profession for the primary and secondary school, high school and university, the progress registered, in comparison with the previous curriculum is obvious. The Program of training had the structure and the number of hours required for the European professor training and offered the students proper conditions for acquiring the entire assembly of professional abilities necessary for the profession of university teaching personnel.

REFERENCES

1. Eurydice Database, (2008-2009), *Source*. [online]. Available:

http://eacea.ec.europa.eu/education/eurydice/documents/eurybase/eurybase_full_reports/AT_EN.pdf.

2. Delors, J., *Treasure Inner* Iaşi, Polirom Publisher; (2000).
3. European Commission, *Organization of education systems in Romania*, (2007-2008) *Source*. [online]. Available: www.eurydice.org.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

USING VIRTUAL LEARNING ENVIRONMENTS IN ADULT EDUCATION

Gabriela Carmen OPROIU *, Teodora Daniela CHICIOREANU **

* Associated Professor PhD., Teacher Training Department, University Politehnica of Bucharest,
** Lecturer & PhD candidate eng., Teacher Training Department, University Politehnica of Bucharest,

Abstract: *Information explosion in recent years has resulted in changing the context in which learning takes place with online education as a consequence of the emergence of the virtual classes.*

Virtual education describes education that takes place online in virtual environments, where courses are broadcasted on learning platforms, using the Internet.

The paper is focused on the theoretical aspects of Virtual Learning Environments (VLE). Few characteristics of teaching-learning are presented.

In this type of learning, the roles of learners and tutors are also changed.

The advantages of the integrated online tools in a VLE from the tutor perspective are discussed.

Keywords: *Virtual Learning Environments, education, e-learning.*

1. INTRODUCTION

Although they had been initially created for distance/remote education, the virtual learning means - Virtual Learning Environments (VLEs) are nowadays used as auxiliaries to the traditional teaching activities, also known under the name of de Blended Learning.

In the virtual learning, based on the resources made available to them, the students can perform activities similar to those in the traditional learning, involving however a certain degree of personal effort: they can independently study contents, solve exercises, analyse case-studies, etc..

The Virtual Learning Environment includes the following elements:

- Administrative information including the venue (location the event takes place), conditions for enrolment, information concerning the number of credits awarded to the course;
- Basic materials for teaching the course (full contents of the course, if we are to speak about distance learning, copies of supporting documents, etc.);
- Additional resources including links, virtual libraries, etc.
- Self-evaluation tests;
- Evaluation procedures;
- Electronic communication space (e-mail, chat);
- Different access rules for the teacher and for the students.

A feature of the Virtual Learning Environment is the capacity to host several courses, so that the students and teachers (tutors) may go from one course to another both within the institutions, and between institutions. Most of the study programmes use e-learning platforms: blackboard, dokeos,

efront, joomlalms, moodle, sharepointlms, webct, wiziq).

The moodle platform, used more and more often in Romania, comes to support the educators aiming at increasing the quality of online courses.

Moodle - modular object-oriented dynamic learning environment - is a free e-learning platform used worldwide by schools and universities, companies of independent teachers. Developed by Martin Dougiamas, the platform is based on interaction and collaboration in order to build contents and with the aim of performing a continuous evaluation.

The use of online learning platforms has a series of advantages for all the players involved in the training processes: students, teachers, organisations.

Thus, the students can enrol for online courses, learn in virtual classrooms, watch a series of tutorials online, fill-in tests and access a series of learning resources.

The teachers teach in virtual classrooms, learn more about how to teach online, improve their knowledge and adapt their teaching styles depending on the trainees' demands, create online tutorials, and apply tests.

2. CHARACTERISTICS OF THE VIRTUAL EDUCATION

The virtual education has a series of particularities, which differentiate it from the traditional education. Amongst these, the following can be noticed:

- **It encourages the student - tutor contact**

Through the communication tools in the virtual environment, the student – tutor contact is made more easily. The students can post messages at the time and moment they choose to.

- **It encourages cooperation among students**

The discussion tools can be used to encourage cooperation among students, in small or large groups, face to face or online. Communication areas can also be created whereby the students can share the results of their work. For instance, the student groups can be made available a private space where they will develop the group presentations.

- **It encourages active learning**

A careful designing of the course, with a focus on the activities performed by the students, encourages the active learning. Before uploading the materials onto the platform, thorough thinking must be put into what the pupils are asked to achieve and into how such activities will contribute to achieving the learning results.

- **It provides immediate feedback**

The evaluation tools and questionnaires can provide feedback within due time. Not only can the pupils be informed whether the answers are correct, but they can also provide clues, suggestions and advice necessary for continuing the study, as well as links to further information.

- **The accent falls on achieving the task and not on doing the research**

Having the links, and online resources available to them, the students will use time more effectively, performing learning activities, instead of surfing the internet. Therefore, they are more likely to focus on achieving the task, rather than on obtaining the materials for the work task.

- **It adapts to the different learning manners**

The online discussion area can be used to build a trainees' community where the abilities of each trainee can contribute to the learning process of everyone else involved in the learning journey.

3. THE TUTOR'S AND THE TRAINEES' ROLES IN THE VLE

In this type of learning, a change in the teachers' (tutors') role, as well as in the students' role, can be noticed. Thus, the Teacher:

- shifts from the role of orator, lecturer that it has in the traditional learning, to that of tutor, consultant, guide and resource provider, in the online learning.
- will particularly concentrate on how the work tasks and questions are formulated, rather than being concerned about the answer provision.

- designs (builds) the students' learning experiences, instead of directly providing them with the contents.
- encourages creativity and helps the trainees orient in performing the task.
- can present the topic from different perspectives, focusing on the important aspects.
- ceases to be a solitary element, and becomes a member of a learning team.
- stops holding full control over the learning process, and shares the responsibilities with the students, becomes a learning partner, a colleague.

Obviously, together with the change in the teacher's role, in the process of learning using the virtual environments, a change can also be noticed in the students' role. Thus:

- from the passive reception of knowledge, the students become the constructors of their own knowledge (they participate in building the knowledge);
- the shift from memorising information to involving it in the creation and solution of problems can be found;
- the students can have multiple perspectives on the topics;
- the students formulate their own questions and look for the answers themselves;
- the students perform collaborative activities, and cooperate within the group, which leads to a significant increase in the interactions between them;
- learning in the virtual environment leads to raising the degree of multi-cultural awareness;
- the students become more independent, more motivated, turning into managers of their own learning process;
- accent is placed on the elaboration of effective learning strategies (both individually, and in collaboration);
- the students have wider access to resources;
- a change in the student's role is noticed, from that of information receiver to information user;
- discussions between students are encouraged, as well as the presentation of their results in front of everyone.

For many teachers, the shift from traditional education to the use of new learning environments can be quite difficult. The application of new working methods, the use of online resources, and the need to acquire new teaching conceptions may scare and inhibit them. For others, however, these changes are challenging and exciting.

The exchange of information between the teachers, and the dissemination of experiences encountered in the online learning process may have a positive impact on all the teaching professionals who should encourage the use of the Virtual Learning Environments, either independently, or integrated in the traditional teaching process.

4. THE ADVANTAGES OF USING VIRTUAL LEARNING ENVIRONMENTS

The use of the Virtual Learning Environments can contribute to improving the learning experience by using the resources within the platform, but, at the same time, it supports the tutors in organising and delivering the online courses.

- Traffic monitoring

The tutors benefit of a series of platform traffic control tools. Thus, information is provided regarding the frequency the platform is accessed with by the students, the date they accessed it and the length of time they spent solving the work

tasks. The online learning platform can also provide information on the students' readings, in the online discussion area.

As regards the distance learning students, the tutors can monitor whether they involve in the online communication and study the materials made available, as resources. The evaluation section allows a virtual evaluation of the students.

- Collaboration and communication

VLE provides the tutors with tools encouraging the collaboration and communication. For example, a virtual space can exist on the platform, where the students, teachers or other specialists can initiate and participate in discussions, interact, share ideas and materials, and work together on case-studies.

- Active involvement

Unlike the face to face sessions, where it is difficult for each student to participate in the discussions, because of the time limits, the initiation of online discussions allows the students to actively participate and involve in the learning process, within the time and space chosen in agreement with the tutor.

The learning platforms offer common working spaces for all the students, without them physically attending the spaces.

- Creation of a virtual community

As a result of such collaboration and communication, a unique space can be developed where the student group builds its own identity and community, a learners' community.

- Effective use of time

The students no longer waste time copying information, since they can be directly transferred on the platform. Once online materials are created, they can be easily updated, by several mouse clicks. The addition of a new online resource, of a clearer picture, or of a new relevant case study can take several minutes.

5. CONCLUSIONS

The increase in the VLE use by universities and other continuing education institutions is a reality and it will have a particular impact on the learning process. Amongst the multiple advantages of using the learning environments we presented in this paper, we mention hereinafter several, which support this way of learning turning into an alternative to the traditional learning:

- Teaching time saving for the teachers, especially when they are also involved in administrative or research activities.
- A provider of services for the students using the Internet as a means to find information and obtain access to a series of resources.
- The Virtual Learning Environments allow the distance education be correlated with the traditional education, as well as the connections between the various universities.
- The increase in education quality and efficiency by means of the computer as a instrument of collaborative learning.

REFERENCES

1. Popat, K, MacLean, H, Heppell, S. (2007). Virtually There: Learning Platforms - YHGfL/Cleveratom ISBN 987-0-9556006-0-9.
2. Weller, M. (2007). Virtual Learning Environments: Using, choosing and developing your VLE - London. Routledge.
3.http://www.virtuallearning.org.uk/virtuallearning/index.html
4. http://www.alt.ac.uk/
5.http://www.jiscinfonet.ac.uk/InfoKits/effective-use-of-VLEs/intro-to-VLEs/introtovle-approaches/introtovle-models

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

A MODEL OF ACTIVITY DESIGN IN GCDF TRAINING

Ramona – Cristina PACHEF

Teaching Personnel Training Department, POLITEHNICA University of Bucharest, Romania

Abstract: *The mission of the GCDF (Global Career Development Facilitator) trainer is as important as it is difficult, entailing a great deal of training, commitment, creativity and effort. The creative, educational and specialized competences of the GCDF trainer are interdependent and can be embodied in the design and implementation of the training programme. This paper proposes a strategy which can be employed by GCDF trainers in the process of developing and evaluating communication and support abilities in trainees preparing for career counselling. Examples of exercises, methodologies, worksheets and other useful instruments are offered; however, due to the spatial restrictions imposed on this paper, their inclusion has not been possible.*

Keywords: *activity design, GCDF trainer, career counselling, support abilities*

MODULE 2: SUPPORT ABILITIES OF THE GCDF CAREER COUNSELLER

When beginning the activities, the trainer will present *introductive information,* namely: module title, purpose, time allotted for its completion (24 hours, 12 of which for direct activities and 12 for individual ones), as well as an enumeration of the themes which will be addressed in the module (presented in the table, under the didactic term of subject matter).

The purpose of the module is to identify and characterize the key support abilities of a GCDF career counsellor, in addition to the practice and development of these abilities by trainees, with an aim to enable them in attaining professional success.

Subject matter	**Objectives**	**Teaching process** (activities, teaching methods, organization of learning activities and instruments used by the trainer)	**Resources** (temporal and material)
Qualities of a successful counsellor	· mark the distinction between the concept of help and support; · identify the abilities of a successful career counsellor; · reflect on the effects of personal	Through the use of *conversation,* the trainer clarifies the distinction between the concepts of "help" and "support", using the module title as a starting point. Then, the trainees are asked to do the exercise *People I like and reasons I like them* individually, listing the qualities of these	120 minutes; The worksheet *People I like and reasons I like them,* from the workbook; Flipchart.

	attitudes, prejudices and feelings on interventions and evaluation of clients; · factually prove the existence of these abilities in real or simulated situations; · identify which personal abilities need to be improved in order to achieve proficiency as a career counsellor.	persons. The exercise is followed by collective discussions. Using *brainstorming,* the trainer and the trainees shall identify the abilities of a successful career counsellor. These will be recorded on the flipchart by the trainer and/or trainees. The trainer proposes an individual reflective exercise, the object of which will be providing examples of personal attitudes, prejudices and feelings which may affect the counselling process. The examples are then analysed. Using *role-play,* abilities such as tolerance, acceptance, empathy, observance, and self-reflection will be demonstrated. Either the trainer can play the role of the client, and the trainees that of the counsellor, or groups of two can be organized for this role-play. The participants then share their experiences. Homework: *An exercise in self-knowledge and self-assessment.* Draw a table with the following three columns: · qualities and abilities of a counsellor, which I possess; · qualities and abilities of a counsellor, which I need to improve; · strategies for the augmentation of the latter.	
The Process of Communication	· correct and justified use of general communication-specific concepts; · identify the structure of the communication process, with emphasis on the	The trainer proposes drawing a mind map on the flipchart, centred on the concept of "communication". The worksheet *Elements of the communication process and their characteristics* will be used in order to achieve the objective. The worksheet will require the trainees to analyse	90 minutes; Flipchart; The worksheet *Elements of the communication process and their characteristics*;

	interdependence of its components; · characterize and make use of the different types of communication necessary in career counselling.	and enumerate the elements of the communication process, as well as their characteristics. This is an individual written task. The trainees will be split in groups of 3, 4 or 5 and will read the extract from a textbook on communication, namely a chapter on types and forms of communication. Their task is to identify, from the list of communication types presented in the textbook, those which are adequate for use in career counselling. During the discussion, the relevance of verbal and non-verbal communication in career counselling shall be emphasised.	Extract from a textbook on communication.
Non-verbal Communication	· apprehend the importance of non-verbal communication abilities in the counselling process; · provide at least 3 examples of supportive conducts and 3 examples of non-supportive conducts; · factually demonstrate non-verbal communication abilities.	The trainer proposes *watching a short Charles Chaplin film,* in order to emphasise the importance and effects of non-verbal communication. The tasks the trainees carry out during the viewing are: observing non-verbal behaviour, describing the organizational environment in which Charles Chaplin's activities unfold, and formulating at least 3 of his counselling needs. This will be followed by group discussions. The trainees receive a worksheet, which consists of a drawing relating to non-verbal communication. Using this drawing as a starting point, trainees shall individually write essays describing the non-verbal behaviour of the counsellor. Group discussions concerning these aspects may be continued, using the presentation *Non-verbal communication and its implications for the career counselling process* as a starting point.	90 minutes; Internet access; Audio-video equipment: laptop, projector; The worksheet *Non-verbal communication: a drawing*; PowerPoint® Presentation; Worksheet containing proposed exercises.

		The presentation may be associated with different *role-play exercises,* such as those proposed in the worksheet.	
Active Listening	· mark the distinction between hearing and listening; · identify potential hindrances to active listening; · illustrate active listening abilities.	The trainer initiates a *conversation* with the trainees, clarifying the distinction between hearing and listening, on a number of levels, such as: emotional, logical/cognitive, behavioural and biophysical. Exercise 6 from the worksheet containing proposed exercises is submitted to the trainees' attention. Based on this role-play, trainees can identify the main hindrances to active listening: pseudo-listening, selective attention, judgmental attitudes, a preoccupation for the next topic, etc. Short role-play exercises will be organized, in order to demonstrate and augment the trainees' active listening abilities (physically, mentally and verbally). To draw conclusions, the *Chart for active listening* is analysed and debated.	90 minutes; Worksheet containing proposed exercises; *Chart for active listening*.
Coordination	· mark the distinction between direct and indirect coordination; · identify the pros and cons of open- and closed-ended questions; · make use of different types of questions in adequate contexts.	After defining the concept, by use of *explanation* and *exemplification,* the trainer will illustrate the distinction between direct and indirect coordination. The trainees will be split into two workgroups, each of which will receive different tasks: identifying the pros and cons of open-ended questions, for one group, and closed-ended for the other. This will be followed by group discussions. The trainer will organize role-play exercises, in order to demonstrate the adequate use of different types of questions (clarification, assurance, scaling).	60 minutes.

Reflection	· apprehend the necessity for reflection in the counselling process; · mark the distinctions between reflecting on content, feelings and meaning; · practically illustrate reflection abilities.	The trainer shall submit three short *case studies* to the trainees' attention, based on which they are asked to identify the reflection abilities of the counsellor. Group discussions shall be organized, debating examples on the topic, in order both to identify the differences between reflecting on content, feelings and meaning, and their respective importance to the counselling process. Following this, the trainees may be offered a short worksheet, containing a summary of rules for effective reflection on content, feelings and meaning. Trainees will be split into groups of three (counsellor, client, observer), and a role-play exercise in reflection on content, feelings and meaning shall be organized. The observer shall offer the counsellor feedback, and the trainer will provide feedback to both counsellor and observer. The exercise will continue until every person in each group has acted all three roles.	120 minutes; 3 case studies; Worksheet.
Provocation / Confrontation	· apprehend the importance of provocation in the counselling process; · exercise provocation and confrontation abilities.	The trainer and trainees will watch a number of video snippets, in which the counsellor illustrates different provocation and confrontation abilities. Following this, trainees will describe what was observed, and the trainer shall clarify certain aspects concerning the situations under which provocation and confrontation arise, emphasising their importance. For exemplification, the trainer, aided by a volunteer, may demonstrate a counsellor's confrontation abilities.	120 minutes; Audio-video equipment: laptop, projector.

Summarizing	· apprehend the importance of summarizing to the counselling process; · practically demonstrate efficient summarizing.	After the concept of summarizing is clarified and its importance to the counselling process is pointed out, trainees will receive a worksheet containing a case study. Their individual task shall be to write a summary of its contents. The summaries are then analysed.	60 minutes; Worksheet containing the case study.
The Theory of Active Engagement	· characterize the Theory of Active Engagement; · offer justified examples of situations in which the principles of active engagement may be applied.	Through the use of description, the trainer summarizes the elements central to the Theory of Active Engagement. Individual oral exercise: Give examples of situations in which the principles of active engagement may be used. Offer arguments for your answers.	30 minutes.

Continuous and formative assessment of the trainees is to be undertaken both for face to face activities (by permanently offering adequate and constructive verbal feedback), and for individual activities carried out by trainees at home, at their own pace, namely the activities proposed in the second module of the *GCDF Consultant* textbook (by providing written feedback, through e-mail). Should the trainees' knowledge permit this, the trainer may also choose to include additional topics, in accordance with what is deemed necessary for their personal and professional evolution.

Upon completion of the module, the trainer will verbally present general assessments regarding their own and the trainees' activities, and the results of the oral, written and practical evaluations.

Final or summative evaluation requires the elaboration of a portfolio. This should contain the aforementioned exercises, supplementary homework, certain audio or video recordings, based on which the trainer shall assess the trainee's counselling abilities, transcripts thereof, critical analyses of these recordings, pointing out certain aspects regarding self-assessment, a test for the identification of the dominant communication style, etc. The portfolio shall also include the *Final Test for Module Two* in the workbook.

REFERENCES

1. Liţoiu, N., Panc, I., *Manualul trainerului GCDF – România,* Bucureşti (2009).
2. Porumb, I., Pachef, R., Balgiu, B., *Psihopedagogia comunicării,* Bucureşti, Editura Academia Oamenilor de Ştiinţă din România (2011).
3. Szilagyi, A., *Manualul consultantului în carieră*, Iaşi, Institutul european (2008).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

CONCEPTUAL IDENTITY OF NUTRITIONAL PSYCHOPEDAGOGY AS A SUBJECT OF UNIVERSITY STUDY

Maria Dorina PASCA

Univ. Medicine and Pharmacy Tg. Mures

Summary

Abstract: *The conceptual appearance of the nutritional psycho-pedagogy represents a new way of approaching to individuals' development and value in a certain given conjuncture. Thus, it has to respond atitudinal-behavioral through education, but also structural to the social-economic command, defining and then enframing the individual in a qualitative segment of its existence, starting from the nutritional act itself.*

Being a new and interdisciplinary domain, the nutritional psycho-pedagogy determines by its involvement in the personalized nutritional act, being aware of the fact that "eating is an art" and also charging those who plead for the concept "I live to eat" and/or "I eat to live".

This fact involves intellective the acquaintance but also the application of necessary elements in approaching a healthy lifestyle which will determine a valuable growth of life quality, as a response of the personal identity.

Making an elocutionary question, can nutritional psycho-pedagogy give an answer to: "Tell me what you eat, so I tell you who you are?"

The need to understand human reporting to food, determines the existence of a behavior and attitudes in line with the arrangements that determine the development and human evolution, under a structural aspect. Basically, when we are in our reporting as being not object to the environment, makes the development of interdisciplinary elements to become a sign of knowledge through acceptance, understanding and tolerance in terms of development and human value.

In this context, nutritional psychopedagogy is that dimension that involves behavioral-educational act concerning the nutritional phenomenon, in terms of training and human development and reporting to the community in the pattern of a positive attitude about the concept and importance of a healthy life, due to the balance between soul and body / body and soul.

In its conceptual identity, nutritional psychopedagogy starts from clearly defined objectives namely:

- maintain physical and mental health;
- knowledge and application of particular nutritional requirements by age;
- involvement of educational elements in nutritional acts;
- training and adopting a healthy life style by improving quality of life;
- maintaining a balance of evolution and values between body and soul, as a result of a healthy life;

- eliminate weaknesses attitude-behavioral-educational nutritional targeting act itself;
- development of structural concepts of the role of nutrition in pedagogical and social assistance to persons SEN (special educational needs).

In this context, nutritional psychopedagogy standards will prevent deviation from normal life and health of people, from new-born until old age, emphasizing the need for conditions that can foster the elements mentioned above, in personal involvement.

Under such auspices, nutritional psychopedagogy will subject, the human being involved in training their own act, feeding and development, while managing to understand and solve those problem situations in which conceptual deviance can lead ultimately to destructuring of human personality , without forgetting that everything is in our power, from the famous Latin dictum "Men sana in corpore sano." (healthy mind in healthy body.)

Also nutritional psychopedagogy concurs through its conceptual identity to achieveing the personalized nutritional act, starting from those referred to Holford P. (2008 personalized-nutrition), is required to:

- increase the I.Q. level;
- improve physical performance;
- improve quality of sleep;
- improve resistance to infection;
- defending ourselves towards the illness;
- enjoing a longer and healthier life;

adding physical and mental performance, reported to the low incidence of disease.

As a discipline that is based on interdisciplinarity, it is necessary to mention that connections created to this end, reinforce the need of its conceptual identity. Thus, nutritional psychopedagogy has structural affinities with:

a) - medical psychology, in terms of health-disease concept, networking and communication between physician and patient vs. patient-physician and nutritional impact of the phenomenon in the patient's medical educational act;

b) - medical sociology, targeting the quality of human life in terms of social development of a community, the matrix of a healthy lifestyle values, necessary to a valuable implication by professional status and not only (role, position);

c) - psychology of human nourishment as an element of complementarity concerning, Iordachescu G. (2006), the physiological needs context without which life is not possible: food, oxygen, a certain level of temperature, rest, etc.. ;

d) – special psychopedagogy, in order to understand the need for implementing a proper nutritional regime, taking into account that this science, Green E. (1997), dealing with disabled persons, the study of mental peculiarities, of their training and education, changes and their psychological development, the corrective-regenerative procedures for unlocking the existing human potential and formation of their personality to integrate socio-professional as appropriate.

Also, nutritional psychopedagogy has its roots in philosophical concepts about the soul and body and their reporting to the essence of life, ethics and morals being those which, along with religion, complete the interdisciplinary palette which aims: traditions, customs, initiation, prohibition, styles , cultures and civilizations, all of which, a priori speaking, the idea that human survival and may be or has already made from food: friend, foe, attitude and / or philosophy of life, managing to live by the time and the times at which, willingly or not, is reported.

Our entire conceptual approach lies in the fact that nutritional psychopedagogy must find a deserved place alongside to the other components of knowledge and human development, and determining its progress and not regress, fulfillment and no disappointments, love and not hate, loving nature and refering to it as component part and not as an abyss or gulf.

Basically, as a subject of study in tertiary care, nutritional psychopedagogy is addressing to students in first year at Faculty of Medicine- speciality Nutrition-Dietetics, having allocated two hours per week during a semester course, its main purpose being to achieve specific methodology, training of future professionals to implement in practice personalized nutritional act, taking into

account all the strategic goals and logistics of assigned person / patient in question. In the preparation of students, in addition to the related literature are also available and those directly involved, namely:

1) - the book "Elements of nutritional psychopedagogy"-2009-Ed. Univerity Press, Tg. Mures;

2) - the university coure support "Nutritional psychopedagogy"-academic year 2009/2010, edited by the printing house of UMF, Tg. Mures.

3)- foods cooked in Romanian stories and fairy tales- 2010, Ed. " Ardealul"

BIBLIOGRAPHY:

1.Cosmovici, G. (2006)- Psihologia generală, Ed. Polirom, Iaşi

2. Holford, P. (2008)- Cartea nutriției optime, Ed. All, Bucureşti

3. Iordăchescu, G. (2006)- Psihologia alimentației umane,Ed. Academica, Galați

4. Nicola, I. (1996)- Tratat de pedagogie şcolară, Ed. Didactică şi Pedagogică, Bucureşti

5. Paşca, M.D. (2009)- Elemente de psihopedagogie nutrițională, Ed. Univerity Press, Tg. Mureş

6. Pasca M. D. (2010) – Mancarurile gatite in povestea si basmul romanesc, Ed. „Ardealul"- Tg. Mures

7. Şchiopu U, Verza E. (1981)- Psihologia vârstelor, Ed. Didactică şi Pedagogică, Bucureşti

8. Verza E. (1997)- Psihopedagogia specială, Ed. Didactică şi Pedagogică, Bucureşti

xxx cursul universitar „Psihopedagogie nutrițională"- anul universitar 2009/2010, editat de tipografia U.M.F., Tg. Mureş.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

POETRY AND ART: RETHINKING SYMBOLISM AND IMPRESSIONISM ACCORDING TO SEMIOTIC INTERFERENCES

Oana-Andreea PIRNUTA*, Anca BADULESCU*

*Department of Literature and Cultural Studies - Faculty of Letters,
TRANSILVANIA University of Brasov, Romania

Abstract: *The present paper analyzes symbolism and impressionism as well as the interferences between poetry and other arts. After highlighting the meaning of the term 'symbol', the focus is laid upon the symbolist movement and rhetoric rendering the multifarious semiotic interferences between arts, such as: music, painting, sculpture. Then the emphasis is placed on impressionism as well as on the connection between symbolism and impressionism as there is an almost perfect overlapping between the two theories, the impressionist and the symbolist one. A possible explanation of the close connection between the different artistic realms is the artists' united efforts to discover the essence of existence.*

Keywords: *symbolism, music, painting, impressionism, semiotics, interferences.*

1. INTRODUCTION

Originally, the word *'symbol'* - from the Greek *'symbolon'* – signified an object cut into two separate pieces, two halves or fragments made of metal, wood or ceramics. These parts were given to two people – pilgrims, a host and a guest, a lender and a borrower or simply two people who were bound to be separated for a long period of time. When putting together the two fragments, the owners would be able to recreate the links established prior to their parting.

In time, the semantic area of the term *'symbol'* has gained unexpected dimensions. The word has both concrete and figurative meanings. It may characterize a significant image, but also a conventional sign, and therefore, may mean different things to different people: an emblematic analogy, a fragment of reality, a secret, a graphic sign, a means of measurement, an operation.

If we go deeper into the matter, we will certainly realize that linguists, semioticians, philosophers, anthropologists have given different definitions of the symbol. Nevertheless, in all cases, the word represents an object or an image, which is a substitute of another object or image.

The *'symbol'* we will refer to in this paper is a sign which necessarily carries spiritual energy by means of which the visual and the intuitive realms are connected.

The aim of this paper will, therefore, be to dwell on some significant interferences between different arts. To this purpose, we will choose as a motto a fragment from Ion Minulescu's poem *Într-un bazar sentimental*: 'Stofe vechi, o mandolină,/ Un Cezanne şi doi Gauguin,/ Patru măşti de bronz:/ Beethoven, Berlioz, Wagner, Chopin...'.

The poet thus creates an artistic universe in which painting, music, but also poetry and decorative arts coexist and influence each other. The limits between them are blurred, and disappear altogether, ultimately.

2. SYMBOLISM AND THE INTERFERENCES BETWEEN ARTS

2.1 The symbolist movement. The symbolist movement was born in France at the end of the nineteenth century and manifested itself as a reaction against positivism and, implicitly, didacticism as well as melodrama in poetry.

Symbolist poets are creators of a real cult of beauty and eternal seekers of pure poetry. The subject of symbolist poetry becomes mystery, restlessness, undefined feelings.

The poet is in a state of vague fervour and his work is the result of his communion with the universe. All the parts of a symbolist work of art are simultaneous, just like the harmonies produced by the instruments of an orchestra.

2.2 The symbolist rhetoric. The new symbolist rhetoric relies on the power of suggestion, but also on innovation in prosody in order to illustrate vague, fluid transient, musical states of spirit in the process of creation.

Suggestion becomes the fundamental element in the poet's efforts to recreate the world. Thus, symbolist poets create poetry on poetry and within poetry. The result is a coherent and autonomous creation characterized by a new interior rhythm.

Verlaine's verse 'De la musique avant toute chose' (*Art Poétique*) should be interpreted as a final break with the external world. In this way, poetry reduces itself to its own music, becomes poetry '*per se*'. It constantly turns to itself, communicates itself.

2.3 Symbolist poetry and music. Symbolist poets, attracted by musical harmonies, manifest a strong tendency of musicalization of their poetry. Their precursor, Baudelaire, states that Wagner expresses in his music the real harmony of correspondences.

To Baudelaire, Wagner's music is a mixture of breath, darkness and light, wild imagination. It is his music that makes the poet vibrate in accordance with his passions, his interior storms, and sometimes his despair: 'La musique souvent me prend comme une mer.' (*La musique*).

For E.A. Poe, another important precursor of symbolism, music is the art that comes closest to the 'supernal'. Israfel, in the poem bearing the same title, is an angelic musician, a spirit 'whose heart-strings are a lute' (*Israfel).*

Paul Verlaine speaks about a new kind of poetry by which confusing states of mind and feelings are rendered. If Mendelssohn composed *Lieder ohne Worte*, Verlaine created *Romances sans Paroles*, thus exploiting the sounds of words in order to create a vague emotional contour.

Likewise, a late symbolist poet, T.S. Eliot in *Rhapsody on a Windy Night* imitates the rhythms of music when describing the evolution of the spirit: 'Half-past three,/ The lamp sputtered,/ The lamp muttered in the dark;/ The lamp hummed.'

For Rainer Maria Rilke, music is part of our heart, the essence of our being. In his poem *An die Musik*, the poet considers music as: 'Die Sprache wo Sprachen enden. Die Zeit, Die senkrecht steht auf der Richtung vergehender Herzen.'

By its unifying force, music becomes for Rilke the breath of statues and the silence of paintings.

The symbolist movement is also closely linked to the music of Franck, Debussy and d'Indy. In the preface of his volume of poems entitled *Poèmes*, Gustave Kahn strongly states that music makes it possible for the poet to perceive a poetic form which is at the same time fluid and more precise.

Musical instruments become real characters in the works of the symbolist poets. The elegant piano, the mysterious organ, the magical flute, the delicate harp, the proud guitar – all reoccur almost obsessively in their verse: 'Le piano qui baise une main frêle/ Luit dans le soir rose et gris vaguement...' (Verlaine: *Romances sans Paroles*).

Similarly, in *Chanson d'Automne* by Verlaine, the violins have human feelings: 'Les sanglots longs/ Des violins/ De

l'automne/ Blessent mon coeur/ D'une langueur/ Monotone.'

2.4 Symbolist poetry and painting. Painting seems to be even closer to symbolist poets. Baudelaire, who aspires to give his work the power of expression characteristic to visual arts, considers Delacroix and Manet to be his models, his idols.

To Delacroix, nature is just a dictionary which helps the artist create. The same idea is expressed by Baudelaire in his poem *Correspondances*: 'La nature est un temple ou de vivants piliers/ Laissent parfois sortir de confuses paroles,/ L'homme y passe à travers des forêts de symbols/ Qui l'observent avec des regards familiers.'

In his turn, Baudelaire creates in *Les Fêtes Gallantes* illustrative descriptions of Watteau's paintings, an album of 'painted' poems. Thus, Watteau's world is a landscape of fantasy, which helps the poet escape the present.

Also, Rilke's admiration for Cézanne's work is very well-known. He believed that Cézanne's paintings were not painted, but they simply and purely exist, make themselves present.

Under the influence of a sculptor, Rodin, and that of a painter, Cézanne, Rilke works as an authentic plastic artist, creating his marvellous *Ding-Gedichte*.

In the same vein, Mallarmé considered Whistler's work as being undoubtedly eternal, a means to glorify beauty, the mysterious, the miracle. The same Mallarmé dedicates some exquisite pages in his volume *Quelques Medaillons et Portraits en Pied* to the impressionist painter Berthe Morisot.

Maybe the best known poem by the Romanian poet Petică, *Fecioara în Alb* is another illustration of the idea that modern symbolism has its origins in the Pre-Raphaelite movement in England – the artistic current, which manifested itself in the nineteenth century and rediscovered the mythical and symbolical simplicity of the Italian painting before Rafael.

3. IMPRESSIONISM AND THE INTERFERENCES BETWEEN ARTS

The impressionist equivalent or the symbolist poetic creed, published in *Le Figaro* in 1886, is without any doubt *Impression. Sunrise* by Monet, which was first shown at the official exhibition on 15 April 1874 (le Salon des Refuses).

There is an almost perfect overlapping between the two theories, the impressionist and the symbolist one. The first verse of Verlaine's poem *Art Poétique* sums up the 'impression' created by Monet's painting: the music of nuances, the harmonious dialogue between sky and water.

Likewise, Verlaine's 'Plus vague et plus soluble dans l'air' is re-echoed in the painting. The free verse in the symbolist poem is doubled by the reflection of light on the sky and in the water, rendered by a multitude of coloured lines.

Furthermore, the verses 'Rien de plus que la chanson grise/ Ou l'Indecis au Precis se joint' are the counterpart of the grey-greenish, grey-bluish tones in the painting, in contrast to the orange of the solar disc and its reflection in the water. 'De beaux yeux derrière des voiles' should be the essence behind the haze of the morning, which the observer might have a glimpse of.

'Car nous voulons la Nuance encore/ Pas la Couleur, rien que la Nuance.' Maybe these verses best express the connection between symbolism and impressionism. Although these are the words of a poet, Paul

Verlaine, they clearly illustrate a basic principle of the impressionist painting: the dilution and juxtaposition of colours, thus obtaining a visual mixture of nuances. Both in poetry and in painting this is the only way in which the vague, the evanescent, the impression, the dream can be materialized. In Monet's painting the nuances of grey, green, blue intermingle, flow into one another. Nothing dares destroy this equilibrium.

'Fuis de plus loin la Pointe assassine.' This means that precise contours, lines, drawing would only create artificiality in painting. In poetry, on the other hand, precision, even violence, will never be able to express the Absolute. Monet's *Impression*, like Verlaine's *Absolut* do not have a clear-cut contour. Everything is volume and essence created by the use of proper nuances and words.

4. CONCLUSIONS

The present paper does not claim to have said all about this vast and very interesting topic. It may only be considered as the tip of the iceberg.

Further research will certainly reveal more relevant issues regarding interferences between arts, no matter how different they might seem. A possible explanation of the close connection between the different artistic realms is the artists' united efforts to discover the essence of existence.

REFERENCES

1. Aquino, T. *Summa theologiae*. Bucuresti: Editura Stiintifica (1997).
2. Aristotel. *Poetica.* Bucuresti: Editura Iri (1998).
3. Aumont, J. *L'image*, Paris: Nathan (1990).
4. Barthes, Roland. *Image, Music, Text.* London: Fontana Paperbacks (1982).
5. Dautun, Jean-Pierre. *10 modeles d'analyse d'image*. Alleur: Marabout (1995).
6. Debray, Regis. *Vie et mort de l'image*, Paris: Gallimard (1992).
7. Dolezel, L. *Poetica occidentala.* Bucuresti: Editura Univers (1998).
8. Eco, Umberto. *Limitele interpretarii.* Constanta: Editura Pontica (1996).
9. Eliade, Mircea. *Imagini si simboluri.* Bucuresti: Editura Humanitas (1994).
10. Florea, Anca. *Muzica si imagine.* Bucuresti: Editura Fundatiei Culturale Romane (1997).
11. Foucault, Michel. *Cuvintele si lucrurile.* Bucuresti: Editura Univers (1996).
12. Grayling, A.C. *Wittgenstein.* Bucuresti: Editura Humanitas (1996).
13. Huyghe, Rene. *Les puissances de l'image.* Flammarion (1990).
14. Jung, C. *In lumea arhetipurilor.* Bucuresti: Editura Jurnalul literar (1994).
15. Liiceanu, G. *Incercare in politropia omului si culturii.* Bucuresti: Editura Cartea Romaneasca (1980).
16. Miclau, P. *Signes poetiques*. Bucuresti: Editura Didactica si Pedagogica (1983).
17. Miroiu, Adrian. *Filosofie fara haine de gala.* Bucuresti: Editura All Educational (1998).
18. Nicolas, H. *Mallarme et le symbolisme.* Classiques Larousse (1989).
19. Rewald, J. *Die Geschichte des Impressionismus.* Dumont (1990).
20. Ricoeur, Paul. *Despre interpretare.* Bucuresti: Editura Trei (1998).
21. Smith, P. *Impressionismus.* Dumont (1995)
22. Valcan, C. *Recherches autour d'une philosophie de l'image*. Timisoara: Editura Augusta (1998).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

NARRATIVE WEAVING OF NATIVE AMERICAN VOICES IN "THE ANTELOPE WIFE"

Oana-Andreea PIRNUTA*, Anca BADULESCU*

*Department of Literature and Cultural Studies - Faculty of Letters,
TRANSILVANIA University of Brasov, Romania

Abstract: *The present paper analyzes the multifarious narrative techniques depicting essential aspects of the impossible reconciliation between two separate worlds represented by multiple voices: on the one hand, the strong traditional Native American thread and on the other hand, the weaker and weaker "civilized" Minneapolis' statement of the 1990s. Erdrich's contrast between the well-defined and pale utterances manages to bring into focus the tremendously rich heritage of the Native American civilization as it is presented in "The Antelope Wife". The diverse narrative structures constantly interweave, thus creating a complex vista of the contemporary American society.*

Keywords: *Native Americans, narrative techniques, multiple voices, heritage, civilization, weaving.*

1. INTRODUCTION

Karen Louise Erdrich is a famous Native American writer belonging to the second wave of the Native American Renaissance. She was born in Little Falls, Minnesota and grew up in a family of storytellers in Wahpeton, a small town in North Dakota.

Erdrich's novel entitled *The Antelope Wife* can be considered a mixture of independent tales told in her own way thus shaping an intricate narrative design.

Her fiction consists of patterned designs highlighted by motifs and themes derived not only from the Ojibwa culture inherited from her mother and grandfather who was a tribal chief belonging to the Turtle Mountain Band as well as a fine storyteller and beader, but also from her father who was of German origin and whose parents owned a butcher shop which turns into a bakery shop in *the Antelope Wife*.

2. NARRATIVE WEAVING

The Antelope Wife is a hybrid piece of work in which Louise Erdrich blends poetry with short story fragments. The multiple tales stand for narrative threads which are interwoven by the multiple characters.

Erdrich's main technique is that of weaving stories together using multiple narrators within the framework of a mythic landscape. Her characters, be they strong female ones or pale male representations, are part of the landscape presented in her novel.

The same technique is used by William Faulkner in his Yoknapatawpha novels. The multiple tales are not necessarily presented in a chronological order.

Louise Erdrich uses a wide range of narrative techniques: multiple narrative points of view, multiple tales, the strategy of weaving stories together as well as multiple narrators.

Erdrich's storytelling includes poetic rhythms as well as sensible images as poetry aims at connecting the written text to the oral

tribal tradition, thus her readers turn into a kind of listeners.

The metaphor is highly used in Erdrich's fiction and the best examples might be the metaphors of beading and sewing, different tinges of color being blended, such colorful patterns being dyed on the Ojibwa quills.

The novel is divided into four different parts, each part starting with the same recurrent motif.

Part One, entitled *Bayzhig*, starts as follows: 'EVER SINCE THE BEGINNING these twins are sewing. One sews with light and one with dark. The first twin's beads are cut-glass whites and pales, and the other twin's beads are glittering deep red and blue-black indigo. (…) They sew with a single sinew thread, in, out, fast and furious, each trying to set one more bead into the pattern than her sister, each trying to upset the balance of the world' (Erdrich, 2002:1). Thus, women decide the most important things in life weaving the pattern of their existence.

Part Two, entitled *Neej*, starts with the same motif: 'THE PATTERN GLITTERS WITH CRUELTY. The blue beads are colored with fish blood, the reds with powdered heart. The beads collect in borders of mercy. The yellows are dyed with the ocher of silence. (…) The design grows, the overlay deepens. The beaders have no other order at the heart of their being. Do you know that the beads are sewn onto the fabric of the earth with endless strands of human muscle, human sinew, human hair?' (Erdrich, 2002:73). As we can see from the previously presented quote, the narrators address directly the readers turning them into the listeners of the tale, thus they are 'you', the style being colloquial.

Part Three, *Niswey*, has the following opening quote: 'SOUNDING FEATHER, GREAT GRANDMA of first Shawano, dyed her quills blue and green in a mixture of her own piss boiled with shavings of copper. No dye came out the same way twice. (…) The final color resulted from what she ate, drank, what she did for sex, and what she said to her mother or her child the day before' (Erdrich, 2002: 99). The numberless color nuances on the Ojibwa quills represent the multicolored patterns of the Native American culture and existence.

Part Four, *Neewin*, starts with the same metaphor of beading: 'THE RED BEADS WERE HARD to get and expensive, because their clear cranberry depth was attained only by the addition, to the liquid glass, of twenty-four-carat gold. Because she had to have them in the center of her design, the second twin gambled, lost, grew dcesperate, bet everything. At last, even the blankets of her children' (Erdrich, 2002:183).

As we have previously mentioned, each part starts with a short introduction acting as connector, thus giving access to the tales told in that particular part.

Erdrich's novel includes interesting aspects from both the Native American tribal storytelling and the Western forms including German influences.

In *The Antelope Wife*, Erdrich uses an Anishinaabe worldview and an Ojibwa word, which turns into a recurrent motif: that is, *daashkikaa* meaning 'splitting apart' or 'cracked apart', a split between cultures, identities as well as languages.

Each part bears dual titles: the English version -*Part One, Part Two, Part Three, Part Four* and the Ojibwa variant - *Bayzhig*, *Neej*, *Niswey*, *Neewin* meaning one, two, three, four in the Ojibwa language. Thus, there is a split and a mixture of languages and cultures.

The Ojibwa word *daashkikaa* refers to two different worlds which are fused in the present narrative pattern: the strong traditional Native American thread and the weaker and weaker 'civilized Minneapolis' statement of the 1990s.

3. NATIVE AMERICAN VOICES

Erdrich's novel entitled *The Antelope Wife* is representative for the Native American culture and literature. The author creates a fictional realm inhabited by multiple narrators whose voices are interwoven in a very sophisticated pattern.

In her fictional world, by means of her multiple narrators, Erdrich creates a community within which multiple life experiences are interconnected. The narrative voices address directly the audience, the style

being informal. Her characters tell stories, sew, cook and their names bear certain significances.

Several narrative threads are interwoven around the Roys, the Whiteheart Beads and the Shawanos throughout several generations in between the 1880s and the 1990s.

Among the narrators, there are both human and non-human voices, each contributing to the pattern of the Native American existence.

For instance, Klaus Shawano when explaining why he is 'no longer friends with Whiteheart Beads' is weaving part of the Native American design in the novel. The whole chapter four which belongs to Part One is a monologue, Klaus asking and answering his own questions. 'Richard Whiteheart Beads, I've thought so often, foe or friend? I decided on the first because he cost me everything I had. I did manage to keep my life, but aside from that – my clothes, my savings, my house, my boat, and even, yes, my wife, Sweetheart Calico. My Antelope Girl. Gone. Due to Whiteheart' (Erdrich, 2002:43). Along eight pages, he recalls bits of conversation with Richard, Rozin's husband, and analyzes their relationship in minute details. The whole chapter is structured like very many other fragments of the novel resembling a diary entry.

In subchpater 13, entitled *The Blitzkuchen*, belonging to Part Three, the same narrator, Klaus Shawano, tells a story. This time the tale is retold being an objective one. The events narrated are filtered through his life experience. It is as if he recalls happenings before his own birth. 'From inside the kitchen, then, where Frank had stubbornly placed himself and from where Regina, heavy as the stove herself, refused to move, they got as much of the story as they could, or maybe as I was ever supposed to know' (Erdrich, 2002:135). And thus the story of the Blitzkuchen is retold just as the re-baking of the Blitzkuchen by Frank Shawano, his brother, will be a climax in the later development of the novel.

Frank strives all his life to achieve the Blitzkuchen he had once tasted in an ecstatic moment. 'They breathed together. They thought like one person. They had for a long unbending moment the same heartbeat, same blood in their veins, the same taste in their mouth' (Erdrich, 2002:139), but he fails in his endeavor and is deeply disappointed.

In opposition to the previous weak voice of Klaus, Cally's strong voice is echoed several times throughout the second half of the novel.

Cally is Rozin and Richard Whiteheart Beads's daughter. Tormented by the past and especially by the death of her twin sister, she tells a tale of the past at the same time trying to guess what the future would be like for her mother and former lover, Frank 'Mama is uncomfortable, even standoffish with Frank Shawano. Or it could be that she is locked up in the past. She figures that she is done with, finished, all over with love and those complications. No more. A relief. I understand her and that makes sense. But here is Frank, so kind, his hands plucking cotton candy off a paper cone to hand first to her, then me. And so unassuming' (Erdrich, 2002:144).

Although still very young, she is a very experienced observer of the people who surround her: her mother, Frank, Cecille – Frank's sister, her grandmothers, Mary and Zosie: 'For instance, Mary and Zosie, the two powerful twins, have the complex history of having loved the same vanished man' (Erdrich, 2002:197). Interestingly enough, she succeeds in being both subjectively and objectively involved in the 'colliding histories

and destinies. Loss, darkness', this being the only universe she knows.

Another interesting voice, this time a non-human one, is that of Almost Soup, an 'extra clever' dog stating the following: 'I survived into my old age through dog magic. That's right. You see me, you see the result of dog wit. Dog skill' (Erdrich, 2002:75).

Almost Soup tells the amazing story of dog survival. According to a Native American custom white puppies born on a reservation were destined to give substance to soup. This dog knows how to escape his fate by doing everything humans want to see: 'I throw puppy love right at her in loopy yo=yos, puppy drool, joy, and big-pawed puppy clabber, ear perks, eye contact, most of all the potent weapon of all puppies, the head cock and puppy grin' (Erdrich, 2002:78).

The consciousness of a dog proves to be more experienced and wiser than that of a human. Like most of the main characters, Almost Soup is a looker on, an attentive perceiver of important details and even gives advice to puppies like himself but also humans surrounding him: 'Avoid all humans when they get into a feasting mood' (2002:79); 'I tell you, when a man goes out drunk in his motorboat, hide.' (2002:80); 'Humans call that fate. We dogs call that stupidity' (2002:80).

The story very nicely told by Almost Soup is the story of love and reliability between a master and his dog: 'my friends and relatives, we have walked down the prayer road clearing the way for humans since before time started. We have gone ahead of them to present their good points to the gatekeeper at that soft pasture where they eat all day and gamble the night away. (..) The dog is bound to be human. Raised alongside the human. With the human. Still, half the time we know better than the human' (Erdrich, 20002:81).

Therefore, these are only three of the narrative voices heard in the novel, but there are several other utterances who take part in the creating of the network of strings and beads some of which are strong voices, others being only weakly perceived.

There is also a unifying utterance, that of an objective anonymous narrator who seems to pull all the strings together. This is how the pieces fall into their places and the pattern is masterfully completed.

Here is the ending quote of *The Antelope Wife*: 'Who is beading us? Who is setting flower upon flower and cut-glass vine? Who are you and who am I, the beader or the bit of colored glass sewn onto the fabric of this earth? (…) We stand on tiptoe, trying to see over the edge, and only catch a glimpse of the next bead on the string, and the woman's hand moving, one day, the next, and the needle flashing over the horizon' (Erdrich, 2002: 240).

The Antelope Wife is a novel which teaches us, the readers, a lesson: the lesson of humility. Are we in the hands of someone stronger than us or is it possible for us to forge our own destiny? The answer is maybe that we have the power to change the course of our lives if we act positively at crucial moments, like Almost Soup did when on the verge of losing his life.

4. CONCLUSIONS

Louise Erdrich's novel can be considered a tapestry of culture and myth, a very sophisticated tale of family with a very complicated pattern consisting of the interwoven lives of the family members.

Erdrich's *The Antelope Wife* can be considered a re-dimensioning of the Native American voices, a re-birth of the Native American culture.

REFERENCES

1. Erdrich, Louise. *The Antelope Wife*. London: Flamingo (2002).
2. Lee, A. Robert. *Multicultural American Literature. Comparative Black, Native, Latino/a and Asian American Fictions.* University Press of Mississippi (2003)
3. Stookey, Lorena L. *Louise Erdrich: A Critican Companion*. Westport: Greenwood Press (1999).
4. Witalec, Janice (ed.) *Smoke Rising: The Native North American Literary Companion.* Detroit: Visible Ink Press/ Gale (1995).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

TEEN PREGNANCY. FACTORS. OPTIONS. CONSEQUENCES

Aurora SIMIGIU

University of Bucharest, Romania

Abstract: *Teen age pregnancy and motherhood was something normal along human history, but in the present society there are widely recognized the girls' need and right to continue their education, to achieve financial independence. Adolescence is a period when maturation is not complete yet and young people often give proof of ignorance on sexual activity or intimate responsiblity. Pregnancy in adolescence is primarily a social "plague", which can have serious medical consequences.In our country, there are about 27.000 births to teenagers every year, plus about 700 births to girls aged up to 15. Other aproximately 14.000 teenagers who become pregnant choose to discontinue it and 40% of girls are today 14 years old will become pregnant at least once before reaching 20, according to a study of the organization "Save the Children" in "Child's abuse and neglect"(2000).Giving birth to teenager in Romania ranks us as second in Europe after Great Britain and on the third place to abortion after GB and France, shows the failure of sexual health education in Romania and the earlier sexualization of young generation.* We believe the study is important because teenage pregnancy is social problem due to the implications deriving from the mother's status; psychologically immature, without professional skills, pregnant teens face multiple risks

Keywords: *teen pregnancy, abortion, consequences*

1. INTRODUCTION

Adolescence is the age of sexual debut. It lies after puberty, between 14-20 years, including the time of beginning of sexual life. Sexuality is an attractive, mysterious field, often prohibited by parents, society, school or other educational factors. As the media have developed, the broad field of sexuality has become more lax. Internet and television remain, despite the measures taken by the NAC, the main means of information and promotion of sexuality.

Adolescence is the period of dreams, career preparation, and the design of future life. A pregnancy appeared in this context is often an accident.

Teenage pregnancy indicates either the absence of knowledge about contraception, or their contraceptive education is poor.

Before 1989 the Romanian school totally ignored education for sexual health. The reform totally of Romanian education must take into account the international regulations. According to UNESCO, XXI century education is "education for life", which includes sexual education. However, the National Commission of Curriculum does not see in the graduate more than its cognitive and social dimension because there is nothing

specified about the sexual education component" (Neamtu, 2005).

Adolescent pregnancy is a natural consequence of sexual activity unprotected through contraception; teen pregnancy is socially and economically a social problem because of the implications deriving from the mother's status: psychologically immature, having no consistent skills nor the ability to ensure a steady income, so unable to raise and educate her own child, the pregnant teenager faces multiple medical risks and complications at birth or affecting the child's constitution and health.

2. DETERMINANT FACTORS OF TEENAGE PREGNANCY

The determinants of pregnancy in adolescence are early sexual relations in conjunction with a poor sexual education. The research led by Udry (1984) apud Adams - Berzonsky, shows that there is a highly significant correlation between early age of mothers at first sexual intercourse and their daughters'. These tend to begin their sexual life before 14, with the risks connected to educational gaps.

2.1. Family's influence. Sudies by Jaccard, Dittus and Gordon (1996) claimed that closeness to the mother is related to delaying daughter's sexual intercourse and the use of contraceptive methods by sexually active adolescents of both genders. Most cases show that active surveillance, monitoring of children by parents is related to sexual behaviour of adolescents in that it would lower the risk of pregnancy. Rogers (1999) reported that intrusive maternal control was associated with early age for the first sexual intercourse.

Associations between parent-child communication and adolescent pregnancy risk were investigated in more than 30 studies, and associations between parent-adolescent communication and adolescent sexual behaviour are moderated by the moral values of parents.

Studies of Lammares et al., 2000, Benson and Galbraith, 2001 cited in Adams - Berzonsky, demonstrate that family structure has great importance for teen pregnancy. Thus, girls raised by single parents are at risk of pregnancy due to more permissive sexual attitudes, as parents do not monitor them constantly and even arrange their dates. Also, traumatic experiences, especially those involving sexual abuse, are associated with a higher risk of occurrence of pregnancy through the early debut of sexual intercourse.

2.2. Congener's influence. Regarding congeners' influences, studies show that teenagers will befriend with those with similar attitudes, beliefs and desires (Bauman 1994). So young people are affected by the influence and pressure of congeners but they are not as large and negative as anticipated.

However researchers have established a link between the risk of early start of sexual life and of early pregnancy in the case of pre-teenagers living with adolescents who are sexually active or with pregnant sister (East, 1996). Benda and DiBlaso (1991) found that when relationships with parents are strong, congeners' negative effects are reduced.

2.3. Community's influence. As concerning the community where girls grow, research revealed that high unemployment in the district is a consistent predictor of the likelihood of teenage parenthood (Guard, 1994). Also, in most analyzes, the religiosity has a preventive influence on teen pregnancy.

Ethnicity is also an important factor in the prediction of teen pregnancies. Some cultures support a more tolerant attitude towards the phenomenon of pregnancy at a very early age. This is the case of Hispanics, black populations especially in rural areas and Gypsies. Early birth in these communities can be linked with low expectations from some ethnic groups.

3. OPTIONS ABOUT TEEN PREGNANCY

Sexual intercourse without adequate contraception leads to pregnancy. In the situation of an unwanted pregnancy, adolescents have three options: abortion, child placed for adoption or keeping it.

3.1. Abortion can be chosen by some teenage girls because they want to keep secret the fact that they are sexually active. They often mention lack of economic resources and concerns about how the newborn baby would affect future plans for teens as concerning education. Hardships or instability in the relationship could also be reasons to resort to abortion.

Stevans (1992) found that religious affiliation has no effect on the decision to solve teenage pregnancy in one way or another. Much more important is the role of teenagers' mother who the higher their educational level is, the more they influence teens to resort to abortion.

3.2. Adoption. In the decision for giving the baby for adoption or keeping the child, Warren and Johnson (1989) found that white women are more likely to send their children for adoption than Hispanics or Afro-Americans. The greatest decrease in giving to adoption in the last decade was registered with the white girls, who are starting to behave like other races.

Miller (1995) demonstrated through his research that teenagers who have a good education and professional goals are more likely to postpone sexual activity, to use contraception to prevent unwanted pregnancies and to place children for adoption than girls with lower targets in terms of education.

Women who have personal experience with adoption (eg know someone adopted or were adopted themselves) or living in foster care are more likely to choose adoption (Cushman, 1993).

We can summarize that young women who make an adoption plan are mostly white, come from an advantageous environment, want to attend college and to make a career and have positive attitudes regarding adoption.

4. CONSEQUENCES OF CHILDBIRTH IN ADOLESCENCE

They have an impact on the young teenage girls, the fathers, the children and society in general.

4.1. Consequences for teenage mothers. Girls who become teenage mothers remain single over a double period in the age range 14-30 than those that have a child after 20 and only 19% of them marry the father of their child (Sanders, 1997). In the case of adolescents who got married, the probability that the relationship ends with a divorce is higher than for those who give birth after 20, according to the study. As single mothers, teenagers have a higher probability to abandon school. This actually results in fewer employment opportunities and thus lower income.

4.2. Consequences for the fathers. Adolescent fathers earn 25% less than those who decide to become parents later (Willis, 1997) and seem to engage in more delinquent behaviours than older fathers.

4.3. Consequences on children born to teen mothers are primarily medical; they are often premature, with a probability of 1.5 times for low birth weight, under 2.5 kg (Perozek, 1997). As they grow, they are prone to disorders such as dyslexia and hyperactivity.

Birth to a teenager has negative effects on the quality of care and feeding of the child because of the mother's material difficulties

and lack of experience. Children born to adolescents are taken to the doctor 2 times more rarely than those born to more mature mothers (Perozec, 1997). Teenage mothers spend 20% longer in hospital than women who have children later.

According to studies conducted by Moore and Greene in 1997, babies born to teenage mothers scored lower on cognitive tests in mathematics, reading and comprehension than children of non adolescent mothers. According to the study, they have only 30% chance of becoming good students, maybe due to reduced cognitive stimulation at early ages and their poor feeding.

Also, babies born to teenage mothers are at increased risk of school dropout, to flee from home or juvenile delinquency, being 2.7 times more likely to spend part of their lives in prison (Mayard, 1996).

4.4. Consequences on society. A birth has a great financial impact on society. Maynard (1997) estimated that in the mid 90s, the Americans paid about $ 21 billion annual cost of the assisted teen mothers. In Romania, the state pays 2000 lei per month per child in placement centres.

5. CONCLUZIONS

Researchers who studied adolescent pregnancy often considered variables as sexual intercourse and contraceptive use as indicators of teen pregnancy risk. These behaviours are affected by wider contextual influences, individual and familial ones.

Family influences on adolescent pregnancy risk include the characteristics of parent-adolescent relationship, the family structure and other contextual features.

Congeners can either encourage or discourage risky sexual behaviour, their influence depending on the girls' relations with the nuclear family.

Community characteristics such as low socio-economic status and low employment opportunities correlated with an increased number of adolescent pregnancies, whereas increased religiosity lead to fewer teen

Family and contextual factors influence the manner in which girls make a decision on the course of gestation. The decision to abort is positively correlated with family income and the educational level, as well as the mother's influence. Race, family's socio-economic status, future educational and career aspirations of the adolescence are among the most prominent variables in the decision to give the baby for adoption.

Consequences for teen mothers include longer periods of loneliness, educational sacrifice, low employment opportunities, smaller income than those of non-adolescent mothers.

Early motherhood tends to interrupt the long period of education and training required in developed societies. Children born to teenage mothers will face cognitive, social and economic disadvantages. Teen motherhood also requires a significant financial burden on the extended family and society over the forms of public assistance.

A teenage mother's child is a potential social assisted person, either directly or indirectly, from neglect or mistreatment by the mother, who is not mature enough to understand and to satisfy the baby's needs. The Romanian State spends about 2000 lei per month with child in its care.

REFERENCES

1. Adams, R.,G.,Berzonsky, D.,M.,.*Psihologia adolescentei.*Iasi: Ed. Polirom (2009)
2. Graham-Scot, G., *Erotic Power.An explanation of dominance and submission.*New Jersey: Citadel Press Book**.** (1991)
3. Haas, A., Haas, K., *Understanding Sexuality*.St Luis: Times Mirror College Publishing. (1990)
4. Haeberle, E.J.,*The Sex Atlas: A new ilustrated guide*.New York: Seaburg Press. (1978)
5. Neamţu, C. *Educaţia sexuală o provocare pentru şcoala românească.*Bucureşti: I.E. (2005)

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

THE MILITARY ORGANIZATION AND THE PROFESSIONAL STRESS

Marilena TICUŞAN , Elena HURJUI

Department of Psychology and Pedagogy, Institution: Spiru Haret University, Braşov, Romania

Abstract:*The complexity of the social-military life, on its whole, induces major implications in the theoretical instruction and the specific practice of the military field. The identification of the connections which are instituded in the military groups' field, constitues a substantial contribution in the so needed scintization of the military organization in general and of its groups in particular. The preponderant role in combating the stress situations is had by the personnel selection and by ensuring of a certain personality profile meeting its case, as well as a professional and psychological adequate training. The relation between the levels of stress at the military and the psycho-social climate of the military units, is closely bounded both, of the perception of stress and also of the professional performances level. Looking for the social support is the most frequent and efficient strategy of adaptation, imposing the role of the military structures cohesion as a resistance at stress factor. The realization and the maintaining of a high level of cohesion constitutes a favourable premise to the manifestation of high spirits, of the obtaining of superior results in the process of training for the fight and of the victory in an eventual conflict.The research has demonstrated the importance of the intern place of the control in the perception and evaluation of stressing situations. The interaction manner of this variable with the anxiety, the frustration, the liberty of chioce and the social behaviour reveal the importance of introducing of this variable in the professional selection process.*

Key words: *professional stress, professional selection, cohesion, high spirits, psychological profile, anxiety, social behaviour.*

1. INTRODUCTION

The interaction between the organism and the environment appears as an esential element of life and it imposes a continuous adaptation of the organism, both on the phylogenetic and the ontogenetic lines. Stress has been and remains one of the most controversed concepts in the history of science. But, despite of criticisms and its lack of precision, stress continues to arouse the interest of specialists in diverse fields of science (physiologists, biochemists, biologists, pharmacologists, sociologists, psychologists, psychiatrists, anthropologists); the notion of stress offers an acceptable consensus, being relieved of deprecating moral and psychiatric connotations. The reactions of stress don't reveal the physic or mental deficiency, but they are normal reactions of the man confronted with a situation which he must manage. In the military psychology stress is a key concept and, according to the specialists in this field, for studying stress at human beings, there is no better context of the research than the military field. Of the way in which this phenomenon is conceived in the context of military type activities, it depends on a series of practical measures, connected with the application of the psychology in: military personnel selection, approaching to the training process for the armed warfare, leading

the troops during peace and war time, a.s.o. Long ago it was proposed a distinction between the sistemic stress, produced by physical, chemical and biological agents, that underlines mostly the physiological and psychobiological aspects and the psychical stress that involves firstly the psychological state of the organism.

2. PSYCHO-SOCIAL ASPECTS INVOLVED

The organism, being a bio-psycho-social unit, the sistemic stress becomes a somatopsychic stress and the psychical stress - a psychophysiological stress. But in the last period of time the accent of the research has been moved on the psychosocial aspect of stress, owing to the alert rhythm of the contemporary society evolution, which has imposed the replacement of requests of physical nature with those of superior psychical functions.

3. ELEMENTS OF THE RESEARCH

The natural frame is constituted by: the participation in military actions; situations of natural calamities; social seclusion; captivity; training (fight firing, pilots, parachutists); special socio-cultural contexts (poverty, informational deprivation); the upseting of the needs of affirmation, interaction, affiliation, affection, a.s.o.); the intervention of some life events (death, disease); professional stress; social stress; decisional stress; stress induced by the pressure of time.

Psychical stress reveals the discrepancy between wishes, expectations and what the individual obtains from the environment and it appears not only if the requests of the environment rise above the individual's capacities, but also when the resources are not requested at the optimum level by the environment. The affirmation needs, the expression possibility, may become acute needs, so that the understimulation and undersolicitation (through the deficit of stimuluses, their repetitive and uniform features, monotony, social isolation, reduced communication and co-operation) produce effects comparable with those of stress through supersolicitation. The results of experiences of the sensorial deprivation are arguments for the affirmation that the maintaining of a normal and efficient physical and psychical activity requires an optimal extern stimulation, the level of which alters from individual to individual. It is proven, for example, that the extrovert experiences undersolicitation more than the introvert.

Stress is a key concept in the military psychology and of the way in which this phenomenon is conceived in the context of the military type activities follows a succession of practical activities bounded by the application of the psychology in: personnel selection, dealing with the training process for armed fight, troup's management while peace and war time, a.s.o. It has been studied especially the military personnel with complex functions and specialities in which there is a high degree of solicitation of aptitudes and specific skills.

3.1 Involved factors

The military profession presumes a high specialization, being involved in the management of violence. The motivations in choosing this profession are, mainly, of a pulsatory type (a significant part of military cadres chose this profession when they were fourteen; each military considers the peace situation but, mostly, the one of war – the nearer the instruction is of the real conditions, the more passionate they are, because they achieve themselves as persons).

The fact, intuitve, of being able to act after the own decision, in conditions of pronounced uncertainty, creates the feeling of fulfilment, of using the specific and special abilities.

The military organization is characterized by a hierarchical structure and it is constituted on rigorous criterions. The hierarchy of military

functions or ranks generates a stimulative and competitive frame for individuals. Because of these hierarchies the relations between the members of the organization, compared with those in the civil life, suffer changes, so that, in the military life the aggregate of behavioural rules, in the interindividual relations, is determined strictly by the military regulations.

While being a military the conditions can generate frustration, behavioural rigidity, the shutting off of the initiative, moulding after certain patterns, so getting to stereotypy and rigidity that determine the neglecting of the content and quality of work, the rounding of individual responsibilities, self-seeking, conservatism, inertia and resistence at changes.

The bureaucratic organisations context speaks about the individual's practised incapacity of adapting himself at new situations and of the professional deformation as negative effects on the human factor.

The everyday completion of a certain routine gets to develop individual's preferences, antipathies, determiantions, which exert a constant pressure on the individual, determining a methodical, prudent and disciplined behaviour. The conformity and the fidelity reported to prescribted actions is encouraged, more than it should be necessary, ensuring a comfortable safety threshold. The adhesion to norms conceived initially as means, becomes purpose for individual, getting to a process of shifting of purposes through which an instrumental value becomes a final value. The adhesion to formal procedures leeds to behavioural formalism and even to ritualism.

Such a vision upon the career imposes the fear of risks and innovations, conscientiousness without personal engagement, conformity, impersonal behaviour and respecting all the unwritten laws. All these are the price of the comfort offered by the wish, at any cost, for permanence and the fear of new, of change. With other words, the talk is about a psychological contract between individual and organization through which, in exchange of renouncing at creativity, at personal engagement in tasks and interpersonal relations, at assuming of the responsibility, the individual receives the reducing of incertitude, organizational equilibrium and continuity. While peace, military cadres are marked by the bureaucratic criterions because, while peace time, the task of the army is abstract and with simbolic eficiency. In exchange, the obedience faced with the system and with the leaders is concrete. This situation masks both the capacity and the incapacity of militaries.

The professional activity becomes stressing when, through the nature and volume of obligations, it oversolicits the employed, it carries on in its own rhythm, that is in contradiction with the individual's natural biorhythms.

The military domain allows the affirmation of the competivity, as a masculine feature. The competition generates satisfactions and insatisfactions that, in their turn, constitute factors of remotivation.

The circle of duty and responsibility involves guilt as sanction. The plan of socio-cultural existence and the frame of interpersonal relations are ordered through the functioning of norms and values. These impregnate all human practices, from the productive to the

artistic, medical and educational ones. What is desirable is promoted by a socio-culture given by the way of examples, by positive heroes; in the microgroup this is promoted by praise and reward. What is undesirable is forbidden. Functioning externally, this socio-cultural normativity organises itself progressively and stucturing the living, atitudes and behaviours inside the psychism.

The underoptimal solicitation of individual's resources, underloading which is asociated with the repetitive work, the routine, the unstimulating work, the boredom, a.s.o., has negative effects upon the individual's health.

The persons who have in subordinate other persons, to guide them in their work, to recompense them, to punish them, to communicate with, these persons report a stronger level of stress than the persons who deal with other functions than working with people. This situation is owing to the moral and legal responsibility for the subordinates.

From the observations and discussions with the militaries who compose the pattern taken into study, it followed that the military personnel who has in subordination in term militaries report a stronger level of stress than the military cadres who deal with administrative activities, or those who lead professional militaries.

Following the observations and discussions with the militaries from the pattern taken into study, it followed that the main factor that makes the difference between in term militaries' commanders and professional militaries' commanders is the perception on the subordinates, although the activities with encreasing risk are the same: those in the first category are seen especially as disinterested and immature, while the professionals are seen as they are interested directly in the good course of activities.

3.2 Analysis and results

The analysis of the results of the study has thrown into relief the fact that the differences found in the distribution of the results of stress, between the groups characterized by the perception of intense sources of stress, respectively through the use of active strategies of copying, are significant in the sense that the persons who perceive a more intense stress manifest a low level of satisfaction and health. The use of active strategies of adjustment (seeking of the social support and rational organizing of activities) report significant more decreased levels of stress. The place of the control acts as mediator of stress through the favouring of an adequate perception and evaluation of the sources of pressure.

The difference between what the individual hopes and what he finds in the army is significant and generating of pressures for the individual.

The perception of the interhuman relationships as a source of pressure can be put on the behalf of the individual's wish of forming a clearer conturated image about himself and of his hope that his relationships with the others (idealized) will have an important role in self-defining.

The persons characterized by self-control manifest an increased satisfaction with reference to the activity itself and to the organizational structure and climate, a superior physical health (percepted a physical energy) and a good psychic health (state of wellness).

The pressure of time contributes at the development of activities following a programme strictly framed in time. The bureaucratic system, in the pattern of which the army functions, favours the trace of loads with an unsufficient term for solving and nobody can motivate the unsolving of a problem through the exhaustion of the time of work of eight hours. These two factors, alone, can describe the way in which the lack of time practises pressures upon the militaries. But in situations of crisis, time has other dimensions: the planning of actions must be made in a time as short as possible, their development is based on the presence of a certain type of disposition

elements, in certain places, in well specified moments. The army collocation that presumes punctuality is ubiquitous, even if not always the limits of time are traced in a fair way.

People tend to take other's opinions into account, mostly of those who they compare themselves with, or of those whose opinions they are tempted to change, which generate consequences on the constitution of social relationships and on the dynamics of the groups. So, "pressures of uniformity" appears and, if those are not followed by effects, they can make room for hostility and conflict.

Considering the pressure of interhuman relationships as an indicator for the individual's dependency upon the group, we get to the same conclusion, as it is known that decreased dependency is oriented towards the social environment of life and work, with the object of seducing and cognitive confirming of the cognitive state and in the case of strong dependency the

psychological needs are overestimated (the perspective of self-knowledge or competition). The evaluation of the practised attraction is a specific feature of all persons with leading functions and the competitivity is a specific male feature which is cultivated intensely in the military environment.

Work in conditions of physical danger leads to a behaviour that involves difficulties in the maintaining of the interpersonal relationships, the tendency to nonconformism, the military trusting less to the traditional judgments and values.

The conflict of role appears when a person must perform many roles in the same situation. The expectations concerning each and every role can be clear, but the roles themselves may be in a conflict. For example, between the military officers and second officers' multiple roles may appear such conflicts: in the situations in which military officers or second officers must report the performances obtained by soldiers in the training process to the superiors, to defend their interests and in the same time to be themselves sanctioned for the soldiers' results that contravene the superiors' expectations.

It results that the persons characterized by the intern control manifests an increased satisfaction

reported to the activity itself and to the organizational structure and climate, a superior physical health (percepted a physical energy) and a good psychic health (state of wellness).

The answer at stress is manifested on three levels: physiological, psychological and behavioural. The difference occurs in the direction in which it is manifested the answer at stress. Some people react more conspicuously at the physiological level, others through feelings of a certain psychical coloratura and others react at stress through the exacerbation or inhibition of certain behaviours. So, according to individual characteristics, the behavioural answer at stress may be manifested through changes of the verbal behaviour, of the one of motorial co-ordination, or through the decreasing of the performance, absenteeism or abandonment. Intensifications of some behaviours from the unhealthy style of life are specific as reactions at stress. The frequency of smoking, of alcohol and drug consumption, is greater at persons characterized by high scores at the sensations

seeking feature and it intensifies in the periods of stress. The introvert persons smoke more in stress situations, in situations that solicit an increased level of concentration, while extrovert persons smoke more in situations that undersolicit the individual's capacities. Factors belonging to the individual's style of life are interpretated as ways of copying or as reactions in the absence of some effective alternatives of copying. At some persons the cumulative impact of stressors is experienced mostly at the level of cognitive processes, being manifested through decreasing of the concentration capacity, decreasing of the decision making capacity, decreasing of the capacity of creative and flexible thinking.

An important part of the components of the respective stereotype (which, initially, were not identified as identical with the self-image) are asimilated, the person adopting an adequate conduct. The differences in the perception and evaluation of pressure sources and in the manifestation of reactions at stress between employed militaries and military cadres, owe mainly to the feeling of belonging or not belonging, at the corps of permanent military cadres (as military officers or second officers) and to the adoption, or not, of the conduct which consists from this behaviour. The stereotype of the professional military includes also the availability of being called to the unit for the solving of varied work problems, alarms, military actions and exercises, the responsibility for persons more or less disciplined.

4. CONCLUSIONS & ACKNOWLEDGMENT

In a world in which changes occur nowadays with an unimaginable speed for those living half of century ago, our adaptating capacity and, implicit, our processing information capacity, are really overfulfilled; our feeling of helplessness comes from here.

Certainly all of us have a representation, at least a summary one, of the stress concept, but few of us know the efficient methods of diminishing it and so, of getting through solicitations easily, the not negligible solicitations of a life that flows, maybe, too fast.

The psychical stress accompanies any activity in which human is engaged, being a resultant of *"the conflict"* that can be generated by the action itself and by the one who performs it, but it is also owed to the increased rhythm of evolution of the society, to the volume of solicitations and to the accelerated dynamics of the social environment.

The sources of professional stress are bounded of work, a part in the organization, the development of the career, professional relationships, the organizational structure and climate.

The individual's evolution in the career, the exceeding of certain stages, determine the appearance of stress which will cause certain problems in the insividual's psychological plan.

The middle of the career is accompanied by a suite of disappointments: the slowing down or the braking of the promotion, the restriction of opportunenesses, any of these leading to the individuals' isolation.

The end of the career and the retirement, the end of the active professional life and, so, the reconversion of the psychical energy from the working place to other activities, are other possible sources of frustration.

In conditions in which the seeking of the social support is the most frequent and efficient strategy of adaptation, the role of (vertical and horizontal) cohesion of the military structures, as a factor of resistance at stress, is imposed prominently.

The realization and the maintaining of a high level of cohesion constitute a favourable premise for the manifestation of a high morale and, in consequence, for obtaining superior

results in the process of training for the fight and of the victory in a possible conflict.

REFERENCES

1. Arădăvoaice, Gh., *Stresul psihic în lupta armată,* Editura Academiei de Înalte Studii Militare, Bucureşti, (1993).
2. Bartone, P.T., Vaitkus, M.A., *Stress, Cohesion and Morale in Peacekeeping Operations,* în „*Psychological Support for Military Personnel*". International Stress Workshop, 6-10 Dec. (1993).
3. Moskos, Ch., *Armata mai mult decat o ocupaţie*, Editura Ziua (2005).
4. Nita M., *Introducere în sociologia militară*, Bucureşti Editura I.NI, (1995).
5. Robertson, I. T., Cooper, C.L, Williams, J., *The validity of the Occupationl Stress Indicator,* în Work&Stress, vol.4, No. 1, (1990).
6. Turcu, M., *Conflict şi stres*, în revista „*Spirit Militar Modern*", nr. 3/1995, Bucureşti, (1995).
7. Vasilescu, I.P., Ceauşu, V., *Evaluarea caracteristicilor deciziei în condiţii de risc, în expertiza psihologică a aviatorilor şi paraşutiştilor*, în Ceauşu, V., (coord) „*Solicitări psihice la aviatori şi paraşutişti*", Editura Militară, Bucureşti, (1987).
8. Zulean, M. *Diferenţe culturale dintre armată şi societatea românească*, Editura Universităţii Naţionale de Apărare Bucuresti (2006).
9. Yves Saint- Arnaud, *Dinamica grupurilor* Editura Polirom Iasi, (2001).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

THE OPTIMIZATION OF THE PERFORMANCE INSIDE THE MILITARY GROUP

Marilena TICUŞAN, Elena HURJUI

Department of Psychology and Pedagogy, Institution: Spiru Haret University, Braşov, Romania

Abstract: *At present the individual who belongs to the system is no more a product of the system, he is treated as an active member of the organization, with distinct personality, aptitudes, skills, needs, necessities and motivations. The hierarchy of the military functions or ranks generates the stimulative and competitive frame for individuals. The role-status system is precisely stated fulfilling all the conditions for the constant reproduction of the specific relations. The person's statute is acknowledged through the specific instructions by all the group's members and the formal relations are in conformity with these. The relationships between the members of the organization are different from those in the civilian life. It is tried the turning to the maximum account of the individual potentialities but also the forming of new ones through the person's integration in an educational system meant to provide for him the professional and personal development. The preferential relationships and the level of the group's cohesion are in a pressed interdependence and they influence the performance in the activity.*

Key words: *military group, cohesion, self-esteem, role, status, performance.*

1. INTRODUCTION

The approach to the military organizations focused mainly on its subsystems. Nowadays, the person who makes part of the military organization is treated as an active member of the organization with distinct personality, skills, abilities, needs and motivations. There is trying to be valued the person's individual potentialities but in the same time, there is trying also the formation of new ones by integrating the person into an educational system designed to assure both personal and professional development.

2. ASPECTS INVOLVED

The hierarchy or military grades generate a stimulating and competitive framework for individuals, other and different than the one of civil life. The contact with the rigors of military life is also made during the hours of training and after graduation. For each person is created an environment dominated especially by formal relations of military

organization. The working time is not enough, sometimes requiring additional work hours for them to solve tasks with maximum appreciation. In the framework of formal ties, informal collaboration is lacking. The group cohesion is higher as the formal and informal relations coincide, being an indispensable condition of appearance and action common rules accepted in the group.

Attitudes, representations that they have about each other, solidarity and sympathy play an essential part. The psycho-social climate of a military organization is a reference system for each individual that choices the behavior in the adaptation of exemplary conduct and the way in organizing.

The consent to cooperate is ultimately responsible for the smooth running of the organization, deciding about its dynamics.

In fact, group dynamics occurs in the context of constant interaction with external social environment and the natural environment.

As a basic core structure of the military, micro-groups (primary military collective - group, platoon) are those inside which there are placed all the relationships formal and informal that ensured immediate moral qualities and fighting ones.

As a consequence, it should be kept in mind that the soldier inside of the group is asked twice, on one hand the technical and business conditions and on the other hand, socially and psychologically, because of its interactions and relationships with other soldiers.

The affective relationships by attraction and by rejection that exist in the military group, are based on a series of personality traits of those involved which are not different much from those that arise in the civil life. We actually talk about the existing network of informal relationships in a small military group (platoon), the network that influence the degree of cohesion and group psychosocial climate. Affective relations of attraction and rejection are born on deep mutual knowledge and involve from the part of actors of these types of relationships a number of personality traits mentioned also in socio-metric test.

The persons involved in test who were chosen for leisure are characterized as being right-minded/equilibrated and self-controlled. The group relations are friendly and talkative, cheerful and humorous. Objectivity in assessment and organization of the activity appears as a mark placed on institutionalized environment of these interpersonal attraction.

In interpersonal perception self-esteem occurs quite rapidly, therefore they tend to classify others. As soon as people perceive a person tend to include in a category. Including him in a category is assigned certain characteristics that people know that each category has its representative.

Self-image fulfills an important role in a person's relationships with others and in the quality and efficiency of the activity they perform. Self-image greatly influences how the person really appreciates and qualifies his peers. More than this, specifics of an individual reaction in human relationships often reflect the opinion of himself. Any distortion either in sense of exaggeration in terms of quality or minimization has a negative impact on their relationships with others.

3. COHESION AND PERFORMANCE ASPECTS OF THE STUDY

In order to evaluate the relationship between performance and cohesion have used these tools:

- Appreciation of military records and performance evaluation criteria in a military group.
- Perceived degree of cohesion of each member by grouped perceived cohesion index (I.C.G.P.) for each group member and group cohesion index that clarify the level of cohesion achieved by group during the intervention moment.
- Scheme socio-emotional relationships, through the preferred structure analysis enables to be observed relationships, attraction, rejection of members and to interfere in tangible, in order to increase cohesion.

The characteristics and personality traits of group members, the informal leaders in order to improve relations and increase the default level of interest of members, so the cohesion, are known and are emerging from psychological evaluation of the military activity in accordance with the existing methodologies used in military system .

The research done by psychologists on military cohesion in military groups, conclude that there are specific features informal leader agreed, and the low self-esteem is one of the causes of the rejection of individuals in the group.

They could test multiple, complex and diverse qualitative assessments based on the number of elections / rejections, subgroups that form, socio-metric status of the persons subjects that are part of a subgroup or another, the distance between them. Although a subject sends election to his colleagues with high socio-metric status has another meaning than another one who sends election to a colleague with a lower socio-metric status. We can assign a positive meaning to the leader or a negative position relative to the subgroup to which he belongs in the team. I gave to each category defined *a preferential power index* whose value decreases according with the falling relative index value of preferential status so that subjects in the first category allocate a power index equal to "+3" and the last category a power index equal to "-1".

Such a restriction was needed to give military rank and their correlation with the rank of semester evaluation sheets in order to measure the performance and then its relationship with group cohesion. Also it offers our focus attention to those individuals who have managed to polarize the most relevant sympathy as a number of members, occupied by this formal position of the group leaders, but also to those who have been rejected or indifferent group in order to optimize intra-group relations.

There are observed low values of cohesion index for group assignment criteria and leisure, part of the category of groups with low cohesion. The platoon cohesion index criterion leisure, being close to zero, the group describes, the cohesion, as a preferred maximum instability or a maximum preferred indifference.

The plan of psychological intervention led to increased group cohesion was developed in collaboration with the formal leader of the group. The plan aimed more joint leisure, assigned formal roles - like organizational, informal leaders participating in various

competitions on the theme applicative, military preparation for battle, which continued with sports competitions and outside.

4. CONCLUSIONS & ACKNOWLEDGMENT

Seeking to answer the initial question originally regarding the connection between military group cohesion and performance, we could give an affirmative answer. Between the two variables studied and operationalized, there is some influence, so even if you cannot determine each other but we can pit on each other. We notice a performance boost when cohesion increases. By comparative analysis of the two variables studied, the two moments test and posttest, each subject has evolved into professional results with a very significant percentage, and on the other grouped perceived cohesion index is much higher in each subject, as a fairly significant margin.

In the preferred structure of the group it was observed as those persons that were rejected had better results in work which makes us ask ourselves: is the phenomenon caused their motivation? We started from the idea that has not yet occurred to the negative leaders attempting to integrate them in groups.

We are attributing a significance value to the socio-metric intervention plan, which increased the cohesion of the military group studied. It was developed in collaboration with the formal leader of the group, aiming more joint leisure, assigning formal roles - like organizing, participating in various competitions with the theme applied-military training activities sports / military in the training activities sports / military in preparation for battle, which continued with sports competitions and outside. There were introduced the participation in cultural activities and cultural common military. As a conclusion more formal involvement of the leader of the group leads to the growth of performance by increasing the cohesion of groups, both at the platoon and company level. These results can be influenced by other random variables, but without ignoring the role, we can conclude that hypothesis confirmation saying that the group studied more cohesive military led to improved performance by significant results exclude chance or randomness. There is a clear influence of cohesion on performance at least in the group studied. The knowing of the preferred structure of the group allows us to measure personality traits of leaders through psychological knowledge by specific instruments addressing their assimilation strategy group.

REFERENCES

1. Ani□ei. M., *Psihologie militară* Ed. Polirom, Ia□i, (2007).
2. Lorenzi-Cioldi, F., Doise, W.,*Relaţiile între grupuri: Identitate socială şi identitate personală*, în Neculau, A., coord. „*Psihologie socială. Aspecte contemporane"* Editura polirom, Ia□i, (1997).
3. Beauvois, J.-L., Dubois, N, *Credinţe interne şi credinţe externe, în Moscovic*i, S., coord. „*Psihologia socială a relaţiilor cu celălalt*", Editura Polirom, Iaşi, (1997).
4. Stoica, V., *Bazele managementului militar*, Bucuresti, Editura AÎSM, (2003).
5. Neculau, A., *Dinamica grupurilor*, Editura Polirom , Ia□i, (2001).

6. Schermerhorn, J.R., Hunt, J.G. and Osborn R.N. *Managing Organizational Behavior*, New York: Wiley & Sons (1994).
7. Hoop,A.,*Source* [online]. www.hoopandtree.org/sociometry.htm&ei=RWfXTY (2011).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

ATTITUDES TOWARDS INCLUSIVE EDUCATION – A QUALITATIVE META-ANALYSIS OF RECENT STUDIES

Ecaterina Maria UNIANU*

*Faculty of Psychology and Educational Sciences, Transilvania University of Brasov, Romania

Abstract: *Inclusive education represents an issue focused on different problems such as conceptual delimitations, attitudes towards children with special needs or children from different social and economical areas. It is very important that we understand the need for inclusive education in a society based on human and, especially, children rights, on values such as equality, responsibility and implication. At the international level, the attitudes towards inclusive education represents an issue that has been developed in so many studies concerning attitudes towards children with special needs, children with Down syndrome, children with epilepsy and so on. The teachers' attitude towards inclusive education in its all aspects also represents a very important issue because the social and economical context (national and international) is not a favourable one for this type of education. The studies analyzed in this qualitative meta-analysis present some interesting points of view concerning teachers' attitudes towards this domain. This little research tried to show that many countries have encouraged the idea of inclusive education but, at practical level, the implementation of inclusive policies is a very slow process and takes time and lots of effort in order to apply the principles of inclusive education. It is a very hard work but it can be done starting from changing teachers' attitudes towards those principles.*

Keywords: *inclusive education, teaching, attitude, meta-analysis*

1. INTRODUCTION

Since the end of the 20th century priority has been given to building an educational context, in which all children could learn, all children or adolescents could be integrated in the mainstream educational system, all children have potential that should be valorised – an inclusive educational context. This is the aim of the majority of educational systems, international or European, in order to respect and valorise the possibilities of every child no matter what is his ethnic group, his religion, his family background, his level of development and so on. The concept of inclusive education has been and still is a controversial one because of the lack of correct comprehension of the term. For a great period of time, *inclusion* was a concept related with the *special educational needs* one. This relationship was developed in the individual gaze paradigm (Fulcher, 1989), which stipulated that it is important to know those characteristics of the child with disabilities which are an obstacle to children' adaptation to the mainstream education. Therefore it is necessary to develop a special education system in order to elaborate a special curriculum for those children and to remediate their deficiencies.

The interactive or organizational paradigm has in the centre of its preoccupation the need to recognise the differences between children but it is also underlying the incapacity of

educational system to adapt itself to those differences. Therefore, it is necessary to build an educational context which can satisfy the individual needs of the children and to raise their learning performances. Nowadays educational inclusion is seen as an appropriate context for all children development no matter their family background or level of development.

European educational systems see this concept more related with educational integration but there are major differences between these two. Integration represents the challenge to adapt children with special educational needs to the standards of mainstream education an inclusion represents the challenge to adapt the educational standards and context to the children's needs and characteristics.

The teachers' attitude towards inclusive education in its all aspects also represents a very important issue because the social and economical context (national and international) is not a favourable one for this type of education.

This analysis is meant to identify the main and relevant studies which approached the teachers' attitude towards inclusive education and to determine the main factors which can contribute in a valuable way to the appropriate implementation of its principles.

It is also meant to investigate the following research questions:

* How is defined inclusive education in different educational systems?

* Which are the factors which have an important role in the development of inclusive systems?

* Why it is necessary and worthwhile to implement the principles of inclusive education?

* How it can be develop a teacher's positive attitude towards inclusion in order to improve learning performances of the children?

These questions and their answers could have an important impact on how the Romanian educational system is seen now and on how it could be build in order to apply the principles of inclusive education.

2. METHODS

2.1 Literature search. The literature search was started with the analysis of nine online data bases (Science Direct; ProQuest; SpringerLink; Oxford Journals; Cambridge Journals; Wiley Online Library; Ebsco; Thomson Reuters. Web of Knowledge; Ulrichsweb. Global Serials Directory). The first step was a simple search of the terms (*inclusive education* and *attitudes towards inclusive education*) in order to identify the number of publication which approached them. The results are presented in table 1.

Table 1. The results of the search of the concepts in online data bases

Online data bases	**Inclusive education (no. of results)**	**Attitudes towards inclusive education (no. of results)**
Science Direct	24439	4665
ProQuest	161149	18669
SpringerLink	17865	4933
Oxford Journals	197619	415597
Cambridge Journals	35312	18998
Wiley Online Library	36500	10321
Ebsco	3671	30
Thomson Reuters	1991	54
Ulrichsweb	9071	9167

The search was restricted to studies published in English, regarding teachers' attitude towards inclusive practices, programmes or principles. Studies were conducted at primary, secondary and high school level. Finally, the search was restricted to the publication years 1994 to 2012.

2.2 Eligibility criteria. A number of 27 studies have been included in this research, all regarding teachers' attitude towards inclusive education. These studies were made by specialists from all over the world with the help of different research methods and instruments such as: case study, statistical

analysis, experiments, and questionnaire. The selection of the studies was based on the following eligibility criteria:

Purpose of the study: the keywords regarding the objectives of the studies used for the first step of the selection were: evaluation of teachers' attitude towards inclusive education, instruments used to this evaluation, identification of the implications of teachers' attitude towards inclusive education on teaching strategies, assessment of knowledge and practice of teachers regarding inclusion.

Research design: the selected studies were both quantitative research (experimental, correlational or descriptive) and qualitative research.

Teachers' training: the studies presented different aspects of teachers' initial or continuous training.

Participants' characteristics: in order to identify the most relevant studies for good practice examples, regarding the development of positive attitudes towards inclusive education, this analysis was focused on those which involved students who were preparing to become teachers and/or teachers with more or less experience in the educational system.

Educational context: due to the vast area of inclusive education concept, this research was focused on the studies that were implemented in specific educational context (situations when teachers work with children whit SEN or different ethnical background).

3. RESULTS

The majority of the studies from this selection were based on the idea that teachers should have a positive attitude towards inclusive education but unfortunately they didn't. There are several educational conditions which can influence this attitude both in a positive way and in a negative way. The subject is still a controversial and a challenging one because of the various implications on different levels: individual (teacher or/and child, parents), organisational (the necessary resources for the implementation of inclusive education principles), community (the relationship between school and community regarding an appropriate development of an inclusive educational system) and social (further social inclusion based on educational inclusion).

As shown in the table no.1, a simple search of these terms could mean thousand of results. This underlies the importance of this subject not only in the field of research but also in the educational practices area.

How is defined inclusive education in different educational systems? The research revealed that there is much confusion regarding the meaning and significance of this concept. Kalya, Gojkovic and Tsakiris think that inclusion is „*the organised placement of children with disabilities in mainstream classrooms*" [15]. There were also a number of 12 studies in which the definition of inclusion was likely the same and it was reflecting the confusion between inclusion and integration. Panerai, Zingale, Trubia, Finocchiaro, Zuccarello, Ferri and Elia defined inclusive education as a context in which „*all students in a school, regardless of their strengths or weaknesses in any area, became a part of the school community*" [19]. There were another 13 studies with likely the same definition of this concept but with variations from *equal opportunities for all* to *educational setting*.

Which are the factors which have an important role in the development of inclusive systems? Regarding teachers' preparedness for inclusive classrooms the studies revealed that there are many difficulties in applying the

principles of inclusive education as follows: lack of teachers' training (24 studies), learners with special educational needs need more attention but no enough time is available (12 studies), the lack of appropriate resources (16 studies), insufficient time for preparing the activities in order to valorise the characteristics and potential of every child (17 studies), the number of children in a class (15 studies), the experience with children with special educational needs (5 studies), parents attitudes towards school and their own children (2 studies), teachers' attitudes towards inclusive practices and their own work (27 studies) and the lack of support from the specialists in special educational needs field (15 studies).

Why it is necessary and worthwhile to implement the principles of inclusive education? The benefits of an inclusive policy and practice could be organized on the following levels: teachers' beliefs about their work and abilities to teach all children, the increase of children' learning performances, organisational changes in schools.

How it can be develop a teacher's positive attitude towards inclusion in order to improve learning performances of the children? Around the world there are many educational or research programmes aimed to develop a positive attitude towards inclusive education.

4. DISCUSSION

How is defined inclusive education in different educational systems? The selected studies revealed a demand of all educational systems which are preparing teachers for tomorrow: the initial or continuous training should make a bigger investment in knowledge of the right meanings of inclusion and integration. The teachers should know the differences between these two concepts and also they should know how to apply the principles of inclusive education in order to increase children' performances. All university study programmes should have a domain dedicated to this concept and practice in order to contribute in a valuable way to the development of an educational system which can be inclusive.

Which are the factors which have an important role in the development of inclusive systems? This research has identified a number of factors which can contribute to the development of the teacher's attitude towards inclusive education. These factors are not acting in a separate way, they are connected and each of them has its main role in facilitating the inclusive practices. We talked about the importance of knowing the right meaning of inclusion but it is also important to know how to apply the principles, how to make inclusion in school or in the classroom. The inclusive practice depends on how well is the teacher prepared to do this, on which resources are available, on how much time it is invested by the teacher in the preparation of the educational activities, on their experience with children with special educational needs and so on. This all means that inclusive practices will be efficient when all these conditions will be met. There is a need for changing in education practice but it has to be a revolutionary one in order to apply all the principles of inclusive education (individualized curriculum, the valorisation of the characteristics and potential of every child, equal opportunities for learning).

Why it is necessary and worthwhile to implement the principles of inclusive education? Regarding teachers' beliefs about their work and abilities to teach all children, there are studies focused on how one could reduce the expectations that can negatively affect the children' learning performances, how could be developed an attitude of acceptance of difference, how teachers could become more tolerant. There are also studies focused on teachers' ability to critically analyse their educational practice in order to detect and eliminate or reduce those factors which can act as barriers to inclusive education. One of the main conclusions of these studies is that the confidence of teachers in their teaching efficacy is very important in development of a positive attitude towards inclusive education.

An increase of children' learning performance is not an easy task but the first step in this process is represented by the acceptance of difference. There were studies

which demonstrated that teachers who worked in the spirit of inclusion felt that they could make a difference. Finally, the implications of inclusive education are seen to an organisational level: school culture, values and beliefs which have a major impact on teachers' values, beliefs, expectations, and relationships with the children and their parents. There is a need to have an organisational change in schools, a change that could enhance children' performances and their social inclusion.

How it can be develop a teacher's positive attitude towards inclusion in order to improve learning performances of the children? The studies revealed two main contexts in which teachers could develop a positive attitude towards inclusion in order to improve learning performances of the children. Firstly, even is not educationally prepared to make inclusion, the teacher is facing this need due to the diversity of the children. Secondly, the teacher could participate to educational programs of initial or continuous training in order to know what inclusion is, to know how to make inclusion and how to promote further the principles of inclusive education. There are universities which have study programs at bachelor level which promote those principles and teach the students to apply them. There are also programs of continuous training designated to the teachers who could chose to participate in order to understand and know good practice examples in inclusive education. The programs are aimed to develop those competences which are necessary to implement the principles of inclusive education: knowledge, abilities and attitudes towards this educational domain.

5. IMPLICATIONS FOR FURTHER RESEARCH

This research was aimed to identify the main and relevant studies which approached the teachers' attitude towards inclusive education. The conclusions of the analysed studies are underling the importance of several factors which could contribute to the development of positive attitudes towards inclusive education such as: knowing the right meaning of the concept, initial or continuous training in order to increase the confidence in their own competences, resources, time and tolerance to diversity.

In order to valorise the conclusions of this research it is important to recognise its limitations. Firstly, due to the large period of publication time it would be necessary to increase the number of studies included in this research. Secondly, the selected studies didn't use the same instruments of research and they didn't have the same training program in order to develop a positive attitude. Thirdly, the generalisation is not possible due to the fact that there are many factors to be considered: the age of the teachers, their experience in this field, their motivation or work satisfaction and so on.

REFERENCES USED TO THE META-ANALYSIS (SELECTION)

1. Ainscow, M., Booth, T., Dyson, A. *Understanding and developing inclusive practices in schools.* Available: http://www.bipsolutions.com/docstore/pdf/8215.pdf (November 2010).
2. Angelides, P., Stylainou, T., Gibbs, P. *Preparing teachers for inclusive education in Cyprus*. in Teaching and Teacher Education 23, p. 513-522 (2006).

3. Avramidis, E., Bayliss, P., Burden, R. *A survey into mainstream teachers' attitudes towards the inclusion of children with special educational needs in the ordinary school in one local education authority*. in Educational Psychology, vol. 20, no. 2, p. 191-212 (2000).
4. Bishop, M., Slevin, B. *Teachers' attitudes toward students with epilepsy: results of a survey of elementary and middle school teachers.* in Epilepsy and Behavior 5, p. 308-315 (2004).
5. Campbell, J., Gilmore, L. *Changing student teachers' attitudes towards disability and inclusion.* in Journal of Intellectual & Developmental Disability, vol. 28, no. 4, p. 369-379 (2003).
6. Chhabra, S., Srivastava, R., Srivastava, I. *Inclusive education in Botswana: the perception of school teachers*. in Journal of Disability Policy Studies, 20 (4), p. 219-228 (2010).
7. Cochran, H.K. *Differences in teachers' attitudes towards inclusive education as measured by Scale of Teachers' Attitudes Towards Inclusive classrooms (STATIC).* Available: http://www.eric.ed.gov/PDFS/ED426548.pdf (September, 2010).
8. Forlin, C., Tait, K., Carroll, A., Jobling, A. *Teacher education for diversity*. Available: http://www.iier.org.au/qjer/qjer15/forlin.html (November 2010).
9. Ghanizadeh, A., Bahredar, M.J., Moeini, S.R. *Knowledge and attitudes towards attention deficit hyperactivity disorder among elementary school teachers.* in Patient Education and Counselling, 63, p. 84-88 (2006).
10. Ghergut, A. *analysis of inclusive education in Romania. Results from a survey conducted among teachers*. in Procedia Social and Behavioral Sciences 5, p. 711-715 (2010).
11. Hay, J.F., Smit, J., Paulsen, M. *Teacher preparedness for inclusive education.* in South African Journal of Education, 21 (4) (2001).
12. Kalya, E., Gojkovic, D., Tsakiris, V. *Serbian teachers' attitudes towards inclusion*. in International Journal of Special Education vol. 22, no. 3, p. 30-35 (2007).
13. Lee, H. *Collaboration: a must for teachers in inclusive educational settings*. Available: http://successde.org/pdfs/088collaborationamustforteachers.pdf (September 2010).
14. Lee, S.A., Yim, S.B., Rho, Y.I., Chu, M., Park, G., Park, S.P., Jung, D.S. *Factors contributing to Korean teachers' attitudes toward students with epilepsy*. in Epilepsy and Bevavior 20, p. 378-381 (2011).
15. Loiacono, V., Valenti, V. *General education teachers need to be prepared to co-teach the increasing number of children with autism in inclusive settings.* in International Journal of Special Education, vol. 25, no. 3, p. 24-32 (2010).
16. Panerai, S., Zingale, M., Trubia, G., Finocchiaro, M., Zuccarello, R., Ferri, R., Elia, M. *Special education versus inclusive education: the role of the TEACCH program*. in J Autism Dev Disord, 39, p. 874-882 (2009).
17. Pijl, Y.J., Pijl, S.J., Van des Bos, P. *Teachers' motives for referring students to special education*. in Keith Ballard *Inclusive education: international voices on disability and justice*, London, Falmer Press, p. 10-27
18. Shehata, G.A., Mahran, D.G. *Knowledge, attitude and practice with respect to epilepsy among school teachers in Assiut city, Egypt*. in Epilepsy Research, 92, p. 191-200 (2010).
19. Symeonidou, S., Phtiaka, H. *Using teachers' prior knowledge, attitudes and beliefs to develop in-service teacher education courses for inclusion.* in Teaching and Teacher Education 2, p. 543-550 (2009).
20. Vrasmas, E., Vrasmas, T. *Inclusive education in Romania (1995-2007).* Available: http://www.ibe.unesco.org/fileadmin/user_upload/Inclusive_Education/Reports/sinaia_07/romania_inclusion_07.pdf (December 2010).

Panel 3 Socio-Economic anthropology: everyday issues

"HENRI COANDĂ"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPERS
AFASES 2012
Brașov, 24-26 May 2012

INTERACTION AND CONFLICT IN 2009 ROMANIAN PRESIDENTIAL ELECTIONS. WATCHING THE DEBATES

Andreea Elena Cârstea*

National School of Political Studies and Public Administration, Bucharest, Romania

Abstract

It has been argued that the electoral debates, created as another opportunity for assuring accurate and complete information to the voters and equal rights of expression and presentation of the platform to the candidates, are seen today as a mere directed spectacles. On the other hand the televisual studies have pointed out the fact that, beside the formal character of this type of confrontations, they have the merit of bringing together opposed candidates, incite discussions about political platforms and solutions between candidates and, more important, afterwards have different types of echoes into society.

A fundamental point in starting this research is the premise that mass-media in general and televised debates in particular have an important role in reconfiguring public space because they provoke a sort of dialogue between actors, between citizens and between citizens and different actors. Also, the analysis of the televised debates becomes extremely important for understanding the electoral climate, but also for investigating the more complex transformations in political communication under the pressure of commercialization, commodification and tabloidization of mass-media.

Keywords: *electoral debates, political communication, 2009 Romanian presidential campaign, television*

1. INTRODUCTION

This paper addresses the phenomenon of televised debates both as rituals happening in every campaign and as specific manifestations that relate to certain political and historical contexts.

Starting from the idea that electoral confrontations are in fact "mirrors" for the manner in which debates and arguments are carried in the public sphere, the purpose of the paper is to investigate the approaches the moderator and the political actors took in the confrontation and the frame imposed by the televisual resorts that transmitted the debate. I aim to investigate how much of the confrontation was devoted to presenting governing programs and solutions and how much was a reverberation of the conflicting atmosphere that characterized the entire campaign. In my analysis I focus both on the mediation realized by the television channel and on the content and development of the debates. The electoral debates, in my opinion, are staged spectacles that ensure visibility to the candidates and involve a double dimension of control. On the one hand the *setting* has control over the candidates, by imposing its context and rules to the candidates, and, on the other hand, the candidates control the *setting* by bringing their own deviations and diversions from the agreed themes and conducts.

2. POLITICAL COMMUNICATION AND TELEVISION

It has been argued that television changed the character of political communication more than any other mass-media channel. Through its combination of image and sound, television provoked an intensification of political communication and transformed it in something less controllable by the political actor.

Permitting a huge visibility for the political actor, the television produced a need for an increasing professionalization of political communication. As a result, there appeared a need for professionals of political communication, the so-called "spin-doctors", with the mission to "sell" the politician, to make him appear in a positive light, to make his imperfections appear as simply human and unimportant mistakes and to amplify his quality and education. The politician became the subject of a new kind of visibility [1,2,3] provoked by the fact that the information environment became "more intensive, more extensive and less controllable than it was in the past" [4]. As a result the political actor is more often the victim of different types of scandals (sexual and financial scandals, so-called "declaration scandals" or gaffes) [5] and the role of the "spin-doctors" is to prevent or solve this type of situations.

Discussions about the character of political journalism agree upon the fact that it changed in the past decades, mass-media – especially television – using more and more narrations and interpretations when talking politics. It has been said that "the media alter the message" and that political communication "is largely *mediated* communication, transmitted through the print and electronic media" [6]. A menace has been identified in this strong mediation because, by inducing phenomena like extreme commercialization through scandal and tabloid approaches to diverse subjects, mass-media encourage a so-called "spiral of cynicism" [7], which could be characterized as the negative tackling of all situations both by the mass-media and by the political actors. The political situations are increasingly presented in terms of conflict, and the political confrontations look more and more like small battles in a generalized war. These methods in political journalism "invite the attribution of cynical motives to political actors in campaigns and public policy debates". [8] The result is a weaknesses chain, in which "reporters and politicians justify their own cynical discourse by saying that it is required by the other". [9] A similar approach is conveyed by the theory of "video-malaise" [10], term that would designate the Americanization and commercialization of television. According to this interpretative model mass-media focuses on negative news and mediatizes excessively the back-stage games, which results in a negative perception of politics and political actors at the level of the public with consequences in political participation (namely absenteeism and stand-off of the citizens).

The discussion about this phenomenon is not unidirectional and there are voices to sustain that the commercialization of political journalism is not necessarily a bad thing, the most important being the fact that television shows attract spectators and develop a sort of civic competences among citizens. Pippa Norris asserts that "the news media have become diversified over the years, in terms of channels, availability, levels, and even the definition of news. This means that today information about public affairs (broadly defined) is reaching audiences over a wider range of societal levels and with more disparate interests. (…) A citizenry that is better informed and more highly educated, with higher cognitive skills and more sources of information, may well become increasingly critical of governing institutions. (…) But increasing criticism from citizens does not necessarily reduce civic engagement; indeed, it can have the contrary effect". [11] In other words, no matter the approach of political journalism and mass-media in general, the debate, the diversification of information sources and the free exchange of ideas and opinions are seen as fundaments of democracy.

3. THE CONTEXT OF 2009 DEBATES

The 2009 presidential elections from Romania were preceded by an electoral campaign with a strongly conflicting character which generated numerous controversies

regarding the utilized practices. On the whole, the discussions about political programs where quasi-inexistent while huge spaces were conferred to the conflict and misunderstandings which often degenerated in ad-hominem attacks between candidates. Another characteristic of the 2009 presidential campaign is related to the role assumed by the mass media, which in most cases seemed to ignore the necessity of impartiality while presenting the political actors and events.

The electoral campaign was violent and aggressive and was dominated by corruption accusations that the adversaries caught in the competition brought one another. The candidate Traian Băsescu (the president in function at the moment) introduced the theme of the so-called "moguls" in the equation, theme quickly assumed by other candidates (Crin Antonescu). Another characteristic of the campaign consisted in distracting attention from real governing programs and an excessive focalization on false problems or solutions, for example the referendum for unicameral parliament and the reduction of parliamentarians from 471 to 300 and the so-called solution "Johannis", the well-known mayor of Sibiu, which was Antonescu's proposal for prime-minister.

The conflicting atmosphere reached its climax between the two tours of the presidential elections, while in the electoral race remained only Traian Băsescu and Mircea Geoană, with the scandal provoked by the presentation on Realitatea TV (by Dinu Patriciu, one of the media "moguls" identified by Traian Băsescu) of a short film in which the candidate Traian Băsescu seems to hit a child during the electoral campaign from 2004 and with the disclosers made by Traian Băsescu during the last debate regarding Mircea Geoană's visit at Sorin Ovidiu Vântu, the owner of Realitatea-Cațavencu Group (also one of the media "moguls" identified by Traian Băsescu).

4. METHODOLOGY

The method utilized in this paper is an adaptation to televisual *setting* (*dispositif* in original, in French) analysis as formulated by P. Charaudeau and R. Ghiglione. This method addresses televised debate as "a change of words in front of the public". The public is seen in this *televisual setting* as "present-absent because of the interposed camera, which creates a second space that we will call *demonstration space*". The televised debate is seen as having two fundamental components: a verbal staging and a visual staging.

My analysis focuses on the verbal staging of the discourse and on some elements of visual staging considered essential for understanding the character of the debates. The purpose of this research is to investigate the conflicting character of the debate, to examine if the conflicting atmosphere that characterized the entire electoral campaign provoked reverberation at the level of the debates and to discuss the rapport between information and entertainment present in these debates.

The corpus of this study is composed by the three debates that took place before the two tours of 2009 presidential elections. The first debate took place on November 14, 2009 at Cluj between Crin Antonescu and Traian Băsescu (Mircea Geoană refused to participate) and was moderated by the journalist Mihnea Măruță. The second one took place on November 20, 2009, a few days before the first tour of the elections, at the Palace of Parliament, and had as protagonists the three candidates with most chances in winning the elections (according to the polls) and was moderated by the journalist Robert Turcescu.

The third debate took place on December 3, 2009, before the second round of elections, between the two winners of the first tour, Traian Băsescu and Mircea Geoană at the Palace of Parliament and was also moderated by Robert Turcescu. I've used in my research the transmissions of Realitatea TV and Antena3 (for reasons of audiences – see www.paginademedia.ro – and availability of resources).

5. INTERACTION AND CONFLICT IN 2009 ELECTORAL DEBATES
- Findings -

Each of the analyzed debates consisted in more sequences meant to bring into discussion aspects regarding the political programs, but also sequences intended to stimulate conflict and spectacle.

The debate in Cluj included as topics the de-politicization of the state structures, the state's reform, education, fiscal relaxation and agriculture, with an underlined focus on the topic education, which was supplemented by the moderator with two questions: one regarding the concrete case of a high school principal affected by the law of unique remuneration and one concerning the young Romanians exodus.

The next two debates, organized by the Public Policies Institute, proved to be more structured and followed a precise program with the rules more clearly announced by the moderator from the beginning of the debate.

The debate in November 20 involved six episodes. The first of them consisted in five minutes speeches of every candidate on the question: *Why I want to become president of Romania?* The second round contained confrontations one to one, while the third round, the longest from all, lasted more than an hour and consisted in a debate between the three candidates regarding nine subjects agreed by the organizers and the campaign staffs. The nine themes were: foreign policy, ethical crisis of the Romanian society, presidential model, the reform of the state, education, economic crisis, agriculture, health system, future government. The next two sequences contained questions from the journalists: first, a question extracted by casting lots for each candidate and the second the same question (of the moderator) for all candidates. At the end of the confrontation the candidates were given two minutes for convincing the electorate to vote for them.

The debate in December 3, organized after a similar pattern, consisted in 10 rounds. After the opening discourses of the candidates, each was asked to explain why he wouldn't vote for his counter-candidate. The third round involved a 15 minutes dialogue between the candidates regarding the relation between president and government and between president and parliament. The fourth and the sixth sequences consisted in a dialogue on the ten themes agreed by the organizers and the campaign staffs: foreign policy, national security, economy, finances and economic crisis, business environment, justice, constitutional reform, social protection, education and young people, health, rural development and agriculture. The fifth round consisted in two free questions of every candidate to his counter-candidate. The seventh episode included the journalists' questions. In the eighth round each of the two candidates was invited to give a gift to his political opponent. The ninth round consisted in the moderator's question for each of the candidates. Finally, the tenth round included the closing speeches of the candidates.

From the three analyzed debates, the one that was less intended (by the organizers) to create a media show seems to be the first debate. In this debate the conflicting charge was produced by the two candidates, who brought into discussion the controverted topics of the campaign and the image problems of the counter-candidates: connections with "moguls" and groups of interests, inactivity or lack of fulfilling one's duty and attitude towards women (as political actors or journalists).

In fact candidates acted during all debates like strategists and assumed as purpose to win as many little discursive "victories" as possible in the competitions. It can be said that the interactive part of the debate consisted mainly in attacks and counter-attacks between the candidates. The conflicting atmosphere was produced and amplified by the grave accusations of corruption and affiliation to different groups of interests, party jumping, incompetence and weakness, conflicting character

(as a source for *tension* and *scandal*), inactivity or authoritarianism that the candidates brought to their opponents and to their opponents' sustainers. Besides direct and explicit accusations introduced in all sequences of the debates, the competitors used soft allusions and insinuations, but also ironies and sarcastic remarks. Only a few examples from November 20 Debate (my translation): *too "great" diplomat* (TB about MG), *I only wanted to assure you that these people really live well!* (CA about members of TB group of sustainers), *But they* (the words) *were so few and so rich, I would have remembered, I wouldn't have read them*! (CA about MG reading the citation from John Golden-Mouthed, brought to him by Victor Ponta in the time of the debate), *Say all the numbers that you know, Mister Geoană!* (CA towards MG).

It must be pointed out that in all debates the candidates introduced into discussion – as a high controverted topic – the communist past as a manner of legitimizing their course of action, either by referring to the 2009 moment as the anniversary of 20 years from December 1989 Revolution, either by referring to the condemnation of communism (theme connected with candidate Traian Băsescu) or by mentioning connections with political actors perceived as belonging to the past.

The debates organized on November 20 and December 3 had a strong conflicting charge, because the approach introduced by the candidates during speeches and discussions on the agreed topics, but also because of the format of the debates. There can be identified episodes especially created to generate conflicting encounters between candidates. This is the signification of the second sequence in both debates.

Mister (name of the candidate), *before, but also during the electoral campaign, you or your supporters criticized repeatedly the way in which mister* (the name of the counter-candidate), *here present, or the party whose leader he is,* (name of the party), *considered or consider to develop their political activity or their administrative attributions. Express now and here the most important of these criticisms that you brought to mister* (name of the counter-candidate) *and to* (name of the party). (November, 20 Debate, my translation)

We are at the moment in which every candidate is asked to answer a question, attention!, apparently simple: Mister (name of the candidate), why wouldn't you vote for mister (name of the counter-candidate) to become president of Romania? (Debate from December, 3, my translation)

Particularly these last two debates stood under the sign of spectacular and entertainment. While the debate in Cluj included only one episode regarding the "human" behind the politician (the round where the candidates where asked to name the last book read and the last movie seen), the two debates organized in Bucharest included more *exercise-demonstration* episodes, more *test* sequences meant to reveal information about the political candidates' characters. For example, the task of naming the most beautiful deeds of their lives.

Honored candidates, you are political figures, but, before being political figures, you are simply and solely human beings like all of us. You've done over the years good deeds. You have confronted situations in which you maybe acted less correctly or even wrong, sometimes seriously wrong. About the dark side of your biography you gave sometimes explanations, you were asked to give explanations or you will be asked to give explanations. Please, in the order settled by casting lots, tell us this evening which is the most beautiful deed you believe you have ever done. (November, 20 Debate, my translation)

In the same area of entertainment should also be placed the questions about ethical models in the Romanian society, the oath on the Bible, the episode of giving and receiving gifts from the counter-candidate. The moment of the oath can be perceived as particularly tensional because it was related to the situations that represented the peak of conflict during the campaign: the film with Traian Băsescu hitting the child and the connections between Mircea Geoană and the so-called "moguls".

Additionally, the media resorts pointed out the conflicting potential of the events by using terms specific to war or sports vocabulary like *confrontation* (*The Big Confrontation* – Realitatea

TV, November 20; *The Big Confrontation Day* – Antena3, November 20), *duel* (*The Duel of the Candidates* – Realitatea TV, November 14), *combatants* or *rounds*.

Also, the television transmissions used mostly shoulder-shots and waist-shots when presenting the candidates, perspectives that give a personalization effect. In the conflicting moments the candidates were shown either in close-up shots (a perspective that produces an intimacy effect and permits to the audience to examine the facial expression of the speaker), either in semi-ensemble views that create the debate effect and shows how the disputing speakers interact.

6. CONCLUSIONS

In my opinion the conflicting charge of the debates was extremely high, partly because the candidates' attitudes towards opponents, competition and themes included in the debates, partly because of the format of the debates, especially of the sequences that permitted and encouraged the exchange of accusations between candidates.

The format of the debates and television transmissions imprinted the events the signification of confrontations similar to battles. Also, the themes brought into discussion by competitors regarded in general grave accusations like corruption and affiliation to different group of interests.

Concerning the character of the televisual *setting* of the debates, it can be noticed a certain phenomenon of commercialization of political communication. The candidates are increasingly becoming commercial resources, debates being perceived rather as extraordinary events with commercial potential than as informative resources.

Still it can't be denied the importance of such debates for the public. In spite of the conflicting atmosphere, the debates bring elements of political information and incite the dialogue on themes that matter for society. From this point of view the electoral debates remain essential exercises of interaction in the public sphere and provoke echoes at the level of public opinion.

REFERENCES

1. Thompson, J.B.,. *Media and Modernity*. Cambridge: Polity Press (1995).
2. *Idem*, „The New Visibility". *Theory, Culture & Society*. London, Thousand Oaks & New Delhi: Sage, 6 (2005), pp. 31-51.
3. T. Mathiesen uses the term *synopticon* to describe the present society (along with the term *panoptincon* proposed by M. Foucault) as a "viewer society" in which everybody sees everybody (the many see the few, but also the few see the many). Mathiesen, T.,. "The Viewer Society. Michel Foucault's 'Panopticon' Revisited". *Theoretical Criminology*. London, Thousand Oaks & New Delhi: Sage. 2 (1997), pp. 215-234.
4. Thompson, J.B.,. *The New Visibility*, pp. 48-49.
5. *Ibidem*, pp. 43-47.
6. McNair, B.,. *An Introduction to Political Communication*. London: Routledge (2003), p. 29.
7. Cappella, J. & Jamieson, K.H.,. *The Spiral of Cynicism*. New York: Oxford University Press (1997).
8. *Ibidem*, p. 37.
9. *Ibidem*, p. 237.
10. Robinson, M.J.,. "Public Affairs Television and the Growth of Political Malaise". *American Political Science Review*, 70 (1976), pp. 409-432.
11. Norris, P.,. *A Virtuous Circle. Political Communications in Postindustrial Societies*. Cambridge University Press (2003), pp. 318-319.
12. Charaudeau, P. & Ghiglione, R.,. *Talk Show-ul. Despre libertatea cuvântului ca mit*. Iași: Polirom (2005).

* Beneficiary of the „Doctoral Scholarships for a Sustainable Society" project co-financed by the European Union through the European Social Fund, Sectorial Operational Programme Human Resources and Development, 2007-2013.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

MAJOR CHANGES IN WOMEN HELD PSYCHOBEHAVIORAL

Lucian GHEORGHE *, Carmen Mariana NEAGU**

*Mechanical Industrial and Maritime Engineering Faculty , Ovidius University, Constanta, Romania,
** Police County Inspectorate of Constanta

Abstract:

Female crime is of much lower percentage, representing 10-15% of overall crime. The causes are, as in the other categories of criminals, always the same: biological, psychosocial and educational. By their natural constitution, women are much less present in violent crimes. In their case, there prevail deception offenses, offenses against public property or personal crimes of forgery and forgery, crimes against the norms of social life, perjury, slander and libelous accusations especially.

As Leaute noted, lower participation of women in crime is even more remarkable as in general population, the percentage of women is equal or almost equal to men. Obviously, these differences are due to the historical period of the individual, age, et cetera.

Papers must be prefaced by an abstract in English up to 250 words. The text will be written in 11pt high, Italic, justified, left-right alignment. A number of maximum 8 keywords will be written 12pt below the abstract. The words will be 11pt high, Italic, left alignment, separated by a comma.

Keywords: *detention, women, agresivity, behavior, personality*

1. INTRODUCTION

Lower percentage of women's participation in crime is not fixed, immutable, but rather variable. As far as women increasingly participate in economic, political, life is even more present in social life, just as it offers more opportunities to commit crimes, which lead to her participation in a larger extent at the crime. In terms of quality, differentiation is not very obvious, and there are cases of violent crimes: murder of her husband poisoning the child or physical aggression or biting with hard objects: axes, kitchen knives, firearms, etc..We conclude that women commit less crimes, which are represented mostly by women specific offenses (infanticide, prostitution).But there can be no fixed limit here. To the extent that women's concerns and activities increase there may occur multiply opportunities to commit crimes and other categories. By reference to the same issue it reveals a criminal approach of women to men to upcoming terrorist acts, robbery, hostage taking, participation in drug trafficking, economical and financial crimes accounting, and others. Studies of how women have circumvented the law showed that the delinquent come, especially from urban areas and have no more than secondary education, wich indicate a reduced capacity to negotiate and resolve crises. The study shows that Romanian women find a greater pleasure in killing husbands rather.

1. Psychosocial aspects of the prison environment

Incarceration shock, contact with the prison subculture have a great influence on the behavior of the prisoner, his safety feeling being seriously affected.This area's subculture

is made up of a system of norms and rules created and enforced by the prisoners to ensure their best possible living conditions according to their point of view. Out of the system's general rules there can be named, each prisoner has his problems, you can see notice a toughness against the weak, in each case, a minimum effort must be made, ideas of persecution, obsession on termination by other prisoners, convinced the belief and none trusts them and so on (Dumitrescu, 1991). Specific rules of the prison subculture have a negative feature to reductive actions performed on prisoners or to the real prison rules of the improvised prison and not them. They have the effect of inmate solidarity, creating intra-group cohesion detention and of course, they constitutes an important barrier to educational influences. But not all prisoners adhere to the legal system and risk to be despised, disapproved by others and kept on the periphery group. Some prisoners are subject to rules without any real sense of solidarity, preserving the secret of the domestic insubordination in order, to live a better life. In prison, inmates have a hierarchical authoritarian, rigid structure, and the position of each member depends on experience and specialty to crime, on the sentence's length and it's personality. In the first stage of detention, the new social conditions that have created within the first plan implies a narrowing of his consciousness, an excessive focus on the new environment unknown through direct experience and to which forms of behavior has not yet been developed. Watershed moments occur when the prisoner or detainee did not know which system to join that of the rules or that of integration in the new group or community. As may be noticed the phenomenon of "prisonisation" named Detention integration of by the American criminologist D. Clemer, 1940 (Community Prison) which often hinders the reeducate phenomenon (apud.T. Bogdan, 1973). The term is defined as "social" deviant culture of prisoners, the prisoner may adopt in periods of detention, other imprisons point of view on prison and the world in general, and often record distortions of reality due to physical isolation from society, lack of information, panic which establishes among prisoners and the "general syndrome of detention", which all seem to suffer (frames hostility, by extending to everyone outside the prison, sometimes for the family, as well T.Butoi 2006). According to a study by Brendan Meher and Ellen Stein - there is nothing surprising in this process because every man learns to behave according to what is most profitable and oldest inmates came in better position than the new ones teaching strategic advice in her/him favor/ disadvantage, punish or reward in it. From their point of view the world could share in free and imprisoned. Soon, subculture makes the prisoner form, not always explicitly, a new vision of their own people and create a "survival strategy", enough to take and share the inmates concept of prison about life and about society in general. Prisonisation means adopting a hostile attitude, open or concealed from prison staff, to the outside world and a concomitant increase loyalty to other inmates. So, the prisoner will try to join the informal group, although may not be seen well by prison staff. Stanton Wheeler (1968) points out that this phenomenon of prisonisation is only the first step in the development of the detainee prison population as in the second phase there can be observed the phenomenon deprisonisation. You can see that closer to release, the prisoners tend to release more of the prison subculture. (Apud.T.Butoi, 2006).

As far as the as in any other human group psychosocial aspect is concerned within prison there, appear interpersonal relationships heavily loaded socio-emotionally. Despite its relatively closed structure, this institution does not preclude human social relationship which develops within imprisoned as a result of a process of compensation or overcompensation to the specific relations of life in freedom. You can find relations of sympathy, antipathy, and various informal statuses: popular prisoners leaders, united, isolated and rejected. A specific feature group held in informal structure is the large number of rejections. An important rejection have those who committed crimes of robbery and murder. Prisoners Group is guided by some rules that are not only similar to those of leadership, but it happens to come in conflict or opposition to

them. It seems that there is really a treasure that prisoners transfer from generation to generation, a specific language used by prisoners to conceal their actions, intentions. The "friendships" and hostilities are on "life and death" and affect organizational climate and discipline. A special place is provided to who do not participate in social and emotional life of the group, they even delimit and often do not realize that.To avoid marginalization, educational factors give them their full attention. Very interesting is the fact that most isolates are considered more popular than they actually are, and the popular ones think otherwise about themselves.

2. Specific elements of the prisons of women and female identity in prison

Officially, prison administration seem to apply the same conditions of detention of women and men. Specifically there is no differential treatment practices applied to men and women. Certain deviations from this rule are due to the effect of their structure and to fewer number of women who are imprisoned than the number of man. Other irregularities are due and gender stereotypes, male or female, but in terms of their work, the differences are not obvious enough, although men have their specific activities - the mechanical work and building and while women work in tailoring and clothing, to decorate hats, curtains and other activities such as manufacture of packaging. During their stay in prison they are offered a training (or training in some cases) in areas such as sewing, cooking, accounting/office, hairdressers. During imprisonment, some held are saturated by frequent reports, sanctions and reprimands, and yet persevere in their attitude to face prison environment.Prison clothes (often tailor-made for men) is not used. Detainees are free to choose their own attire. Possession or carrying of objects that are symbols of femininity, such as jewelry, are prohibited in the prison environment, to prevent other contextual crimes. But detainees try at any price to keep them, preferring to leave the mess by lying. They say they are married in order to keep a ring on her finger, saying it has sentimental value, it is religiously invested and whose port is allowed by the Church. Other held manufacture wire earrings of black thread or use aluminum foil to make holes in coins for the same purpose, or used to wear chain mail curtain ring instead. All these things that women carry out their aesthetic rituals are use to release a picture of a valued note. May be at a certain time a personal lifestyle and a way to compensate for deprivation. There be can seen clearly without a prior analyzes the specific slang (even if some women do not haven't after spending several years in prison they take it) it's a tendency to look different from that it really is, constant frustration, irritability, self-centeredness.

3. Psychosocial consequences of imprisonment

Freedom is for human being, both male and female, minor or old, a fundamental need. This gives individuals a choice between alternatives, lifestyles, activities, whose satisfaction makes the formation, development and manifestation of balanced and harmonious personality. In a word, gives the individual the opportunity to "live" because freedom is the very life, the optimal parameters as each desires. It means not only survival. In ontogenesis, some persons may be deprived of liberty for a shorter or longer time. Effects of the limitation of freedom for normal development of personality, creates conditions

for the occurrence of mental disorders and psychosocial development. Imprisonment can profoundly affect individual lives and their social relationships, being the family (especially the husband or wife), collegial, or the relationship to the environment, thus influencing the whole personality and putting their mark on the whole behavior. A special form of restriction of liberty is the social reaction towards people who break the law at a time and therefore it the results sanction of deprivation of liberty in a place of detention. Deprivation of liberty through criminal serving a sentence in a prison hospice is a special and very complex situation. This does not mean total isolation of the offender and is not intended to produce physical, emotional, mental or spiritual suffering, but represents a constraint and a means of rehabilitation to prevention of committing new crimes. The aim is therefore to remove especially social danger and then and other kinds of danger (economic well-known as an inmate is maintained by the Ministry of Justice and that means each time an additional cost). In Romania deprivation system is based on common detention regime and labor rehabilitation of those who violated the law at a time.Imprisonment does not seek to dehumanize the detainees but the provide recovery and social reintegration. The current legislation, seeks to make the prison a qualitatively new institution where rehabilitation is the result of joint activity by the held or detained usefully submitted to educational actions upon them. The positive effect of these actions sometimes lead to probation. Prison administration is obliged to combine work with a wide range of educational, vocational qualifications to cultural activities of all kinds, they aim at preparing prisoners for their rapid reintegration in society. Add to this the criteria for separation of offenders by age, type of offense during the punishment, relapse status, responsiveness to rehabilitation work and of course by gender (women never sit together with men.) There may be special prisons for women or at least separate sections for them. Under current prison practice, the separation of prisoners on these criteria is the treatment of differentiation and individualization premises of the detention regime. Offender who are for the first time in prison could be considered psychologically traumatized. They enter into the covenant of prison already tense by the contact with judicial authorities, by the method of due process and especially the punishment received which is often considered too high in relation to the offense committed and hence under all sorts of frustrations. As long as the treatment of offenders, be it the highest reductive will be under age, the danger of contamination exists, especially since it is impracticable homogenization age criteria, hazard, level of culture, and while the practical teacher cannot spend 24 hours of 24 among the prisoners. To these we add other frustrating elements unique to the new environment. Prison has features which undermine the psychosocial integration of the primary prisoner or detainee. The first feature is related to the removal of external symbols of personality by wearing the uniform required that standardizes the way of life and stops specific interindividual differences in freedom. Restricting physical, mental and psychosocial environment is another specific characteristics prison, poor life relationship with profound implications on the ability of the individual to express their natural roles of significantly reducing the possibility of psychosocial interaction. Impersonal relations, controlled activity regime strictly monotonous daily schedule and psychosocial distance between prisoners and prison staff or is another series of particular life in a prison environment, often perceived as a touch of on his integrity by the primary inmate.

Ascertaining experimental aspects

The research was conducted on a group of 30 women held in Maximum Security Prison White Gate. This were aged between 20 and 50 years, most elementary studies (up to 10-11 classes, graduates of vocational schools, with various qualifications). For capturing significant difference index was used and a group of 30 women free to meet the same characteristics (level of culture,

age, etc..). Since no randomization method could be used due to the complexity of the selection criteria, subjects were carefully selected from geographical and social environment of the author. This means that they were acquaintances of the author, but it did not have any family or friends. The main criterion for selection was to free women not to have been held ever and especially not to have been recently released from prison, which would have invalidated the results. Also, the complexity of selection derives from the fact that free women would have to have a balanced lifestyle without mental illness, family abuse, trauma or other problems that would have contributedto invalidate them. Research p rototype image need normal free woman, to be compared with that of the prisoners.

H 1: It is alleged that detainees have external control of actions compared to the free

Testing the hypothesis

To demonstrate the hypothesis 1, was used to locate control Rotter scale. This was applied in the normal, two samples of women: free and held. Since thedistribution is asymmetrical form, were used for the statistical comparison ofindependent samples n onparametric method that is sample median. Home index: standard deviation plot of 30 women held the locus of control variable is 5.33 and average of 10.6 (see Figure1). Standard deviation of 30 women free group is 1.71 and average of 5.6 (see Figure 2). According to Table 1, is calculated and the median.

		WOMEN STATUS	
		held	free
membership motivaton	> Median	4	22
	<= Median	26	8
complexity	> Median	8	21
	<= Median	22	9
meta knowledge	> Median	9	21
	<= Median	21	9
interaction	> Median	5	23
	<= Median	25	7
abstract	> Median	4	22
	<= Median	26	8
external causal	> Median	4	22
	<= Median	26	8
causal past	> Median	6	22
	<= Median	24	8

Table 1 - Calculation of the median statistic, Fletcher scale on the sample ofwomen owned, fre e respectively.

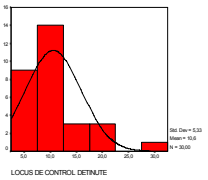


Figure nr.1
Asymmetric distribution of the variable locus control, the sample of women held

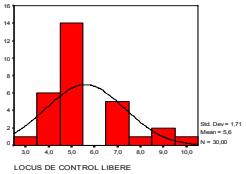


Figure nr.2
Asymmetric distribution of the variable locus control, the sample of women free

Tabel nr.2 - Statistical calculation of the median, the variable locus of control, the two samples

		WOMEN STATUS	
		held	**free**
locus of control control	> Median	21	4
	<= Median	9	26

Verify the hypothesis

Taking into account above may pass the verification stage of the hypothesisissued. In Table 3 to specific elements inherent in any statistical calculation of the samplemedian number of subjects, median, etc., is the coefficient of statistical,differencefor independent samples comparison, the asymmetric distribution, which in this case the threshold of significance is p .000, a highly statistically significant p <0.01 (see figure 3)

Tabel nr.3 - Coefficient calculating statistical difference with the sample median, the twosamples of women

		LOCUS OF
Nr.subjects		60
Median		7,0000
Chi-square		19,817
df		1
Asymp.		,000
Yates' Continuity	Chi-square	17,554
	df	1
	Asymp.	,000

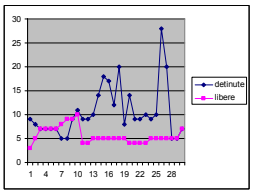


Figure nr.3
Total scores distribution chart variable locus of control on the two samples.

Totals are printed vertically Locus of Control Scale Rotter and horizontally displaysthe number of subjects. On the chart, the blue line represents the values of women prisoners at this scale, and the pink line represents values obtained from women neprivate lot of freedom. Total score of women prisoners, was always higher, of course, with its variations. Starting from the value 10, it exceeds 25, while themaximum score is 29.

H 2: It is assumed that there are significant differences between women prisonersand free the complexity of the award

After applying the scale of complexity of the Fletcher award two free samples of30 women, respectively held, were visibly asymmetric distributions obtained in most contructelor considered. Raw scores obtained on this scale in the twosamples is at Annex 1. Few normal distribution (see figure below) were obtained,usually unilateral, only one sample, in which were used for demonstration andnonparametric tests this time. The case for independent samples was applied tothe median test (see Table 5).

Indices Index - The following figures appear as indices of home mediaseparately for each sample, standard deviation and number of subjects tested.The asymmetric distributions, and median întotdeaua calculated (see Table 5)

Annex nr.1 - Raw scores to scale the complexity of assigning sample held

Tabel nr.4

1	2	3	4	5	6	7
5	5	5	5	5	5	7
2	2	2	2	2	2	3
2	2	2	2	2	2	2
5	5	5	5	5	5	5
6	5	6	6	6	6	6
9	9	9	9	9	9	9
7	7	7	7	7	7	7
3	3	3	3	3	3	3
5	5	5	5	5	5	5
5	5	5	5	5	5	5
6	6	6	6	6	6	6
6	6	6	6	6	6	6
3	3	3	3	3	3	3
5	5	5	5	5	5	5
4	4	4	4	4	4	4
3	3	3	3	3	3	3
5	5	5	5	5	5	5
5	5	5	5	5	5	5
7	7	7	7	7	7	7
8	8	8	8	8	8	8
6	6	6	6	6	6	6
6	6	6	6	6	6	6

3	3	3	3	3	3	3
4	4	4	4	4	4	4
3	3	3	3	3	3	3
4	4	4	7	4	4	7
4	4	4	4	4	4	4
4	4	4	4	4	4	4
4	4	4	4	4	4	4
4	4	4	4	4	4	6

Horizontal values are indicated for each variable construct.Pe number of subjects
tested appear vertical. Raw scores to scale the complexity of assigning a freesample of women.

Tabel nr.4A

12	12	12	12	12	12	12
9	9	9	12	12	9	12
7	9	8	8	12	9	12
7	5	5	7	7	7	12
5	5	5	9	5	5	6
5	5	5	5	5	5	5
3	5	4	5	5	5	5
7	7	7	7	7	7	7
8	9	12	12	12	9	9
12	11	11	11	11	11	11
11	11	11	11	11	11	11
10	10	10	10	10	10	10
5	5	5	5	5	5	5
1	1	1	1	1	1	1
3	3	3	3	3	3	3
5	5	5	5	5	5	5
5	5	5	5	5	5	5
8	8	8	8	8	8	8
9	9	9	9	9	9	9
9	9	9	9	9	9	9
9	9	9	9	9	9	9
9	9	9	9	9	9	9
9	9	9	9	9	9	9
12	12	12	12	12	12	12
12	12	12	12	12	12	12
12	12	12	12	12	12	12

11	11	11	11	11	11	11
11	11	11	11	11	11	11
12	12	12	12	12	12	12
12	10	10	10	10	10	10

Horizontal values are indicated for each construct variable.
Appear vertical number of subjects tested.

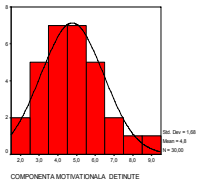


Figure nr. 4

Symmetrical distribution of variable motivational, the sample of women held

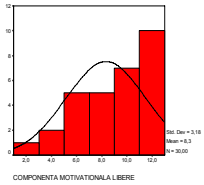


Figure nr.5

Asymetric distribution of variable motivation, the sample of free women

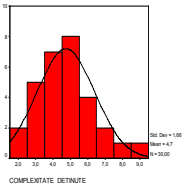


Figure nr.6

Symmetrical distribution of variable complexity, the sample of women held

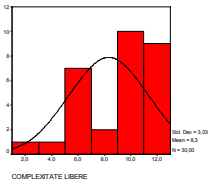
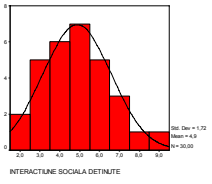


Figure nr.7

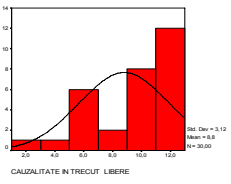
Asymetric distribution of variable complexity, the sample of free women

Figura nr.8



Symmetrical distribution of variable meta knowledge, the sample of women held

Figura.nr.9



Asymetric distribution of variable meta knowledge , the sample of free women

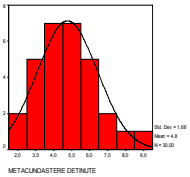


Figura nr.10

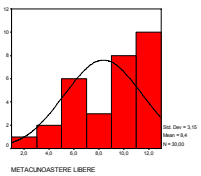


Figura nr.11

Symmetrical distribution of variable social interaction, the sample of women held

Asymetric distribution of variable social interaction, the sample of free women

Tabel nr.5 - Statistical calculation of the median on the scale Fletcher held that free sample ofwomen

		Componenta motivat	Complexitate	Metacunoastere	Interacțiune	Abstract	Cauzalitate externă	Cauzalitate în trecut
Nr.sub		**60**	**60**	**60**	**60**	**60**	**60**	**60**
Media		**6,0000**	**5,0000**	**5,5000**	**6,000**	**6,000**	**6,0000**	**6,0000**
Chi-		**21,991**	**11,279**	**9,600**	**21,69**	**21,99**	**21,991**	**17,143**
df		**1**	**1**	**1**	**1**	**1**	**1**	**1**
Asymp. Sig.		**,000**	**,001**	**,003**	**,005**	**,000**	**,000**	**,000**
Yates' Contin	**Chi-pătr**	**19,615**	**9,611**	**8,067**	**19,353**	**19,615**	**19,615**	**15,067**
	df	**1**	**1**	**1**	**1**	**1**	**1**	**1**
	Asymp. Sig.	**,001**	**,002**	**,004**	**,203**	**,000**	**,000**	**,000**

		women status	
		hold	**free**
omponent motivati	> median	4	22
	<= median	26	8
complexity	> median	8	21
	<= median	22	9
meta knowldgw	> median	9	21
	<= median	21	9
interactive	> median	5	23
	<= median	25	7
abstract	> median	4	22
	<= median	26	8
external causality.	> median	4	22
	<= median	26	8
causal past.	> median	6	22
	<= median	24	8

Tabel nr.6

Statistical difference coefficient calculation as ymmetric distributions, the samplemedian

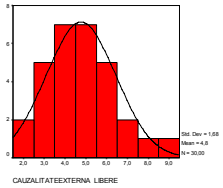


Figura nr.12
Symmetrical distribution of variable social interaction,

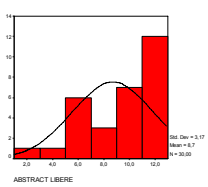


Figura nr.13
Asymetric distribution of variable social interaction,

the sample of women held

the sample of free women

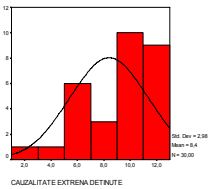


Figura nr.14
Symmetrical distribution of variable external causal, the sample of women held

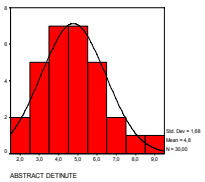


Figura nr.15
Asymetric distribution of variable esternal causal, the sample of free women

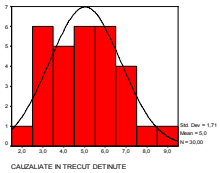


Figura nr.16
Symmetrical distribution of variable social interaction, the sample of women held

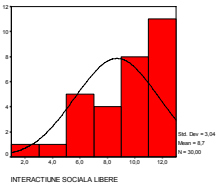


Figura nr.17
Asymetric distribution of variable social interaction, the sample of free women

Verify the hypothesis

Observing Table 5, coefficients can be found statistical difference between the two samples measured at contructele Fletcher Scal e, complexity award. At all testconstructs resul ted significant differences, but with different w eights. Strongdifferences (at p de.000, you can significantly at p <0.01) were significant v ariablesobtained: abstract, external causal and causal in the
past. Significant differences,but with smaller weights were
obtained from contructele motivaţonală compo nentof sig .001, significant at p <0.02 significa nt complexity to a p 0.02 p <0.05
and pmetacunoaştere with the .004 significant at p <0.05.
Construct have not been statistically significant
difference is social interactionwith the .203 p

Conclusions and recommendations

Prison space is by definition a closed, dichotomous space, with its property to divide people into two sections: on side and on the other side of the bars. It is a force field that is

determined by the influence of teaching tactics and the resistance of detainees. Adapting to this environment is very difficult task, mainly due to the hardships placed on the detained. But life is more difficult for women prisoners. Women prisoners are more aggressive than women who are not deprived of their liberty. The study showed that there are differences defavouring women prisoners, except where they construct social interaction achieving a statistically significant difference coefficient. This shows that women prisoners are not too interested in the events and complex things in life, learning and explaining their one behavior and that of others. Referring to the control location there can be said that women prisoners have largely external control of behavior and actions, unlike the free ones that have a largely internal control. Woman held is more dependent on external environmental changes, focuses more on external events and places her gravity center and meaning of life on the outside world. According to this research, prison environment does not eliminate or blur the background to their aggressive manifestations that have been punished, but amplifies them. There for living conditions and treatment to prevent relapse and improve behavior, with little chance of worsening mental or behavioral deterioration. It should not be ignored that even if she committed an offense or several then held is still a human being and society is obliged to rehabilitate her. After it was sanctioned by law, no one is able to give any other verdict on her previous acts and behavior and must therefore try to change something. Researcher in psychology has the task of providing qualitative and quantitative information on these issues to improve the situation of women prisoners. Data provide clues that are meant, in this case, to remove prejudices, stereotypes and false ideas that have emerged around these issues and provide a true picture of life of women in prison. This study is valuable as long as performance conditions are recognized. A total of 30 people on a sample is small, but sufficient in terms of statistical research at this level. Taking into account the inherent limitations, once the objectives are achieved and hypothesis are confirmed in present conditions the validity and utility of the study may be recognized.

Bibliography

1. Butoi, Tudorel,Treaty university judicial p sychology, theory and practice, Phobos, Bucharest, 2003
2. Gheorghe, Lucian, Legal psychology, Lecture notes

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

THE STRONG HISTORY AND PROBLEMATIC FUTURE OF INTERGENERATIONAL EVERYDAY RELATIONS IN ROMANIA

Dragos Lucian IVAN

The National School of Political Studies and Public Administration Bucharest
Beneficiary of the „Doctoral Scholarships for a Sustainable Society" project, co-financed by the European Union through the European Social Fund, Sectoral Operational Programme Human Resources and Development, 2007-2013

Abstract: *So what is happening to the European Union? A lot of people have asked this question, but very few asked it about Romania. Romania, just like the EU is under tremendous pressure. It is registering changing trends with powerful effects, such as demographic change which is widening rapidly. The real sting behind demographic change resides in the elements that have led to it and which ensure future similar trends. The largely unnoticed extension of the new intergenerational relationships in Romania has brought their own contribution to demographic evolution. The above discussion it is not just about demographics, but, it is crucially a social inquiry on "meta-demographics" or who gets to make the rules within which demographic transition takes place. We consider pertinent historical examples and clear qualitative and quantitative data related to Inter-generational relationships and the way they have been coupled for long periods of time and the way in which have been uncoupled presently. The ramifications created by inter-generational relationships cannot be identified or equated in that perfect way, but we can capture realities that prove their importance in social cohesion, economic development, community networking, value transmission and dominant system meaning. Different social forces and interests are rearticulated with the change of inter-generational relationships in Romania. On what conditions does it depend? Inter-generational relations reflect and sustain the general consensus while also manufacture consent. Extensive empirical work has been conducted to demonstrate the adequacy to explain this theory and to develop this insight.*

Keywords: *demography, intergenerational, relationships, Romania, Europe,*

1. INTRODUCTION

Our purpose in this research paper is to tease out some of the broader issues which lie behind this apparently simple question of "What did you ever do for me?" We believe this question encapsulates the existence of intergenerational relationships, represented by the relations between the members of such relationships and the relationship between the welfare state and the person that should benefit from social protection. By identifying the nature of the expectations and presuppositions which have constructed such social relations we may understand the way in which they function. More particularly, our concern is to show that there was a difference between the way in which social protection was envisaged and the way in which it functions today. Expectations "have begun to shatter" [1] (Brie,Horga, 2010:153-171) Naturally the area of interest is the European continent. We consider that the current situation in

Europe presents a great interest and we believe that through the existence of the EU it was "built the first economical region of the world. An economical edifice raised gradually, with a purely pragmatic attitude in mind, so much so that its allure grew in time" [2] (Dobrescu, 2008: 122).

A common misunderstanding is to see Europe only from the purely economic point of view. That is why both advantages and problems of EU received a great of interest from the economic point of view. Solutions and risks are evaluated in accordance with the economic aspect leaving aside other complementary perspectives. We are experiencing change within the greater context of globalization. We believe that the statement that globalization is a process "through which the center, the West, America displays dominance upon the periphery, seeing that modernity wins in face of tradition, experiencing the victory of capitalism" [3] (Ciocea, 2009: 41) captures the move of periphery countries towards the western model. In this case we believe a good comparison is between the model of the welfare state, the modern response for social risks and intergenerational relationships, seen as the traditional way of preventing social risks. We believe the two should be complementary in handling such a complex situation.

The sort of assumptions that are being made around this topic affects the structure of our society. The European Commission acknowledged in 2009 within the Ageing report that public expenditure will increase as the population will experience a process of ageing. This increase in expenditure was meant to provide social security for the population. The European Commission anticipated a constant increase of about 1.5% out of total GDP per year. In this conditions the current pension system the PAYG is under threat. The European Commision anticipated that till the year 2060 the number of people dependant or needing social assistance due to age will considerably outnumber the number of people active that are paying the necessary taxes so as to support the dependant population.

Due to demographic transition Romania will have to invest a lot of its funds into social systems. Not having at its disposal such important funds it will have to turn to the possibility of borrowing money. Under these conditions the European Commission anticipates that the public debt will amount to 633.8 % in 2060. Again these figures are valid as long as the traditional welfare state approach is used. We wish to point out the possibility of using an intergenerational relationships approach to such problems. This huge debt would be totally different from the debt estimated in 2010, around 22%. It is easy to notice that even in 2012 the debt has seriously increased. This brings further confirmation to the European Commission's estimation from 2010.

Some demographic trends will help clear the situation and exactly understand the current context. In 2008 the population pyramid had some definite alarming signs. The number of children between the ages of 0 and 5 years represented only 45% out of the active population. The active population is also called the population peak and represents the number of persons active within a society at a moment in time. In order for it to be replenished it needs a higher percent of children between 0 and 5 years. The percent of approximately 45% was well under the replenishment value. From the gender point of view, the number of young female was significantly lower than the number of young male. This means that in order for the population to grow, it needed at least 2 children per family, but this is highly improbable in a culturally different society as Romania today. The possibility of families having at least 2 children decreases even more when considering the current economic crisis. Currently the median age in Romania is approximately around 37 years, but prognosis by the European Commission forecasts a median age of 53 in the year 2050. This makes PAYG (Pay as you go) pension system, currently used in Romania impossible to sustain.

In the table bellow it is obvious that the amount investment in social security in Romania is well under the median figure in Europe and well bellow some of the other countries recently added to the European Union. The acknowledged need in social spending did not find appreciation in Romania due to several broader economic, political reasons. It is highly doubtful that Romania will have soon the financial ability to provide social protection at the level of Romania did not experience population loss before the 1990's. Partially for this we believe is the social security system made out of intergenerational relationships. Such relationships compensated for the lack of direct intervention from the state. In time we notice that although Romania stopped being part of the communist states and headed towards the construction of a modern European state, the percent of GDP invested in social protection remained at a low level,

Year	1991	1995	1998	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
COUNTRY													
Romania		2.4	2.6	4.2	4.1	4.1	3.5	3.2	3.4	3.3	3.7	3.8	4.4
Hungary		5.8	5.2	4.9	4.8	5.4	5.7	5.4	5.6	5.6	4.9	4.9	5
Czeck Republic		5.9	5.8	5.7	6	6.2	6.4	7.3	7.2	7.2	7.1	7.2	8
Bulgaria			2.9	3.6	2.5	5.3	5.9	5.2	5.4	4	4.1	4.5	4.4
Greece		3.8	3.9	3.9	4.6	4.5	4.7	4.7	4.9	5.3	5.4	5.6	6
Latvia		3.4	4.1	3.9	3.2	3.7	3.4	3.5	4.3	4.9	4.3	4.6	4.7
Spain		5.3	5.2	5.2	5.1	5.2	5.2	5.5	5.7	5.7	5.7	6.1	6.7
Denmark	6.7	6.5	6.4	6.6	6.8	7	7.1	7.1	7.2	7.3	7.5	7.8	8.8
Germany	5.8	6.3	6.1	6.2	6.3	6.4	6.5	6.1	6.2	6.2	6.1	6.3	6.9
United Kingdom	5.3	5.5	5.4	5.7	5.9	6.2	6.3	6.7	6.9	7.1	7.1	7.5	8.5
Finland	6.7	6.2	5.8	5.7	5.9	6.2	6.5	6.6	6.9	6.9	6.6	7	8
Portugal		5.4	6	6.2	6.5	6.5	6.7	7	7.2	6.7	6.6	6.3	7.1
Slovakia		5.1	5.4	5.2	4.9	5.1	6.5	4.7	4.8	5.8	6.4	6.9	7.8
Austria		7.7	8.3	8.2	6.9	7.1	7.4	7.3	7.4	7.5	7.6	7.7	8.2
EU - 15		6.1	6.1	6.1	6.2	6.3	6.5	6.6	6.7	6.6	6.8	6.8	
EU - 27						6.2	6.4	6.5	6.6	6.6	6.6	6.8	

Figure 1 – Dynamics of public Expenditure for social protection as percentage of GDP during 1991-2009

2. OBJECTIVE

From the start we notice the fact that Romania even in comparison with other ex-communist countries relied very little on social protection from the state. Although the state provided little social security

from 1909 when van Genep, an anthropologist noticed and started investigating the results of intergenerational relationships. Each age come with a certain set of duties and started at a certain moment in time. Currently statistics has used us to use age as a determinant for old age, but from qualitative studies we find out another way of determining who is of an old age and who is not. The term of pyramid population [4] (Hagestad, 2001) best represents intergenerational relationships but from a front view perspective and a bottom up perspective.

I shall specify at first why is important to study intergenerational relationships. According to our research, sustained by other scientific opinions the current demographic trends and globalization has brought in sight issued regarding the efficiency and effectiveness of public spending on social protection. Next, we shall consider the rapid process of demographic ageing, especially in Romania and the increasing number of older people that need support, this in turn represent public spending in a welfare state. Romania, as a EU state should have and apparently is trying to construct a welfare state, but it is very difficult to realize this goal while demographic change is actually taking place. Such rapid and dynamic shifts in demographics lead to the lack of a economic and social base for any welfare state type reforms. More important, perhaps is the apparent absence of a public system, mature enough to handle such difficult demographic problems and the existing pressure on families to boost family spending on children and elderly, while their own financial stability is not what is could be. We believe that intergenerational relationships represent a solution in this dynamic time. We believe that this type of relationships presupposes care provided for relatives and that such a relationship presents itself as a resource of a concrete economic value. In Romania the demographic transition is very dynamic. In just 2 years Romania has moved from a stage in which the number of active members surpassed that of dependant population to a stage in which the number of dependant population is net superior to that of the working active and contributor type population. The percentage of persons over 65 has doubled in just a decade, reaching 15% out of the total number of inhabitants. As a comparison we would like to mention the case of France. In the case of France it took around 100 years for the population to reach such a percent. A similar percentage of a population over 65 can be found in Japan, which also experienced a rapid ageing process, in just 26 years. We have chosen to present other countries as examples to demonstrate that ageing is in fact an universal process that does not occur dependant on a specific culture. Although it is not culturally or regional dependant, the way in which the social risks involved by it are solved can be of a vital importance for the existence of a community.

A change in the demographic trends naturally leads in changes in intergenerational relationships. For example, the life expectancy has increase, especially in the last hundred years. Nowadays it is not uncommon for more than three generations to have contact and influence each other. Prolong life expectancy means also that people of a certain age will need social support and economic help for longer periods of time, especially when they do not benefit from special support from a welfare type state. It also means that the ratio of people active, the working force will be shrinking in comparison with those that need pension support or are no longer active in the work environment.

3. Material and Methods

Our analysis on intergenerational relationship used both qualitative and quantitative research methods. Quantitative data was used from EUROSTAT, the World Bank, The National Romanian Institute of Statistics with own calculations. We wished to supplement the quantitative information and included a qualitative research conducted in 2011, based on face-to-face in-depth interviews. There were conducted a

number of 40 interviews, 20 were females and 20 were males with persons that were over sixty years old. They were from lower, medium and higher occupational areas, al of them with grandchildren. The project participants were freely selected and the interviews were conducted in public places with their consent. The median age of the participant was 62, the variation of age being between 58 and 65. All of the respondents reside in the city of Bucharest, half of them being the first generation living in Bucharest. They have provided consent.

Despite the fact that intergenerational relationships have not received a lot of attention from the part of the scientific community it has been proven that people's interest in intergenerational relationship is very high [5] (Hank, 2007).

How on chooses to assess the impact of intergenerational relationships depends on the perspective from which one views this sensitive issue. There can be little doubt that this type of relations need to be viewed as more than just an isolated social phenomenon. It's centrality to social cohesion, economic development, community network, value transmission should play an important role in underpinning it in a contemporary analysis of current social developments and social risks. Nevertheless, the centrality premises mentioned by us just before have been mostly rejected or left aside. The reasons for this have principally concerned the over attention paid to economic developments, social aspects being considered a result of the economic and political developments or as autonomous phenomena. Our purpose is not to change from the ground up the entire foundation of looking at our society, but to refuse to confer to current analysis an economic consecration of the rationality of reality. Thus, we believe that by adopting a purely unique economic view on reality we deprive scientific research by any means of connecting to social reality, thus being unable to understand how it functions and being unable to change it.

The concept of intergenerational relationships carries with it the implication of complexity. Although it has its relative autonomy, with some distinctive properties it has to be viewed as a social instrument with a high degree of complexity. There is little doubt that the life course is no matter the research formulation embedded with vulnerabilities. It means that it proves influential for both micro and macro level that these vulnerabilities are contained or held in check. Nevertheless, this social reality was castigated as being a problem of the state, thus the emphasize was on the welfare state, or as being a problem of the micro, the family, thus being formed a serious of powerful cultural and social interpersonal relationships bases on a cultural model. The second solution was encapsulated in the phrase "intra household cooperation" [6] (Bird, 2007). Before surveying these developments, the mention that the beginning and the end of the life course present a particular problem due to the limited capacity of the individual to produce or care for oneself. Pruchno transported some of this type of perceiving intergenerational relationships in his work. He paid little attention to this type of social relation into his general theory Indeed, it seems that the dynamics of grandparent-grandchildren [7] (Robertson, 1996) offered little significance as its most pertinent effect or result was emotional support, at least in the eyes of this research mentioned

researcher. The establishment of an achieved linked between intergenerational relationships and identity came with Kornhaber. Identity, was secured through intergenerational practices [8] (Kornhaber, 1996). We have to mention that his statements were in direct connection with certain conditions that had to be fulfilled. We can think of few pertinent statements around the intergenerational relationships between child-parent-grandparent. Most of the time the focus is on a dual type relationship in which the third element is excluded not being taken into consideration. We acknowledge that the presence of a third element or even a forth element representing another generation could add difficulty in understanding the relation, but omitting it can lead to misinterpretation. By limiting research to only dual partnerships of two generations it is present the danger of leaving out important elements that are the result of interactions or even over or under estimate the importance of one generation. Another limit to the research undertaken till now was the limit of scope. Most research conducted in view of intergenerational relationships was from only point of view, it lacked the perspective of all of those involved. The research was focused on the point of view of grandparents, parents or seldom children. At the present time, the research also lacks a historic perspective. Seldom was the case when the researcher has taken into consideration the reach and power in time of the intergenerational relationships. This gives new urgency to the need of putting together more accurate and close to reality research in this field. As we shall see, interaction [9] (Baranowski, 1982) between more than two generations or even third generations due to the increase in longevity is paramount in understanding this complex social mechanism.

There are numerous instances that represent potential social risks that could be resolved in a type of intergenerational relationship. As we noted earlier we believe that currently there are numerous social risks that need to be properly managed. In an attempt to get around this dangerous societies have encouraged two models: that of the welfare state or that of intergenerational relationships. Most of the time, one was the most visible, while the other worked alongside the first, as a sort of support. Although such interventions may not prevent all together and in all cases the social risk they do prevent some of the inherent problems. This somewhat bold assertion is supported by current trends in the social life. As supported of the importance of intergenerational relationships we can not help but notice a series of changes in the social order. Conducted qualitative studies have managed to capture the first reasons that make intergenerational relationships important even in our contemporary context. There are a number of problems that have appeared with the new economic mentality. The idea of the classic family, with only one parent working and the other taking care of the family has become unrealistic. The rather general nature of families of having both parents working has led to a tendency for them not to have enough time for children or for intimate household time. It is difficult to offer emotional support and care while having to work in a competitive economic environment. At the same time we notice a deterioration in the traditional structure of the family. This is achieved through a higher number of families that experience divorce and a lot of single parent type families. Since transport and travel have become a lot easier to manage we experience migration at a higher degree than before. Migration operates in most cases with one of the parents working abroad, the parent remaining at home being in the situation of supporting himself or herself the entire family. Hence, while accepting the need for financial support through migration, families also accept the need for support in taking care of the family. In this situation the existence of intergenerational relationships present a positive alternative, especially for a country with lithe social protection for these cases, such as Romania. Analysis has revealed tensions within split families. In seeking to establish or to provide financial

stability, people often put in danger social cohesion and social stability. In seeking to establish economic stability through economic activities both abroad and within the same country we suggest the necessity of placing intergenerational practices in the correct context. The focus on the social structure of the family in today's context does raise certain problems. We would like to bring another element that suggest the need for practical intergenerational relationships. So far we have underlined the divorce rate, the one parent working abroad context, both parents working abroad, long working hours for the parents and we wish to consider also the possible low raising children skills of some parents. Furthermore, the demographic development plays also an important role in intergenerational relations while the numbers active population is decreasing, while the number of inactive from the point of view of economic production is increasing. The connection between all of these elements is a systemic one. We believe all of these social variables operate at the level of overlapping and coinciding social structures. The existence of intergenerational relationships, especially in Romania, has been taken for granted. It becomes apparent that this system is breaking down, without being replaced in time with a welfare state system. Intergenerational relationships have served unconsciously and perhaps even unwittingly as support for social cohesion, preventing social risks. What cannot be doubted is the profound revolution in these practices.

Interest and discourse of the value brought about by intergenerational relationships has come from a variety of reasons. Concern with the emotional support represented by intergenerational relationships is something most mentioned in qualitative research. It suggested that the general atmosphere of our society, in Romania, was that of a peculiar emotionally repressive one, an important concern being that for the need of emotional support, under all of its forms, especially from the part of those of an older age. They tended to be concerned with the overall problem of lacking the means and context for socialization. When questions related to emotional supported were directed towards the young generation it reflected also pessimism around both capacity and occasion to socialize or meet new person or of emotional support. Emotional support was a vital issue and early intergenerational relationships were able to provide a solution. This was achieved through frequent contact, serving one another, conversational patterns, conversation within the family and recreational outings represented by either active participation through games, network activities such as involving other people or passive participation. Similar perceptions regarding emotional closeness were displayed at the different generations represented in the study. An interesting fact arose out of the research. The satisfaction obtained out of doing something for somebody. In this case all generations present felt as if they were demonstrating their own instrumental capabilities through instrumental assistance and showed emotional support. The great value of doing something for somebody is clearly a stabilizing element in such relationships. Through this action we observed the aspect consent. Gaining satisfaction out of doing something for somebody represses the notions of power and dominance and put in their place the notion of consent. In this case

dominance that is often used in depicting the difference between active working people and those that are called dependant is taken out of the analysis in the presence of intergenerational relationships. By taking into consideration intergenerational relationships it is difficult to label people at an early age or those at an late age as dependant population. This way of looking at population is most of the time from the economic point of view and leads to misinterpretations. We agree that there are certain economic ties that link and future the relationship independent as in producer and dependant as in consumer, but it should be viewed from other points of view, not only an economic one. We believe this is a vital issue, one that needs a critical revision. For the weaker position given to older or younger persons is a result of the inability of explaining their role. The great value of an intergenerational approach is that includes these elements.

During the qualitative study it has been reveled another interesting fact. It has always been a problem defining old age. In terms of age studies have generally taken into consideration that old age comes with one's retirement. As a result of the interviews the respondents considered that old age comes with the moment in which they start taking care of their grandchildren. It seems that retirement is a very emotional moment in a person's life. Most of the time the respondents agreed that along with retirement they experienced the feeling of being out of place without a purpose. Such a situation is very difficult for somebody. The respondents living in an urban environment did not have the option of taking care of a garden or getting engage with agricultural activities. Keeping strong ties with their family was among the top priorities and getting involved in raising grandchildren was of paramount importance. On the other hand the respondents agreed that it was important for them to retire so as to make room for the younger generation. This is a very interesting fact, because till now we have discusses intergenerational relationships at the level of the family, but it seems that they transcend the family level and find direct application through a cultural model in the economic market. This natural succession although difficult for those that leave the active region of the economy is seen as something needed and beneficial. In a way the respondents see it as a sacrifice of their own, making room for the others, but taking on other roles in the family. We believe that this sort of thinking benefits grandchildren because they could enter into contact with the experience of their grandfathers and this in turn will help them because a young person is looking to break free from routine tasks that are time and energy consuming and to dedicate himself to creative professional activites [10] (Guranda,2011 :93).

Respondents recognize their need to continue contributing in a way for society, even if it is as the level of the family. At the same time the expectations towards the state are high. Indeed people would like to see a greater involvement in social protection, but expect very little to happen. It is a general disillusion with both the willingness and with the capacity of the Romanian state to provide the care and social security that they feel they deserve and need.

From the perspective of expectations, very few respondents considered that the state is able to provide the necessary social support that a family needed. It seems that intergenerational relationships are the base for their social security. Off course, the majority of the respondents were satisfied that they live in proximity to their grandchildren and acknowledged the danger of moving further from their relatives. It seems that the frequency of contact was directly linked with geographic proximity. The majority of respondents although admit that they started to feel old of age as soon as they had grandchildren, although this happened before retirement they did not renounce their job before retirement just to help with the raising of the grandchildren. It seems that job security is a top priority, considering that they can provide financial aid or at least not become an economic burden for the family.

The contours of this argument have to start with a look at each of the two systems used to cope with social difficulties. We would define the intergenerational relationship system through the context that encourages its existence. The contribution of intergenerational relationships to the emergency of social risks is evident in a country like Romania. If this process worked it was because the wide range of interests and variety of competing needs of the family where confronted by the unavailability of public institutions. Intergenerational relationships were the bedrock of the family structure. They were constantly under check and were meant to limit the social risks to which the family was naturally exposed. None of the members gained a position of dependence preponderance in relation to the others. The members of the family lived close. The grandparents took care of the children, thus allowing the young to work and financially sustain the family. The grandparents also functioned as a sort of social capital base for the grandchildren, often enough coming together into gathering where both them and the children socialized. The two generations came together and provided financial and time release for the young core of the family. The young core of the family did not have to worry about the children or their grandparents and were able to pursue other economic problems. Grandparents being vested with the responsibility for the children led to the removal of the constrain pose by family to the young core. These social realignments had marked consequences for the way in which family was viewed. Grandparents took care of the children while the young took care of their parents. The financial burden was mostly centered on potential health care issues that surpass the possibility of the grandparents, while education was the primary target for investment in the case of the children. "The old taking care of the youngest and the young taking care of the old" [11] (Silverstein and Bengston, 1997) best captures this reality. This type of structured functioned and was needed due to the lack of proper trustworthy public institutions, an existent active culturally defined model of values and aspirations and a powerful emotional aspect involved in the closeness between the members of the family. We would like to admit the existence of dependence between the members of the family. Grandchildren were dependant on the grandparents for time, care and social capital, parents were dependant on grandparents for help in raising and forming a family and most importantly saving part of the money so as to be able to create an endowment for their children, while the grandparents were dependant on parents for economic help sometimes and on grandchildren for emotional relief. The intergenerational relationships were strong, having at their base emotional, economic and social interests and needs.

Country/ Year	1991	1999	2000	2005	2008	2009
Romania		56	75	124	249	238
Czech Republic		322	342	706	1027	1046
Bulgaria		48	61	160	210	200
Hungary		224	244	494	515	465
Slovakia		193	213	346	824	905

Table 2 : The Dynamics of public expenditures for social security per capita 1991-2009

4. RESULTS AND DISCUSSIONS

The clash and diversity of the relationships within generations contained within the free and open circulation of emotions, cultural patterns, economic interests and ideas, thereby enabling them to play the role of a social cohesion and development system. Its participants were constantly reminded of their dependency on the other, but at the same time relieved from social pressures and risks such as health care, care giving, solidarity, social security and social capital. It was noticeable that a concern with what happens with and in between the members of the family was an extremely important issue. The interests of the family as a micro social entity were secured by virtue of the clash and discordancy of interests that existed between the members.

The welfare system currently being developed in Romania in place of this, however, is not yet so convincing. Its version seems to cut down to size the intergenerational workings, to trim it down so as to enable it to fit the observed welfare state in other cases. Although apprehensive with regard to the system proposed we do not oppose these developments so much as merely point to their consequences and to the safeguards that would be needed to be taken against them. Be believe in a welfare state, but it should not be constructed on social division between generations, but on these innate social characteristics.

In the table above we wished to compare the level of expenditure on a person just with the neighboring countries that share a similar history with Romania. We notice that the values are still at somewhat great distances apart. The only country with values closer to the values found in Romania is found in Bulgaria, but this in the context in which the problems in Romania have been viewed in international research, press and policy think tanks as graver than in Bulgaria.

We believe in the statement "In the general context of the economic downturn, internal problems of the European Union have generated a constant decrease of trust and enthusiasm towards the European project, especially in the new member states." [12] (Corbu, Botan, Bargaoanu, Negrea,2011) and we think a poor handling of social risks and social security may in time lead to a powerful distrust in the system propose by the European Union.

5. Conclusions

Clearly this is a very different approach to the changing demographics of Romania and of the EU. Currently the social crisis has been started to be viewed as of equal importance to the economic crisis, but little attention has been given to the intergenerational potential. Rather than being regarded as a natural way of coping with the demographic crisis that unleashes social risks and perils for economic development it was been seen as merely another issue of not so great importance. Intergenerational relationships can become a sort of social vehicle through which both the social and the economic sphere can gain a significant balance. Some social risks can be contained through the existence of these relationships. How one chooses to assess the current social and economic context depends on the perspective from which one views it. For there it can be little doubt that in fact we are dealing with a demographic change that has a powerful impact upon the evolution of our society. Although the centrality accorded to the economic problems that plague our society has played an important part in understanding our society it also played a negative part in undermining the importance of other natural and social mechanism that existed before the welfare state to cope with such social risks. The reason for rejecting of any other variables than the economic variable is that the foundation of today's society has been built on economic reaction and causality. The social thus became passive, even negative in its function. By adopting a social position of transcendence in relation to our contemporary problems we might be able to find solutions that are in fact natural social mechanisms that allow us

a contact with reality. The potential consequences of leaving aside the social mechanisms that guide most of our lives could and in fact are serious. Without the social aspect and only adopting a purely economic perspective upon social risks we remain above the matter without being able to penetrate into it, without comprehending it. We do not wish merely counterposing social means with economic means, but wish to attract attention upon the existence of other ways that can bring their own contribution.

Our current reality has started to be castigated as a bad reality, but it is not irremediable. We agree with the author "When we debate Europe, we are accustomed to debate the big issues (and most probably those regarded as traditional): trans-Atlantic relations, the diplomatic relations with Russia, China and with Asia as a whole. In other words, we debate the links with the major players. Less attention is directed towards the future tendency, the reality of tomorrow which will certainly become more important; a tendency that will most likely become permanent and will exercise a powerful influence that can't be measured today." [13] (Dobrescu, Viclenia Globalizarii: 268). We agree that "It is natural to emphasize the fact that social change nowadays is dramatic in its amplitude, rhythm, and complexity" [14] (Coposescu, 2009) and wish to investigate further these topics of interest.

Acknowledgements

Beneficiary of the „Doctoral Scholarships for a Sustainable Society" project, co-financed by the European Union through the European Social Fund, Sectoral Operational Programme Human Resources and Development, 2007-2013; assistant professor PhDc, The *National School of Political Studies* and Public Administration of Bucharest.

REFERENCES

1. Baranowski, M.D., *The grandfather-grandchild relationship: meaning and Exchange*, Family Perspective, 24(3), 201-215 (1990). See reference [9].
2. Brie, Mircea, Ioana Horga, *Europe: A Cultural Border, or a Geo-cultural Archipelago*, Eurolimes, vol. 9 The Cultural Frontiers of Europe, Oradea University Press (2010). See reference [1]
3. Ciocea, M., *Securitatea culturală. Dilema identităŃii in lumea globală*, Ed. Tritonic, Bucuresti (2009). See refence [3].
4. Coposescu, S., *Defining Identity in the context of Globalization*, Bulletin of the Transilvania University of Braşov • Vol. 2 (51) - 2009 Series VII: Social Sciences and Law. See reference [14].
5. Corbu, Nicoleta, Botan, Madalina, Bargaoanu, Alina, Negrea, Elena, *Framing European Issues in Romanian Media*, International Conference The New World of Public Opinion Research, World Association of Public Opinion Research, Amsterdam, Olanda (2011). See reference [12]
6. Dobrescu, P., *Viclenia Globalizarii – Asaltul asupra puterii americane,* Institutul European , *The European Institute (2010).* See reference [13]

7. Dobrescu, P., *Geopolitica*, Editura Comunicare.ro, Bucuresti, 2008. See reference [2].
8. European Commission, *Sustainability Report 2009- European Economy 9|2009, Luxembur*g, Office for Official Publications of the European Communities (2009).
9. Guranda, Mihaela, Draghici Cosmins-Oana, The Characteristics of Decision Making Process in Adoslecents Career, Review of the Air Force Academy, "Henry Coanda" Air Force Academy Printed House, November 2011, Brasov, pp. 93-97. See reference [10].
10. Hagestad, G. O., *Adult intergenerational relationships*, In Gender and Generation Programme: Exploring Future Research and Data Collection Options. New York and Geneva: UNECE and United Nations Population Fund, pp 125-143 (2001). See reference [4]
11. Hank, Karsten, *Proximity and contacts between older parents and their children: A European comparison, Journal of Marriage and Family*, 69: 157–173, (2007). See reference [5].
12. Kornhaber, A., *Contemporary grandparenting*. Thousand Oaks, CA: Sage (1996). See reference [8].
13. Pruchno, R., *Grandparents in American Society: Review of recent literature*. National Institute on Aging (1995).
14. Roberto, K.A., & Skogland, R.R. (1996). *Interactions with grandparents and greatgrandparents: A comparison of activities, influences, and relationships*, International Journal of Aging and Human Development, 43(2), 107-117.
15. Robertson, J. F., *Grandparenting in an era of rapid change*. In R. Blieszner & V. H. Bedford (Eds.), Aging and the family: Theory and research (pp. 243-260). Westport, CT: Praeger (1996).
16. Smith, P.K., *Grandparenthood*. In M.H. Bornstein (Ed.), Handbook of parenting.Vol. 3: Status and social conditions of parenting. Mahwah, NJ: Lawrence Erlbaum (1995).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

NETWORKING ON A BIGGER SCALE

Romulus OPRICA[1]

National School for Political and Administrative Studies

Abstract:*LinkedIn started in the-living room of Reid Hoffman 10 years ago, was officially launched in May 5th 2003 and today operates the world largest professional network on the internet with more than 161 million members in over 200 countries and territories, with a rate of subscription of 2 new members per second. Twitter, the online microblogging social network was founded in 2006 in San Francisco and today is numbering more than 140 million members and is generating over 340 millions tweets per day. LinkedIn and Twitter are linked together so that users (members) can share their thoughts, ideas, information in both networks into the same time.*

The explanations of such a powerful bust can be founded into the theory of networks – subject of an explosion of interest over the past decade, the theory of networks offered explanation for a wide range of phenomenon from psychology to economics.

Into this paper we offer a short explanation on why networks such LinkedIn or instruments like Twitter and Blogs are so powerful into the day-to-day managers life, by analysing them in the frame of networking theories.

KeyWords: *Social-capital, networks, online-networks, trust, success.*

1. INTRODUCTION

Even that most of managers have not studied theories about networking they are all experiencing into the everyday life the power of networking (Burt, Ronald S. 1995, Uzzi, B, and Dunlap, S, 2005). Clubs, business clubs, country clubs – there are all meant to link managers from a wide variety of fields.

The explosion of online social networks has considerable potential for enhancing the way people connect with each other, the root of social capital.

Aware or not, people are using online networks like Facebook or LinkedIn as instruments for maximizing their social capital. Social networks are not about IT, programming, technology or media; they are social construct, social phenomena of this years. Maybe one of the most important ways through which online social networks are shaping today's sociology of business is that it is facilitating the accumulation of social capital, which is 'the ability of actors to secure benefits by virtue of membership in social networks' (Portes, 1998, p. 6).

As individuals, managers have to ways of success in business: through human capital and through social capital.

Human capital, which includes talent,

[1] Ph.D. candidate, Sociology, Scoala Nationala de Studii Politice si Administrative, Bucuresti

intellect, charisma, and formal authority, is necessary for success but often beyond our direct control. Social capital, on the other hand, derives from our relationships. Putnam defines social capital as the collective value of all social networks and the inclinations that arise from these networks to do things for each other (Putnam, 1993).

Individuals with greater social capital close more deals, are better respected, and get higher-ranking jobs. Online social networks offer access to social capital, empowering those who are well connected with private information, diverse skill sets, and others' energy and attention.

Recent studies even suggest that the creation of social capital through the Internet principally benefits those already privileged (Zinnbauer 2007). An interesting case it is offered by two very spread and appreciated online social networks among managers: Twitter and LinkedIn, as will further describe.

2. BRIEF NETWORKING THEORIES

Both sociologists and economists are recognising the dependency between social capital and wealth (Grootaert, 1998, Putnam, 193, Robinson, 1999, Zak and Knack, 2001) which means that a rich social capital of a manager can attract a faster development of his/her personal career and/or company.

Studies about social capital, respectively social network as part of social capital, have been developed since the beginning of the 19th century, if we consider Comte or Durkheim, but it is Moreno (Moreno, 1934) who pin-pointed a way of making this abstract tangible.

As the connection between social capital / networking and wealth is no longer questioned, studying the networking behaviour of managers is one hot topic, as there is a new question to answer due the (recent) economic challenges: how to raise the wealth through social capital?

Some studies conducted on managers (employed) are showing that the vast majority are succeeding neither to develop nor to successfully utilise their own social (Ibarra and Hunter, 2007).

Those doing it (developing and successfully using the social network) are those that have rationalised (Parsons, 1951) the necessity of networking (Blau, 1972).

One of the studies conducted on managers (Ibarra and Hunter, 2007) revealed that social networks (that are generating trust – as in social capital) are working as a economic lubricant generating lower transactional costs, new ways of collaborating and business opportunities – prosperity, in general (Fukuyama, 1996), those (the managers) are failing in making a sustainable effort in order to "establish or reproducing social networks that are going to be used on long term" (Bourdieu, 1985).

Ibarra and Hunter identify 3 types of social networks that managers can have:

- Operational
- Personal
- Strategic

For all the managers, the operational networks represents daily routine, this type of network being the most present one's manager social capital. This particular type of network has a clearly defined role: getting the business tasks completed.

The "operational" networks are the one helping the manager to easily manage the daily routine from his/her company, the "personal" network is enhancing the personal potential, but the "strategic" network is the one "enlightening" one's future to new potential directions and strategies both for her/his company and her/his personal development.

What Ibarra and Hunter stated is that through the daily tasks that may take way more than 8 hours per day, managers are most likely to fail on developing their network outside the company in which they work.

If all the managers have a similar schedule, and they have, then it may look pretty obvious why they don't go out to network outside their own "operational" network. Yet, if one wants to have access to a better and more valuable information good both for business and for self, she/he must go out networking!

The same rule of the "weak ties" that Granovetter (Granovetter, 1973) developed to explain how people find a job applies to managers when came to perform better, solve a task faster, evolve in career, and so on.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

As in Granovetter's research the close family members and friends prove to be not too valuable in finding a job, the same happened into a company if you try to solve a sensitive or big task just using the internal connections (the operational network). The persons to whom you are in close connection will usually possess the same sets of information and skills as the one you have (people known also as the "strong ties") while the persons to whom one have less frequently contacts and are (generally) from totally different backgrounds ("the weak ties") possess newer and various information.

A "personal network", as seen by Ibarra and Hunter, is made up of professional associations, alumni, clubs (as in non-professional associations or free time associations) and other personal interest communities. Through the personal networks managers can get new perspectives and evolve in their career. Even that, most of the managers studied fail answering the question: "why should I use precious time in activities so less related to my usual job/tasks?". Most of them questioned themselves "why should I lose valuable time and get involved in occasional activities while I don't have time even for urgent ones?" (Ibarra, 2007)

The answer stays in the power of the network system (Uzzi and Dunlap, 2005). Networks seem to deliver three unique advantages: private information, access to diverse skill sets and power. Even if managers can see these advantages working into theirs every-day life, they usually don't realize how network regulate them.

When taking a decision we are using two different type of information: public and private. As public information is at a click away from everyone – meaning that it is easily available from various sources – it gives, precisely because of its easiness to get character, significantly less competitive advantages in today's "battlefields" than the private information.

Private information, instead, is offered by a select source: personal contacts. Personal contacts can offer him/her truly valuable and unique information that cannot be found from public sources. So, it is private information the one offering managers (people in general) a competitive advantage into the competition with others.

Knowing this facts about information and knowing also that usually newer and different information are held by the contacts that are not in ours near circle of connections (Granovetter, 1973) it is clear why managers (as well as every other persons) should spend "precious time" networking.

Private information is, in the same time, more subjective than the public information because it is not verified, validated by an independent party. This means that the value of private information is in close connection with the amount of trust existing in the network of relationship. (Uzzi and Dunlap, 2005) Trust allow partners to concentrate on getting tasks done because it acts as a "screening-off device in relation to the risk and dangers in the surrounding settings of action and interaction", a sort of "protective cocoon". (Giddens, 1991) Trust it is not in information itself or into the technology that it delivers it, but it is into the individual that is delivering it. (Fukuyama, 1996, Sztompka, 1999)

Networks give access to the other connections set of skills. The expertise is

nowadays more and more specialized in almost all domains, so it is most likely that one's set of skills will be, at a certain point, limited. Success is close to be granted to those having the ability to transcend this limitation through others. This advantage offered by a network is in fact an exceptionally valuable resource.

Power is huge advantage offered by a correct developed network. While in the past the management use to be vertically organize – from top management to bottom – nowadays it is wider and wider meet the horizontal management, given the fact that organization are rather flatter than pyramidal. A strongly clustered network is less valuable than a network made up from a wide range of clusters, due the strong relation between the individuals (Ilut, 1997). When an individual is linked in a limited or, extremely, only one cluster, he/she is in fact into an "operational network" in Ibarra's perspective or a "family network" in Granovetter's perspective.

Personal networks are usually developed outside the company/organization and are formed by preferential connections with individuals with whom are sharing a common value. As a result, a personal network is a strong network because it can offer references.

According to the "Six Degree of Separation" principle (Milgram, 1967) everyone's contacts are as valuable as it can help him/her to reach an individual outside his/her network in as less possible steps. So, executives focusing mostly on outside the operational networks are acting wisely.

Developing a strategic network it takes far more time and effort than grooving the personal network; while the operational network is mainly predefined. An individual developing his strategic network gets to accept his dependence from others and search to enlarge his personal influence to.

A skilled networker will utilise a strategic network like leverage: it uses one/more connection(s) from inside the network to get individuals from outside the network to do what he need or want; they will use the connections from one side of the network to get information, support and resources from another part of the network. Even more, skilled networkers will use strategic networks not just to control the environment, but to transform it according to his/her personals vision. It involves a big amount of generating trust and a great capacity of crossing through a big number of clustered networks (Blau, 1972, Grootaert, 1998, Putnam, 1993, Zak, 2001).

3. ONLINE NETWORKING

Researchers have recently underline the importance of Internet-based linkages for the formation of weak ties (Granovetter, 1973), which serve as the foundation of bridging social capital (Putnam, 1993). Online relationships are supported by technologies like distribution lists, photo directories, and search capabilities (Vieweg, 2008), so it is possible that new forms of social capital and relationship building will occur in online social network sites.

Such a social network is LinkedIn, a project that started in 2010 and today operates the world largest professional network on the internet with more than 161 million members in over 200 countries and territories, with a rate of subscription of 2 new members per second. (Fig. 1)

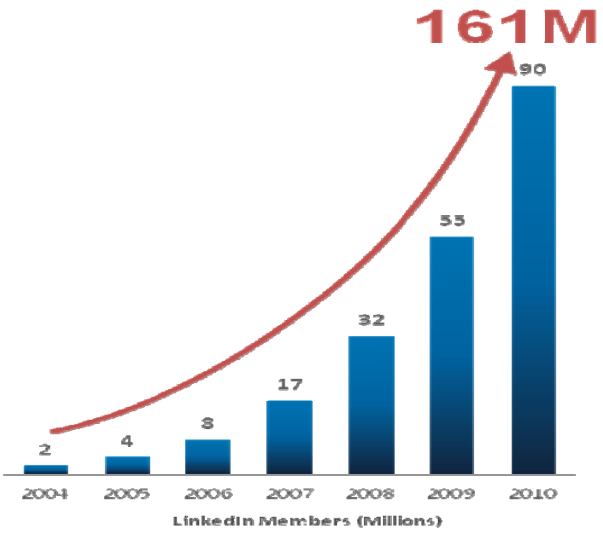


Fig. 1. LinkedIn growth graphic.

LinkedIn is fully applying all the theories of networking doing a sustained work on enlarging users (online) social capital by highlighting connections, offering detailed information about their social network such as

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

degree of separation from one potential connection, offering statistics about how many times ones appeared in searches and even offering suggestions for how to enlarge their social networks.

By creating a smart and easy to use application they facilitate LinkedIn users to visualize how their LinkedIn network looks like, in term of cluster distribution (Fig. 2):

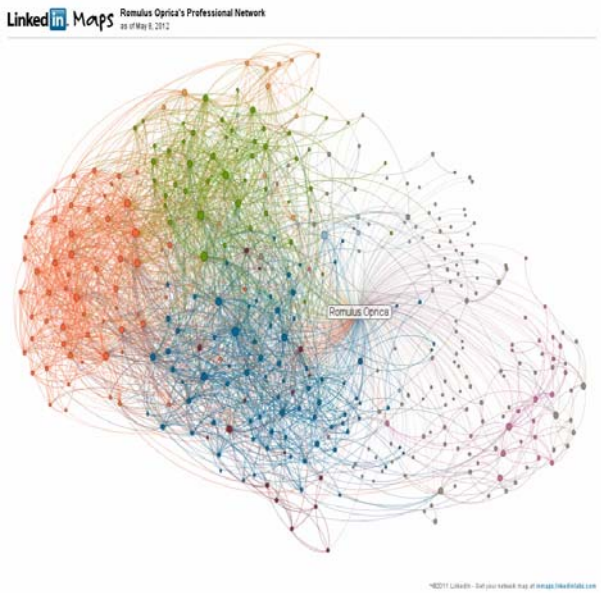


Fig. 2. Cluster distribution of a LinkedIn user.

The LinkedIn cluster network is different by the "traditional" cluster network (Ilut, 1997) due the fact that are composed by loose ties. Even so, LinkedIn show users different colours on the network map and is suggesting users to enlarge area that are weaker represented in the map.

Unlike Facebook, which focuses on friends networks and generating strong ties, LinkedIn focuses on people that are emotionally distant and it is generating bridging and linking connections (Woolcook 1998), which can provide access to wide informational support (Granovetter 1982).

Bridging and linking social capital can eliminate poorness from communities (Szreter & Woolcook 2004), being strong social empowerment instruments (Woolcook 2001).

Studies are suggesting that the development of social capital into the online principally benefits those already privileged (Zinnbauer 2007), which may be the case of Twitter – the bigger social capital one's have, the bigger the chances are to have more followers.

Twitter is an online microblogging social network that was founded in 2006 in San Francisco and today is numbering more than 140 million members and is generating over 340 millions tweets per day. LinkedIn and Twitter are linked together so that users (members) can share their thoughts, ideas, information in both networks into the same time.

4. CONCLUSIONS

Operational networks, personal networks and strategic networks do not exclude each other. Individuals can and they may use their personal hobbies, regardless if these are chess or fishing, in order to meet other individuals from as many as possible different backgrounds.

It might be that none of the individuals one will meet with a certain occasion will not activate into the same area, but information they will share will be even more valuable this way. (Granovetter, 1973, Uzzi, 2005)

The added value of networking is that through networks individuals are covering their own structural holes (Burt, 1995) which offer them competitive advantages.

Competitive advantages, by increasing the bridging social capital, might be offered by online social network like LinkedIn and Twitter which allow users generate and maintain larger network of connections (weak ties) from which they can get resources. (Sunnafrank, 1986).

Bibliography

1. Blau, P., Dialectical sociology: Comments" Sociological Inquiry, 1972
2. Bourdieu; Pierre (1985) The social space and the genesis of groups. Social Science Information
3. Burt, Ronald S. 1995. Structural Holes: The Social Structure of Competition. Harvard University Press
4. Fukuyama, F. (1996) Trust: The Social Virtues and the Creation of Prosperity, Touchstone Books.
5. Giddens, A. (1991). Modernity and Self Identity; Polity Press, Cambridge 1991
6. Granovetter, M.: *The strength of weak ties.* In: *The American Journal of Sociology*, 78 (6), 1973, p. 1360-1380.
7. Grootaert, C: *Social Capital: The Missing Link,* The World Bank, Social Development Department Publications, W. D.C., 1998
8. Ibarra, Herminia; Hunter, Mark: How leaders creates and use networks; Harvard Business Review; January 2007
9. Iluţ, P.: *Abordarea calitativa a socioumanului*. Iaşi. Polirom, 1997.
10. Milgram, S *Psychology Today*, 2, 60 (1967)
11. Moreno J. L., *Who Shall Survive?* (Washington, DC: Nervous and Mental Disease Publishing Company, 1934).
12. Parsons, T, The Social System, Routledge, 1951
13. Palen Leysia, Sarah Vieweg, the emergence of online wide scale interaction in unexpected events: assistance, alliance & retreat, Proceedings of the ACM 2008 conference on Computer supported cooperative work, November 2008, San Diego, CA, USA
14. PORTES, A. (1998) 'Social Capital: Its origins and applications in modern sociology', *Annual Review of Sociology,* Vol. 24, pp. 1-25.
15. Putnam, R, D, with Leonardi, Robert, and Nanetti, Rafaella, Y. (1993) *Making Democracy Work. Civic Traditions in Modern Italy.* Princeton University Press.
16. Sunnafrank M, Predicted outcome value during initial interactions: A reformulation of uncertainty reduction theory, (1986), Journal of Human Communication Research, 13. pp 3-33.
17. Sztompka, P. (1999) Trust: A Sociological Theory. Cambridge University Press.
18. Uzzi, B, and Dunlap, S, (2005), How to Build Your Network, Harvard Business Review, 2005
19. SZRETER, S. and WOOLCOOK. M. (2004) 'Health by Association? Social capital, social theory, and the political economy of public health', *International Journal of Epidemiology,* Vol. 33, pp. 650-667.
20. Zak, P. J., and Knack, S. (2001) Trust and growth. Economic Journal,111: 295-321.
21. ZINNBAUER, D. (2007) *What can Social Capital and ICT do for Inclusion?,* Institute for Prospective Technological Studies. Seville: European Commission Joint Research Centre.
22. WOOLCOOK, M. (1998) 'Social Capital and Economic Development: Towards a theoretical synthesis and policy framework', *Theory and Society,* Vol. 27, pp 151-208.
23. WOOLCOOK, M. (2001) 'The Place of Social Capital in Understanding Social and Economic Outcomes', *ISUMA, Canadian Journal of Policy Research,* Vol. 2.

Beneficiary of the „Doctoral Scholarships for a Sustainable Society" project , project co-financed by the European Union through the European Social Fund, Sectoral Operational Programme Human Resources and Development 2007-2013

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

ROLE OF THE ANTHROPOLOGY IN THE ELABORATION OF THE RURAL DEVELOPMENT STRATEGY

Ileana SĂDEAN[i]

National School of Political and Administrative Studies - Bucharest

Abstract: *When I conducted the anthropological study in view of elaborating the development plan for Ţara Secaşelor, I had the feeling that I was considered an obstacle, an enemy of the individuals who effectively aimed the change and "welfare" of the microregion. This article is designed to contribute to the legitimacy increase of the anthropologist involved in the rural development. It is very important to understand that the focus is not a critical spirit of the anthropologist, but a different vision on change and development following his different training in terms of the development. In conclusion, the active role of the anthropology is represented by these actual "criticisms", necessary for the elaboration of the development strategies, in order to reduce the eventual risks, related in particular to the economic reductionism.*

Key words: *anthropology, rural development, strategic planning*

Is there any currently recognized role of the anthropologist in the rural development in Romania?

In Romania, the anthropology generally continues to have a new character, shaping something abstract, theoretical, and thus it is outstripped by any expression or concept which includes the terms suggesting dynamism, as development agent, social contractor, community facilitator, hereinafter referred to as "developers".

In the situations where the development agent acts convinced of its good intentions and of the best ideological solution for the community welfare, the anthropologist reveals another attitude towards the changes. His "susceptibility" towards the "utility" of the change, towards using the power in order to fulfill the change, towards "improvement" is well known.[1] "Change does not have to be considered as an actual value; it is useful to the extent where it brings benefits and it allows the preservation of the existing life style". In the evolutionary anthropology there is a law – Rommer's law – which states that the biological organisms change and adapt themselves, not in order to benefit from new opportunities, but to preserve their life characteristics when faced with certain outer changers. Outer changes often cause suspicious reactions without being assimilated by the communities, regardless of the fact that they would implement them by themselves, in the most natural way, after a while. The anthropologists who worked in community development projects insist that the projects to improve the local inhabitants' life are successful to the extent where they do not attempt to radically change the local institutions or the local means of support. [2]

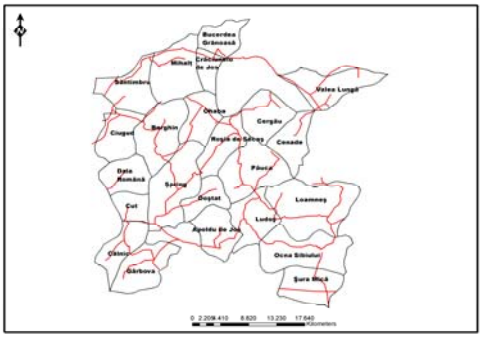
Are the issues and needs discovered by the "developers'' real?

[1] http://www.scritube.com/istorie/ANTROPOLOGUL-AGENT-DE-DEZVOLTA223710228.php

[2] http://www.evz.ro/detalii/stiri/schimbarea-spaima-romanilor-670063.html?id_domain=15

I will concretely present certain revealing aspects extracted from an anthropological study I conducted in view of elaborating the development plan of Tara Secaselor microregion. Their goal is to reveal the anthropologist's involvement degree and contribution to the establishment of the development directions of an area.

ȚARA SECAŞELOR MICROREGION



Overall, the microregion includes 22 communes and a city. Țara Secaşelor includes small villages (under 500 inhabitants), medium villages (between 500 and 1500 inhabitants) and large villages. The urban centers defining the microregion are: Sibiu in South, Sebeş in West, Alba Iulia in North and Blaj in North – East.

The cultural typology of the villages reveals a differentiation of the life styles, not only under the aspect of contact with the city or the cultural consumption, but also for the life options adopted by the individuals. We are dealing with a mosaic of realities and mentalities, where it is obvious that there are no development networks generally consented. Thus, a long –term research is necessary, which would reveal the imperatives of the development directions, what is not possible and what has to be achieved. The anthropologist can provide such answers.

Various ruralism versions of the inhabitants exist among these types, more or less marked by traditionalism or modernity, mainly associated with the village type.[3] From the standpoint of the subjective perspective, correlated with the economic dimension, the youth living in the rural today display the will to live in villages or "under similar conditions with the ones from the city", which involves both the desire to migrate in cities and the desire of a modern and satisfying life in the rural environment.

Which is the role of the anthropological study? Why does it help us to know how people live, what is their life style and what are their preoccupations? Because in the elaboration of the development strategy we will need the answers to the question: what type of change are the communities from Țara Secaşelor capable of? What does the adaptation for the preservation of the specific character imply?

REALITIES FROM ȚARA SECAŞELOR

For the following part of the paper, I selected some observations taken from the anthropological study[4], apparently details which a developer does not consider given the short time to elaborate the strategies, but which are able to contribute, through the anthropologist's support, to the decisions taken in terms of the development directions: "approximately four years ago (the study was finalized in July 2010), anyone could obtain a personal credit in a relatively simple manner, and thus many had the possibility to fulfill their desire to "keep up with the others". Among the individuals questioned, most of them would change something, but they require more money. Through the fact that people contracted certain credits under the conditions where the criterion that the monthly installment would not exceed 30% of the revenue is not verified on the long term, we draw the conclusion that their desire to keep up with the others, with the current times, is primordial. A credit implies constant monthly revenue, and most of the inhabitants of the villages in Țara Secaşelor do not "function" in a similar manner with the cities, namely with the status of wage earners. The installments and credit reimbursement can be sustained by

[3] www.cuvantul.ro/articol/?artID=21&nr=330

[4] Ileana Sădean, Anthropological Study of Țara Secaşelor microregion, to support the elaboration of the development strategy for Țara Secaşelor – "Leader" module, 2010 – unpublished

working harder and thus having more goods to sell. The credit was present in many households I visited, being used to increase the number of animals. I encountered two situations: when people, in order to "modernize" themselves, respectively to change their furniture, to redecorate their façade, windows, etc., increased the number of animals in order to obtain more goods to sell and then, with the money raised throughout a long period of time, they manage to fulfill their dream; and a second situation which applies the reverse logics, they reduce the waiting time by contracting a credit and they undertake the payment of interest and monthly installments throughout tenths of years, followed by the increase of labor volume and number of animals. A developer only notes the increase of the animal numbers, but not the reasons underlying such increase.

While the elderly continue to raise animals because they cannot live without this activity, despite the fact that it is no longer economically profitable, the youth only keep them because they represent the main source of revenue. In other words, *ancient people for new times*.

Apart from the differences between the traditional and modern villages, in terms of the living standard there are mixed elements related both to tradition and to modernism within the same village. On the long term, the traditionalism will lose ground in front of the modernism. For a good evolution of the microregion, the population should be stabilized throughout the following years by insuring local labor places, but also through an efficient transportation for qualitative commuting. The structure of the population relies on the economic development and on the development policies. The highest changes will take place when the elderly are gone. They are the ones who do not change anything substantial. They only participate to what the time subtlety changes, but they are not the promoters of events. There is a significant divorce between generations. This can be easily noticed at the consumption level. In most of the cases where two generations, children with parents, live together, when the elderly were gone, namely the owners, the remaining generations set freely all their ideas into practice. These included the reassembling of the dwelling, consumption preferences, life style.

To the extent possible, we have to take into consideration the elaboration of the development strategy, the harmonization of the rural development with the valorization of the cultural, natural and landscaping patrimony. The development policies do not have to alter the rural means of life or to fall into the trap of the economic reductionism.

I presented below the conclusions of the anthropological study from Ţara Secaşelor, which attempts to draw the attention on certain "temptations" in development which , on one hand, could have negative effects on long term on the communities and, on the other hand, to underline certain "impositions" with positive effects on the long term:

1. The promotion and increase of the appreciation of communities for the labor performed by the woman, especially in the villages where the traditional family is dominant. The achievement of the financial independence could balance the power and authority reports within the family and thus the involvement of women, objective aimed by the Leader programme, through the development of certain projects.

2. We have to try to keep the youth in villages, especially in the villages with high depopulation index (thus, we preserve the local language, the dialect and subsequently the local culture), to avoid the risk of

becoming unpopulated. The attraction of youth established in cities, with the debatable solution to move with their parents, taking into consideration the mentality gap between generations. I noticed that most of the times the cohabitation based on cooperation is only proved on short – time basis. Along with the infrastructural rehabilitation of roads from center towards outskirts, current water, the spare time ruralism will develop and the population's displacement will be balanced.

3. Labor places have to be mainly created in the field of services provided to the inhabitants and to the individuals visiting the premises as tourists, due to a deficient social, cultural and health infrastructure and to the poorly represented non – governmental sector (NGOs). It can be a warranty for the improvement of the inhabitants' life quality, maintaining the youth in villages, supplementing the children for the elderly left alone, occupation of a labor place corresponding to the qualification.

4. The development of the rental fund has to be taken into consideration on the long term, based on the separation tendency of youth from parents.

5. The establishment of some residentially elderly centers will not be a facilely assimilated idea in the first place, due to the mentality of such category of individuals, but we have to consider the ageing process of villages, especially the villages from the center of the microregion. In this particular case, we can suggest projects which would not imply the dismemberment, but home services in a first stage. Thus, we can avoid the investment of certain funds and the education of population about the advantages provided by the elderly centers.

6. Support of the preservation activities related to the endangered material and immaterial cultural patrimony, due to the fact that the best information sources are represented by the individuals aged 65-70 years old or more.

7. Education and counseling of population in terms of providing certain solutions related to the modification of the architecture of houses, facades, contracting a credit, and in all the other challenges which imply an adapting "effort".

8. Valorization of the household and craft abilities and competences of the inhabitants through programmes of rural tourism, green tourism, agrotourism, creation of trade markets and distribution networks.

9. The development of a qualitative tourism will allow the dissolution of the border between the traditional and modern villages. The tourism acts on two levels, as an economic development factor and as a cultural modernization factor (cultural animator), especially for the isolated and aged villages.

Thus, the "active" role of the anthropologist in the community (rural) development represents the formulation of these conclusions to be indicated to the developers, the most adequate development sense for a better life of the communities.

The anthropologist's risk through his involvement in the rural development is to become an outcast of this space. It is a risk which the anthropologist has to take if he wants to remain an anthropologist. Modernization, as any other ideology, has its "rebels". Whoever shapes himself as an anthropologist will inevitably be aware of such risk.[5]

BIBLIOGRAPHY

1. Barnier, Michel: *Rural Development in an Enlarged Europe*. European Conference on Rural Development, Salzburg, 2003.
2. Lele, Ulma, *The Design of Rural Development, Lessons from Africa*, International Bank for Reconstruction and Development, 1975.
3. Segalen, Martine (coord.): Etnologie. Concepte şi arii culturale, Editura Amarcord, Timişoara, 2001 Segalen, Martine (coord.): *Ethnograph., Concepts and Cultural Areas*. Timişoara: Editura Amarcord, 2001)
4. Zamfir Cătălin, Rebedin Ioan, Stiluri de viaţă. Dinamica lor în societatea contemporană, Editura Academiei RSR, 1989. (Zamfir Cătălin, Rebedin Ioan, *Life*

[5]http://www.scritube.com/istorie/ANTROPOLOGUL-AGENT-DE-DEZVOLTA223710228.php

Styles. Their Dynamics within the Contemporary Society. Editura Academiei RSR, 1989.)

5. Mark Hobart, *An Anthropological critique of development*. USA: Routledge, 1993
6. John Van Willigen, *Applied Anthropology*. USA: Greenwood Publishing Group, 2002.

---

i "Beneficiary of the „Doctoral Scholarships for a Sustainable Society" Project , project co-financed by the European Union through the European Social Fund, Sectoral Operational Programme Human Resources and Development 2007-2013"

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

THE RELIGIOUS FEELING AND MORAL VALUES. COMPARATIVE STUDIES

Mihaela SANDU [*]; Gheorghe NADOLEANU [*]

[*]"ANDREI ŞAGUNA" UNIVERSITY, Constanța, mihaela_psy1977@yahoo.com
[**]ARCHIEPISCOPATE OF TOMIS, Constanța, george.nado@gmail.com

Abstract:*Before having been researched from an ethnological, historical, psycho-sociological point of view,* ***religion*** *- namely issues regarding its essence, origins and development - had been an object of reflection for generations of thinkers preoccupied with the inherent oscillations and non-sequiturs, what we might call a philosophy of religion. Religion is not merely a form, or a system of thought, it is a vast reality which needs to unfold the fate and the happiness of man. This is why the link between God and man must be a free one, to make room for the sanctions that reward the good or the bad deeds of men in this lifetime. It needs be a conscious one, because it is a reality that the man can only encompass with his mind and is of a spiritual nature, therefore unseen*

.

Key Words*: sentiment, religion, values, Orthodox, Muslim.*

INTRODUCTION

We cannot define religion based on sociological and psychological research. From an etymological point of view, the term **religion** comes from a family of Latin words which initially designated certain practices related to the sacred and to which in time the faith and the theoretical aspects of religion were added[1].

- **religare** – **Cicero** said that this term denotes fulfilling one's duties towards the Gods. **Lucretius** defined religion as "the feeling and faith and duty towards the gods".
- **relego** – the word in an iterative, this meaning that religion refers to rebuilding the link with the sacred (the Quran means "to read", Biblos denotes "the Book", the Mantras are fragments of poems).
- **religio** – is translated by covenant, a covenant between the individual or the community and the sacred.
- **relegare** – to connect, connection, it represents the connection with the divine. This connection was initially established by practices (eg: shamanism is a system of practices).

Later, the word **religion** added, associated the spiritual aspect as well, designating not only the practices, but also the faith. In the Middle Ages, the basic term was **fides** (faith). During this time, the practical activity shifts on a secondary plane, the term **religio** referring more to the monastic practice.

Bearing the meaning of *faith*, religion can be **false** or **true.** The rebirth is what separates the true religions (Christianity) from the false ones (superstitions).

[1] Florian, Mircea (1993), *Misticism şi credinţă*, Ed. Minerva, Bucharest, p. 22

The definition of religion, according to Durkheim, is the following: "**Religion is a solitary system of faiths and practices related to the sacred**"[2].

The religious feeling is defined as "purity, veneration and piety", "reasoning for the affective evaluation of an invisible world", "mental faculty or disposition which, independent or in spite of the senses and of reason, makes the human being capable of feeling the infinite under various names and divine disguises"[3].

The man as an individual or as a member of the family or of society needs religion. Through it, man knows God as the source of truth and as norm of the moral life, bringer of happiness. Through religion, man becomes confident with his deeds and rises above the creatures living around him.

Man has the religious feeling as something more than any other living creature. And if Aristotle called the human being a social animal, modern later anthropology calls man a religious animal. Religion is necessary for the family and for society as a whole and the fact that those who want to hurt the institution of family or society itself start by hurting the religious feeling, and those who want the social nucleus, family, to gain prestige, talk about the absolute utility of religion.

The value we believe in and that we cherish ask us to choose and praise those forms of conduit which sustain and help spread in the whole world the values that deserve to exist, and to avoid, despise and, if possible, to decimate those deeds which undermine our values. Unfortunately, the next step is a more difficult one.

"What are values?" - here is a question whose answer is not easy to find, although we are dealing with a pretty common word in the daily vocabulary. In the first instance, values appear as attributes of persons, ideas, deeds, institutions or things which are important, worthy of being respected and cherished, and which people consider as worthy of trying to see accomplished to the fullest extent. To put it briefly, value is important and respect-worthy. Important *for whom* and *why?*

There were various answers to these questions, formulated during the ages, and each of them had pros and cons.

Moral values always refer to the effects or consequences of our actions on the others or on our own selves. They define those character traits that when cultivated and, more than anything, put into practice, are capable of reining in our aggressive and antisocial impulses, stopping us from causing useless harm and unnecessary suffering but, most of all, to stimulate our attitudes of solidarity with the others in such a way that our deeds lead to the full affirmation of the humanity within ourselves and within our fellow men.

Factors influencing the religious life

The religious life of communities of believers is not subject to a casual determinism. There is a plurality of factors which influence it and their role modifies according to age, culture and geographic areas. Thus we have a model of added values which influence in a very diverse manner the confessional distribution and intensity of the religious life.

It has been attempted to define the fundamental or unique cause which determines the religious life. The purpose was to influence this cause and to manipulate the believers and the religious life.

During the communist times, had they been able to discover the cause of man's faith, it would have been very easy to eliminate it. But faith is determined by a large number of social, natural, personal factors, each of them modifying its role during the life of the man of faith.

The religious life varies, depending upon one's natural environment, political system, economic situation, place of living, social events, culture etc. All these factors influencing the religious life are assimilated by the believers through their own social filter, i.e. the family, school, culture that encompass the individual.

[2] Durkheim, E. (1912), Les formes elementairede la vie religieuse, Paris.
[3] Mânzat, I. (1997), *Psihologia credinţei religioase. Transconştiinţa umană*, Ed. Ştiinţă &Tehnică, Bucharest, p. 135.

The natural environment has a bigger religious influence both upon the individual and upon populations in the incipient periods. Natural factors mostly influence the child and the archaic population. Nature influences the religious feeling by means of impressionability. Man notices the complexity of nature, is incited by the landscape, by the social order and harmony, because ever since childhood it was taught to him that it was all the hand of God. The evolution in terms of age decreases the role of the social environment in the religious life. It has been noted that the natural environment mostly influences boys. Natural phenomena (earthquakes, thunders, storms) predominantly influence girls, who attribute these manifestations to the sacred.

Family plays a fundamental role in forming a religious life in the first part of childhood (up to 14 years of age). Family, mostly the grandparents in the modern society, transmits the religious model to the children. Family acts upon children by means of: family atmosphere, family practices, religious education, family events. For the child religiosity is not something distinct and specialized, it is identified with the entire spiritual life (God is good, God is right, God is beautiful, God rewards them or God punishes them). It has been observed that the downfall of authority in families pushes children away from religious faith. Abandoned children, orphans, children coming from broken homes are more easily convertible to other religions or atheism.

The territorial community - the village, the town, the geographical area has a number of religious models that it passes down to the descendants by means of the atmosphere from that community, by practices, events within the community, all having a religious influence on people. Communities have certain traditions that influence the believers as long as they stay within the boundaries of the community.

Church plays an important role in the forming of religious life, both as a place of worship and by means of the staff in churches. This personnel plays the role according to the number of believers that the community has. Priests play a less important role if the number of believers is large, or if they are located at large distances. Frequenting the house of worship is discontinuous. The quality of the church staff is that of transmitting, in time, the religious feelings and of guaranteeing a frequent presence in churches.

Culture is yet another important factor in forming the religious life. The Enlightenment, the Positivist and Marxist currents have stated that the higher the culture, the lower the religious state becomes. The religious state, as a spiritual experience, is influenced both theoretically and dogmatically by the level of education and culture. As feelings, it continues to exist, no matter the level of culture. The illiterate, the intellectuals and the scientists can have the same amount of faith. Studies in this field proved that as the culture level gets higher, the peripheral religiosity is gradually eliminated and the religious experience of the true believers is consolidated.

School - education implements certain spiritual values which modify the religious proportion from the affective level to the intellectual level. The modification takes place quicker in the case of boys, who reason their faith before girls and become more selective. Girls stay affective in their religiosity for longer and towards adolescence they tend to a religiosity with specific aspects (they start believing in female religious personalities:

The Virgin Mary, St. Friday etc.). Moreover, their religiosity is a more intimate one - they retreat and pray in solitude.

The bio-psychic dynamics of the human personality - some psychologists and sociologists have exaggerated the personality factors in the religious life. For example, Jung when talking about extroverts and introverts, shows that the extroverts are more sociable and have a more frequent religious practice, while the introverts, oriented towards the interior, live their religious feelings more intensely, even if they express them less. Research outlined a few stages in the religious evolution of personality. There is an ascension of the religious state under the influence of family until the age of 13-14 in the industrial and developed areas. In the case of the less developed countries, this ascension continues until the age of 15-16. The period of adolescence represents a search of the religious ideal and a decline of the religious state. After 20 years the religious life recovers. During the mature years it is stable, not very intense, but the cases of conversion (confessional migration) are very rare.

How age influences the religious life[4]:

- **until 7 years of age,** the child grows within the family and adopts the religious model of the parents.
- **after 7 years of age** the family religious ideas and beliefs are completed by the school influences. Schooling increases the theoretic aspect of religiosity, while diminishing the affective dimension. Besides the positive aspects of the religious education in schools, there is also a negative side: pushing children away from the religious experience. Students perceive Religion as a compulsory subject, ruled by grades, a schedule, exams, and all this serves to diminish the affective attachment. When no longer under supervision, children tend to avoid the practices they had complied with before.
- after 13 years of age they have access to religious literature and to means of information that bring to their attention other models besides the family religiosity and they begin to doubt the authenticity of their parents' model.
- adolescence is a transition period, when the personality leaves the realm of childhood, claims the adult status which is only obtained when no longer claimed. The adolescents have the tendency to verify the authenticity and veracity of everything they had known up to that point. They exaggerate antagonism (opposition), manifested in different shapes: it can be detached from previous values, it practices a real or fictitious narcissism. From a religious point of view, the sacred and the traditional church seem as values belonging to the aged. They would like to create their own model regarding the sacred. The evasion towards the secular-sacred models appear now, they admire cinema artists, musicians and people from other confessions. Some theoreticians state that this tendency towards religious evasion is formed on the basis of a lack of bio-psychical maturity.
- towards 25 years of age, when an adult, the person becomes religiously stable, the religious and spiritual influences affect him or her less. They generally return to the religious life from their previous family. During this time the religious practices are lower, so is the religious extremism, the adult perceives the church more as an institution.
- the third age reawakens the preoccupations related to religiosity. More than anything it is faith that grows bigger, the religious practices aren't extraordinary intense. The reasons why the practices are thus restrained belong to the secular (people are old and can no longer often get to church, are ill etc.).

The affective dimension of religiosity (faith)

The religious life is accomplished in several correlated dimensions, but some can be more emphasized or more diminished. For example, some believers may be more intensely religious, without having an accentuated practical externalization as

[4] Meslin, M. (1993), *Ştiinţa religiilor*, Ed. Humanitas, Bucharest, pg. 154

compared to others, with less faith, who frequent church on a more regular basis.

Faith is the affective dimension of religiosity. Even in the current times there are theologians who consider that the religious feeling is born in man, as a gift from God. Man has set himself apart from other living creatures by moral feelings and religious feelings.

In reality people are born and acquire predispositions which in contact with the religious models become religious feelings.

Faith is defined as a power, a confidence that turns what we wish for into something that exists. Paul the apostle said in his letter to the Jews: "faith is the entrusting (confidence) in what one hopes for". (Jews 11:1). This confidence encompasses some certainties:

- God exists.
- God influences the world, the man, the everyday life.
- A relationship with God is possible.

These certainties form in the believer the psychic state of dependency towards God. Being aware of certain religious models, this dependency transforms into a psychological need. In the centre of this need lies the conviction that God is sublime. The sentiment of guilt (sin) and the expiatory (salvation) wish appear.

The religious feeling is defined as "purity, veneration and piety", "reasoning for the affective evaluation of an invisible world", "mental faculty or disposition which, independent or in spite of the senses and of reason, makes the human being capable of feeling the the infinite under various names and divine disguises".

The man as an individual or as a member of the family or of society needs religion. Through it, man knows God as the source of truth and as norm of the moral life, bringer of happiness. Through religion, man becomes confident with his deeds and rises above the creatures living around him.

Man has the religious feeling as something more than any other living creature. And if Aristotle called man a social animal, the modern anthropology calls him a religious animal. Religion is necessary for the family and for society as a whole and the fact that those who want to hurt the institution of family or society itself start by hurting the religious feeling, and those who want the social nucleus, family, to gain prestige, talk about the absolute utility of religion.

Religious feelings can be amplified or diminished by correlating them with the events in their lifetime or in contact with art. The diminishing of the religious feeling can reach to atheism. Extracting normal religious feelings may create states of social disintegration. Religious disintegration may take two forms for psychologists:

- religious passion.
- religious insanity.

Religious passion is socially manifested as fanaticism, fundamentalism and it engulfs the life of the individual who neglects other social obligations. Passion can be of two kinds:

- bigot - the bigot is a very gullible person, with a pure soul and who wants salvation at any cost. The bigot is excessively pious, the rituals he or she practices are meticulous. However, bigots lack judgement, which makes it easy to manipulate them.
- mystic - the mystics are maniacs who can manifest themselves either periodically (under the form of seizures), or permanently. The mystic becomes one with the divine, his visions tend to

seem to him more real than the actual truths.

Religious insanity occurs when the believer manifests a permanent ecstasy, either passive (as is the case of Hinduism and Buddhism), or hysteric. The cases of religious hysteria are dangerous. Religious insanity can have two forms:

- theomania - in the case of theomania, the individual becomes one with God, thinks himself to be God or His Chosen One. Sometimes these individuals can be dangerous as well.
- demonomania - in the case of demonomania, the believer considers himself as possessed by the devil and commits devilish deeds, such as: vampirism, lycanthropy (the patient believes he has turned into an animal), erotomania (girls thought they could only have sexual intercourse with the devil). Such cases are treated by Church through exorcism.

The religious faith has a fundamental dimension of the spirit which can be expressed in a table of values. Faith is not an act of intellectual consent towards certain assertions, but moral commitment which involves the complete integration in a whole of both the intellectual consent and an infinite trust.

Research Objectives

This study aims to highlight the intensity of the religious feeling and to identify the moral values of the study participants. It also aims to emphasize a possible relationship between the religious feeling and the moral values, as well as to highlight certain differences between the participants of Orthodox confession and those of Muslim confession as far as the religious feeling is concerned.

Specific objectives:

- to evaluate the intensity of the religious feeling with persons belonging to the Orthodox and the Muslim confessions.
- to identify the moral values of the study participants;
- to emphasize significant relationships between the religious feeling and the moral values of the study participants;
- to highlight the significant differences between the Orthodox and the Muslim participants according to the religious feeling.

Research Hypotheses

Hs. 1. It is presumed that the moral values adopted by the Orthodox participants are oriented towards freedom, honesty, education and independence, and those adopted by the Muslim participants are oriented towards altruism, tolerance, respect and responsibility.

Hs. 2. It is presumed that there are significant relationships between the religious feeling and the moral values of the Orthodox and Muslim participants.

Hs. 3. It is presumed that there are significant differences between the Orthodox and the Muslim participants in the intensity of religious feeling.

Study Participants

Table 1. Frequency table for the "biological gender" variable

		Frequency	Percentage
Valid	female	39	48.8
	male	41	51.3
	Total	80	100.0

This study involved 80 subject, 39 women and 41 men, both Orhtodox and Muslim. By analysing the sampled subjects from the perspective of the "age" variable, this varies between 19 and 62 years of age, the biggest frequency is that of the subjects who are 35 years old. The average age of the study participants is of 43.05 years.

Instruments used

The Questionnaire for Assessing the Religious Feeling (Chestionarul de evaluare a sentimentului religios - C.E.S.R.) -is made up of 37 items and it addresses the Christian population in Romania, over 18 years of age. The religious feeling assesses the extent to which the individual got closer of further from divinity and expresses the degree of intensity of the religious life.

For the purpose of this study we built a Questionnaire for Assessing the Moral Value (Chestionar de valori morale - C.V.M.) - is

made up of 20 items representing values that reflect the positive or the negative aspects of morality.

To validate this questionnaire we used the aspect validation method and for finding fidelity we used the test-retest method (r = 0.834, p <0.01) and the Alpha Cronbach coefficient of internal consistency (α = 0.820).

Data analysis and result interpretation

In order to better emphasize the moral values that the survey participants have integrated, we have made a comparative analysis between the integrated values of the Orthodox and Muslim participants for each of the 20 items of the moral values survey.

From the analysis of the results of statistical processing it can be said that the first hypothesis was confirmed, the Orthodox participants adopted values based on freedom, honesty, patience, education and independence, and the Muslim participants adopted values based on respect, responsibility, tolerance, love towards their family, their peers, as well as to living creatures, based on altruism and responsibility. The Orthodox participants have registered higher frequencies for the "important" and "very important" answers for the following values: freedom, honour, patience, education, independence, and the Muslim participants have registered high frequencies for the same answer variants for the following values: kindness, love to your fellow men, love towards family, respect, tolerance, love towards living creatures and responsibility. These results should not be surprising because the Orthodox are not very bound to the traditional family anymore while the Muslims are raised to respect the traditions and in the spirit of responsibility, especially for men, taught to respect their family and especially the elder.

In order to confirm the second hypothesis the data was subjected to a correlational analysis between the religious feeling and the moral values.

Table 2. The Correlation between "the religious feeling" and "the moral values"

		feeling	Values
feeling	**Pearson Correlation**	**1**	**.750(**)**
	Sig. (2-tailed)		**.000**
	N	**80**	**80**
values	**Pearson Correlation**	**.750(**)**	**1**
	Sig. (2-tailed)	**.000**	
	N	**80**	**80**

The results obtained from a correlational analysis confirm the original hypothesis, i.e. there are highly significant relationships between the religious feeling and the moral values adopted by the study participants.

** The correlation is significant for a threshold of 0.01.

A religious feeling of moderate to high intensity involves the integration of moral values expressing certain general requirements which are necessary for the behaviour of the participants, for an orientation towards the human ideal.

For the validation of the third hypothesis the obtained data was subjected to a comparative analysis meant to identify differences between the Orthodox and the Muslim participants, as far as religiosity is concerned.

Table 3. The average of the Orthodox and Muslim participants regarding the religious feeling

Table 4. Comparison of the means between the
scores obtained for the religious feeling

Independent Samples Test

		stul Levene pent alitatea dispersii		testul t pentru egalitatea mediilor			
		F	Sig.	t	df	g. (2-taile	diferenta mediilor
sentime	Dispersie omogena	1.988	.163	15.974	78	.000	-30.431
	Dispersie eterogena			16.047	77.989	.000	-30.431

The statistical analysis has allowed for the identification of significant differences between the Orthodox and the Muslim participants, from the point of view of the religious feeling. The t test for independent samples ($\mathbf{t_{(78)} = -15.974, p < 0.01}$) statistically argues in favour of this hypothesis. It can be noted that the value of t test is negative because the Muslim participants scored higher as far as the religious feeling is concerned, which means that they have a favourable attitude toward religion, have a knowledge and self awareness of religious nature, are closer to divinity and express a higher degree of internalization of religious ideas. This also concerns the religious training of the individual, in the Muslim environment if the man of the family is a religious one, he imposes the religious practices and devotion upon the other family members as well.

The Orthodox participants also have a religious feeling, but of a lower intensity than the Muslim ones. The Orthodox are more independent as far as practices and the individual religious devotion are concerned, they are subject only to their conscience on theological considerations.

Conclusions

Based upon the methodological approach we may state that the hypotheses have been confirmed. Thus, the Orthodox participants showed high frequencies for the answer variants: "important" and "very important" for the following values: freedom, honesty, patience, education, independence, while the Muslim participants have had more frequent choice of the same answer variants for values such as: kindness, love for one's fellow man, love for one's family, respect, tolerance, love towards living creatures and responsibility.

The Orthodox participants adopted values based on freedom, honesty, patience, education and independence, and the Muslim participants adopted values based on respect, responsibility, tolerance, love of family and fellow men, as well as towards living creatures, based on altruism and responsibility, because they are raised in a spirit of responsibility, especially in the case of men, with a high respect towards the family and especially towards the elderly.

Regarding the confirmation of the two hypotheses it should be noted that between the religious feeling and the moral values integrated by the participants there is a direct and reciprocal relationship, i.e. a religious feeling of moderate to high moral intensity leads to the adoption of moral values expressing certain general requirements that are necessary for the participants' behaviour for an orientation towards the human ideal.

Based on previous results, we can appreciate that the third hypothesis was also confirmed, showing that there are significant differences between the Orthodox and the Muslim participants regarding the religious feeling. The Muslim participants have a stronger religious feeling than the Orthodox ones, meaning that they have a favourable attitude towards religion, have religious knowledge and a religious conscience, are closer to the divine and express a higher degree of internalisation of the religious ideas. This also concerns the religious training of the individual, in the Muslim environment if the man of the family is a religious one, he imposes the religious practices and devotion upon the other family members as well.

The values we believe in and that we cherish ask us to choose and praise those forms of conduit which sustain and help spread in the whole world the values that deserve to exist, and to avoid, despise and, if possible, to decimate those deeds which undermine our values.

In the modern world, still very diverse, but slowly becoming more integrated by the process

of globalisation, given both the weakening of the authority of local and traditional customs, and the great religious diversity, moral values tend to exert an increasingly coordinating and hierarchical role within the sphere of all values. This trend is still very feeble, due to competition with other dominant or hegemonic values. Religion has been the coordinating axis of the axiological spectrum for so long, but the world has started bowing to other "gods": profit, economical interests, the production and accumulation of material wealth, in close connection with science, which, on the one hand, has offered through the technical revolution increasingly efficient means of economical growth and progress in the sphere of utilities, while on the other hand usurping religion's supremacy on the plane of spiritual living, becoming itself, for many laymen, a true religion.

Bibliography

1. Florian, M. (1993), *Misticism şi credinţă*, Ed. Minerva, Bucharest.
2. Durkheim, E. (1912), Les formes elementairede la vie religieuse, Paris.
3. Durkheim, E. (1997), *Formele elementare ale vieţii religioase*, Editura Antet Press, Bucharest.
4. Mânzat, I. (1997), *Psihologia credinţei religioase. Transconştiinţa umană*, Ed. Ştiinţă & Tehnică, Bucharest, Muller, M. (1892), *Anthropological Religion*, London.
5. Meslin, M. (1993), *Ştiinţa religiilor*, Ed. Humanitas, Bucharest

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

CITIZENS RIGHT TO INFORMATION – BENEGICIARY OF ADMINISTRATIVE REFORM

PhD. Adrian Dumitru SOLOMON*, **PhD. Gherasim Solovestru DOMIDE****

***National School of Political and Administrative Studies, Bucharest, Romania **Technical University Cluj-Napoca, North University Center, Baia Mare, Romania

Abstract:

Citizens right to information, benficiary of administrtive reform represents a major concern both in government programs and in citizens expectations. The topic discussed may have a significant impact and to provoke the interest to specialists of Legal and Administration Science, students, politicians and public officials or civil society through nongovernmental organizations that are militating for the compliance of this right on national level, and by organizational entities that monitor the protection and enforcement of the law worldwide to follow the citizen's right to information, on international level. The right to information is premise not only for national objective, to accept the information, but also its exigency to request quality information corresponding to the principles of truth and fairness, with the consequence of state duty, to provide the legal and material support necessary to achieve free access to all the public interest information. The strong points of an informative collaboration between the administration and citizens would be: the consensus and unanimous cooperation especially at the local level, transmitted afterwards to the central structures, responsible and convenient decision making to both parties, stimulation of the direct dialogue between public administration representatives and citizens through which shall be made known another points of view taken in the debate, the corollary which represents the transparency in the decision act made by decision makers from public administration.

***Keywords**: right, information, administration, citizen.*

General consideration of right to information

Citizen's right to information and administrative reform represents a major concern both in government programs and to the expectations of citizens of a country.

The topic discussed may have a significant impact and to provoke the interest to specialists of Legal and Administration Science, students, politicians and public officials or civil society, through non-governmental organizations that are militating for the compliance of this right on national

level and by organizational entities that are taking care by monitor the protection and enforcement of the law worldwide to follow the citizen's right to information, on a global scale.

The right to information represents for the citizen not just a objective premise to accept information but also the legal ability to request quality information, appropriate to the truth and fairness principles, having as consequence the correlative obligation of the state to ensure the legal material and support necessary to all free public information. The need for better informed citizens claims that peoples should always know what is happening in their community to can propose meanings and methods to the local administration.

The strengthens of informational collaboration between local administrations and citizens would be: consensus and unanimous cooperation especially at local level transmitted afterwards to the central structures, making responsible and favorable decisions for both parties; encouraging direct dialogue between citizens and responsible of public administration that make known the points of view taken into debate. Those mentioned above shown the necessity of informational transfer between collective and administrative sector, the honest partnership between citizens and local administrations, and the requirement of citizen inclusion like equal partners into the governance process.

Certainly this concern for citizen information involves certain costs related to availability of human resources, the time had at disposal, the budget provided for financing the meetings and the means of communication.

The sustainability of this theme is based on the following central theme: the information is a vital source for the decision making process into a democratic society. Selection of this objective was made after a prior evaluation of data utility of theory approach and the existing results and concerns about the research from the literature updated until now, about the significance of information for citizen activities as center of gravity of public administration progress reform. Thus bring to the forefront the importance of citizen's rights especially the right to information in the context of a democratic society characterized by decisional transparency and free access to information, considerate as essential goal to bring together under the same title: „Citizen Right to information – Beneficiary of administration reform".

Public administration reform involves substantial changes to the major components of public services, local and central public administration. On the other hand, the development of democracy requires the establishment of a new model of relationship between citizens and local administrations, by increasing and reconsidering the partnership between civil society and local officials. In the recent years, public service reform was a major concern for governments, social partner and international organizations.

This reform is liked to redefining the role of the state in the context of globalization and liberalization, it responds to criticism on the efficiency and effectiveness of public services. The decentralization and privatization are means encounter in all public service reforms.

Therefore to determine the administration to become more and more oriented toward the citizens it is the central aspect of the changes made and also the path to be followed for performance. Of course, this orientation is focused equally on increasing the rank of public sector receptivity and by setting up standards for services with the aim to transformation from „recommended goods" to „experimental goods" and finally to „wanted goods" [1].

Public services must offer a wide variety of services to the community. Radical improvements are needed to deliver them. Quality and speed of service is crucial, courtesy and efficiency must be simultaneous[2].

One major aspect of public administration reform is to ensure appropriate management in the process of implementation [3].

A serious risk in public administration reform is crowded daily tasks, which are leaving too little time to seek for new solutions

[1] Matei L., 2004: 29.

2 Serving the Country Better: A White Paper on Public Service, Dublin, Govern of Ireland, 1985: 57.

[3] Profiroiu, Marius ,2005: 2.

to dysfunctions encountered or reported. Consequently, for public administration reform is necessary to succeed as a large number of target groups (in particular, key management levels and decision) to express support, commitment and recognition that changes and their implementation.

Activity of the government and the citizen's fundamental right to information is the mirror through the importance given to all theses presented in previous chapters applicability fundamentals valued by research. Regarding access to information, the Council of Europe Parliamentary Assembly evident to the Member States that any information of public interest must be decided within a reasonable time.

If public authorities evade or delay the provision of public depriving citizens of their right to information, they must give reasons for refusing to provide information, and any refusal on an application is likely to be appealed.

Right to information and freedom of information can be found both in the Romanian Constitution and in: Universal Declaration of Human Rights, European Convention on Human Rights and Fundamental Freedoms, the International Pact on Civil and Political Rights, the Aarhus Convention on access to Information, Public Participation in Decision Making and access to Justice in Environmental Matters.[4]

France established administrative duty to state reasons in writing refusing to grant a request for information, the applicant having a right to appeal the Commission access to administrative documents. Also, in art. 9 of resolution no. 1003 / (1993) on journalism ethics, Council of Europe Parliamentary Assembly, it states: "Public authorities should not be considered proprietary information." Nationally, the Romanian Constitution makes a provision that aligns to the most modern on European Constitution on the right to information and framework to restrict this right. Thus, art.31 Point 1 states: "A person's right to access any public information cannot be restricted". State's obligations to ensure the realization of this right are set forth in section 2: "Public authorities, according to their competence, are obliged to provide correct information to citizens on political affairs and matters of personal interest." Of course, personal information can not only inform the person directly concerned subject. It is noteworthy that Article. 31, called "right to information", regulate the right to information and its correlative obligations, far more accurate than the constitutions of other states that include the phrase "freedom of expression". In addition, all compared to the constitutions of other states, the reduction of right to information is not left to the Parliament, in art. 53 of Romanian legislature setting limits, situations in which Parliament may restrict the right to information under the following conditions: only by law and only if necessary, as appropriate, to protect national security, public order, health or morals the rights and freedoms; conducting a criminal investigation, preventing the consequences of natural disasters, of a disaster, or an extremely severe catastrophe, and the restriction must be proportionate to the situation that caused it to be applied without discrimination and without prejudice to the right or freedom. Public intervention in the sphere for the exercise of fundamental rights is not unique to Romanian Basic Law, but important international documents contain similar provisions. So through International Pact on Civil and Political Rights, ratified by Romania through Decree no. 212/1974, expressly states that only in times of public necessity and threatening the life of whose existences proclaimed, the signatory may use the exemptions to the obligations they have assumed by taking to that pact, and this only if the situation demands an urgent requests and exemptions does not conflict with other obligations they have assumed states and internationally and do not lead to discrimination. Even under these conditions, states cannot derogate from some rights specifically enumerated in the Pact, which included the right to life, protection from torture and slavery, the principle of legality of

[4]Environemental Experts Association, 2005, p.33

offenses and penalties and non-retroactivity in criminal law and freedom of conscience.[5]
The Law no. 544/2001 contains provisions on organizing and providing access to public information, the procedure for requesting and obtaining information from public authorities, limits and exceptions right to information specific provisions regarding mass media access to public information, and penalties to violators of this right.

All this laws gives a legal definition, but the narrow notion of "public information" - any information concerning or resulting from activities of public authorities or institutions, whatever their medium or form or mode of expression information ". But the sphere of public information is more extensive, including any information of interest to society, not only information about the activities of public authorities or public institutions.

Many citizens wonder which might be the utility this right? The answer can be nuanced: we must be aware that this is one of fundamental human rights, because the information is vital for human existence, because it must harmonize our daily work we relied on information what is happening around us because every citizen pays taxes and the state by its servants are obliged to inform citizens of what happens to the money. The existence of an efficient and democratic administration is one of the most important criteria that define a country's modernity. Currently, Romania is making efforts to try and reform the administration. So, a major priority of the Romanian Government is achieving, in a few years, a real reform through which the government of our country to be at European standards and characterized through transparency, through predictability, accountability, adaptability and effectiveness.

Therefore requires a deep reform and to succeed, reform cannot be achieved only by effort and political will of the Government but it takes a concerted effort and the whole society structure. To meet these priorities, the Romanian Government in the last 22 years has adopted various strategies for developing administrative reform, but acknowledged that the results were quite modest. Objectives were perhaps too ambitious, requiring considerable financial means to compete with other priorities or were taken by people without skills in public administration management. There has been real progress by adopting a comprehensive package of laws on civil service, decentralization of public services, local public finances, fighting corruption and creating new institutions to prepare and implement reforms. Experience shows, however, that many of these laws were tight, and new institutions have not fulfilled its mission. That general was often expressed in terms of critical European Commission reports.

Therefore it is required a deep reform and to succeed, the reform cannot be carried out only by effort and political will of the Government but it takes a concerted effort and the whole society structure. To meet these priorities, the Romanian Government in the last 22 years have adopted various strategies for developing administrative reform, but acknowledged that the results were quite modest. Objectives were perhaps too ambitious, requiring considerable financial means to compete with other priorities or were taken by people without skills in public administration management. There has been real progress by adopting a comprehensive package of laws on civil service, decentralization of public services, local public finances, fighting corruption and creating new institutions to prepare and implement reforms. Experience shows, however, that many of these laws were tight, and new institutions have not fulfilled its mission. That general was often expressed in terms of critical European Commission reports. It was also found that the ministries are very much concerned with daily administration, particularly those with regulatory role and political agenda has always reflected the key issues of public administration.

In accordance with the requirements of the modernization of public administration and alignment with the “acquits communautaire”, have been identified priorities for public

[5] I. Muraru, E.S. Tanaaescu, 2008:530

administration reform: civil service reform which will ensure creating a professional civil servants, stable and neutral the policy through: implementing unified and coherent framework, cohesion development of human resources management strategies and professional training, the full commitment of ministries, agencies and other government bodies, the reform of local government decentralization process and the deconcentration of public services which must ensure: improving management of public services locally and increase their quality, allocation of responsibility, financial resources and rights related services, improve policy formulation process by creating systems of coordination and improving management capacity of government structures.

However, in insufficient incentives for civil servants, the manifestations of corruption in the system and bad image to the public, are real shortcomings and malfunctions in the system of public administration in Romania, weaknesses, such as financial and human resources allocated insufficient National Agency of Civil servants and institutions responsible for the recruitment and improvement of civil servants, lack of complete information database to meet the real needs of an efficient management of public service to operability of data can facilitate the collection of information necessary for better human resource management in public administration.

In the process of decentralization of public services, although many laws have been adopted, the allocation of responsibilities between central and local government remained unclear. In practice, due to insufficient funds, there is a kind of decentralization process taking part in some of the ministries.

In public policy formulation, the efficiency is reduced by insufficient inter ministerial coordination and partial compliance with regulations and administrative procedures related to the process of formulating and implementing public policies.

Aspects concerning the applicability of administrative reform come with ideas that are based citizen participation in decision making as it follows:

- Citizens desire to be consulted in decision making in local government;
- Citizen participation in decision making process depends very much on the level of satisfaction related to government services;
- Citizens get involvement into the decision making process only if it finds that their opinion influence decisions in the public administration;

Solutions and proposals to citizen support:

✓ To encourage public involvement in decision making is not sufficient merely receptive attitude of the administration, but need a confirmation of this participation, which can be achieved by developing documents, include how to implement the proposals made by the population and informing the public about these results.

✓ Editing newsletter quarterly town halls across the country, including information about decisions that were taken or will take, schedule hearings, council meetings agenda, some information of interest to communicate. A key feature of this newsletter would be that the information be written in a form understandable by citizens. With this bulletin informed citizens will be much easier will know in advance what will be discussed, the project will take place. Through this newsletter citizens interested in a particular issue will be the time to prepare to support their own point of view.

✓ It should also be created a mechanism to direct information to those interested in issues important to participate in the discussion. Thus it is a debate on a topic, they will be required to inform the people affected by this problem. This eliminates the discontent of citizens, who are obliged to respect the decision by the authorities, even if they are in unknowingly.

✓ Another recommendation would be the citizens identified and that is organizing public meetings with citizens, regularly. Through these meetings, will benefit both citizens and public administration will benefit, promoting the image of the

institution, increasing public confidence, getting information from them, or even viable solutions in solving community problems

- ✓ Setting up a Citizens Advisory Committee, thereby the development of community acts of public or local budget decisions and then to allow citizens with information on budget execution, its role being to underpin informed and concerned citizen perspective on how to obtain and spend public money.
- ✓ As a "ferenda" law proposal, violation of this fundamental human right - the right to information by public authorities and institutions in Romania, to be more severely punished, the official who is guilty of violating this right knowingly applying them additional penalty is the right to practice for a period of time established by law.

Until this moment the legal system that should provide access to public information and to allow the Romanian society to regain confidence in state institutions has many deficiencies.

We are contemporary with an impressive crisis of public authority, which is also based on lack of transparency, perhaps more striking than for the other former countries with communist administration, that have gone through similar situations

This lack of transparency is deeply rooted in past and unfortunately it has projections until present; we stills hope that in the not too distant future to express its top priority.

REFERENCES

1. Law nr. 326/2001 regarding the Public Service of local management M.O. nr. 359/4.VII.(2001).
2. O.G. 87/2001 regarding the sanitation service,M.O.543/2001, (2001)
3. O.G. 86/2001 regarding the public transport of passengers , M.O. 544/2001, (2001)
4. The Government strategy regarding the development of public services for local management from 2001 to 2004, the Government of Romania, (2001).
5. Alexandru Ioan, *Treaty of public administration*, Bucharest, Juridical Universe, (2008).
6. Environmental experts association, *The rights and the freedoms of the citizens*, Sibiu, Regional Centre of Training Continuous for Public Administration,(2005).
7. I. Muraru, E.S Tănăsescu, *The Constitution of Romania- Comment on articles*, Bucharest, . C.H.Beck, (2008).
8. Matei Lucica, *Public services*, Bucharest, Economic, (2004).
9. Profiroiu Marius cord. ” *Research studies. Public administration reform in the context of European integration*, Bucharest, (2005).
10. Serving the Country Better: A White Paper on Public Service, Dublin, The Government of Ireland, p.57, (1985)

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

POLICIES TO ENCOURAGE THE EMPLOYMENT OF PEOPLE WITH DISABILITIES: CASE OF ROMANIA

Razvan STEFANESCU*, Ramona DUMITRIU*, Costel NISTOR*

* Faculty of Economics and Business Administration, University **"**Dunarea de Jos**"**, Galati, Romania,

Abstract: *In the last decades, the employment of persons with disabilities became a priority for the social policy from many countries. Usually, such policies are oriented in two directions: to support the persons with disabilities seeking jobs and to provide for the employers who hire these persons some facilities that compensate certain supplementary costs. In the last years, Romania updated its legislation regarding the persons with disabilities, being offered some stimulants for their employment. In this paper we examine this legislation by comparing it with those from other countries. We also present the results of an enquiry among some managers from Romanian enterprises, who were interviewed about hiring people with disabilities.*

Keywords: *Employment, Romanian Labor Market, people with disabilities*

1. INTRODUCTION

The employment of people with disabilities is one of the most complex problems to be solved by social policies. Empirical researches revealed that, in comparison with the people without disabilities, these persons are in larger proportions unemployed, although most of them are willing to find a job [3, 5, 7, 8, 13, 27, 31, 35]. The results of some investigations proved that unemployed persons with disabilities were highly exposed to depressions and their employment could strengthen their mental disposition [9, 15, 16, 24, 28, 29, 30]. Other arguments in favor of the people with disabilities employment refer to the possibility of some public expenses reduction or to solve the problem of offer shortage for some segments of the labor market [1, 2, 6, 10, 11, 14, 22, 23, 32].

In the last decades, central and local authorities from many countries paid a considerable attention to the people with disabilities. Their social policies included objectives related with the employment of these persons. In general, such policies have two main directions:

- support for the persons with disabilities seeking jobs;
- stimulation of the employers to hire people with disabilities.

Governments could support the persons with disabilities which want to be employed by education and training programs, by acting as an interface between them and the employers or by inducing them a successful job-seeking behavior. Several studies revealed the benefits of education and training programs for the people with disabilities. In many countries such programs reduced the unemployment and increase the productivity of persons with disabilities [19, 20, 26, 27]. There are some countries where the government institutions act as interfaces between individuals with disabilities and employers during the pre-employment, job-placement and post-placement phases,

intermediating between the supply and the demand of labor. It was proved that such activities facilitated the employment of persons with disabilities [34]. Government institutions could induce a successful job-seeking behavior among these persons by teaching them how and where to look for jobs and by strengthening their self-efficacy [4, 25].

Authorities could stimulate the employers to hire people with disabilities by offering tax incentives and other benefits. These facilities are meant to compensate the eventually supplementary costs involved [25, 33].

In the last decades governments introduced anti-discrimination legislations meant to protect persons with disabilities. In 1990, in the United States the Congress voted the Americans with Disabilities Act (ADA) which asked the employers to provide reasonable accommodations to individuals with disabilities and forbid the discharge on the basis of disability. In the last years, in the European Union, EU Disability Action Plan (2003 - 2010) and the new European Disability Strategy (2010 - 2020) recommended that social inclusion of persons with disabilities to be stipulated in the national legislations.

However, the results of these initiatives were ambiguous. Some researches revealed that anti-discrimination laws reduced the demand for workers with disabilities [12, 17, 18, 21].

In this paper we approach the Romanian policy regarding the employment of people with disabilities. In the last years, Romania updated its legislation about the people with disabilities, offering some benefits for employment of those persons.

The rest of this paper is organized as follows. The second part describes the Romanian legislation regarding the people with disabilities, the third part presents the results of an investigation about hiring individuals with disabilities by Romanian employers and the fourth part concludes.

2. ROMANIAN LEGISLATION REGARDING OF PEOPLE WITH DISABILITIES

During the negotiations regarding the adhesion to the European Union, Romanian authorities assumed the obligation to promote legislation for people with disabilities in concordance with European anti-discriminatory principles. In December 2006 it was adopted “The Law for Protection and Promoting the Rights for People with Handicap” which created a framework for the government policies to protect the persons with disabilities. Since 2007 this law suffered a lot of modifications which didn’t change it radically.

The Romanian legislation stipulated the rights of individuals with disabilities to a permanent education and training. It recommends special forms of examination for the students with disabilities and educational services to support them.

By law, the Romanian enterprises would have to employ persons with disabilities to an amount which represent 4 percent from all their employees. For all the persons missing to that amount, enterprises have to pay a tax which represents 50 percent of the minimum wage. From this tax could be deducted expenses caused by buying good or services produced by enterprises or organizations of people with disabilities.

In comparison with the laws from other countries, the Romanian legislation for persons with disabilities seem to be more permissive for the employers. There are no stipulations obliging them to provide reasonable accommodations or forbidding them to discharge employees on the basis of disability.

3. INVESTIGATION AMONG ROMANIAN EMPLOYERS ABOUT HIRING PEOPLE WITH DISABILITIES

Between December 2011 and March 2012 we interviewed 34 owners of small and medium Romanian enterprises about hiring people with disabilities. We asked their opinion about three main subjects:

- knowledge about the Romanian legislation regarding people with disabilities;

- circumstances of hiring persons with disabilities;
- benefits of hiring individuals with disabilities.

We find that only 11 employers (32%) read the legislation about people with disabilities, while 20 (59%) didn't read but they knew its main aspects and three of them (9%) knew nothing about it.

At the time of our investigation 8 employers (24%) had between 1 and 5, while 6 (18%) had between 6 and 10 employees with disabilities. Other 14 (41%) had never employed persons with disabilities, while 6 (18%) had employed such individuals in the past, but they had no person with disabilities at the time of the investigation. We questioned them about the factors of hiring people in their enterprises. The answers revealed five relevant factors:

- cost of work;
- experience;
- productivity;
- work quality;
- ability of the employees to work as part of a team.

The employers' perceptions about the importance of these factors, presented in the Table 1, indicate that more than two thirds of them considered the cost of work as very important in hiring people.

We transposed these answers on a rating scale from 1 to 5 (1 for "very low" and 5 for "very high"). The descriptive statistics resulted indicated again the cost of work superiority, while the ability of employees to work as part of a team was perceived as the least important (Table 2).

We interviewed the employers about their perceptions about the people with disabilities regarding the five factors. Excepting the cost of work, these perceptions are less favorable for the persons with disabilities in comparison with the rest of employees (Table 3).

Regarding the benefits of hiring individuals with disabilities, 16 employers (47%) considered the eventually tax cuts didn't compensate the significant risks involved, while the rest of 18 (53%) found these benefits as stimulating.

4. CONCLUSIONS

In this paper we approached the Romanian policies regarding the employment of people with disabilities. We found some significant differences between the Romanian legislation for individuals with disabilities and similar laws from other countries. Romania didn't impose to the employers to provide reasonable accommodations to individuals with disabilities and it didn't forbid the discharge on the basis of disability. However, since such measures were considered in many studies as responsible for reducing the demand for workers with disabilities, it is hard to view their absence from the Romanian legislation as a weakness.

The results of an investigation among the owners of Romanian small and medium enterprises indicate that only a third of them had read the legislation about the people with disabilities. Most of them perceived the work provided by the individuals with disabilities as cheaper in comparison with those of other people, but less productive and with inferior quality. Almost a half of them considered the risks involved by hiring individuals with disabilities were not compensated by the tax reduction offered by the authorities.

The efficiency of the Romanian policy about employment of people with disabilities could be increased by implementing adequate programs of education and training. It would

be also indicated the introduction of programs meant to improve employers information about the aspects of hiring people with disabilities.

REFERENCES

1. Ahn, K. H. Outcomes and future directions of projects for improving employment conditions of the disabled. *Employment Journal of persons with disabilities*, pp.70-93. (2000).

2. Autor, David H., Duggan, Mark G., The Rise in the Disability Rolls and the Decline in Unemployment. *Quarterly Journal of Economics*, Available: http://ssrn.com/abstract=308502 (February, 2003).

3. Baldwin, M., Johnson., W. Labor market discrimination against men with disabilities. *Journal of Human Resources* 29(1): 1-19 (1994).

4. Bandura, A. Self-efficacy: Toward unifying theory of behavioral change. *Psychological Review*, 84, 191-215 (1977).

5. Bergeskog Anders, Labour market policies, strategies and statistics for people with disabilities; A cross-national comparison, IFAU – Labour market policies, strategies and statistics for people with disabilities, *Working Paper* 2001:13.

6. Bound, John, Richard V. Burkhauser. *Economic Analysis of Transfer Programs Targeted on People with Disabilities*. In Handbook of Labor Economics, Vol. 3. Edited by Orley Ashenfelter and David Card. New York, Amsterdam: Elsevier Science, pp. 3417-3528 (1999).

7. Bound, John, Waidmann, Timothy. Accounting for Recent Declines in Employment Rates among the Working-Aged Disabled. NBER Working Paper No. W7975. Cambridge, MA: *National Bureau of Economic Research* (2000).

8. Burkhauser, Richard V., Daly, Mary C., Houtenville, Andrew J. and Nargis, Nigar, The Employment of Working-age People with Disabilities in the 1980s and 1990s: What Current Data Can and Cannot Tell Us FRB of *San Francisco Working Paper* No. 2001-20. Available: http://ssrn.com/abstract=721062 or http://dx.doi.org/10.2139/ssrn.721062 (November, 2001).

9. Caplain, R., Vinokur, A., Price, R. H., van Ryan, M. Job seeking, re-employment, and mental health: A randomized field experiment in coping with job loss. *Journal of Applied Psychology*, 74, 759-769 (1989).

10. Choi, H.S. Future directions of Employment promotion policy and legislation. *Employment Journal of Persons with Disabilities*. pp. 4-23 (2000).

11. Conly, R. W. *The economics of vocational rehabilitation*. Baltimore: The Johns Hopkins Press (1965).

12. Donohue, John J., Stein, Michael Ashley, Griffin, Christopher L. and Becker, Sascha, Assessing Post-ADA Employment: Some Econometric Evidence and Policy Considerations Journal of Empirical Legal Studies, Forthcoming; *Yale Law & Economics Research Paper* No. 358. Available: http://ssrn.com/abstract=1282307 (October 10, 2008).

13. Gannon, B. A dynamic analysis of disability and labour force participation in Ireland, 1995-2000, *Health Economics*, vol. 14, p. 925-938 (2005).

14. Harris, Seth D., Stein, Michael Ashley, Workplace Disabilities Labor and Employment Law and Economics, Kenneth G. Gau-Schmidt, Seth D. Harris and Orly Lobel, eds., Edward Elgar Publishing, 2008; *NYLS Legal Studies Research Paper* No. 08/09-5. Available: http://ssrn.com/abstract=1226433 (August 14, 2008).

15. Hergenrather, K. C., Rhodes, S. D. Placing consumers with major depressive disorder into jobs: Applications of behavioural theory. *Rehabilitation Education*, 18(2), 77-92 (2004).

16. Hergenrather, K. C., Rhodes, S. D., Clark, G. The Employment Perspectives Study: Identifying factors influencing job-seeking behavior of persons living with HIV/AIDS. *AIDS Education and Prevention*, 17(2), 132-144 (2005).

17. Jolls, Christine, Identifying the Effects of the Americans with Disabilities Act Using State-Law Variation: Preliminary Evidence on Educational Participation Effects. *NBER*

Working Paper Series, Vol. w10528, 2004. Available: http://ssrn.com/abstract=1806115 (May, 2004).

18. Jolls, Christine, Employment Law and the Labor Market. *NBER Working Paper* No. w13230. Available: http://ssrn.com/abstract=999872 (July, 2007).

19. Jung, J. J., Jung, D. Y., Yoon, J. R. Education for persons with disabilities. Seoul: *Asian and Pacific decide of disabled persons, 1993-2002*. pp. 171-187 (2002).

20. Kang, W.Y., Jung, D.Y. The problems and perspectives of vocational rehabilitation of learning disabilities. *Korean Journal of Rehabilitation Science*, 9(1), 5-17 (1991).

21. Kruse, Douglas L., Schur, Lisa, Employment of People with Disabilities Following the ADA. *Industrial Relations*, Vol. 42, pp. 31-66, Available: http://ssrn.com/abstract=371223 (2003).

22. Lee, D. Y. A study of the employment policy for people with disabilities. The 5th Rehabilitation Symposium. Seoul: *Korean Society for Rehabilitation of persons with disabilities*, pp. 15-44 (1995).

23. Lee, I. S. Disability policy of Korea in the decade: A fundamental approach. Seoul Conference on Rehabilitation. Manpower development and networking in the Asia and Pacific of Disabled Persons 1993-2002, *Korean Society for Rehabilitation of Persons with Disabilities* (1993).

24. Locke, G., Winters, D., Latham, E. Cognitive and motivational effects of participation: A mediator study. *Journal of Organizational Behavior*, 15, 49-63 (1994).

25. Loprest, Pamela, Elaine Maag. *Barriers to and Supports for Work among Adults with Disabilities: Results from the NHIS-D*. Washington DC: Urban Institute. (2001).

26. Mavromaras, K., Polidano, C. Disabilities, Vocational Education and Employment, Working Paper No 23, *Melbourne Institute of Applied Economic and Social Research* (2009).

27. Mavromaras Kostas, Polidano Cain, Improving the Employment Rates of People with Disabilities through Vocational Education, *IZA Discussion Paper* No. 5548 No. 5548, (March 2011)

28. Rhi, B. Y. Psycho-social rehabilitation of persons with psychiatric disabilities. Seoul: Korea Psycho-social rehabilitation Association. *International Symposium or psychiatric Rehabilitation*. pp. 67-86 (1995).

29. Rubin, S. E., Roessler, R. T. *Foundations of the vocational rehabilitation process* (5th ed.). Austin, TX: Pro-Ed (2001).

30. Shaffer, H., Gambino, B. Psychological rehabilitation, skills building, and self-efficacy. *American Psychology*, 33(4), 392-396 (1978).

31. Stern, S. Measuring the effect of disability on labor force participation. Journal of Human Resources, vol. 24(3), p. 361-395 (1989).

32. Uh, S. B. An analysis of the labour market of people with disabilities. *Paper presented at Seoul International Conference on Disability* (1997).

33. Unger. Darlene D. Employers' attitudes toward persons with disabilities in the workforce: myths or realities?, *Focus on Autism and Other Developmental Disabilities*, Volume 17, Number 1 (Spring 2002)

34. Waterhouse, P., Kimberley, H., Jonas, P., & Glover, J. What would it take? Employer perspectives on employing people with a disability. *National Vocational Education and Training Research* (2010).

35. Wilkins, R. The effects of disability on labour force status in Australia. *The Australian Economic Review* 37(4): 359-83 (2004).

APPENDIX

Table 1 – Employers' perceptions about the importance of the factors of hiring

Degrees of importance	Costs of Work	Experience	Productivity	Work Quality	Ability to Work as Part of a Team
Very high	25	16	15	15	5
High	6	12	14	12	7
Medium	3	3	3	4	14
Low	-	3	2	3	6
Very low	-	-	-	-	2
Total	34	34	34	34	34

Table 2 - Descriptive statistics for the importance of the factors of hiring

Indicator	Costs of Work	Experience	Productivity	Work Quality	Ability to Work as Part of a Team
Mean	4.647	4.206	4.235	4.147	3.206
Standard Error	0.111	0.162	0.147	0.164	0.188
Median	5	4	4	4	3
Mode	5	5	5	5	3
Standard Deviation	0.646	0.946	0.855	0.958	1.095
Sample Variance	0.417	0.896	0.731	0.917	1.199
Kurtosis	1.620	0.502	0.932	0.105	-0.393
Skewness	-1.665	-1.122	-1.106	-0.970	0.007
Sum	158	143	144	141	109
Count	34	34	34	34	34

Table 3 – Employers' perceptions about the people with disabilities

Answers	High Cost of Work	Lack of Experience	Low Productivity	Low Quality of Work	Low Ability to Work as Part of a Team
Yes	8	24	19	15	16
No	17	4	6	8	11
I don't know	9	6	9	11	7
Total	34	34	34	34	34

3. *MATHEMATICS, COMPUTER SCIENCE, IT&C*

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

A MATHEMATICAL MODEL FOR COMPUTING THE TRAJECTORIES OF ROCKETS IN A RESISTANT MEDIUM TAKING INTO ACCOUNT THE EARTH'S ROTATION. THE SYSTEM OF DIFFERENTIAL EQUATIONS OF THE ROCKET'S TRAJECTORY

Bogdan-Alexandru BELEGA*

*Military Technical Academy, Bucharest, Romania

Abstract: *Within this paper, there is established the system of ordinary equations of the trajectory of a rocket with respect to the Earth, while taking into account, the aerodynamic drag, the weight, and the Earth's rotation and curvature. The local latitude and the longitude during the, flight, which implicitly appear in the expressions of the forces acting upon the rocket, are also calculated. The mathematical model thus obtained is rendered in forms utilized in ballistics. This system of equations can also he used for the calculation of the trajectory of an active-reactive projectile, and also, with some adjustments, for the calculation of the orbit of an aerospace vehicle.*

Keywords: *rocket, Earth's rotation, trajectory, rocket latitude and longitude.*

1. THE EXPRESSIONS OF THE FORCES ACTING ON THE ROCKET WITHIN THE HYPOTHESIS OF THE FUNDAMENTAL PROBLEM OF THE EXTERNAL BALLISTICS

The vector equation of the rocket's, equation $m \cdot \frac{d\overline{V}}{dt} = \overline{\mathcal{T}} + \overline{R} + \overline{\mathcal{G}} + \overline{F}_c$ of [9], contains the forces which effectively act on the rocket:

- engine's thrust, $\overline{\mathcal{T}}$;
- the aerodynamic resultant force, $\overline{\mathcal{F}}_a$, which, within the main hypothesis of the fundamental problem of ballistics, reduces to the aerodynamic drag, $\overline{R}$;
- the weight, $\overline{\mathcal{G}}$;
- the Coriolis force, $\overline{F}_c$.

1.1 FORCES EFFECTIVELY APPLIED

1.1.1 THE THRUST

It is assumed that the thrust, $\overline{\mathcal{T}}$, is oriented along the axis of the rocket, which in turn (whithin the main hypothesis of the fundamental problem of the external ballistics) is tangent to the trajectory (***Figure 1***).

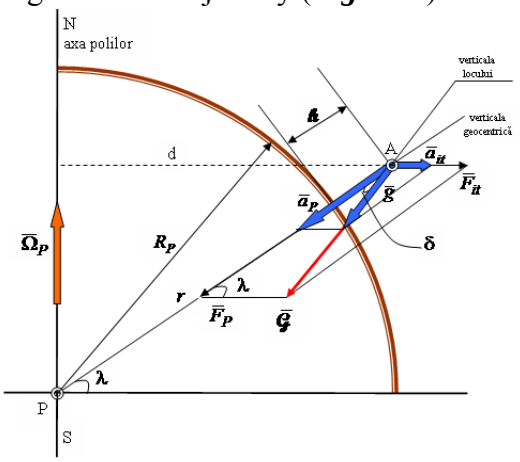


Figure 1. *Forces effectively applied*

Within the Earth-linked frame O_1xyz (the

trajectory is expressed with respect to ***Figure 1***), the velocity vector $\bar{V}$ can be written as $\bar{V} = V_x\bar{i} + V_y\bar{j} + V_z\bar{k}$ **(1)**

So the thrust vector is $\bar{\mathcal{T}} = \mathcal{T}\dfrac{\bar{V}}{V}$ **(2)**

In general, the absolute value of the thrust is function of the flight's altitude, h, and time [6, 11].

The absolute value of the thrust created by the rocket engine can be expressed as [5, 6] $\mathcal{T} = \mathcal{T}_0(t) + S_e p_0[1 - \mathcal{B}(h)]$, **(3)** where $\mathcal{T}_0(t)$ is the ground-level thrust (which depends upon the time t), S_e - the area of the nozzle's exit section, p_0 - the ground-level air pressure, and $\mathcal{B}(h)$ - the function which indicates the relative variation of the air pressure with respect to the altitude, h, $\mathcal{B}(h) = \dfrac{p}{p_0}$ **(4)** where p is pressure at the flying altitude, h.

For the constant thrust motor (which is often encountered) the value of $\mathcal{T}_0$ is given by [6] $\mathcal{T}_0 = Q_e V_{ef} = \dfrac{G_e}{g}V_{ef} = \dfrac{\omega_0}{\tau_2}I_{sp}$ **(5)** where Q_e and G_e are the mass flow rate and the weight flow rate of the exhaust gasses in the exit of the engine's nozzle, respectively, V_{ef} is the "effective" speed of the gasses in the nozzle's exit, I_{sp} - the specific impulse of the engine, ω_0 - the total amount of fuel, τ_2 - the "ballistic" duration of the "active period" (of engine running), while $Q_e = \dfrac{G_e}{g}$, $G_e = \dfrac{\omega_0}{\tau_2}$, $I_{sp} = \dfrac{V_{ef}}{g}$ **(6)**

1.1.2 THE AERODYNAMIC DRAG

Within the hypotheses mentioned above, the aerodynamic drag, $\bar{R}$, is oriented along the velocity vector $\bar{V}$, but it acts in opposite direction, $\bar{R} = -R\cdot\dfrac{\bar{V}}{V} = -R\cdot\dfrac{V_x\bar{i} + V_y\bar{j} + V_z\bar{k}}{V}$ **(7)**, and the absolute value is $R = \dfrac{1}{2}\cdot\rho\cdot V^2\cdot S\cdot C_x$ **(8)**

The density, ρ, and the specific weight, γ, at the altitude of the flight, h, $\rho = \rho_0\cdot\mathcal{H}(h)$, $\gamma = g\cdot\rho$, **(9)** where ρ_0 is the density of the air at the ground-level, while $\mathcal{H}(h)$ is the function which indicates the relative variation of air's density (or specific weight) with respect to the altitude, h [7, 6].

The symbol S of formula (8) is the reference aria, usually the aria of the transverse section of the body, $S = \dfrac{\pi\cdot d^2}{4}$, **(10)** where d is the maximum diameter of the transverse section of the body (fuselage), and C_x - the dimension-less aerodynamic drag coefficient.

Within the adopted hypotheses, at a given altitude, h, the C_x coefficient is function of the Mach number during the flight, $M = \dfrac{V}{a}$, **(11)** where the speed of sound, a, at the flight altitude, h, is given by $a = \sqrt{T\mathcal{R}\mathcal{K}}$, **(12)** in which $\mathcal{K}$ is the ratio of the specific air's heats, $\mathcal{K} = \dfrac{C_p}{C_v} = 1.405$, $\mathcal{R} = 287.1\cdot\dfrac{J}{kg\cdot K}$ is the air's constant, and $T = T(h)$ is the air temperature at the flying altitude, h [7].

Substituting the numerical values, formula (12) becomes $a = 20.08\cdot\sqrt{T(h)}$ **(12')**.

Within the same hypothesis, the value of C_x is expressed as a function $C_x = C_x(M, h)$ **(13)**.

It should be noticed that C_{xact}, which is the C_x function which correspond to the active phase of the flight, is different than C_{xpas}, which is the corresponding function during the passive phase. This is due to the fact that, during the active phase, the part of the drag produced by the vortices which appear at the posterior part of the rocket (at the bottom) while flying with engine off disappears due to

jet of gasses exiting the engine.

Consequently, the drag coefficient of the rocket can be expressed as $C_x(M,\hbar)=\begin{cases}C_{xact}(M,\hbar), t_1<t<t_2\\ C_{xpas}(M,\hbar), t>t_2\end{cases}$ **(14)** where t_1 and t_2 are the value of the time at the beginning and the end of the active phase, respectively, while $C_{xact}=C_{xpas}-C_{xpost}$, **(15)** in which C_{xpost} (also noted C_{xp}) is the posterior drag coefficient (bottom drag) which disappears during the active phase, when the engine is running.

The function $C_x=C_x(M,\hbar)$, which is usually given numerically, is established using experimental data and/or calculations.

Calculation in the ballistic practice often employ "drag functions" like $F(V,a)=\frac{\pi}{8000}\cdot\gamma_{0n}\cdot V^2\cdot C_x^{et}\left(\frac{V}{a}\right)$ **(16)** or $G(V,a)=\frac{\pi}{8000}\cdot\gamma_{0n}\cdot V\cdot C_x^{et}\left(\frac{V}{a}\right)$, $K\left(\frac{V}{a}\right)=\frac{\pi}{8000}\cdot\gamma_{0n}\cdot C_x^{et}\left(\frac{V}{a}\right)$ **(17)**, where γ_{0n} is the specific weight of the air at ground level in "normal conditions" (for the ballistic standard atmosphere, according to [6], $\gamma_{0n}=1.206\frac{kgf}{m^3}$), and $C_x^{et}\left(\frac{V}{a}\right)\equiv C_x^{et}(M)$ is the "standard drag coefficient" or the "drag law" which corresponds to certain class of aerodynamic shapes [5, 6, 8, 11, 13, 15].

In the case, the C_x coefficient is expressed as $C_x(M)=i\cdot C_x^{et}(M)$, **(18)** where i is the shape index (or coefficient) of the rocket and it corresponds to the drag law which was chosen (usually using experimental data).

From formulae (16) and (17), we can obtain $F(V,a)=V\cdot G(V,a)=V^2\cdot K\left(\frac{V}{a}\right)$ **(19)**

and $C_x^{et}(M)=\frac{8000}{\pi\cdot\gamma_{0n}\cdot V^2}F(V,a)=\frac{8000}{\pi\cdot\gamma_{0n}\cdot V}G(V,a)=\frac{8000}{\pi\cdot\gamma_{0n}}K\left(\frac{V}{a}\right)$ **(20)**

where function $K\left(\frac{V}{a}\right)\equiv K(M)$ is a dimensional drag coefficient.

Consequently, the drag, defined by formula (18), can be expressed as

$$R=\frac{1}{2}\cdot\rho\cdot V^2\cdot S\cdot i\cdot\frac{8000}{\pi\cdot\gamma_{0n}\cdot V^2}F(V,a)=$$
$$=\frac{i\cdot S}{\pi\cdot g}\cdot\frac{\gamma}{\gamma_{0n}}\cdot 4000F(V,a) \quad \textbf{(21)}$$

where $\gamma=\rho\cdot g$ is the specific weight of the air at flight altitude.

If $H(\hbar)=\frac{\gamma}{\gamma_{0n}}=\frac{\rho}{\rho_{0n}}$ **(22)** is the function that indicates the variation of the relative specific weight of the air with respect to the height, then the expression of R, expression (21), becomes

$$R=\frac{4\cdot i\cdot S}{\pi\cdot g}\cdot 10^3\cdot H(\hbar)\cdot F(V,a)=$$
$$=\frac{4\cdot i\cdot S}{\pi\cdot g}\cdot 10^3\cdot H(\hbar)\cdot V\cdot G(V,a)= \quad \textbf{(23)}$$
$$=\frac{4\cdot i\cdot S}{\pi\cdot g}\cdot 10^3\cdot H(\hbar)\cdot V^2\cdot K\left(\frac{V}{a}\right)$$

Taking as reference surface the area of the maximum cross-section of rocket's body, formula (10), the expression of the drag, formula (23), becomes

$$R=\frac{i\cdot d^2}{\pi\cdot g}\cdot 10^3\cdot H(h)\cdot F(V,a)=$$
$$=\frac{i\cdot d^2}{\pi\cdot g}\cdot 10^3\cdot H(h)\cdot V\cdot G(V,a)= \quad (24)$$
$$=\frac{i\cdot d^2}{\pi\cdot g}\cdot 10^3\cdot H(h)\cdot V^2\cdot K\left(\frac{V}{a}\right)$$

The function $F(V,a)$, $G(V,a)$ and $K\left(\frac{V}{a}\right)$ are given numerically or in closed form (for various laws) [5,6,8,10,4,1], while the shape index, i, must correspond to the drag law which was adopted.

If the function of rocket's drag coefficient is available, then, in equation (23) and (24), the shape index must be chosen $i=1$, while $K\left(\frac{V}{a}\right)$ is replaced by

$$K\left(\frac{V}{a},h\right)=\frac{\pi}{8000}\cdot\gamma_{0n}\cdot C_x(M,h) \quad (25)$$

1.1.3 THE WEIGHT

As presented in [9], it is considered that the weight, $\overline{G}$, is oriented toward the center of the Earth (point P, ***figure 1***), so

$$\overline{G}=m\cdot\overline{g}=m\cdot\left(g_x\cdot\bar{i}+g_y\cdot\bar{j}+g_k\cdot\bar{k}\right), \quad (26)$$

where m is the mass of the rocket; the weight's acceleration vector, $\overline{g}$, at the current location O of the rocket in flight [9], is

$$\overline{g}=-g\cdot\frac{\overline{PO}}{\left|\overline{PO}\right|}=-g\cdot\frac{x\cdot\bar{i}+\left(y+R_p\right)\cdot\bar{j}+z\cdot\bar{k}}{\sqrt{x^2+\left(y+R_p\right)^2+z^2}} \quad (27)$$

If the distance $\left|\overline{PO}\right|$ between the rocket and the Earth's center is written as $\left|\overline{PO}\right|\equiv\mathcal{D}_{PO}\equiv\mathcal{D}_{CP}\equiv r_p=\sqrt{x^2+\left(R_p+y\right)^2+z^2}$, **(28)** then the weight's acceleration vector becomes

$$\overline{g}=-g\cdot\left(\frac{x}{\mathcal{D}_{CP}}\cdot\bar{i}+\frac{R_p+y}{\mathcal{D}_{CP}}\cdot\bar{j}+\frac{z}{\mathcal{D}_{CP}}\cdot\bar{k}\right). \quad (29)$$

In point O, located at the distance r_p and at the latitude λ from the center of the Earth, the value of g can be obtained from Expression (14) [9] (taking into account Equation (7) as well).

Neglecting the small terms and combining Equations (14) and (7), we have

$$g\cong a_p-\Omega_p^2\cdot r_p\cdot\cos^2\lambda=a_p\cdot\left(1-\frac{\Omega_p^2\cdot r_p}{a_p}\cdot\cos^2\lambda\right)=$$
$$=\frac{f\cdot M}{r_p^2}\cdot\left(1-\frac{\Omega_p^2\cdot r_p^3}{f\cdot M}\cdot\cos^2\lambda\right) \quad (30)$$

Now, $r_p=R_p+h$, where, usually, $R_p=R_p(\lambda,\mu)$ is the distance between the center of the Earth and the surface of the Earth, along the geocentric vertical which passes through O, while h is the altitude of point O, so Formula (30) becomes

$$g=\frac{f\cdot M}{\left(R_p+h\right)^2}\cdot\left[1-\frac{\Omega_p^2\cdot\left(R_p+h\right)^3}{f\cdot M}\cdot\cos^2\lambda\right] \quad (31)$$

For altitudes h between zero and up to the order of magnitude of tenths of kilometers, and even higher, Equation (31) becomes [6]

$$g\cong\frac{f\cdot M}{\left(R_p+h\right)^2}\cdot\left[1-\left(\frac{\cos\lambda}{17}\right)^2\right] \quad (32)$$

At the ground level, where $h=0$, from Equation (31) we have

$$g_P=\frac{f\cdot M}{R_P^2}\cdot\left[1-\frac{\Omega_P^2\cdot R_P^3}{f\cdot M}\cdot\cos^2\lambda\right] \quad (33)$$

so

$$\frac{g}{g_P}=\left(\frac{R_P}{R_P+h}\right)^2\left[\frac{1-\frac{\Omega_P^2\cdot\left(R_P+h\right)^3}{f\cdot M}\cdot\cos^2\lambda}{1-\frac{\Omega_P^2\cdot R_P^3}{f\cdot M}\cdot\cos^3\lambda}\right] \quad (34)$$

The fraction which appears in the brackets in the above equation is practically equal to 1 for flying altitudes h of up to several hundred kilometers, so in such cases Formula (34) is

$$g=g_P\cdot\frac{R_P^2}{\left(R_P+h\right)^2}=g_P\left(1+\frac{h}{R_P}\right)^{-2}, \quad (35)$$

which allows for the calculation of the variation of g with respect to the height.

In such situations, the series expansion of the brackets in Equation (35) (using the binomial formula) is

$$g = g_P \cdot \left(1 - 2 \cdot \frac{h}{R_P} + 3 \cdot \frac{h^2}{R_P^2} - 4 \cdot \frac{h^3}{R_P^3} + \ldots\right) \textbf{(36)}$$

For heights of the order of magnitude of tenths of kilometers (up to 100 km) it can be admitted that

$$g \cong g_P \cdot \left(1 - 2 \cdot \frac{h}{R_P}\right). \textbf{(37)}$$

For points located on the Earth surface or close to it (at altitudes of the orders of tenths of kilometers, up to approximately 100 km) calculations can also employ the formula used in geodesics [14]

$$g = 9.806059 - 0.025028 \cdot \cos 2\lambda - \\ - 0{,}00000307h \quad \textbf{(38)}$$

which, for the latitude $\lambda = 45^0$ and $h = 0$, provides $g_P = 9.806059 \cdot m \cdot s^{-2}$. The standard value $g_P = 9.80665 \cdot m \cdot s^{-2}$ may be used instead, as well.

Correspondingly, g_P may also be estimated using [3]

$$g_P = 9.780573 \cdot (1 + 0.0052837 \cdot \sin^2 \lambda - \\ - 0.0000059 \cdot \sin^2 2\lambda) \quad \textbf{(39)}$$

which, for $\lambda = 45^0$, yields $g_P = 9.806354 \cdot m \cdot s^{-2}$.

1.2 THE INERTIAL CORIOLIS FORCE

The Coriolis force acting upon the rocket which has the velocity $\overline{V}$ with respect to the Earth, which, in turn, rotates with the angular transport velocity $\overline{\Omega}_P$ about the $P \cdot x_G$ [9] has the expression $\overline{F}_C = -m \cdot \overline{a}_C$, **(40)** where m is the mass of the rocket and $\overline{a}_C$ is the Coriolis acceleration, $\overline{a}_C = 2 \cdot \overline{\Omega}_P \times \overline{V}$, **(41)**

so

$$\overline{F}_C = -m \cdot 2 \cdot \overline{\Omega}_P \times \overline{V} = 2 \cdot m \cdot \overline{V} \times \overline{\Omega}_P. \textbf{(42)}$$

The velocity $\overline{V}$ is expressed using the components in the Earth-linked frame O_1xyz, with respect to which the orbit is expressed as well.

Let $\left[\overline{\Omega}_P\right]_G$ be the column matrix containing the components of the $\overline{\Omega}_P$ vector on the axes of the geocentric Earth linked $Px_G y_G z_G$ frame (Figure 1),

$$\left[\overline{\Omega}_P\right]_G = \begin{bmatrix} \Omega_{Px_G} \\ \Omega_{Py_G} \\ \Omega_{Pz_G} \end{bmatrix} = \begin{bmatrix} \Omega_P \\ 0 \\ 0 \end{bmatrix} \textbf{(43)}$$

Since the axes of frame $O_1 x_{G1} y_{G1} z_{G1}$ parallel to the axes of the frame $Px_G y_G z_G$ (f***igure 1***), the $\left[\overline{\Omega}_P\right]_{G1}$ column matrix of the components of the vector $\overline{\Omega}_P$ with respect to the former frame is identical to $\left[\overline{\Omega}_P\right]_G$.

If $\left[\overline{\Omega}_P\right]$ is the column matrix containing the components of the vector $\overline{\Omega}_P$ with respect to the frame O_1xyz (***figure 1***), then

$$\left[\overline{\Omega}_P\right] = \begin{bmatrix} \Omega_{Px} \\ \Omega_{Py} \\ \Omega_{Pz} \end{bmatrix} = \Gamma_\beta \cdot \Gamma_{\lambda_1} \cdot \left[\overline{\Omega}_P\right]_{G1} = \quad \textbf{(44)}$$

$$= \Gamma_\beta \cdot \Gamma_{\lambda_1} \cdot \left[\overline{\Omega}_P\right]_G = \Gamma_{\lambda_1 \beta} \cdot \left[\overline{\Omega}_P\right]_G$$

Taking into account Equation (22) [9], Expression (44) becomes

$$\begin{bmatrix} \Omega_{Px} \\ \Omega_{Py} \\ \Omega_{Pz} \end{bmatrix} = \begin{bmatrix} \cos\beta\cos\lambda_1 & -\cos\beta\cos\lambda_1 & \sin\beta \\ \sin\lambda_1 & \cos\lambda_1 & 0 \\ -\sin\beta\sin\lambda_1 & \sin\beta\sin\lambda_1 & \cos\beta \end{bmatrix} \textbf{(45)}$$

which gives the components:

$$\Omega_{Px} = \Omega_P \cdot \cos\beta \cdot \cos\lambda_1$$
$$\Omega_{Py} = \Omega_P \cdot \sin\lambda_1 \quad \textbf{(46)}$$
$$\Omega_{Pz} = -\Omega_P \cdot \sin\beta \cdot \cos\lambda_1$$

The expression of the Corollas force, (42), can be further expended as

$$\bar{F}_C = 2m\begin{vmatrix} \bar{i} & \bar{j} & \bar{k} \\ V_x & V_y & V_z \\ \Omega_{Px} & \Omega_{Py} & \Omega_{Pz} \end{vmatrix} = 2m[(V_y\cdot\Omega_{Pz} - V_z\cdot\Omega_{Py})\cdot\bar{i}] + (V_z\cdot\Omega_{Px} - V_x\cdot\Omega_{Pz})\cdot\bar{j} + (V_x\cdot\Omega_{Py} - V_y\cdot\Omega_{Px})\cdot\bar{k} \quad \textbf{(47)}$$

Next, taking into account (46), the Coriolis force can be expressed as

$$\begin{aligned} \bar{F}_C &= 2m\Omega_P\cdot(-V_y\cdot\sin\beta\cdot\cos\lambda_1 - V_z\cdot\sin\lambda_1)\cdot\bar{i} + \\ &+ 2m\Omega_P\cdot(V_z\cdot\cos\beta\cdot\cos\lambda_1 + V_x\cdot\sin\beta\cdot\cos\lambda_1)\cdot\bar{j} + \\ &+ 2m\Omega_P\cdot(V_x\cdot\sin\lambda_1 - V_y\cdot\cos\beta\cdot\cos\lambda_1)\cdot\bar{k} \end{aligned} \quad \textbf{(48)}$$

which, defining the symbol $\bar{a}_{Fc} = -\bar{a}_C$ can be further written as

$$\bar{F}_C = m\cdot\bar{a}_{Fc} = m\cdot(a_{Fcx}\cdot\bar{i} + a_{Fcy}\cdot\bar{j} + a_{Fcz}\cdot\bar{k}), \quad \textbf{(49)}$$

where

$$\begin{aligned} a_{Fcx} &= 2\cdot(V_y\cdot\Omega_{Pz} - V_z\cdot\Omega_{Py}) = \\ &= 2\cdot\Omega_P\cdot(-V_y\sin\beta\cos\lambda_1 - V_z\sin\lambda_1) \\ a_{Fcy} &= 2\cdot(V_z\cdot\Omega_{Px} - V_x\cdot\Omega_{Pz}) = \\ &= 2\cdot\Omega_P\cdot(V_z\cos\beta\cos\lambda_1 + V_x\sin\beta\cos\lambda_1) \\ a_{Fcz} &= 2\cdot(V_x\cdot\Omega_{Py} - V_y\cdot\Omega_{Px}) = \\ &= 2\cdot\Omega_P\cdot(V_x\sin\lambda_1 - V_y\cos\beta\cos\lambda_1) \end{aligned} \quad \textbf{(50)}$$

2. THE SYSTEM OF DIFFERENTIAL EQUATIONS OF THE ROCKET'S TRAJECTORY

The differential equations system of rocket's trajectory flying within a resistant medium and taking into account Earth's rotation and curvature is obtained from vector Equation (19) [9] and using Formulae (1), (2), (7), (26) and (49). Collecting the results, the trajectory with respect to the Earth-linked O_1xyz frame is described by:

$$\begin{cases} \dfrac{dV_x}{dt} = \dfrac{\mathcal{T}}{m}\cdot\dfrac{V_x}{V} - \dfrac{R}{m}\cdot\dfrac{V_x}{V} + g_x + a_{Fcx} \\ \dfrac{dV_y}{dt} = \dfrac{\mathcal{T}}{m}\cdot\dfrac{V_y}{V} - \dfrac{R}{m}\cdot\dfrac{V_y}{V} + g_y + a_{Fcy} \\ \dfrac{dV_z}{dt} = \dfrac{\mathcal{T}}{m}\cdot\dfrac{V_z}{V} - \dfrac{R}{m}\cdot\dfrac{V_z}{V} + g_z + a_{Fcz} \\ \dfrac{dx}{dt} = V_x \\ \dfrac{dy}{dt} = V_y \\ \dfrac{dz}{dt} = V_z \end{cases} \quad \textbf{(51)}$$

where

$$V = \sqrt{V_x^2 + V_y^2 + V_z^2}\ . \quad \textbf{(52)}$$

Substituting the drag R with the general expression, Equation (8), and taking into account Equations (27) and (50), the system of differential equations of the rocket's trajectory becomes:

$$\begin{cases} \dfrac{dV_x}{dt} = \dfrac{\mathcal{T}}{mV}\cdot V_x - \dfrac{\rho S C_x}{2m}\cdot V\cdot V_x - g\cdot\dfrac{x}{\mathcal{D}_{cP}} + 2(V_y\Omega_{Pz} - V_z\Omega_{Py}) \\ \dfrac{dV_y}{dt} = \dfrac{\mathcal{T}}{mV}\cdot V_y - \dfrac{\rho S C_x}{2m}\cdot V\cdot V_y - g\cdot\dfrac{R_P + y}{\mathcal{D}_{cP}} + 2(V_z\Omega_{Px} - V_x\Omega_{Pz}) \\ \dfrac{dV_z}{dt} = \dfrac{\mathcal{T}}{mV}\cdot V_z - \dfrac{\rho S C_x}{2m}\cdot V\cdot V_z - g\cdot\dfrac{z}{\mathcal{D}_{cP}} + 2(V_x\Omega_{Py} - V_y\Omega_{Px}) \\ \dfrac{dx}{dt} = V_x \\ \dfrac{dy}{dt} = V_y \\ \dfrac{dz}{dt} = V_z \end{cases} \quad \textbf{(53)}$$

where the traction, $\mathcal{T}$, is determined as shown in **1.1**, the acceleration of the weight, g, can be obtained using Equation (14) [9] or (30), (31) or (36), the distance to the center of the Earth, $\mathcal{D}_{CP}$ is given by Equation (28), while Ω_{Px}, Ω_{Py}, and Ω_{Pz}, are calculated using Equation (46).

Expressing the drag from one of Equations (24), which are usually utilized in ballistics, and taking into account Equation (46), trajectory's differential equations system becomes

$$\begin{cases} \dfrac{dV_x}{dt} = \dfrac{\mathcal{T}}{m}\cdot\dfrac{V_x}{V} - \dfrac{id^2}{mg}\cdot 10^3 H(h) K\left(\dfrac{V}{a}\right)\cdot V\cdot V_x - \\ - g\cdot\dfrac{x}{\mathcal{D}_{cP}} - 2\Omega_P(V_y\sin\beta\cos\lambda_1 + V_z\sin\lambda_1) \\ \dfrac{dV_y}{dt} = \dfrac{\mathcal{T}}{m}\cdot\dfrac{V_y}{V} - \dfrac{id^2}{mg}\cdot 10^3 H(h) K\left(\dfrac{V}{a}\right)\cdot V\cdot V_y - \\ - g\cdot\dfrac{R_P + y}{\mathcal{D}_{cP}} + 2\Omega_P(V_x\sin\lambda_1 + V_x\sin\beta\cos\lambda_1) \\ \dfrac{dV_z}{dt} = \dfrac{\mathcal{T}}{m}\cdot\dfrac{V_z}{V} - \dfrac{id^2}{mg}\cdot 10^3 H(h) K\left(\dfrac{V}{a}\right)\cdot V\cdot V_z - \\ - g\cdot\dfrac{z}{\mathcal{D}_{cP}} + 2\Omega_P(V_x\sin\lambda_1 - V_y\cos\beta\cos\lambda_1) \\ \dfrac{dx}{dt} = V_x \\ \dfrac{dy}{dt} = V_y \\ \dfrac{dz}{dt} = V_z \end{cases} \quad \textbf{(54)}$$

The latitude λ and the longitude μ of the rocket at a certain instant during the flight are obtained using Formulae (36) or (37) and (41) [9], while taking into account Expressions (34), (39) and (40) [9].

The altitude h, of the rocket during the flight is

$$h = \mathcal{T}_{cP} - R_P \quad \textbf{(55)}$$

where $\mathcal{T}_{cP}$ is the distance between the rocket and the center of the Earth [9], while R_P which is generally a function $R_P(\lambda,\mu)$, is the distance from the center of the Earth, P, up to a point P_P, located on the surface of the Earth, at the same latitude λ and longitude μ as the rocket.

Air pressure, p, and air density, ρ (or the specific weight, γ), at the altitude h (which occur in form (53) of the equations system) are obtained from Equations (4) and (9). The functions $\mathcal{B}(h)$ and $\mathcal{H}(h)$, which represent the relative variation with altitude of the pressure and density, respectively, can be expressed as

$$\mathcal{B}(h) = \frac{p}{p_0} = \frac{p_{0n}}{p_0}\cdot\frac{p}{p_{0n}} = \frac{p_{on}}{p_0}\cdot B(h)$$

$$\mathcal{H}(h) = \frac{\rho}{\rho_0} = \frac{\rho_{0n}}{\rho_0}\cdot\frac{\rho}{\rho_{0n}} = \frac{\rho_{0n}}{\rho_0}\cdot H(h) \quad \textbf{(56)}$$

where p_0 and ρ_0 are the ground-level air pressure and density p_{0n}, and ρ_{0n}, are the ground-level air pressure and density in normal conditions, while the functions $B(h) = \frac{\rho}{\rho_{0n}}$ and $H(h) = \frac{\rho}{\rho_{0n}} = \frac{\gamma}{\gamma_{0n}}$ are the functions that describe the relative variations of the air pressure and density (or specific weight), with respect to the altitude within the standard atmosphere model which was adopted [7, 12, 21].

For flight distances (ranges) of 40-50 km or even larger it can be admitted that R_P is a constant equal to the spherical homogeneous Earth ($R_P = 6371110\cdot m$), without affecting meaningfully the accuracy of the results. In such a case the variation of g with respect to the latitude λ can also be neglected, however, its variation with respect to the altitude h must be taken into account.

The system of differential equations that was obtained represents the mathematical model of rocket's trajectory (in a resistant medium), which takes into account the daily Earth's rotation and Earth's curvature. The calculations are further performed via the numerical integration of this system.

The numerical integration of the differential equations system begins at the moment $t = t_1$, when the rocket looses contact with the launching device (e.g., the ramp), and the elements of the motions at the end of the motion of the launching device are used as the initial conditions, i.e.,

$$t = t_1, V_x = (V_x)_1 = V_1\cos\theta_1,$$
$$V_y = (V_y)_1 = V_1\cos\theta_1,\ V_z = 0,\ x = 0,\ y = 0,$$
$$x = 0 \quad \textbf{(57)}$$

where V_1 and θ_1 are the speed while leaving the launcher and the launching angle, respectively.

During the passive phase of the flight, in other words after the end running time of the rocket engine, for $t > t_2$ (where t_2 is the extent of the active phase), the traction term in the equations of motion have to be voided ($\overline{\mathcal{T}} = 0$). The elements of the motion (state variables as well as other parameters) at the moment $t = t_2$ have to be recorded and the integration further proceeds using these ($t = t_2$) data as initial conditions.

The slope θ of the tangent to the trajectory with respect to the horizontal plane at the launching position, xO_1z is given by the expression

$$tg\theta = \frac{V_y}{\sqrt{V_x^2 + V_z^2}} \quad \textbf{(58)}$$

The equations of motion are usually integrated until a predetermined altitude, h, is reached on the descending side of the trajectory (when $\theta < 0$).

Calculation of the range requires integrating until $h = 0$ on the descending part of the trajectory.

Adequate choice of the initial conditions and of the end conditions allows the ordinary differential equations system obtained herein to be used for calculation of the active-reactive projectile's trajectory as well. So, if t_0 is the moment when the projectile exits the barrel, t_1 - the start of the rocket engine and t_2 corresponds to the end of the engine run, the ordinary differential equations system (with the appropriately selected boundary conditions) can be integrated choosing $\mathcal{T} = 0$ for the time-frame $[t_0, t_1]$, next setting, $\mathcal{T} \neq 0$, for the time-frame $[t_1, t_2]$ and, finally $\mathcal{T} = 0$, again for $t > t_2$, when the engine is no longer running.

The mathematical model presented in this paper can also be used (with the adequate adjustments) for calculating the trajectory of an aerospace vehicle within the dense atmosphere.

III. CONCLUSION

The mathematical model obtained is rendered in forms utilized in ballistics. This system of equations can also be used for the calculation of the trajectory of different rockets, active-reactive projectile, and also, with some adjustments, for the calculation of the trajectories of an aerospace vehicle.

For distances of 20-25 km, the inertial Coriolis force introduced by the Earth's rotation can be neglected. For bigger distances, the Coriolis force must be also considered. The variation of g with respect to the altitude h must be taken into account.

For flight distances (ranges) of 40-50 km or even larger, it can be admitted that R_P is a constant equal to the spherical homogeneous Earth ($R_P = 6371110 \cdot m$), without affecting, meaningfully, the accuracy of the results.

For distances over 50-60 km, the variation of g with respect to the latitude λ and altitude h must be taken into account.

REFERENCES

[1] B.A. BELEGA - *Exterior Ballistics of rockets*, MTA, Bucharest, 2011 (in Romanian)

[2] F. MORARU, L. MORARU, B. SCOBENIUC (BELEGA) - *A Mathematical Model for Computing the Trajectories of Rockets in a Resistant Medium Taking into Account the Earth's Rotation. Part I: The Vector Equation of Rocket's Motion with Respect to the Earth. The Position of the Rocket with Respect to an Earth-Linked Geocentric Frame*, MTA Review, Vol. XX, No. 2, pp. 75-86, Jun. 2010.

[3] F. MORARU - *Exterior Ballistics and Rocket Flight Dynamics*, Military Academy Publishing House, Bucharest, Romania, 1973 (in Romanian)

[4] F. MORARU - *Handbook of Exterior Ballistics*, Military Publishing House, Bucharest, Romania, 1976 (in Romanian)

[5] F. MORARU -*Aerodynamics: Part I*, Military Academy Publishing House, Bucharest, Romania, 1980 (in Romanian)

[6] F. MORARU - *Chapters of Numerical Analysis: Applications in Ballistics and Flight Dynamics*, 2ed Edition, Military Technical Academy Publishing House, Bucharest, Romania, 2001 (in Romanian)

[7] M.M. NI-FA, D. St. ANDREESCU - *The Guided and Unguided Rocket '.s Flight*, Military Publishing House, Bucharest, Romania, 1964 (in Romanian)

[8] M.M. NITĂ F. MORARU, R.N. PATRAULEA - *Airplanes and Rockets: Design Concepts*, Military Publishing House, Bucharest, Romania, 1985 (in Romanian)

[9] I.M. SAPIRO - *Exterior Ballistics*, I.D.T., Bucharest, Romania, 1954 (in Romanian)

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

COLORING OF THE SIMPLICIAL COMPLEX AND THE GRUNDY FUNCTION

Sergiu CATARANCIUC

Departement of Mathematics and Informatics, University State of Moldova, Chisinau, Republic of Moldova.

Abstract: *The coloring problem of all elements of the complex of multi-ary relation is formulated. We give a necessary and sufficient conditions for the existence of a correct coloring of this complex. The Grundy function role to solving this problem is studied.*

Keywords: *complex of multi-ary relations, Grundy function, simplex, p-cromatic complex, coloring problem, graph, hypergraph, n-dimensional loop.*

Let $X = \{x_1, x_2, ..., x_r\}$ be a finite set of elements and $X = X^1, ..., X^{n+1}, ..., (n \geq 1)$ be the succession of Cartesian products $X : X^{m+1} = X^m \cdot X, \quad 1 \leq m \leq n.$ Any nonempty subset $R^m \subset X^m$ is said to be an *m-ary relation* of elements from X (the set $R^1 \subset X^1$ is a subset of elements from X).

According to the mentioned above, an *m-ary relation* is a family of ordered successions named sequences. Each sequence consists of m elements of X . Generally speaking, the sequence $(x_{i_1}, x_{i_2}, ..., x_{i_m}) \in R^m$ could contain some elements from X several times. For this kind of sequence any subsequence $(x_{j_1}, x_{j_2}, ..., x_{j_t}), \quad 1 \leq l \leq m,$ which preserves the order of elements of $(x_{i_1}, x_{i_2}, ..., x_{i_m})$ is called a *hereditary subsequence*.

Definition 1. *A finite family of relations* $\{R^1, R^2, ..., R^{n+1}\}$ *which satisfies the conditions:*

1. $R^1 = X^1 = X;$
2. $R^{n+1} \neq \varnothing;$
3. *any hereditary subsequence* $(x_{j_1}, x_{j_2}, ..., x_{j_t}), \quad 1 \leq l \leq m \leq n+1,$ *of the sequence* $(x_{i_1}, x_{i_2}, ..., x_{i_m}) \in R^m$ *belongs to the l-ary relation* R^l ,

is called a ***generalized complex of multi-ary relations (*** G ***-complex)*** *and is denoted by*

$$G^{n+1} = (R^1, R^2, ..., R^{n+1}).$$

From Definition 1 we obtain that the set R^m of a generalized complex R^{n+1} is not empty for each $1 \leq m \leq n+1$.

The study of generalized complex of multi-ary relations is interesting because this notion covers a lot of classical notions like graphs and hypergraphs [2], matroids [4], simplicial complexes, etc. Certainly, this complex could be interpreted as a particular case of the abstract cellular **complex** (CW), but these new mathematical structures serve as effective models for solving a lot of theoretical and applicative problems. Remark that the object R^{n+1} has advantage over the structures

mentioned above. Thus, if it is compared with cellular complex (CW) then it is seen that the R^{n+1} is formed from the elementary "bricks", maybe with non-isomorphic deformations, like there are the abstract quasi-simplexes.

Consider the generalized complex of relations $G^2 = (R^1, R^2)$. It is obvious that this complex represents a directed graph [5]. This allows us to consider the generalized complex of relations R^{n+1} as an **oriented** and **hereditary hypergraph** (according to C. Berge). The last notion could be rarely found in the bibliography of speciality, and it represents a structure different from the notion of hypergraph [3]. Next, we will describe a procedure that allows to obtain the notion of hypergraph in the form of generalized complex and the so-called cycles of hypergraph in a natural form. This will be different from the known one, and it will be starting from the notion of oriented hypergraph transformed into a complex of abstract simplexes.

Most about the G-complex of multi-ary relations see in [6, 7].

By analogy to the know classical bibliography in the combinatorial topology and topological algebra fields [1, 3], further we will also use other notations and notions, that are equivalent to those mentioned. These notations and notions will be used to study the properties of the complex of multi-ary relations, which are needed to solve practical problems.

Definition 2. *The sequence* $(x_{i_0}, x_{i_1}, ..., x_{i_m}) \in R^{m+1}$, *which has pairwise distinct elements, is said to be* ***an abstract simplex of dimension m*** *and donoted by* $S_i^m = (x_{i_0}, x_{i_0}, ..., x_{i_m}) \in R^{m+1}, m = \dim S_i^m$.

Any sequence of elements $(x_{j_0}, x_{j_1}, ..., x_{j_t}) \in R^{l+1}$, *which is a hereditary subsequence of elements* S_i^m, *is called a* ***face*** *of dimension l of a simplex* S_i^m, *and it will be denoted by* $S_j^l = (x_{j_0}, x_{j_1}, ..., x_{j_t})$, $S_j^l \subset S_i^m$. *Sometimes we will be denoted by of dimension zero – **vertices,** and those of dimension one are called **edges** of simplex* $S_i^m, 0 \le m \le n$.

A subset formed by $m + 1$ pairwise distinct elements from the set X can generate several abstract simplexes of dimension m. The maximal number of it coincides with the number of different permutations of the $m + 1$ elements. This means that there are $(m + 1)!$ simplexes. It follows that distinct abstract simplexes of dimension m that are stretched on $m + 1$ vertices from X could be imagined as membranes that strain these vertices.

Further we will denote by S^m the set of all simplexes with dimension m that are determined by sequences from R^{m+1}.

By this way the complex of relations $R^{n+1} = (R^1, R^2, ..., R^{n+1})$ can represented as follows: $S^0 = R^1, S^1 = R^2, ..., S^n = R^{n+1}$ and $(S^0, S^1, ..., S^n) = K^n$.

Thus, we believe that K^n is an abstract simplicial complex, also.

Definition 3. *An abstract simplicial subcomplex*

$$K^m = S^0 \cup S^1 \cup ... \cup S^m \qquad (1)$$

of K^n *is said to be m-dimensional skeleton of* K^n, $m = 0, 1, ..., n$.

We will consider a multi-valued operator $I : K^n \to K^n$ with the property that for each $S_i^m \in K$ the equality $I(S_i^m) = K(S_i^m)$, holds, where $K(S_i^m)$ represents the set of simplices of the complex K^n, too.

Definition 4. *Given a complex* K^n, *the set of nonnegative integers* N_0 *and a single valued mapping*

$$g : K^n \to N_0.$$

The mapping g *is called the Grundy function of the complex* K^n *if for any* $S_i^m \in K^n$ *the following equality holds:*

$$g(S_i^m) = \min_{S_i^m \in K^n} \{N_0 \setminus g(I(S_i^m))\},$$

$i = 1, 2, ..., t_m$, $m = 0, 1, ..., n$, *where* $g(I(S_i^m))$ *denotes the set of values of* g *for all simpleces from* $I(S_i^m)$.

Definition 5. *The mapping*

$$\Gamma_n : K^n \to N_0 \qquad (2)$$

is said to be a color function of the complex K^n *if* Γ_n *is a single-valued mapping and for each two simplices* $S_i^{m_1}$, $S_j^{m_2} \in K^n$, *which are different and have non-empty intersection or which are not neigbouring for* $m_1 = m_2 = 0$ *the following inequality holds:*

$$\Gamma_n(S_i^{m_1}) \neq \Gamma_n(S_j^{m_2}) \qquad (3)$$

In this case we will say that the family of simplices from K^n *has a proper coloring. Let* $\overline{0, \gamma_n - 1} \in N_0$ *be the interval of minimal length for which there exists a proper coloring of the elements of* K^n, *i.e., for every* $S_i^{m_1} \in K^n$ *the value* $\Gamma_n(S_i^{m_1})$ *satisfies the relation* $\Gamma_n(S_i^{m_1}) \leq \gamma_n - 1$ *and there exists a simplex* $S_j^{m_2} \in K^n$ *such that* $\Gamma_n(S_j^{m_2}) = \gamma_n - 1$. *The number* γ_n *is called n-dimensional chromatic number of the complex* K^n.

Considering the restriction (2) for the skeleton (1), i.e.,

$$\Gamma_m : K^m \to N_0, \qquad (4)$$

we will analogously speak about the *m-dimensional chromatic number*, γ_m, of the complex K^n, $m = 0, 1, 2, ..., n-1$. Let $\gamma_0 = 1$ for $m = 0$. The complex K^n is called *p-chromatic* if there exists a coloring of elements of K^n such that (2) satisfies (3) and can be written:

$$\Gamma_n : K^n \to \overline{0, p-1},$$

where for $\forall q \in \overline{0, p-1}$ exists $S \in K^n$ such that $\Gamma_n(S) = q$.

Now it is obvious that there exists a number $p \in N_0$ for which the complex K^n is *p*-chromatic. For this it is sufficient to enumerate all elements of K^n. It is not an easy problem to find a minimal number *p*.

Theorem 1. *Given an abstract simplicial p-chromatic complex* K^n *and the operator* Γ_n *satisfying (3). The number p equals* γ_n *if and only if there exists a Grundy function satisfying the equality:*

$$\max_{S \in K^n} g(S) = \gamma_n - 1. \qquad (5)$$

Proof. $\Rightarrow$ Let the equality (5) holds. We will show that in this case all elements of the complex K^n can be properly colored with the colors $0, 1, ..., \gamma_n - 1$. Denote by S_m the set of all simplices S with $g(S) = m$, $m = 0, 1, ..., \gamma_n - 1$. We will prove that each two simplices $S_1, S_2 \in S_m$ either have non-empty intersection or, if S_1 and S_2 are 0-dimensional simplicies, do not belong to some *k*-dimensional simplex of K^n with $k > 0$. Assume that $S_1 \bigcap S_2 = \varnothing$, or S_1, S_2 are 0-dimensional simplicies belonging to some l-dimensional simplex of K^n. Then, e.g., for $g(S_1) = \min\{N_0 \setminus g(I(S_1))\}$ and according to the definition of a subcomplex, the relation $K(S_1) = I(S_1)$ holds, where $S_2 \in I(S_1)$. This contradicts the definition of the Grundy function. Thus, the necessity is proved.

$\Leftarrow$ Let there exists a proper coloring of K^n with γ_n colors: $0, 1, ..., \gamma_n - 1$, and $S_0, S_1, ..., S_{\gamma_{n-1}}$ be the set of families of all

simplices of K^n colored with colors $0, 1,..., \gamma_n - 1$, respectively. Our aim is to construct another set $\overline{S_0}, \overline{S_1},..., \overline{S_{\gamma_n - 1}}$ and to define for this set the function $g_m(S) = m \Leftrightarrow S \in \overline{S_m}$, $m = 0, 1, ..., \gamma_n - 1$.

0) By induction the set $\overline{S_0}, ..., \overline{S_{\gamma_n - 1}}$ can be constructed in the following way: $S_0^i = S_0^{i-1} \bigcup S_i^1$, where $S_i^1 = S_i \setminus I(S_0^{i-1})$, for all $1 \le i \le \gamma_n - 1$. (here we consider $S_0^0 = S_0$).

Consider $\overline{S^0} = S_0^{\gamma_n - 1}$.

Form another set:

$$ {}^1S_1,\ {}^1S_2, ...,\ {}^1S_{\gamma_n - 1}, \qquad (6) $$

where ${}^1S_m = S_m \setminus \overline{S_0}$, $m = 1, 2,..., \gamma_{n-1}$.

The set (6) has the proprety: ${}^1S_m \neq \varnothing$, $m = 1, 2,..., \gamma_n - 1$. Otherwise, if there exists an m_0 such that ${}^1S_{m_0} = \varnothing$, then the complex K^n can be colored with less than colors. This is possible due to the construction of the se $\overline{S_0}$, ${}^1S_1, ...,\ {}^1S_{\gamma_{n-1}}$ and property of the multi-valued operator $I : K^n \to K^n$.

m-1) Suppose that the following set is constructed:

$$ {}^{m-1}S_{m-1}, {}^{m-1}S_m, ..., {}^{m-1}S_{\gamma_n - 1}, \quad (7) $$

where no family of simplices from (7) is empty. Consider the family $\overline{S_{m-1}} = {}^{m-1}S_{m-1}^{\gamma_n - 1}$ and construct the set:

$$ {}^{m-1}S_{m-1}, {}^{m-1}S_m, ..., {}^{m}S_{\gamma_n - 1}, \qquad (8) $$

where

$$ {}^mS_m = S_m \setminus \overline{S_{m-1}}, {}^mS_{m+1} = S_{m+1} \setminus \overline{S_{m-1}}, ..., $$
$$ {}^mS_{\gamma_{n-1}} = S_{\gamma_n - 1} \setminus \overline{S_{m-1}}. $$

m) Let ${}^mS_m^i = {}^mS_m^{i-1} \bigcup {}^mS_i^1$,

where ${}^mS_i^1 = {}^mS_i \setminus I({}^mS_m^{i-1})$, for all

$$ m + 1 \le i \le \gamma_n - 1. $$

Consider $\overline{S_m} = {}^mS_m^{\gamma_n - 1}$ and construct the following set:

$$ {}^{m+1}S_{m+1}, {}^{m+1}S_{m+2}, ..., {}^{m+1}S_{\gamma_n - 1}, \qquad (9) $$

where

$${}^{m+1}S_{m+i} = {}^{m+1}S_{m+1} \setminus \overline{S_m},\ i = 1, 2,..., \gamma_n - 1 - m.$$

By construction the set $\overline{S_0}, ..., \overline{S_{\gamma_n - 1}}$ is obtained, having the property $\overline{S_m} \neq \varnothing$, $m = 0, 1, ..., \gamma_n - 1$. We will show that $g_m(S) = m$ is a Grundy function i.e.,

$$ m = g(S) = \min\{N_0 \setminus g(I(S))\}, \qquad (10) $$

where $S \in \overline{S_m}$, $m = 0, 1, ..., \gamma_n - 1$.

The relation (10) is obvious (by construction of family $\overline{S_0}, \overline{S_1}, ..., \overline{S_m}, ..., \overline{S_{\gamma_n - 1}}$). Ineed, if $S \in S_m$, then the following holds:

$$ I(S) \bigcap \overline{S_0} \neq \varnothing, ..., I(S) \bigcap \overline{S_{m-1}} \neq \varnothing, $$
$$ I(S) \bigcap \overline{S_m} \neq \varnothing, $$
$$ I(S) \bigcap \overline{S_{m+1}} \neq \varnothing, ..., I(S) \bigcap \overline{S_{\gamma_n - 1}} \neq \varnothing. $$

The terms of Definition 4 are satisfied: $m = g(S) = \min\{N_0 \setminus g(I(S))\}$, i.e., (10) holds.

Theorem 2. *Given an abstract simplicial complex K^n and the operator (2) with the property (3). The complex K^n is p-chromatic if and only if there exists a Grundy function of K^n satisfying inequality* $\max_{S \in K^n} g(S) \le p - 1$.

The proof of this theorem is almost the same as that of Theorem 1.

References

1. Aleksandrov P. S. *Introduction to Homological dimension theory and general combinatorial topology.,* Moscow, 1975 (in Russian).

2. Berge C. *Graphs and hypergraphs,* North-Holland, Amsterdam, 1973.

3. Björner A. *Topological methods (in Handbook of Combinatorics*, eds. R. Grahfm, M. Grotschel, L. Lovasz), North Holland, Amsterdam, 1995, pp. 1819-1872.

4. Björner A. and Ziegler G.M. *Introduction to Greedoids in Matroid applica-tions* (ed. White, N.), Cambridge Univ. Press, 1992, pp. 284-357.

5. Bollobas B. *On generalized graphs*, Acta

Math. Acad. Sci. Hung., 16, 1965,pp. 447-452.

6. Cataranciuc S. *G-complex of multi-ary relations*, Analele stiințifice ale USM, Seria "Științe fizico-matematice", Chisinău, 2006, pp. 119-122 (in Romanian).

7. Cataranciuc S., Soltan P. *Abstract complexes, their homologies and application.* Buletinul Academiei de Stiinte a Republicii Moldova. 2010, 2(63), pp. 31-58.

8. Berge G. *Hypergraphs: combinatorics of finite sets*, North Holland, Amsterdam, 1989.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

THE FIRST ORDER DERIVATIVE OF FUNCTION $\chi_i(t)$

Mihaela DUMITRACHE*, Camelia GHELDIU*

* University of Pitesti, Piteşti, Romania

Abstract: *Linear partial differential equations of second order hyperbolic type are involved in describing oscillating and wave processes in elastic and electromagnetic mediums. In this paper we study two equations, from the canonical form [1] of equation of hyperbolic type, and using the method of integration along the corresponding characteristics, we obtain the first order derivative of* $\chi_i(t)$ *with respect to t.*

Key-Words: *wave equation, hyperbolic equations, characteristics.*
MSC2010: *35L05, 35L10, 45D05.*

1. INTRODUCTION

Linear partial differential equations of second order hyperbolic type have a wide range of applications in mathematical physics problems. They appear in the description of oscillatory and wave processes in elastic and electromagnetic environments. Certain types of first order hyperbolic systems can be reduced to wave equation [2]. But a second order hyperbolic equation, in turn, can be treated as a first order hyperbolic system.

Let consider the set

$$\Omega_T = \{(x,t): x \in R,\ 0 \le t \le T\}, \quad (1)$$

and the second order hyperbolic equation

$$u_{tt} = a^2 u_{xx} + b u_x + c u_t + du + F\ . \quad (2)$$

with the Cauchy data

$$\begin{cases} u(x,0) = \varphi(x), & x \in \mathbf{R}, \\ u_t(x,0) = \psi(x), & x \in \mathbf{R}. \end{cases} \quad (3)$$

The subsidiary information about the problem (2)-(3) solutions is

$$u(x_i,t) = \chi_i(t),\ 0 \le t \le T,\quad 0 \le i \le n\ . \quad (4)$$

We wish to find a function from (2)-(4) with the form $F(x,t) = \sum_{i=1}^{n} g_i(x,t) p_i(t) + h(x,t)$ where $g_i(x,t)$ and $h(x,t)$ are the known functions, while the unknown functions $p_i(t)$, $1 \le i \le n$, are sought. Let $x_1 < x_2 < \ldots < x_{n-1} < x_n$ and let the function $a(x,t)$ be positive, bounded and twice continuously differentiable. The equation of the characteristics $\xi = \xi_i(\tau; x, t)$ passing through a point (x,t) is

$$\begin{cases} \dfrac{d\xi_i}{d\tau} = \varepsilon_i a(\xi_i, \tau), \\ \xi_i(t; x, t) = x, \end{cases} \tag{5}$$

where $i = 1,2$; $\varepsilon_1 = -1$ şi $\varepsilon_2 = 1$.

2. PROBLEM FORMULATION

Let us consider second-order hyperbolic equation where the coefficients $b(x,t) = 0$ and $c(x,t) = 0$ are taken zero. In these circumstances we can establish the following result [1]:

The equation

$$u_{tt} = a^2 u_{xx} + du + F \tag{6}$$

is equivalent with the system

$$r_t = Kr_x + Dr + \Phi, \tag{7}$$

where the new unknowns are given by the the following relations:

$$r_1 = u, r_2 = \frac{1}{2}\left(\frac{v}{a} + w\right), r_3 = \frac{1}{2}\left(\frac{v}{a} - w\right), \tag{8}$$

and

$$r = \begin{pmatrix} r_1 \\ r_2 \\ r_3 \end{pmatrix}, \quad K = \begin{pmatrix} 0 & 0 & 0 \\ 0 & a & 0 \\ 0 & 0 & -a \end{pmatrix},$$

$$D = \frac{1}{2a}\begin{pmatrix} 0 & 2a^2 & 2a^2 \\ d & aa_x - a_t & aa_x - a_t \\ d & -aa_x - a_t & -aa_x - a_t \end{pmatrix},$$

$$\Phi = \frac{1}{2a}\begin{pmatrix} 0 \\ F \\ F \end{pmatrix}. \tag{9}$$

3. PROBLEM SOLUTION

Lemma. Let the system $r_t = Kr_x + Dr + \Phi$ and the relationships $u(x_i,t) = \chi_i(t)$, $0 \le t \le T$, $0 \le i \le n$. If $v = u_t$, by integrating the last two equations of the system along the corresponding characteristics, then the $\chi_i'(t)$ will take the form

$$\chi_i'(t) = R(x_i,t) + a(x_i,t) \times \left[\int_{L_1(x_i,t)} [Bu + Cv + H\mathbf{gp}] + \int_{L_2(x_i,t)} [Bu + Ev + H\mathbf{gp}] \right] \tag{10}$$

where

$$B = \frac{d}{2a}, \quad C = \frac{aa_x - a_t}{2a^2}, \quad E = \frac{-aa_x - a_t}{2a^2},$$

$$H = \frac{1}{2a}, \ \mathbf{p} = (p_1, ..., p_n), \quad \mathbf{g} = (g_1, ..., g_n),$$

$$\mathbf{pg} = \sum_{i=1}^{n} p_i g_i. \tag{11}$$

Proof. From $u(x_i,t) = \chi_i(t)$, $0 \le t \le T$, and given that $u_t = v$ we get relations $v(x_i,t) = u_t(x_i,t) = \chi_i'(t)$, $0 \le i \le n$. But $v = a(r_2 + r_3)$, that is

$$v(x_i,t) = a(x_i,t)[r_2(x_i,t) + r_3(x_i,t)], \tag{12}$$

$$v(x_i,t) = \chi_i'(t). \tag{13}$$

so

$$a(x_i,t)[r_2(x_i,t) + r_3(x_i,t)] = \chi_i'(t), \ 0 \le i \le n. \tag{14}$$

Integrating equality $u_t = v$ results:

$$u(x,t) = \varphi(x) + \int_0^t v(x,\tau)d\tau. \tag{15}$$

We integrate the second equation of system (7), along the corresponding characteristic, as follows:

$$(r_2)_t = a(r_2)_x + \frac{1}{2a}[dr_1 + (aa_x - a_t)(r_2 + r_3)] + \frac{F}{2a}. \tag{16}$$

but

$$\begin{cases} r_1 = u \\ r_2 + r_3 = \dfrac{v}{a}, \end{cases}$$

$$F(x,t) = \sum_{i=1}^{n} g_i(x,t)p_i(t) + h(x,t), \tag{17}$$

so

$$(r_2)_t = a(r_2)_x + \frac{d}{2a}u + \frac{(aa_x - a_t)}{2a^2}v + \frac{1}{2a}\mathbf{gp} + \frac{h}{2a}. \quad (18)$$

Using the integral along the characteristic

$$\int_{L_i(x,t)}(\varphi) = \int_0^t \varphi(\xi_i(\tau;x,t),\tau)d\tau \text{ for } i=1,$$

we obtain

$$\int_{L_1(x,t)}(r_2)_t = \int_{L_1(x,t)}\left[a(r_2)_x + \frac{d\cdot u}{2a} + \frac{(aa_x - a_t)v}{2a^2} + \frac{\mathbf{gp}+h}{2a}\right] \quad (19)$$

$$\int_{L_1(x,t)}(r_2)_t = \int_{L_1(x,t)}[a(r_2)_x] + \int_{L_1(x,t)}\left[\frac{d}{2a}u + \frac{(aa_x - a_t)}{2a^2}v + \frac{1}{2a}\mathbf{gp} + \frac{h}{2a}\right] \quad (20)$$

$$\int_{L_1(x,t)}[(r_2)_t - a(r_2)_x] = \int_0^t\left[\frac{\partial r_2}{\partial t}(\xi_1(\tau;x,t),\tau) - a(\xi_1(\tau;x,t),\tau)\frac{\partial r_2}{\partial x}(\xi_1(\tau;x,t),\tau)\right]d\tau =$$
$$= \int_0^t\left[\frac{d}{dt}r_2(\xi_1(\tau;x,t),\tau)\right]d\tau =$$
$$= r_2(\xi_1(t;x,t),t) - r_2(\xi_1(0;x,t),0) \quad (21)$$

$$r_2(x,t) = r_2(\xi_1,0) + \int_{L_1(x,t)}\left[\frac{d}{2a}u + \frac{(aa_x - a_t)}{2a^2}v + \frac{1}{2a}\mathbf{gp} + \frac{h}{2a}\right] \quad (22)$$

Integrate the third equation of system (7), along the corresponding characteristic using the similar calculations, we have:

$$r_3(x,t) = r_3(\xi_2,0) + \int_{L_2(x,t)}\left[\frac{d}{2a}u - \frac{(aa_x + a_t)}{2a^2}v + \frac{1}{2a}\mathbf{gp} + \frac{h}{2a}\right] \quad (23)$$

Make the following notations

$$B = \frac{d}{2a},\quad C = \frac{aa_x - a_t}{2a^2},\quad E = \frac{-aa_x - a_t}{2a^2},$$
$$H = \frac{1}{2a},\ \mathbf{p} = (p_1,\ldots,p_n),\quad \mathbf{g} = (g_1,\ldots,g_n),$$
$$\mathbf{pg} = \sum_{i=1}^{n} p_i g_i\ . \quad (24)$$

and obtain

$$r_2 = r_2(\xi_1,0) + \int_{L_1(x,t)}[Bu + Cv + H\mathbf{gp}] + \int_{L_1(x,t)}\frac{h}{2a} \quad (25)$$

$$r_3 = r_3(\xi_2,0) + \int_{L_2(x,t)}[Bu + Ev + H\mathbf{gp}] + \int_{L_2(x,t)}\frac{h}{2a} \quad (26)$$

Adding the relations (25) and (26) and multiplying the result by $a(x,t)$ we obtain:

$$a(r_2 + r_3) = a[r_2(\xi_1,0) + r_3(\xi_2,0)] + a\times$$
$$\times\left[\int_{L_1(x,t)}[Bu + Cv + H\mathbf{gp}] + \int_{L_2(x,t)}[Bu + Ev + H\mathbf{gp}]\right] +$$
$$+ a\left(\int_{L_1(x,t)}\frac{h}{2a} + \int_{L_2(x,t)}\frac{h}{2a}\right). \quad (27)$$

We now consider the relationship $a(r_2 + r_3) = v$ and get to the equation:

$$v(x,t) = R(x,t) + +a \times$$
$$\times \left[\int_{L_1(x,t)} [Bu + Cv + H\mathbf{gp}] + \int_{L_2(x,t)} [Bu + Ev + H\mathbf{gp}] \right] \quad (28)$$

where

$$R(x,t) = a[r_2(\xi_1,0) + r_3(\xi_2,0)] + + a\left(\int_{L_1(x,t)} \frac{h}{2a} + \int_{L_2(x,t)} \frac{h}{2a} \right) \quad (29)$$

which is a known function, because:

$$r_2(x,0) = \frac{1}{2}\left(\frac{v(x,0)}{a(x,0)} + w(x,0) \right) = \frac{1}{2}\left(\frac{\varphi(x)}{a} + \varphi'(x) \right)$$

$$r_3(x,0) = \frac{1}{2}\left(\frac{v(x,0)}{a(x,0)} - w(x,0) \right) = \frac{1}{2}\left(\frac{\varphi(x)}{a} - \varphi'(x) \right)$$

We know that $v(x_i,t) = \chi_i'(t)$, $0 \le i \le n$, so the remaining equations are obtained from equation (28) to order $x = x_i$, $1 \le i \le n$.

Thus:

$$\chi_i'(t) = R(x_i,t) + a(x_i,t) \times$$
$$\times \left[\int_{L_1(x_i,t)} [Bu + Cv + H\mathbf{gp}] + \int_{L_2(x_i,t)} [Bu + Ev + H\mathbf{gp}] \right] \quad (30)$$

4. CONCLUSIONS

In this article we found the first order derivative of $\chi_i(t)$ with respect to *t*, integrating along the corresponding characteristics the last two equations of the canonical form of a second order hyperbolic equation. This derivative is useful in proving the theorem of existence and uniqueness of the solution of inverse problem (2)-(4).

REFERENCES:

1. Mihaela Dumitrache, Horia Ene, "*About the canonical form of second-order hyperbolic equation*". Buletin Ştiinţific-Universitatea din Piteşti, Seria Matematică şi Informatică, Nr. 18 (2010), pg.45-48.
2. Romanov, V. "*Inverse Problems for Equations of Hyperbolic Type*", Nauka: Novosibirsk, 1972.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

MATHEMATICAL MODELING AND THE STABILITY STUDY OF SOME CHEMICAL PHENOMENA

Olivia FLOREA, Monica A.P. PURCARU

Faculty of Mathematics and Computer Sciences, Transilvania University of Braşov, Romania

***Abstract**: In this paper is studied a chemical phenomenon, an example of an autocatalytic reaction. Using the stability in first approximation and the theory of bifurcations is studied the stability the autocatalytic reaction. The mathematical modelling was made using the Maple software.*

***Mathematics Subject Classification 2010:** 34D08,35B32*

***Keywords*:** *dynamical systems, asymptotic stability, Hopf Bifurcation*

1. INTRODUCTION

Reaction–diffusion systems are mathematical models which explain how the concentration of one or more substances distributed in space changes under the influence of two processes: local chemical reactions in which the substances are transformed into each other, and diffusion which causes the substances to spread out over a surface in space. This description implies that reaction–diffusion systems are naturally applied in chemistry. However, the system can also describe dynamical processes of non-chemical nature. Examples are found in biology, geology and physics and ecology. The nonlinear reaction-diffusion systems are the general form:

$$\begin{cases} \dfrac{\partial x}{\partial t} = a_1 x + b_1 y + f(x,y) + g_1(l) \\ \dfrac{\partial y}{\partial t} = a_2 x + b_2 y + f(x,y) - g_2(l) \end{cases} \quad (1)$$

The Brusselator is a theoretical model for a type of autocatalytic reaction. The Brusselator model was proposed by Ilya Prigogine and his collaborators at the Free University of Brussels. The Brusselator is originally a system of two ordinary differential equations as the reaction rate equations for an autocatalytic, oscillating chemical reaction, [2,3,4]. In many autocatalytic systems, complex dynamics are seen, including multiple steady states, periodic orbits, and bifurcations. The Belousov - Zhabotinsky reaction [2,3,4] is a generic chemical reaction in which the concentrations of the reactants exhibit somewhat oscillating behaviour.

To obtain the Brusselator model in systems (1) we denote by: $a_1 = -(B+1)$, $b_1 = 0$, $a_2 = B$, $b_2 = 0$, $f(x,y) = x^2 y$, $g_1(l) = A$, $g_2 = 0$ where A and B are positive constants.

In particular, the Brusselator model describes the case in which the chemical reactions follow the scheme:

$$A \to X$$
$$2X + Y \to 3X$$
$$B + X \to Y + D$$
$$X \to E$$

where *A, B, D, E, X*, and *Y* are chemical compounds. Let $x(t)$ and $y(t)$ be the concentrations of *X* and *Y*, and assume that the concentrations of the input compounds A and B are held constant during the reaction process.

2. THE DYNAMICAL SYSTEM

The dynamical system which models these processes is:

$$\begin{cases} x' = A - (B+1)x + x^2 y \\ y' = Bx - x^2 y \end{cases} \quad (2)$$

We are proposing to study the stability and the existence of limit cycles for this dynamical system making a discussion about the real, positive parameters A and B. The main aim is to evaluate what are the values that lead us to obtain an attractor solution.

For this it is a must to find the equilibrium point of the system (2), by computing the following system:

$$\begin{cases} A - (B+1)x + x^2 y = 0 \\ Bx - x^2 y = 0 \end{cases} \quad (3)$$

We'll find that the equilibrium point is: $P(x^*, y^*) \equiv P\left(A, \frac{B}{A}\right)$.

We are interesting about the behaviour of the null solution. For the stability study of the solution we have to make the translation to arrive in the origin, so: $X = x - x^*, Y = y - y^*$.

The new form of the system (2) is:

$$\begin{cases} X' = A - (B+1)(X + x^*) + (X + x^*)^2 (Y + y^*) \\ Y' = B(X + x^*) - (X + x^*)^2 (Y + y^*) \end{cases} \quad (4).$$

Because (x^*, y^*) is the solution of system (3) is obtained the following system:

$$\begin{cases} X' = (B-1)X + A^2 Y + \frac{B}{A}X^2 + 2AXY + X^2 Y \\ Y' = -BX - A^2 Y - \frac{B}{A}X^2 - 2AXY - X^2 Y \end{cases} \quad (5)$$

Which has the equilibrium point in origin $(X^*, Y^*) = (0,0)$.

The stability study is made using the method in the first approximation. So, we have:

$$J(x, y) = \begin{pmatrix} \frac{\partial f}{\partial X} & \frac{\partial f}{\partial Y} \\ \frac{\partial g}{\partial X} & \frac{\partial g}{\partial Y} \end{pmatrix} =$$

$$= \begin{pmatrix} B - 1 + 2XY + 2\frac{B}{A}X + 2AY & A^2 + X^2 + 2AX \\ -B - 2XY - 2X\frac{B}{A} - 2AY & -A^2 - 2XY - 2AY \end{pmatrix}$$

The Jacobi matrix in the equilibrium point $O(0,0)$ is

$$H = J(0,0) = \begin{pmatrix} B-1 & A^2 \\ -B & -A^2 \end{pmatrix}.$$

This is equivalent with the linear homogeneous system:

$$\begin{cases} X' = (B-1)X + A^2 Y \\ Y' = -BX - A^2 Y \end{cases} \quad (6)$$

The characteristically polynomial is:

$$P(\lambda) = \det(H - \lambda I_2) = \begin{vmatrix} B - 1 - \lambda & A^2 \\ -B & -A^2 - \lambda \end{vmatrix} =$$

$$= \lambda^2 + \lambda(A^2 - B + 1) + A^2$$

We'll study the solutions' stability taking into account the type of the characteristically polynomial's solutions. Because the product of these two roots is A^2, which is always a positive number, the study is made for the discriminant and the trace of the matrix H:

$$\Delta = \left[(A-1)^2 - B\right]\left[(A+1)^2 - B\right]$$

$$S = Tr(H) = B - 1 - A^2$$

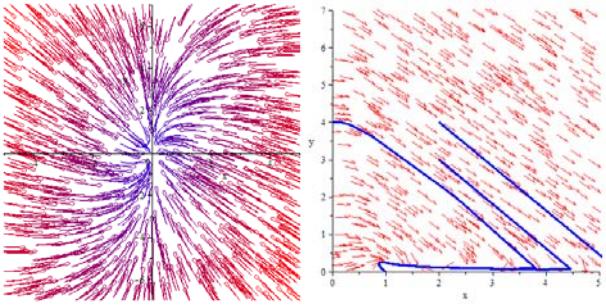
The characteristically equation roots are:

$$\lambda_{1,2} = \frac{-(A^2 - B + 1) \pm \sqrt{\left[(A-1)^2 - B\right]\left[(A+1)^2 - B\right]}}{2}$$

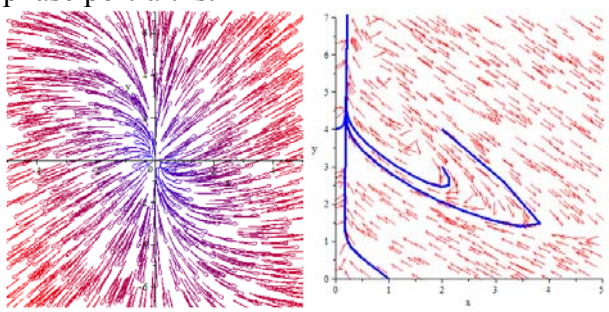
3. STABILITY ANALISYS

We consider the following cases:

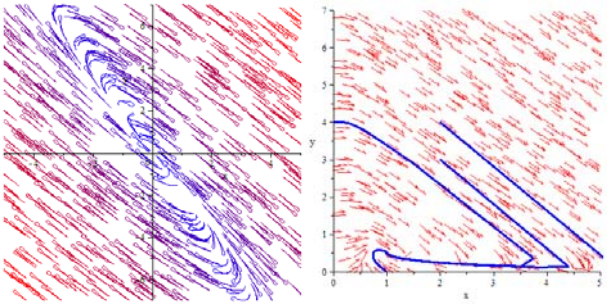
Case 1. If $0 < B < (A-1)^2$, implies that: $\begin{cases} \Delta > 0 \\ TrF_x < 0 \end{cases}$. In this case the roots are real, negative and different: $\lambda_{1,2} \in \mathbf{R}, \lambda_{1,2} < 0, \lambda_1 \neq \lambda_2$. Results that the equilibrium point $\left(A, \frac{B}{A}\right)$ is an attractive node non degenerate, the system is asymptotically stable. The phase portrait is:



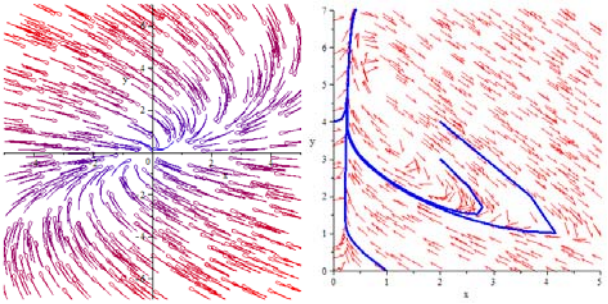
Case 2. If $B > (A+1)^2$, implies that: $\begin{cases} \Delta > 0 \\ TrF_x > 0 \end{cases}$. In this case the roots are real, positive and different: $\lambda_{1,2} \in \mathbf{R}, \lambda_{1,2} > 0, \lambda_1 \neq \lambda_2$. Results that the equilibrium point $\left(A, \frac{B}{A}\right)$ is a rejector node non degenerate, the system is unstable. The phase portrait is:



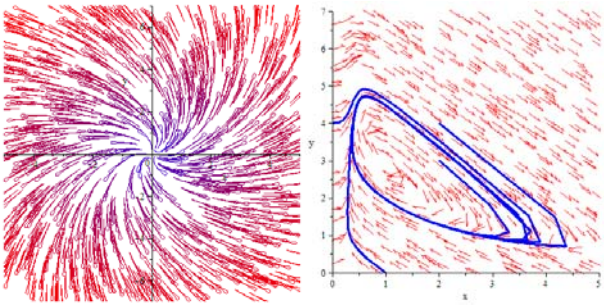
Case 3. If $B = (A+1)^2$, implies that: $\begin{cases} \Delta = 0 \\ TrF_x > 0 \end{cases}$. In this case the roots are real, positive and equal: $\lambda_{1,2} \in \mathbf{R}, \lambda_{1,2} > 0, \lambda_1 = \lambda_2$. Results that the equilibrium point $\left(A, \frac{B}{A}\right)$ is rejector node non degenerate after the line $y = Ax$, the system is unstable. The phase portrait is:



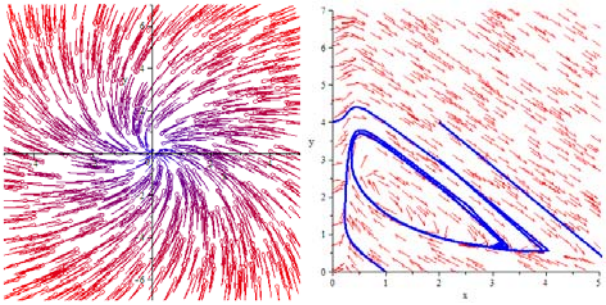
Case 4. If $B = (A-1)^2$, implies that: $\begin{cases} \Delta = 0 \\ TrF_x < 0 \end{cases}$. In this case the roots are real, negative and equal: $\lambda_{1,2} \in \mathbf{R}, \lambda_{1,2} < 0, \lambda_1 = \lambda_2$. Results that the equilibrium point $\left(A, \frac{B}{A}\right)$ is an attractor node non degenerate after the line $y = -Ax$, the system is asymptotically stable. The phase portrait is:



Case 5. If $A^2+1<B<(A+1)^2$, implies that $\begin{cases}\Delta<0\\ TrF_x>0\end{cases}$. In this case the roots are complex, with the imaginary part positive $\lambda_{1,2}\in \mathbf{C}\setminus\mathbf{R}$, $\mathrm{Re}(\lambda_{1,2})>0$. Results that the equilibrium point $\left(A,\frac{B}{A}\right)$ is a rejector focus. The phase portrait is:



Case 6. If $(A-1)^2<B<A^2+1$, implies that $\begin{cases}\Delta<0\\ TrF_x<0\end{cases}$. In this case the roots are complex, with the imaginary part negative $\lambda_{1,2}\in \mathbf{C}\setminus\mathbf{R}$, $\mathrm{Re}(\lambda_{1,2})<0$. Results that the equilibrium point $\left(A,\frac{B}{A}\right)$ is an attractive focus. The phase portrait is:



Case 7. If $B=A^2+1$, implies that $\begin{cases}\Delta<0\\ TrF_x=0\end{cases}$. In this case the roots are complex, with the imaginary part null $\lambda_{1,2}\in \mathbf{C}\setminus\mathbf{R}$, $\mathrm{Re}(\lambda_{1,2})=0$. We have: $\lambda_{1,2}=\mu(B)+i\omega(B)$ where $\mu(B)=0$ and $\omega(B)=A>0$ and $\frac{d\mu}{dB}=\frac{1}{2}\neq 0$. Results that the Hopf theorem's conditions [5] are fulfilled for these values of parameter B.

The new matrices form of the system (5) is:

$$\begin{pmatrix}X'\\ Y'\end{pmatrix}=\begin{pmatrix}A^2 & A^2\\ -(A^2+1) & -A^2\end{pmatrix}\begin{pmatrix}X\\ Y\end{pmatrix}+$$

$$+\begin{pmatrix}\frac{A^2+1}{A}X^2+2AXY+X^2Y\\ -\frac{A^2+1}{A}X^2-2AXY-X^2Y\end{pmatrix}$$

With $h(X,Y)=\begin{pmatrix}\frac{A^2+1}{A}X^2+2AXY+X^2Y,\\ -\frac{A^2+1}{A}X^2-2AXY-X^2Y\end{pmatrix}$

For the eigenvalue $\lambda=-iA$ we have the vector: $q=(q_1,q_2)=\left(q_1,-\frac{A-i}{A}q_1\right)$, and for the eigenvalue $\lambda=iA$ we have the vector: $p=(p_1,p_2)=\left(p_1,-\frac{A+i}{A}p_1\right)$, where q_1,p_1 are random numbers. A choice for the vector q is $q=\left(1,-\frac{A-i}{A}\right)$. Taking into account that $q\cdot\overline{p}=A^2$, from the relation: $q\cdot\overline{p}=q_1\cdot\overline{p}_1+q_2\cdot\overline{p}_2$ it is obtained $p_1=\frac{A^4}{A^2+(A-i)^2}$. The vector p has the new form:

$$p=\left(\frac{A^4}{A^2+(A-i)^2},-\frac{A+i}{A}\cdot\frac{A^4}{A^2+(A-i)^2}\right).$$

We introduce a new variable z, using the diffeomorphic transformation:

$(X,Y)=z\cdot q+\overline{z}\cdot\overline{q}$. In this case it is obtained:

$$X=z+\overline{z}$$

$$Y=-\frac{A-i}{A}z-\frac{A+i}{A}\overline{z}.$$

Compute the new function in the new variables:

$$g(z,\bar{z}) = h(X,Y)\cdot \bar{p} =$$

$$= \frac{g_{20}}{2} z^2 + g_{11} z\bar{z} + \frac{g_{02}}{2} \bar{z}^2 + \frac{g_{21}}{2} z^2\bar{z} + \frac{g_{12}}{2} z\bar{z}^2 +$$

$$+ \frac{g_{30}}{2} z^3 + \frac{g_{03}}{2} \bar{z}^3 + O(|z|)^4$$

For B we evaluate the expression:

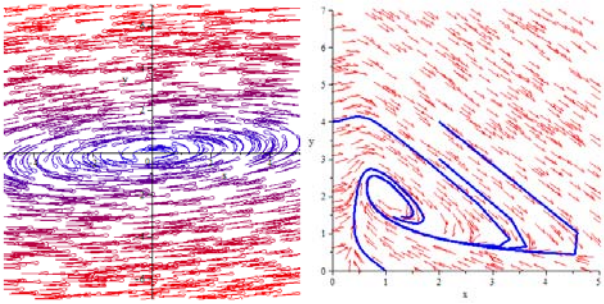
$$C_1(B) = \left(g_{20}g_{11} - 2|g_{11}|^2 - \frac{1}{3}|g_{02}|^2 \right) + \frac{g_{21}}{2}$$

The first coefficient of Liapunov for B is a real number and it is defining by

$$L_1(\alpha_0) = \frac{\mathrm{Re}\, C_1(B)}{\omega}.$$

Using the affirmations above if $\operatorname{sgn} L_1(B) = \operatorname{sgn} \mathrm{Re}(ig_{20}g_{11} + \omega_0 g_{21}) < 0$ results that in the vicinity of $B = A^2 + 1$ the system admits a stable limit cycle, that means a supercritical bifurcation; $\operatorname{sgn} L_1(B) > 0$ results that in the vicinity of $B = A^2 + 1$ the system admits an unstable limit cycle, that means a subcritical bifurcation.

Because $L_1(B) = \dfrac{2(A^2+1)^2 - A^3}{4A^2}$ the system admits an unstable limit cycle in the vicinity of $B = A^2 + 1$. The phase portrait is:



The trajectory is a rotating ellipse. Next we'll determine the equation of the trajectory corresponding to the system described above. Making the ratio between X' and Y' from the linear system, we obtain the differential total exact equation:

$$[(A^2+1)X + A^2 Y]dX + A^2(X+Y)dY = 0$$

By integration it is obtained the equation of trajectory:

$$A^2(X+Y)^2 + X^2 = C$$

REFERENCES

1. Neamțu M., *The study of Differential Systems using geometrical structures*, PhD Thesis, 2001
2. Vernic C., *Analytical methods for the study of biodynamical systems*, Ed. Augusta, Timisoara, 143pg, 2004 ISBN 973-695-107-3
3. Yuncheng You, *Global Dynamics Of The Brusselator Equations*, Dynamics Of Pde, Vol.4, No.2, 167-196, 2007
4. I.R. Epstein, *Complex Dynamical Behavior In Simple Chemical Systems*, J. Phys. Chemistry, 88 (1984), 187-198.
5. O. Florea, C. Ida, *Practical Applications of dynamical systems in engineering*, Ed. LuxLibris, Brasov, 2010

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

MAX-STABLE DISTRIBUTION– part I

Cornelia GABER*, Maria STOICA**

*PETROLEUM-GAS University of Ploieşti, România, **Nichita Stănescu – High Scool, 3 Nalbei, Ploieşti, Romania

Abstract: *The topic is present, because more and more frequently we have been dealing with the issue of extreme values predictions which can be registered for certain phenomena which possess a random behaviour due to their very nature. The limitation of a distribution corresponding to a selection of identically distributed and independent random variables* (*v.a.i.i.d*) *having the stability property defines a distribution class called „max-stable''.*

Keywords: *random variables, distribution function, convergence, probability, sequences, maximumlikelihood estimation.*

***Mathematics Subiect Classifications* 2010**: 60G70

1. Introduction

May $\varepsilon_1, \varepsilon_2, ...\varepsilon_n$ a selection of independent and identically distributed random variables and $M_n = \max\{\varepsilon_1, \varepsilon_2, ...\varepsilon_n\}$, $m_n = \min\{\varepsilon_1, \varepsilon_2, ...\varepsilon_n\} = -\max\{-\varepsilon_1, -\varepsilon_2, ...-\varepsilon_n\}$.

We consider M_n's distribution function as F^n:

$$F^n(x) = P(M_n \le x) = \\ = P(\varepsilon_1 \le x; \varepsilon_2 \le x; ...\varepsilon_n \le x) \quad (1.1)$$

where F is the common distribution function of ε_i, $i = \overline{1,n}$.

The possibilities for the distribution's limit define a class with a certain property of stability, made of the so-called max-stable distributions. This class is formed by three distributions with extreme values and each max-stable distribution G has one of the parametrical forms, defined as follows:

Type I: $G(x) = \exp(-e^{-x}),\ x \in R$,

Type II: $G(x) = \begin{cases} 0, x \le 0 \\ \exp\left(-x^{-\alpha}\right), \alpha > 0, x > 0 \end{cases}$,

Type III: $G(x) = \begin{cases} \exp\left(-(-x)^{\alpha}\right), \alpha > 0, x \le 0 \\ 1, \qquad\qquad x > 0 \end{cases}$.

The study refers especially to the conditions in which for the adequate normalizing constants $a_n > 0$, b_n, there should be verified that:

$$P\{a_n(M_n - b_n) \le x\} \xrightarrow{w} G(x) \quad (1.2)$$

were $\xrightarrow{w}$ denotes „weak convergence"

It will be shown that the convergence appears in the continuity points of G, afterwards determining which G of the distribution function can appear as a limit and it is possible that G non confluent of the distribution function should form the max-stabile distribution class.

Using the relations (1.1) and (1.2) we obtain:

$$P\{a_n(M_n - b_n) \le x\} = \\ = F^n\left(a_n^{-1}x + b_n\right) \xrightarrow{w} G(x) \tag{1.3}$$

2. CONVERSE FUNCTIONS AND KHINTCHINE'S CONVERGENCE THEOREM

The inverse of the monotonous functions can be defined in different ways according to the intended purpose. For the following study, let us choose the next means for building these functions.

If Ψ is a continuous function, nondecreasing, we define the inverse function Ψ^{-1} on the interval $(\inf\{\Psi(x)\}; \sup\{\Psi(x)\})$ through $\Psi^{-1}(y) = \inf\{x; \Psi(x) \ge y\}$.

The definition domain of the function Ψ^{-1} is presented as an open interval, but it can also be closed at any end $\inf\{\Psi(x)\}$ respectively $\sup\{\Psi(x)\}$ tempts towards finite values for *x*.

Lemma 2.1.

1) For Ψ previously defined , if $a > 0, b, c$ constant and $H(x) = \Psi(ax+b) - c$ then $H^{-1}(y) = a^{-1}\left(\Psi^{-1}(y+c) - b\right)$.

2) For Ψ previously defined, if Ψ^{-1} is continuous , then $\Psi^{-1}(\Psi(x)) = x$.

3) If G is a nondegenerate distribution function, then there exists $y_1 < y_2$ so that $G^{-1}(y_1) < G^{-1}(y_2)$ are well defined (and finite).

Proof

1) $H^{-1}(y) = \inf\{x; \Psi(ax+b) - c \ge y\}$

$= a^{-1}(\inf\{(ax+b); \Psi(ax+b) \ge y + c\} - b)$

$= a^{-1}\left(\Psi^{-1}(y+c) - b\right)$ Q.E.D.

2) According to the definition of Ψ^{-1} and property of function Ψ as nondecreasing, we obtain $\Psi^{-1}(\Psi(x)) \le x$.

If there is a z so that for $z < x$ we have $\Psi(z) \ge \Psi(x)$ (*) then taking into account that Ψ is nondecreasing, we get $\Psi(z) \le \Psi(x)$ (**) so, from relations (*) and (**) we obtain $\Psi(z) = \Psi(x)$.

For $y = \Psi(z) = \Psi(x)$ we have $\Psi^{-1}(y) \le z$, while for $y > \Psi(z) = \Psi(x)$ we have $\Psi^{-1}(y) \ge x$, which contradicts Ψ^{-1}'s continuity, therefore $\Psi^{-1}(\Psi(x)) = x$.

3) If G is nondecreasing, then there is $x_1' < x_2'$ so that $0 < G(x_1') = y_1 < G(x_2') = y_2 \le 1$. Obviously $G^{-1}(y_1) = x_1$ and $G^{-1}(y_2) = x_2$ are well defined. But $G^{-1}(y_2) \ge x_1'$ and the equality imposes $G(z) \ge y_2$ for all $z \ge x_1$ so $G(x_1') = \lim_{\varepsilon > 0} G(x_1' + \varepsilon) \ge y_2$, as $G(x_1') = y_1$ there results contradiction, so $G^{-1}(y_2) > x_1' \ge x_1 = G^{-1}(y_1)$ Q.E.D.

Corollary 2.2

If G is a nondecreasing distribution function and a, α, b, β constants with $a > 0, \alpha > 0$ so that $G(ax+b) = G(\alpha x + \beta)$ for any *x*, then $a = \alpha$ and $b = \beta$.

Proof

Let $y_1 < y_2$ and $-\infty < x_1 < x_2 < \infty$ which fulfill the request (3) from Lemma 2.1, such that $x_1 = G^{-1}(y_1)$ and $x_2 = G^{-1}(y_2)$. Using the request (1) from Lemma 2.1 we obtain $a^{-1}\left(G^{-1}(y) - b\right) = \alpha^{-1}\left(G^{-1}(y) - \beta\right)$, any *y*. For $y = y_1$ respectively $y = y_2$ we obtain :

$$\begin{cases} a^{-1}(x_1 - b) = \alpha^{-1}(x_1 - \beta) \\ a^{-1}(x_2 - b) = \alpha^{-1}(x_2 - \beta) \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} a^{-1} = \alpha^{-1} \\ -a^{-1} \cdot b = -\alpha^{-1} \cdot \beta \end{cases} \Rightarrow \begin{cases} a = \alpha \\ b = \beta \end{cases}$$

Theorem (Khintchine) (2.3)

Let the system $\{F_n\}$ of distribution functions and let G be a nondecreasing distribution function. We consider the adequate constants $a_n > 0, b_n$ so that:

$$F_n(a_n x + b_n) \xrightarrow{w} G(x) \tag{2.1}$$

Then for certain $G_\bullet$ nondecreasing distributive functions and for the constants $\alpha_n > 0, \beta_n$ there takes place the relation:

$$F_n(\alpha_n x+\beta_n) \xrightarrow{w} G_\bullet(x) \qquad (2.2)$$

if and only if

$$a_n^{-1}\alpha_n \to a \text{ and } a_n^{-1}(\beta_n - b_n) \to b \qquad (2.3)$$

For each $a > 0$ and b there takes place the equality :

$$G_\bullet(x) = G(ax+b) \qquad (2.4)$$

Proof

„$\Leftarrow$" Suppose first (2.3) is true and proove (2.2).

For $a_n > 0, b_n$ we note $F_n(a_n x+b_n) = F_n'(x)$ so according to (2.1) we obtain:

$$F_n'(x) \xrightarrow{w} G(x) \qquad (2.1')$$

We note $a_n^{-1}\alpha_n = \alpha_n'$ and $a_n^{-1}(\beta_n - b_n) = \beta_n'$ and we get:

$$F_n'(\alpha_n' x+\beta_n') \xrightarrow{w} G_\bullet(x) \qquad (2.2')$$

$$\left.\begin{array}{l}\alpha_n' \to a,\ a>0\\ \beta_n' \to b\end{array}\right\} \qquad (2.3')$$

If (2.1'), (2.3'), (2.4) are true then:

$$F_n'(\alpha_n' x+\beta_n') \xrightarrow{w} G(ax+b) = G_\bullet(x)$$

That is $F_n(\alpha_n x+\beta_n) \to G_\bullet(x)$.

„$\Rightarrow$" Suppose first (2.2) is true and proove (2.3).

As $G_\bullet$ is a nondecreasing distribution function there is x' and x'' so that $0 < G_\bullet(x') < 1$ and $0 < G_\bullet(x'') < 1$.

We consider the sequences $\{\alpha_n' x'+\beta_n'\}$ and $\{\alpha_n' x''+\beta_n'\}$ which must be bounded .

We assume that $\{\alpha_n' x'+\beta_n'\}$ is not bounded then we choose a subsequence $\{\alpha_{n_k}' x'+\beta_{n_k}'\}$ convergent to $+\infty$ and according to the relation (2.1') we obtain:

$$F_{n_k}'\left(\alpha_{n_k}' x'+\beta_{n_k}'\right) \xrightarrow[x=x']{\to 0 \text{ or } 1} G_\bullet(x') \in (0,1) \Rightarrow$$

contradiction so the sequence $\{\alpha_n' x'+\beta_n'\}$ is bounded. Analog for $\{\alpha_n' x''+\beta_n'\}$. If $\{\alpha_n' x'+\beta_n'\}$ and $\{\alpha_n' x''+\beta_n'\}$ are bounded then $\{\alpha_n'\}, \{\beta_n'\}$ are bounded.

If the subsequences $\{\alpha_{n_k}'\}, \{\beta_{n_k}'\}$ are convergent then there are a, b so that $\alpha_{n_k}' \to a,\ \beta_{n_k}' \to b$ so

$$F_{n_k}'(\alpha_{n_k}' x'+\beta_{n_k}') \to G(ax+b) = G_\bullet(x),$$

$G_\bullet$ being a nondecreasing distribution function with $a > 0$.

If we consider another subsequence $\{\alpha_{n_r}' x'+\beta_{n_r}'\}$ bounded with $\alpha_{n_r}' \to a'$ and $\beta_{n_r}' \to b'$ then:

$$F_{n_r}'(\alpha_{n_r}' x'+\beta_{n_r}') \to G(a'x+b') = G_\bullet(x).$$

According to the corollary 2.2 $G(ax+b) = G_\bullet(x) = G(a'x+b')$ implies $a = a'$ and $b = b'$ Q.E.D.

3. Max – stable distributions

In this part we look for those G of the distribution functions which are possible asimpthotic laws for the maximum of the distributed independent and identical selections which form the max–stable distributions class.

Definition 3.1. G, a nondecreasing distribution function, is called max–stable if there are the constants a_n, b_n so that

$G^n(a_n x+b_n)=G(x)$, for each $n = 2,3,...,$ for all $x\in \mathsf{R}$. (3.1)

Theorem 3.1.

a) G nondecreasing distribution function is max–stable if and only if there is a sequence $\{F_n\}$ of the distribution functions and the constants $a_n>0,\ b_n$ so that

$$F_n\left(a_{nk}^{-1}x+b_{nk}\right)\xrightarrow{w}G^{\frac{1}{k}}(x) \text{ for } n\to\infty$$
for each $k = 1,2,...$ (3.2)

b) If G is nondecreasing, $D(G)$ is non void if and only if G is max–stable. At the same time $G\in D(G)$

Proof

a) If G is nondecreasing, so there is $G^{1/k}$ for each k and if (3.2) is true for each k, Theorem 2.3 (with a_n^{-1} for a_n) implies $G^{1/k}(x)=G(\alpha_k x+\beta_k)$, for some $a_k>0$ and β_k, so that G is max-stable. Conversely, if G is max-stable and $F_n=G^n$ we have $G^n\left(a_{nk}^{-1}x+b_{nk}\right)=G(x)$ for some $a_n>0$, b_n and

$$F_n\left(a_{nk}^{-1}x+b_{nk}\right)=\left(G^{nk}\left(a_{nk}^{-1}x+b_{nk}\right)\right)^{1/k}=$$
$$=(G(x))^{1/k}$$

so that (3.2) becomes evident.

b) If G is max-stable $G^n\left(a_n x+b_n\right)=D(x)$ $a_n>0$, b_n (therefore $n\to\infty$) we see that $G\in D(G)$. Conversely, if $D(G)$ is non void $F\in D(G)$ let us say that $F^n\left(a_n^{-1}x+b_n\right)\xrightarrow{w}G(x)$. Consequently $F^{nk}\left(a_{nk}^{-1}x+b_{nk}\right)\xrightarrow{w}G(x)$ or $F^n\left(a_{nk}^{-1}x+b_{nk}\right)\xrightarrow{w}G^{1/k}(x)$. Therefore (3.2) is true for $F_n=F^n$ and consequently from a) G is max-stable.

Corollary 3.2

If G is max–stable, there are real functions $a(s)>0, b(s)>0$ defined for $s>0$ so that :

$$G^s\left(a(s)x+b(s)\right)=G(x),\ x,s>0 \qquad (3.3)$$

Proof

As G is max–stable, there is $a_n>0,\ b_n$ so that

$$G^n\left(a_n x+b_n\right)=G(x) \qquad (3.4)$$

Then $G^{[ns]}(a_{[ns]}x+b_{[ns]})=G(x)$, but

$$G^n(a_{[ns]}x+b_{[ns]})\xrightarrow{w}G^{\frac{1}{s}}(x) \qquad (3.5)$$

From the relations (3.5) and (3.4) and as $G^{\frac{1}{s}}$ is nondecreasing, theorem 2.3 is applied with $\alpha_n=a_{[ns]}$ and $\beta_n=b_{[ns]}$ to show that $G\left(a(s)x+b(s)\right)=G^{\frac{1}{s}}(x)$ for some $a(s)>0$ and $b(s)$, as requested.

Definition 3.2.

We can say that two distribution function G_1, G_2 are of the same type if $G_2(x)=G_1(ax+b)$, for some constants $a>0,\ b$. Then the above definition of the max–stabile distribution can be rephrased as follows: A distribution function G nondecreasing is max–stable if for each $n=2,3,...$ G^n distribution function is of the same type as G.

Further the theorem 2.3 shows that if $\{F_n\}$ is a selection of distribution function with $F_n(a_n x+b_n)\xrightarrow{w}G_1$, $F_n(\alpha_n x+\beta_n)\xrightarrow{w}G_2$, $a_n>0, \alpha_n>0$, then G_1, G_2 are of the same type, taking into account that they are non decreasing. So distribution function can be divided into equivalent classes (that we call types) saying that G_1 and G_2 are equivalent if $G_2(x)=G_1(ax+b)$ for some $a>0,\ b$.

If G_1 and G_2 are distribution function of the same type $(G_2(x)=G_1(ax+b))$ and $F\in D(G_1)$ so that $F^n(a_n x+b_n)\xrightarrow{w}G_1$, for some $a_n>0, b_n$, then the relation (2.3) is fulfilled with $\alpha_n=a_n a,\ \beta_n=b_n+a_n b$ so that

$F^n(\alpha_n x+\beta_n)\xrightarrow{w}G_2(x)$ by theorem 2.3 and consequently $F\in D(G_2)$.

Thus if G_1, G_2 are of the same type $D(G_1)=D(G_2)$. Similarly we can see the theorem from theorem 2.3 that if $F\in D(G_1)$ and $F\in D(G_2)$ then G_1 and G_2 of the same type . from this reason $D(G_1), D(G_2)$ are identical if G_1 and G_2 are of the same type and are thus disjoint .

That means that the attraction domain of G distribution function depends only on G' s type.

Theorem 3.3

Each max–stable distribution is of the same type as one of the following three distributions $G(ax+b)$ for a $a>0$, b some for

Type I: $G(x)=\exp(-e^{-x}), -\infty<x<\infty$

Type II: $G(x)=\begin{cases}0 & x\le 0\\ \exp(-x^{-\alpha}),\ \alpha>0 & x>0\end{cases}$

Type III: $G(x)=\begin{cases}\exp(-(-x^{-\alpha})),\ \alpha>0 & x\le 0\\ 1 & x>0\end{cases}$

Reciprocally, each distribution of the type of extreme value is max–stable.

Proof

From this moment, the centering is clear on the example for type I.

$$\left(\exp\left\{-e^{-(ax+b)}\right\}\right)^n=\exp\left\{-e^{-(ax+b-\ln n)}\right\}$$

with similar expressions for types II and III.

If G is max-stable, then (3.3) is valid for all $s>0$ and all x.

If $0<G(x)<1$, (3.2) gives $s(-\log G(a(s)x+b(s)))=-\log G(x)$, so that $-\log(-\log G(a(s)x+b(s)))-\log s=$ $=-\log(-\log G(x))$.

Now we can notice from the max–stable property with $n=2$ that G can not tempt to any finite point. Thus, for the nondecreasing function $\Psi(x)=-\log(-\log G(x))$ we have $\inf\{\Psi(x)\}=-\infty, \sup\{\Psi(x)\}=+\infty$ and has as inverse function the function $U(y)$ defined for all $y\in R$.

Furthermore $\Psi(a(s)x+b(s))-\log s=\Psi(x)$, so that from lemma 2.1(1)

$$\frac{U(y+\log s)-b(s)}{a(s)}=U(y).$$

For $y=0\Rightarrow U(0)=\frac{U(\log s)-b(s)}{a(s)}\Rightarrow$

$\frac{U(y+\log s)-U(\log s)}{a(s)}=U(y)-U(0)$ and

writing $z=\log s, a(z)=a(e^z)$ and $U(y)=U(y)-U(0)$.

For all $y,z\in R$

$$U(y+z)-U(z)=U(y)a(z) \qquad (3.6)$$

Exchanging y with z we obtain:

$$\tilde{U}(z+y)-\tilde{U}(y)=\tilde{U}(z)\tilde{a}(z) \qquad (3.6')$$

From (3.6) and (3.6') it results $\tilde{U}(y+z)=\tilde{U}(z+y)\ \Rightarrow$

$$U(y)(1-a(z))=U(z)(1-a(y)) \qquad (3.7)$$

There are two possible cases (a), (b) as follows:

(a) $a(z)=1$ for all z we have from (3.6)

$$U(y+z)=U(y)+U(z)$$

The only monotonous increasing solution is $U=\rho y$ for $\rho>0$, so that

$U(y)-U(0)=\rho y$ or

$\Psi^{-1}(y)=U(y)=\rho y+\nu$, $\nu=U(0)$.

As Ψ is continuous the lemma 2.1(2) gives

$x=\Psi^{-1}(\Psi(x))=\rho\Psi+\nu\ \Rightarrow\ x=\rho\Psi(x)+\nu\Rightarrow$

$$\begin{cases}\Psi(x)=\dfrac{x-\nu}{\rho}\\ \Psi(x)=-\log(-\log G(x))\end{cases}\Rightarrow$$

$$\Rightarrow -\log(-\log G(x))=\frac{x-\nu}{\rho}$$

$$\log(-\log G(x))=-\frac{x-\nu}{\rho}\Rightarrow$$

$$\Rightarrow -\log G(x)=e^{-\frac{x-\nu}{\rho}}=\exp\left(-\frac{x-\nu}{\rho}\right)$$

$$\log G(x)=-\exp\left(-\frac{x-\nu}{\rho}\right)\Rightarrow$$

$$\Rightarrow G(x)=\exp\left(-\exp\left(-\frac{x-\nu}{\rho}\right)\right)$$

$$G(x)=\exp\{-e^{-(x-\nu)/\rho}\},\ 0<G(x)<1$$

G can not reach any finite point and consequently it has the above form for all x and thus it is of type I.

(b) $a(z)\neq 1$ for a z the relation (3.7) gives:

$$U(y)=\frac{U(z)}{1-a(z)}(1-a(y))=c(1-a(y)) \quad (3.8)$$

Where $c=\dfrac{U(z)}{1-a(z)}\neq 0$, ($U(z)=0$ implies $U(y)=0$ for all y and consequently $U(y)=U(0)$ is constant).

From (3.6) we obtain as following:

$$c(1-a(y+z))-c(1-a(z))=c(1-a(y))a(z)$$

which gives $a(y+z)=a(y)a(z)$. But a is monotonous (from 3.8) and the only non constant solutions of the functional equation have the form $a(y)=e^{\rho y}$ for $\rho\neq 0$. Thus :

$$\Psi^{-1}(y)=U(y)=\nu+c(1-e^{\rho y})$$

where $y=U(0)$. As $-\log(-\log G(x))$ is increasing , the same for U, thus we must have $c<0$ if $\rho>0$ and $c>0$ if $\rho<0$.

From lemma 2.1(2)

$$x=\Psi^{-1}(\Psi(x))=\nu+c(1-e^{\rho\Psi(x)})=$$

$$=\nu+c(1-(-\log G(x))^{-\rho})$$

,

$0<G(x)<1$:

$$G(x)=\exp\left\{-\left(1-\frac{x-\nu}{c}\right)^{-1/\rho}\right\}$$

From its continuity in any finite point we can see that G is of type II or type III, with $a=+1/\rho$ or $a=-1/\rho$ as , if $\rho>0, c<0$ and $\rho<0$ if $c>0$.

REFERENCES

1. Anserson, C.W., Extreme value theory for a class of discrete distributions with applications to some stochastic processes. *J.Apppl.Probab.*7,99-113, (1970).

2. Balkema, A.A. and Haan, L. de. On R.von Mises' condition for the domain of attraction of exp(-exp(-x)). *Ann.Math.Statist.* 43,1352-1354, (1972).

3. Barndorff-Nielsen, O., On the limit distribution of the maximum of a random number of random variable. *Acta. Math. Acad. Sci. Hungar*, 15,399-403, (1964).

4. Berman, S.M. Limiting distribution of the maximum term in sequences of dependent random variables, *Ann. Math. Statist*. 33,894-908, (1962).

5. Berman, S.M. Limit theorems for the maximum term in stationary sequences, *Ann. Math. Statist*. 35,502-516, (1964).

6. Davis, R.A., Maxima and minima of stationary sequences. *Ann.Probab*. 7, 453-460, (1979).

7. Deheuvels, P., Valeur extremales d'echantillons croissants d'une variable aleatoire réelle. *Ann.Inst.H.Poincaré*. 10, 89-114, (1974).

8. Epstein, B., Elements pf the theory of extreme values, Thechnometrics 2, 27-41, (1960).

9. Feller, W., *An Introduction to Probability Theory and Its Applications*, Vol. 1, 3rd ed. New York: Wiley, (1968).

10. Green, R.F. Partial attraction of maxima. *J.Appl.Probab*. 13,159-163, (1976).

11. Haan, L. de, Sample Extremes: an elementary introduction. *Statist.Neerlandica*, 30, 161-172, (1976).

12. Hall, P., On the extreme terms of a sample from the domain of attraction of a stable law, *L.London.Math.Soc*., 18,181-191, (1978).

13. Hall, P., Representations and limit theorems for extreme value distributions, . *J.Appl.Probab*. 15, 639-644, (1978).

14. Tiago de Oliveira, J., Extremal distributions, *Rev.Fac.Sci.Lisboa*, Ser.A, 7, 215-227, (1958).

15. Weinstein, S.B., Theory and application of some classical and generalizes asymptotic distributions of extreme values. *IEEE Trans. Inform. Theory*, 19, 148-154, (1973).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

MAX-STABLE DISTRIBUTION – part II

Cornelia GABER*, Maria STOICA**

*PETROLEUM-GAS University of Ploieşti, România, **Nichita Stănescu – High Scool, 3 Nalbei, Ploieşti, Romania

Abstract: *In this part we continue the presentation from part I . The present paper demonstrates that this class of "max-stable'' distributions is made up of distributions with extreme values and each max-stable distributions matches one of the parametric forms corresponding to the distributions known as Gumbelle, Frechet, Weibull. In the end we present an important result for* $(\varepsilon_n)_n$ *independent random variables,identically and normally distributed, the series of random variables* $(M_n)_n$ *weakly converges to a Gumbell allotment.*

Mathematics Subiect Classifications **2010**: 60G70
Keywords: *random variables, distribution function, convergence, sequences, maximum likelihood estimation.*

1. THEOREM OF EXTREME TYPES

Theorem 1.2

May $M_n = \max(\varepsilon_1, \varepsilon_2, ..., \varepsilon_n)$ where ε_i are independent and identically distributed random variables. If $a_n > 0$ and b_n constants and

$$P\left(a_n(M_n - b_n) \le x\right) \xrightarrow{w} G(x) \qquad (1.1)$$

For some nondecreasing G functions, then G coincides with one of the three types of extreme values previously defined.

Reciprocally, each G distribution function of the extreme value type which appears as a limit of type (1.1) is unique distribution function for function ε_i.

Proof

If (1.1) is valid, Theorem 3.1 shows that G is max-stable and consequently from theorem 1.1 is of extreme value type. Reversibly, if G is of extreme value type, is max-stable from theorem 1.1 and theorem 3.1(b) shows that $G \in D(G)$.

If $\varepsilon_1, \varepsilon_2, ...$ are not necessarily independent, but $M_n = \max(\varepsilon_1, \varepsilon_2, ..., \varepsilon_n)$ has an asymptotical distribution G in the bearing of (1.4), then (3.1) is true for $k = 1$, where F_n is distribution function of M_n. If one can show that if (3.1) is true for $k = 1$, then it is true for all k, so it will result that G is max-stable from theorem 3.1 (a) and as a result G is extreme value type.

Thus our focus when considering dependent cases will consist only in showing that under the correct assumptions, the truth from (3.1) for $k = 1$ implies the truth from (3.1). For all k, from where, again, it results the Theorem of extreme types.

Coming back to the case independent and identically distributed random variables we note that theorem 1.1 assumes that $a_n(M_n - b_n)$ has a nondecreasing limit distribution function G and than it demonstrates that G must have one of the three presented forms. It is easy to build the

sequences $\{\varepsilon_n\}$, independent and identically distributed random variables for which there is not such a G. in order to see an easy example, for this case it is convenient to use the notation $x_F = \sup\{x; F(x) < 1\} (< \infty)$.

That means that $F(x) < 1$ for all $x < x_F$ and $F(x) = 1$ for all $x \geq x_F$. We assume that each ε_n has a distribution function which is such as $x_F < \infty$ and thus F has at x_F a continuity point i.e. $F(x_{F-}) < 1 = F(x_F)$. Then it results that if $\{u_n\}$ is any sequence and $P\{M_n \leq u_n\} \to \rho$, then $\rho = 0$ or 1. Thus if $P\{a_n(M_n - b_n) \leq x\} \to G(x)$, it follows taking a $u_n = \frac{x}{a_n} + b_n$, that $G(x) = 0$ or 1 for each *x*, so that *G* is nondecreasing.

2. CONVERGENCE OF $P\{M_n \leq u_n\}$

We have taken into consideration convergence of the probabilities of the form $P\{a_n(M_n - b_n) \leq x\}$ which can be rewritten as $P\{M_n \leq u_n\}$, where $u_n = u_n(x) = \frac{x}{a_n} + b_n$.

The convergence was asked for all *x*. On the other hand, we are interested in considering the sequences $\{u_n\}$ which can be non dependent on any parameter *x* or can be functions more complicated than the linear one considered above.

The next theorem is almost trivial in the context independent and identically distribution but it is also very important and will be extended through important means in order to be applied (stationary) to the dependent sequences and continuous time processes.

Theorem 2.1

May $\{\varepsilon_n\}$ a selection of independent and identically distributed random variables. May $0 \leq \tau \leq +\infty$ with the assumption that if $\{u_n\}$ is a sequence of real numbers for which:

$$\lim_{n\to\infty} n(1 - F(u_n)) = \tau \qquad (2.1)$$

Then

$$\lim_{n\to\infty} P\{M_n \leq u_n\} = e^{-\tau} \qquad (2.2)$$

Conversely, if (2.2) holds true for a τ with $0 \leq \tau \leq +\infty$ then the relation (2.1) it is true.

Proof

"=>"

If $0 \leq \tau \leq +\infty$ so that:

$$P\{M_n \leq u_n\} = F^n(u_n) = \{1 - (1 - F(u_n))\}^n \qquad (2.3)$$

According to the hypothesis, from $\lim_{n\to\infty} n(1 - F(u_n)) = \tau \Rightarrow$ there is n_r so that any $n \geq n_r$

$$\left| n(1 - F(u_n)) - \tau \right| < r$$

$$-r < n(1 - F(u_n)) - \tau < r \Big| + \tau$$

$$\tau - r < n(1 - F(u_n)) < r + \tau \Big| : n$$

$$\frac{\tau - r}{n} < 1 - F(u_n) < \frac{r + \tau}{n} \Big| (-1)$$

$$-1 + \frac{\tau - r}{n} < -F(u_n) < -1 + \frac{r + \tau}{n} \Big| (-1)$$

$$1 - \frac{r + \tau}{n} < F(u_n) < 1 - \frac{r - \tau}{n}$$

$$1 - \frac{\tau}{n} - \frac{r}{n} < F(u_n) < 1 - \frac{\tau}{n} + \frac{r}{n}$$

Therefore

$$P(M_n \leq u_n) = \left(1 - \frac{\tau}{n} + 0\left(\frac{1}{n}\right)\right)^n \Rightarrow$$

$$\lim_{n\to\infty} P\{M_n \leq u_n\} = 1^\infty = e^{\lim_{n\to\infty}\left(-\frac{\tau}{n} + 0\left(\frac{1}{n}\right)\right)\cdot n}$$

$$= e^{\lim_{n\to\infty}\left(-\tau + n\cdot 0\left(\frac{1}{n}\right)\right)} = e^{-\tau}.$$

"<="

From

$$\lim_{n\to\infty} P(M_n \leq u_n) = \lim_{n\to\infty}\{1 - (1 - F(u_n))\}^n =$$

$$= e^{-\tau} \Rightarrow (1 - F(u_n) = 0$$

For $1 - F(u_{nk})$ limited by *O* for the sequence $\{n_k\}$ according to the relation (2.3) from which it results:

$$\left.\begin{array}{l} \lim_{n\to\infty} P(M_n \leq u_n) = 0 \\ \ln P(M_n \leq u_n) = \ln e^{-\tau} = -\tau \\ \ln P(M_n \leq u_n) = n\ln(1 - (1 - F(u_n))) \end{array}\right\} \Rightarrow$$

$$n\ln(1 - (1 - F(u_n))) \to -\tau$$

$$n(1 - F(u_n))(1 + O(1)) \to \tau$$

Finally if $\tau=\infty$ and (2.1) is true but (2.2) is not true, there must be a sequence $\{n_k\}$ so that $P\{M_n \le u_n\} \to e^{-\tau}$ while $k \to \infty$ for $\tau' < \infty$. But the relation (2.2) implies (2.1) with n_k replacing n so that $n_k(1-F(u_{nk})) \to \tau' < \infty$, contradicting the assumption that (2.2) is true for $\tau=\infty$. Similarly (2.2) implies (2.1) when $\tau=\infty$.

Corollary 2.2

(1) $M_n \to x_F (\le +\infty)$ with probability 1 for $n \to \infty$.

(2) If $x_F < \infty$ and $F(x_{F^-}) < 1$ and if for the sequence $\{u_n\}$, $P(M_n \le u_n) \to \rho$ then $\rho = 0$ or $\rho = 1$.

Proof

If $\lambda < x_F (\pm\infty)$, $1-F(\lambda) > 0$ so that (2.1) is true for $u_n = \lambda, \tau = \infty$ and from (2.2) we obtain $\lim_{n\to\infty} P(M_n \le \lambda) = 0$. But $P(M_n > x_F) = 0$ for any n, from where it results $M_n \to x_F$ in probability. As $\{M_n\}$ is monotonous and convergent it results that $M_n \to x_F$ and point (1) is proved.

Assuming that $x_F < \infty$ and $F(x_{F^-}) < 1$. Let the sequence $\{u_n\}$ so that $P(M_n \le u_n) \to \rho$. As $\rho \in [0,1]$ we can write $\rho = e^{-\tau}, 0 \le \tau < \infty$ and from the theorem 2.2 we obtain $n(1-F(u_n)) \to \tau$.

If $u_n < X_F$ for an infinite number of values of n and because $1-F(u_n) \ge 1-F(x_{F^-}) > 0$ we have $\tau = \infty$ and $u_n \ge X_F$ and we obtain

$$\left.\begin{array}{l} n(1-F(u_n)) = 0 \\ n(1-F(u_n)) \to \tau \end{array}\right\} \text{ results that } \tau = 0 .$$

Therefore $\tau = \infty$ or $\tau = 0$ and consequently $\rho = 0$ or $\rho = 1$ Q.E.D.

We go on bringing into discussion the interest domain of distributions with extreme values. The normal selections are important and consequently it is demonstrated that theorem 2.1 can be used directly to obtain asimpthotic laws of type Tip I for normal independent and identically distributed selections.

We consider J the normal standard distributive function and Φ the density function corresponding to the mention that there will be repetitively used the known relation of connection:

$$1-J(u) \approx \frac{\Phi(u)}{u} \text{ when } u \to \infty . \qquad (2.4)$$

Theorem 2.3

If $\{\varepsilon_n\}$ is a normal selection independent and identically distributed (standard) of random variables, then the asimpthotical distribution of $M_n = \max(\varepsilon_1, \varepsilon_2, ... \varepsilon_n)$ is of Type I and

$$P\{a_n(M_n - b_n) \le x\} \to \exp\left(-e^{-x}\right) \qquad (2.5)$$

Where $a_n = (2\ln n)^{1/2}$ and

$$b_n = (2\ln n)^{1/2} - \frac{1}{2}(2\ln n)^{-1/2}(\ln\ln n + \ln 4\pi)$$

Proof

We choose $\tau = e^{-x}$ in relation (2.1), then

$$\left.\begin{array}{l} 1-J(u_n) = \dfrac{1}{n}e^{-x} \\ 1-J(u_n) \approx \dfrac{\Phi(u_n)}{u_n} \end{array}\right| \Rightarrow \frac{\frac{1}{n}e^{-x}\cdot u_n}{\Phi(u_n)} \to 1$$ and by

looking up its logarithm we obtain:

$$\left.\begin{array}{l} -\ln n - x + \ln u_n - \ln \Phi(u_n) \to 0 \\ \Phi(u_n) = \dfrac{1}{\sqrt{2\pi}} e^{-\frac{u_n^2}{2}} \end{array}\right\} \Rightarrow$$

$$\Rightarrow -\ln n + \ln u_n + \frac{1}{2}\ln 2\pi + \frac{u_n^2}{2} \to 0 \qquad (2.6)$$

As $\dfrac{u_n^2}{2\ln n} \to 1$ we obtain

$$2\ln u_n - \ln 2 - \ln(\ln u) \to 0 \Rightarrow$$

$$\ln u_n = \frac{1}{2}\left(\ln 2 + \ln(\ln u)\right) + 0(1) \; (*)$$

Using (*) in (2.6) we obtain

$$-\ln n - x + \frac{1}{2}\left(\ln 2 + \ln(\ln u)\right) + 0(1) + \frac{1}{2}\ln 2\pi + \frac{u_n^2}{2} \to 0$$

$$\frac{u_n^2}{2} = x + \ln n - \frac{1}{2}\ln 4\pi - \frac{1}{2}\ln(\ln n) + 0(1)$$

$$u_n^2 = 2x + 2\ln n - \ln 4\pi - \ln(\ln n) + \theta(2)$$

$$u_n^2 = (2\ln n)\left(\frac{x}{\ln n} + 1 - \frac{\ln 4\pi - \ln(\ln n)}{2\ln n} + \theta\left(\frac{1}{\ln n}\right)\right)$$

$$u_n (2\ln n)^{\frac{1}{2}} \left(1 + \frac{x - \frac{1}{2}\ln 4\pi - \frac{1}{2}\ln(\ln n)}{\ln n} + \theta\left(\frac{1}{\ln n}\right)\right)^{\frac{1}{2}}$$

$$u_n = (2\ln n)^{\frac{1}{2}} \left(1 + \frac{x - \frac{1}{2}\ln 4\pi - \frac{1}{2}\ln(\ln n)}{2\ln n} + \theta\left(\frac{1}{2\ln n}\right)\right)$$

$$u_n = (2\ln n)^{\frac{1}{2}} \cdot \frac{x}{2\ln n} + \left((2\ln n)^{\frac{1}{2}} - (2\ln n)\frac{\frac{1}{2}\ln 4\pi + \frac{1}{2}\ln(\ln n)}{2\ln n} + \theta\left((2\ln n)^{\frac{1}{2}} \frac{1}{2\ln n}\right)\right)$$

$$u_n = \frac{x}{(2\ln n)^{1/2}} + \left((2\ln n)^{\frac{1}{2}} - \frac{1}{2}\frac{\ln 4\pi + \ln(\ln n)}{(2\ln n)^{1/2}} + \theta\left(\frac{1}{(2\ln n)^{1/2}}\right)\right)$$

$$u_n = \frac{x}{a_n} + b_n + \theta\left(a_n^{-1}\right).$$

From (2.2) we have

$$P(M_n \le u_n) \to \exp(-e^{-x}) \text{ where } \tau = e^{-x}$$

$$P\left\{M_n \le \frac{x}{a_n} + b_n + \theta\left(a_n^{-1}\right)\right\} \to \exp\left(-e^{-x}\right) \text{ or}$$

$$P\{a_n(M_n - b_n) + \theta(1) \le x\} \to \exp\left(-e^{-x}\right) \text{ that is (2.5) Q.E.D.}$$

References

1. Anserson, C.W., Extreme value theory for a class of discrete distributions with applications to some stochastic processes. *J.Appl.Probab.*7,99-113, (1970).

2. Balkema, A.A. and Haan, L. de. On R.von Mises' condition for the domain of attraction of exp(-exp(-x)). *Ann.Math.Statist.* 43,1352-1354, (1972).

3. Barndorff-Nielsen, O., On the limit distribution of the maximum of a random number of random variable. *Acta. Math. Acad. Sci. Hungar*, 15,399-403, (1964).

4. Berman, S.M. Limiting distribution of the maximum term in sequences of dependent random variables, *Ann. Math. Statist*. 33,894-908, (1962).

5. Berman, S.M. Limit theorems for the maximum term in stationary sequences, *Ann. Math. Statist*. 35,502-516, (1964).

6. Davis, R.A., Maxima and minima of stationary sequences. *Ann.Probab*. 7, 453-460, (1979).

7. Deheuvels, P., Valeur extremales d'echantillons croissants d'une variable aleatoire réelle. *Ann.Inst.H.Poincaré*. 10, 89-114, (1974).

8. Epstein, B., Elements pf the theory of extreme values, Thechnometrics 2, 27-41, (1960).

9. Feller, W., *An Introduction to Probability Theory and Its Applications*, Vol. 1, 3rd ed. New York: Wiley, (1968).

10. Green, R.F. Partial attraction of maxima. *J.Appl.Probab*. 13,159-163, (1976).

11. Haan, L. de, Sample Extremes: an elementary introduction. *Statist.Neerlandica*, 30, 161-172, (1976).

12. Hall, P., On the extreme terms of a sample from the domain of attraction of a

stable law, *L.London.Math.Soc*., 18,181-191, (1978).

13. Hall, P., Representations and limit theorems for extreme value distributions, . *J.Appl.Probab*. 15, 639-644, (1978).

14. Tiago de Oliveira, J., Extremal distributions, *Rev.Fac.Sci.Lisboa*, Ser.A, 7, 215-227, (1958).

15. Weinstein, S.B., Theory and application of some classical and generalizes asymptotic distributions of extreme values. *IEEE Trans. Inform. Theory*, 19, 148-154, (1973).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

USE OF RECONFIGURABLE CELLULAR AUTOMATA, IMPLEMENTED WITH FPGAs, IN CRYPTOGRAPHIC APPLICATIONS

Constantin GROZEA*, Gheorghe GUIMAN*, Daniel-Tiberius HRIȚCU*, Ionuț RĂDOI*, Florent-Mircea ROMAN*

*Military Equipment and Technologies Research Agency, Bucharest, Romania

Abstract: *Cellular automata (CA) are dynamic systems, successfully used in mathematics, biology, chemistry or physics. The random generated by these systems has also been used in computer science (e.g. games industry) as well as in cryptographic applications (e.g. random number generators). As in the case of more well-known LFSR (Linear Feedback Shift Register), the usefulness of these systems in cryptographic applications depends on how it is accomplished, as well as the reconfiguration of the sequence used (seed). In this paper presents the principle of functioning of cellular automata, their usefulness in cryptographic applications, as well as a reconfiguration mechanism is implemented using FPGA (Field-Programmable Gate Array).*

Keywords: *cellular-automata, LFSR, FPGA*

1. INTRODUCTION

Providing encryption data flows through the channels of communications exchanged has become an essential requirement in the objectives realization context on which both large companies and institutions as well as civil and military proposed.

Currently, cryptography is no longer a specific branch of the military scope, which is why more and more companies are investing in civil and financial resources for the acquisition of significant human or implementation of cryptographic solutions to ensure the desired privacy.

Although cryptographic algorithms are based on different deployment scheme *(DES, 3-DES, AES, etc.)*, all make use of a shared-key encryption.

Thanks to the random that you generate, cellular automata have been used in order to obtain some strings of random numbers, [1] either individually or in combination with other mathematical algorithms, such as *LFSR* [2].

The notion of "cellular automata" appeared for the first time in his work titled: *„John von Neumann Theory of Self-Reproducing Automata"*, which represent a model defined a biological system self-regenerating.

Until now, cellular automata have been used successfully in various fields such as physics, mathematics, biology or chemistry. As can be seen in *Figure 1*, cellular automata is formed from a number of cells (for practical implementations consider a finite number is)

interconnected with neighboring cells after a mathematical rule.

Depending on the existing connections between neighboring cells, cellular automata can be one-dimensional or multidimensional [3].

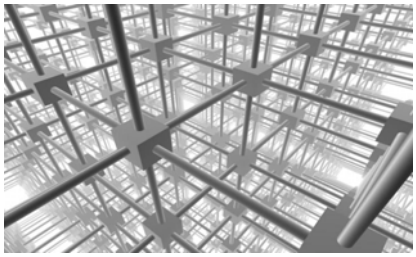


Figure 1 The structure of multidimensional cellular automata

Every cell of an automatic cell is characterized by *3 (three)* parameters:

- The current status *(e.g.: „1L" or „0L")*;
- Status of the neighboring cells;
- Math rule after this will change the current status.

How mode to use an automatic rule specific mathematical cell is described in detail in [4].

In the next section will show how to deploy a cellular automata are implemented in *FPGA* technology, as well as a changing automatic mechanism of mathematical rule.

II. IMPLEMENTATION

In *Figure 2* is presented block diagram of the proposed architecture to examine the possibility of implementing cellular automata reconfigurable. Block control meets second functions. The first function is to count the number of random bits and generate comparison with maximum length allowed for a random sequence. The second function consisted in testing the online statistics of random sequences generated. In the experiments, we used the „Monobit test".

For the purposes of a more stringent statistical tests can add a series of tests, such as tests specified in *FIPS 140-2 (Poker, Longest Run, Runs)*. When the control block passed the *CE* output signal in the *„1L"*, on a length of *32* impulse clocks takes place after the change of the rule that runs the mathematical cellular automata, cells at the level of the module to change the rule.

The new rule will be passed on to mathematics through the serial signal *CDI* by random number generator based on cellular automata, *AC*.

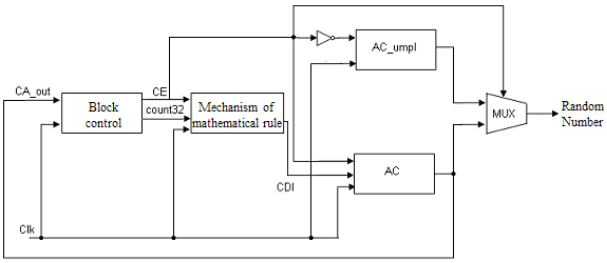


Figure 2 Random Number Generator based on reconfigurable cellular automata

The operation mode is similar to random number generators based on *LFSR*. Assuming that the *LFSR* is composed of *N* cells, maximum length of the random sequence on which he can generate is 2^N. Thus, once the 2^N numbers generated, *LFSR* must be reconfigured.

Similarly, in this article, it is proposed to change the mathematical rule after either generated a random number sequence of maximal length, either after a random test statistic sequences detects a determinist sequence.

For generating random numbers were used two generators (*AC* and *AC_umpl*), the first of which was active during the period of time during which the rule change takes place

by operation of cellular automata in the composition of the second.

The objective of this work is to implement a strong random number generator, it resorted to the method previously mentioned in order to avoid the appearance at the exit of architecture presented in *Figure 2* has a long string of bits in the State due to its connections to *„0L"* during the period of time during which the rule change takes place for *AC* generator functioning.

A more practical alternative might be to use a memory *FIFO (First In First Out)* to withhold only valid outs of random number generator.

In this way you can give up using random number generator *AC_umpl*.

For the implementation of the reconfigurable cellular automata components were used for the basis of programmable logical areas supplied by *Xilinx*, known as *LUT (Look Up Table)*, in the reconfigurable version.

The principle of operation of these components is described in [5].

In *Figure 3* is a block diagram of *LUT* for two-dimensional cellular automata adapted with four neighbors for each cell.

The inputs I_0, I_1, I_2 and I_3 are connected with their four neighbors of a cell.

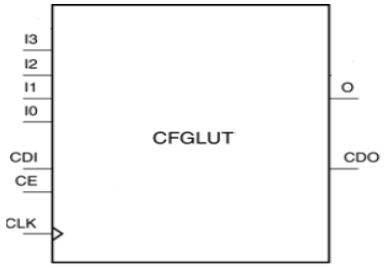


Figure 3 The cellular automata basic cell

The output of a cell depends on the *CA* table of truth, operated on the basis of the four entrances and mathematical rule to change cell condition, as can be seen in *Figure 4*, to rule *CA06990*:

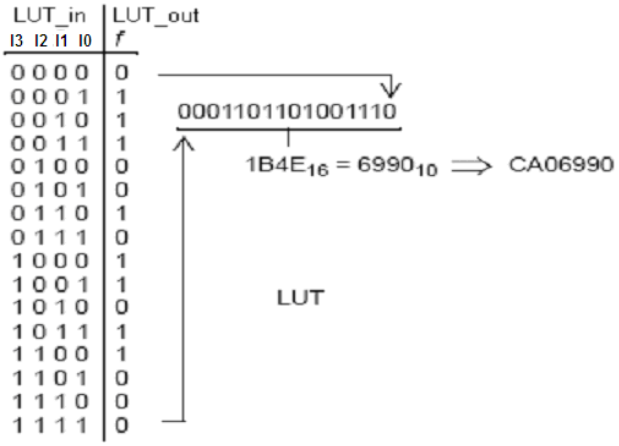


Figure 4 Table of truth

Determination of the neighbors of a cell is made according to the method described in [4] for two-dimensional configuration *{2n2w, c, ne, s}*, illustrated in Figure 5.

For example, starting from the second cell number *7* positions in the direction of North and West in the direction of two positions *(2n2w)*, you will reach the cell number *53*, representing the first neighbor cell number *7*.

The mechanism is similar to the cell *7* inputs *2* and *3 (ne and s)*.

In contrast, entry *1 (c)* is connected to its output, so that one of the neighbors of each cell is considered even the cell oneself.

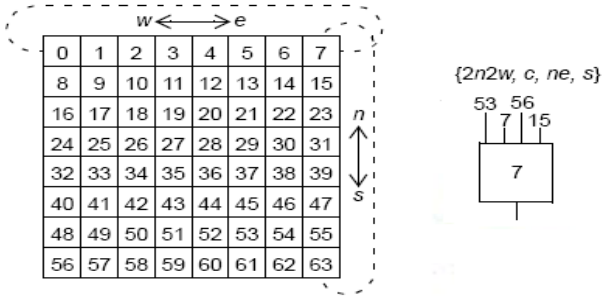


Figure 5 Two-dimensional configuration {2n2w, c, ne, s}

In the next section are presented the results of the implementation of the mechanism for reconfiguration of the mathematical rule change whit cells.

III. RESULTS

The main aspects considered in this paper aims at the implementation of the control block and module to change the rule, both shown in *Figure 2*.

The mechanism of functioning of the control block is illustrated in the following two figures.

In *Figure 6* is presented if it reaches a maximum length of random sequence generated.

For demonstration purposes we considered as maximum length of a random sequence of bits is *60,000*.

In reality, this maximum length sequences depends on the number of cells used.

Count_sw signal pulses counted *20,000* clocks, so when it exceeds the value *2*, the signal goes in *„1L”*, generating *60,000* bits random bits sequences, out-classing reconfiguration process.

Parallel to the length of random testing is accomplished a sequence statistics test for *20,000* bits.

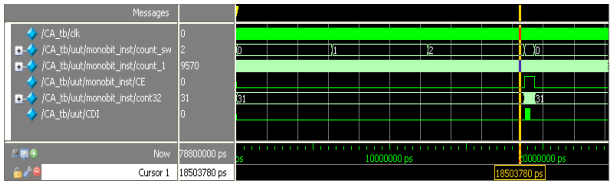


Figure 6 The changing mechanism of mathematical rule if case of maximum sequence random

It has also implemented a simplified variant of the module test statistics, relying only on the *„Monobit test”*.

This module is intended to trigger the process of changing the current mathematical rule that runs after the cellular automata, every time when it detected a sequence of *20,000* bits that cannot be considered random, statistical testing.

You can see in *Figure 7* that, although the signal is less than *count_sw 2* (sequence generated by the random number generator has a length less than *60,000* bits), the signal that has gone in *„1L”*, out-classed the changing mechanism of mathematical rule.

This is due to the amount of the registered signal after *20,000* bits generate *count_1*. The role of signal *count_1* is to count the number of 1 bits in a sequence of *20,000* bits.

The *„Monobit test”*, if the number of *1* bits is within governmental forecasts, $9725 < n_1 < 10275$, test is passed. In the situation illustrated in *Figure 7*, you notice that it was only counted a number of *5385* bits in *„1L”*, in the *20,000* bits sequence frame that was tested.

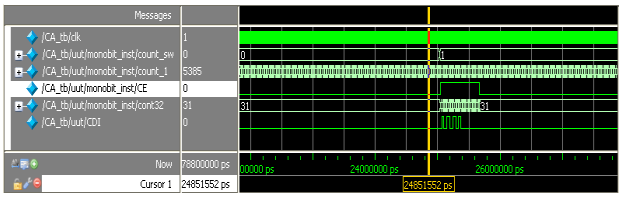


Figure 7 Changing mathematical rule imposed by statistical testing result

Figure 8 shows the gear-changing mathematical rule that runs after the automata cellular cell.

Note that when the signal becomes active for *32* cycles, counted by *cont32* (counter), takes place a change of the signal *CDI*.

In the case presented have used mathematical rules represented by *16-bit* binary functions, for which reason the signal change takes place in the early *CDI 16* pulses of tact.

You can also notice that the mathematical rule change, getting random number generator is provided, it fill-in signal representing getting the generator *AC_umpl* in *Figure 2*.

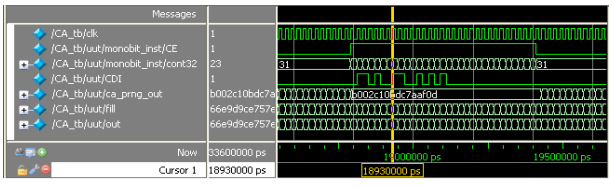


Figure 8 Changing mechanism of mathematical rule

Note also that while the process of mathematical rule change would require only *16 cycles* (in the case of a mathematical rule on *16-bit* representation), due to its structure and *CFGLUT* mode of operation, the *32* cycles are required.

This is a limitation of the mechanism proposed in the event that uses a mathematical rule on represented less than *32*-bit, but if you want to use different mathematical rules represented more than *32*-bit.

IV. CONCLUSIONS

A *RNG* (random number generator) based on components whose operation is controlled by a mathematical algorithm takes reinitializing periodicals.

This mechanism has been used in the case of random number generators based on *LFSR* modules.

In this paper we proposed a way of re-initialization that can be used to implement some random number generators that have automatic membership.

Thus, using the *CFGLUT* component areas programmable *Virtex 5* logic, the re-initialization could not accomplish in *32* cycles.

Re-initialization process is triggered automatically on the basis of tests that are performed during the selection of random number generator.

Thus, the re-initialization mechanism of described can be used to implement the random number generators that require online testing performance.

One of the limitations of the proposed method consists in the fact that the length of the cellular automata sequence re-initialization (mathematics) cannot exceed *32*-bit.

This constraint is due to the structure of the CFGLUT modules that may be initialing with fixed-length sequences *(32*-bit*)*.

REFERENCES

1. R. Santoro, S. Roy, O. Sentieys, „Search for Optimal Five-Neighbor FPGA-Based Cellular Automata Random Number Generators", University of Rennes.

2. T. Tkacik, „A Hardware Random Number Generator", Motorola (2009).

3. M. Woudenberg, „Using FPGAs to Speed Up Cellular Automata Computations", Master thesis for Grid Computing, University of Amsterdam.

4. B. Shackleford, M. Tanaka, R.J. Carter, G. Snider, „FPGA Implementation of Neighborhood-of-Four Cellular Automata Random Number Generators", HP Laboratories (2001 November 14).

5. „Virtex-5 Libraries Guide for HDL Designs", UG621(v 11.3) 2009 September 19.4. Shihong Wang, Huaping Lü, Gang Hu, "A new self-synchronizing stream cipher" (paper presented at Beijing, China, January 11, 2005), Chapter III, Principles to construct efective SSSC, pp. 9-12.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

METHODS FOR THE EVALUATION OF SPEECH ENHANCEMENT ALGORITHMS FROM SPEECH INTELLIGIBILITY POINT OF VIEW

Jaroslav, **Hovorka**

Mesit pristroje spol. s r.o., Uherske Hradiste, Czech republic

Abstract: *Cockpits of the aircrafts, especially those propeller-driven and the interior of a broad range of ground combat platforms, especially tracked ones, are characterized by high amplitude low frequency noise. This noise is coming from the engine and is interfering with communication. Since command and control in critical combat mission is a key to mission success, high speech intelligibility is the basic requirement in practice. A broad range of digital techniques and algorithms exists today which can be used and implemented either in personal headsets or in vehicular communications harness to increase the speech quality. However, these digital techniques and algorithms can have influence on the intelligibility of the processed speech. For this reason, digital algortihms must be assessed from intelligibility point of view, since high intelligibility is a crucial and basic requirement. This article is focused on the methods which are suitable for the evaluation of intelligibility of the processed speech and for the assessment of speech enhancement algorithms. Various methods which can be used for the assessment of speech enhancement algorithms from this point of view are described here.*

Keywords: *Intelligibility, nonsense syllable test, word tests, sentence tests, SPIN, HINT, speech reception threshold.*

1. INTRODUCTION

Noise levels on the board of a broad range of combat platforms can reach extremely high values. As indicated in [1], noise levels can reach up to 117 dB on the board of tracked combat vehicles. Very high noise is entering communications systems which are installed on the board of these platforms, examples of these systems can be radios or vehicle intercoms. The noise is entering communications channel through the microphone of personal headsets used by the crew members [2]. Since the noise is in the frequency range of the speech, it cannot be removed by frequency filtering. Some of the speech enhancement algorithms must be implemented to increase the quality or intelligibility of the processed speech [3]. Improvement of speech quality, however can result in degradation of speech intelligibility [3]. Speech quality and speech intelligibility are totally different attributes of the speech.

Speech intelligibility is very important especially in the field of military communications. The main role of all communications systems, either onboard or man-wearable is to provide reliable and intelligible speech under high noise of the battlefield.

Today, a broad range of speech enhancement algorithms can be used to process speech in these systems [3]. These algorithms and procedures can influence the intelligibility of the speech which is processed by particular digital algorithm. It is the main

reason why methods and tests must exist so that designers of the algorithms and also users of the systems can make assessment of the intelligibility of the processed speech and find out which algorithms and procedures are the best from this point of view.

A wide range of tests is used to assess intelligibility of the processed speech and ability of the particular algorithm to provide intelligible speech at its output. Developing a good intelligibility test is very difficult task. It is important that all major speech phonemes are well represented in the test, all the lists in the tests should be of equal difficulty and contextual information should be under full control.

2. INTELLIGIBILITY TESTS

2.1 The main tests of intelligibility. Intelligibility tests can be divided into three main groups. These groups [3] are nonsense syllable tests, word tests and sentence tests. All these methods have their own advantages and disadvantages.

The first group, nonsense syllable tests [4], is based on using a random list composed of the defined number of nonsense monosyllables. These monosyllables must have the format Consonant-Vowel-Consonant. Each initial and final consonant and each vowel are used only once. These syllables are being presented to a group of listeners and their role is to identify these syllables. This way the number of syllables identified correctly is obtained. This test is called articulation test. Articulation test was modified and modifications of this test exist today. The common disadvantage of using nonsense syllable test is difficulty and inability to prepare test lists of syllables in which all items are equally difficult to recognize [3].

The second group of methods, for the assessment of intelligibility, are the word tests. These tests are based on single meaningful words, which differ in the leding or trailing consonant. Here are the two main ways to make word tests – phonetically balanced word tests and rhyming word tests.

Phonetically balanced word tests [5] are based on presentation of 20 lists of 50 common monosyllables. All the lists must be designed so that the requirement of average difficuilty and equal range of difficuilty was met. It is also necessary words in the list have the very same phonemic distribution as expected in normal speech.

The other method of word tests is represented by the rhyming word test. These tests are fully based on rhyming words [6]. All items of the test are monosyllables. These monosyllables must have the form Consonant-Vowel-Consonant. The trailing vowel-consonant is given and known and the role of the listener is to identify the leading consonant. Test words must be chosen very carefully. This method is also modified to method which is called Modified Rhyme Test (MRT) [7]. Here, in this method, listener response is restricted to a finite set of rhyming words. It means that for aech of the words presented in the test, reponse contains the group of possible rhyming words. These words are words which the listener can choose from.

Other modification of the general word test is Diagnostic Rhyme Test (DRT) [3]. This algorithm is widely used for the evaluation of intelligibility of speech coders. In DRT, rhyming words do not differ only in the leading consonant, but they also differ in one distinctive feature of the leading phoneme. The role of the listener is to choose from two options, of course one of the options is the stimulus word. Distinctive features which are being used in these tests are voicing, nasality, sustention, sibilation, graveness and compactness. DRT test has a big advantage over the other tests, since DRT tests except the overall intelligibility score for the speech enhancement system gives the diagnostic score for each of the distinctive features. DRT tests were recognized to be very reliable tests in practice.

Disadvantage of the word tests is the fact, they do not reflect real-world situations, since humans are using sentences in real situations, not only words. It is the main reason why sentence tests were introduced in practice and are widely used in assessment of speech intelligibility. It is maximally important in sentence tests, phonetic content is balanced and distribution of the sounds in the language

is properly reflected. Two main types of the speech tests exist today – Speech Perception in Noise (SPIN) and Hearing in Noise Test (HINT) [3]. SPIN test is composed of 8 lists, each list contains 50 sentences. Each sentence in the list is composed of 5 to 8 words. It is maximally important to reach equal difficuilty among the lists. It is the main reason why half of the sentences in each list contain words of high predictability and half of the sentences contain words of low predictability. Listeners are asked to give single word response. HINT test contains 25 phonetically balanced lists of the sentences. Each list contains 10 sentences. All the sentences are equalized for naturelness, length and intelligibility. The difference to SPIN test is that in HINT test the sentences are scored on word by word basis. HINT test is very popular and widely used.

2.2 Mesuring speech intelligibility. In the test described above, intelligibility is defined as percentage of the words or syllables which are identified correctly by the listener. Percentage intelligibility is often measured at speech to noise levels which are fixed.

Alternative to percentage correct scores are Speech Reception Threshold (SRT) [3]. SRT can generally be measured under quiet conditions or under a noise. The meaning of SRT is different and is dependent on conditions under which measurement is done, if measured in quiet conditions or under the noise. In quiet conditions, SRT means intensity level at which listeners identify words with accuracy 50 %. It is obtained by presenting speech material at different intensity levels. Performance intensity plot is obtained. It is easy to determine 50 % point, which corresponds to SRT.

Totally different situation is if the measurement is done under the noise. SRT under the noise represents signal-to-noise ration at which listeners identify words with accuracy 50 %. This test is done by presenting speech to the listeners at different signal-to-noise ratios. Performace plot can be made which is a plot of percentage correct scores as a function of signal-to-noise ratio. 50 % point representing the SRT in this plot can be obtained.

4.CONCLUSIONS

A widely used methods suitable for the intelligibility assessment of speech and digital speech processing algorithms were outlined in this article, these methods cover nonsense syllable tests, word tests and sentence tests. Speech reception Threshold under quiet conditions and under a noise were explained.

BIBLIOGRAPHY

1. Hovorka, J., Marko, M., (2009). Predikcia hlukovej expozície osádky bojových vozidiel, SES Liptovský Mikuláš.
2. Hovorka, J.,(2008), Moderní přístupy pro zabezpečení srozumitelnosti komunikace uvnitř bojových vojenských vozidel, *Měření Diagnostika a Spolehlivost palubních sousvat letadel, 8. mezinárodní vědecká konference*, Brno, 2008.
3. Loizou, P., (2007) *Speech Enhancement Theory and Practice*. CRC Press
4. Fletcher, H. and Steinberg, J. (1929), Articulation testing methods, *Bell Syst. Tech. J.,8.*
5. Egan, J. (1948), Articulation testing methods, *Laryngoscope, 58(9).*
6. Fairbanks, G. (1958), Test of phonemic differentiation: the rhyme test, *J. Acoust. Soc. Am.,30(7).*
7. House, A., Williams, C., Hecker, M. and Kryter, K. (1965), Articulation-testing

methods: consonantal differentiation with a closed-response set, *J. Acoust. Soc. Am., 37(1).*

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

A FEW SUBPROBLEMS CONNECTED WITH INFORMATICS AND EDUCATION

Miroslav HRUBÝ*

*Faculty of Military Technology, University of Defence, Brno, the Czech Republic

Abstract: *The paper deals with the problem of informatics and education. The author tries to find suitable approach to each of four selected subproblems connected with the topic.*

Keywords: *adaptive systems, communication, education, informatics, study privacy*
MSC 2010: *68P99, 68U99*

1. INTRODUCTION

The informatics has a great impact on contemporary society, economics and education. The education supported by modern teaching and learning technologies, such as computer networks and digital communication tools, denotes the e-education. The point of view of the author is included.

2. INFORMATICS AND STUDY PROGRAMMES

Nowadays the informatics affects almost all military and civilian university study programmes. Its influence is visible in economy, management, natural and technical sciences, medicine, language studies, etc. Especially availability of electronic information sources and Internet communication can support the development of all mentioned branches. The informatics tools allow easy content storing and updating, information sharing, usage of connected databases, network communication, etc.

Informatics has become an important part of the general education. Contemporary information society requires deeper knowledge of the informatics in compliance with the needs of study branches and working positions.

Contemporary informatics gives the tools and methods for its own development and improvement. E-education in informatics can serve as a pattern for other fields of education.

3. SELECTED SUBPROBLEMS

E-education in informatics offers many various challenges to solve. The author has decided to choose four problem areas from the wide range of interesting subdomains of the topic. Opinions of the author can be found in the following subchapters.

3.1 Setting of goals of education, content of education and information sources usage. The primary task of the leaders of education is setting the right goals of this activity in compliance with the real needs of the target group. Every teacher or tutor should have the capability to successfully defence these goals

in discussion with students. The content should be prepared and suitable study sources should be recommended with respect to the structure of the target group.

Contemporary education needs a good feedback and communication among teachers (tutors) and students. The lectures without feedback and communication can be boring and ineffective. Underestimation of this fact leads also to the low number of students in the lecture halls.

3.2 Modern communication tools and methods and their usage in education. Contemporary education needs a good choice of communication tools and methods which are comfortable for both teachers and concrete target groups of students. A good mix of F2F, phone, videoconference, e-mail, discussion forum, chat, ICQ, Skype, etc. supports the motivation for required study activities fulfilment.

Receiving a syllabus before every lecture (a logical backbone of the lecture) can bring a motivation and higher attention of students during the lectures. The effectiveness of those lectures for students can be significantly higher.

Education based on ICT brings new possibilities for cheating on tests. Teachers and tutors should be prepared for this new environment and responsible for correctness of testing and task assessment.

3.3 Individualization of education, adaptive systems. A very interesting kind of pedagogical research is the development of adaptive learning systems. Such systems should prepare students according their knowledge about the students' learning needs, required study outcomes and specific personal capabilities (learning styles). On the other hand there is a necessity to be prepared for living and working in difficult information environment. Especially university students should be prepared in the real world with its enormous quantity of information of various qualities. From this point of view especially university students should improve their skills to assess the quality and usage of various information sources for their education.

3.4 Study privacy and modern educational technologies. The problem of study privacy in the information society can be an interesting topic for contemporary research. It is the fact that contemporary society uses technologies that can radically interfere with the privacy [1,2]. Insufficient knowledge about the possible danger can lead to the forcing of unsuitable point of view.

4. CONCLUSIONS & ACKNOWLEDGMENT

It should be emphasized that education is not only about getting of new information. Education represents a whole complex of elements and activities, through which students achieve a higher level of knowledge and skills. It is necessary to know how to organize new information, analyze and synthesize them. Education must positively influence or change human thinking. Educational technology can help to achieve this goal, but the technology itself does not guarantee real quality of education and life.

The quality of education and its effectiveness can bring the future prosperity for the states and regions. The investment into education is the investment into the future. E-education is an expression of modern technology usage in education, its development and improving will continue with the key role of the informatics in this process.

REFERENCES

1. Hrubý, M. Freedom in Adult Education. *Journal on Efficiency and Responsibility in Education and Science.* Vol. 1, No. 2. [online]. Available: http://www.eriesjournal.com/_papers/article_56.pdf. (2008)
2. Hrubý, M., Dvorský, J.. Possible 'Roadblocks' in Distance Learning Development. In *Distance Learning, Simulation and Communication 2009. Proceedings.* Brno: University of Defence (2009)

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

ANALYTICS SOLUTIONS FOR TRICOMI PROBLEM REGARDING MIXED ELLIPTIC-HYPERBOLIC EQUATIONS. APPLICATIONS IN TRANSONIC AERODYNAMICS

Mircea LUPU*, Gheorghe RADU**

*Faculty of Mathematics and Computer Science, "Transilvania" University, Braşov, România, corresponding member of the Academy of Romanian Scientists
** Faculty of Aeronautical Management, "Henri Coandă" Air Force Academy, Braşov, România and Faculty of Electrical Engineering and Computer Science, "Ştefan cel Mare" University, Suceava

Abstract: *In this paper is solved bounded Tricomi problem regarding mixed elliptic-hyperbolic equation positioned in x-o-y plan. For y>0 or y<0 canonical cases, is considered D1 domain where the equation is an elliptic type, respectively D2 domain where the equation is a hyperbolic type. By analytical completion from D1 to D2, for wave equation, there is determined exact solution for Dirichlet problem in D1, verifying problems' conditions. By conform representations in superior (upper) semi plan, other, more general, canonical D1 domains could be chosen (like semi circle, band etc.). Problems' applications are important in transonic aerodynamic where elliptic and hyperbolic equations correspond subsonic, supersonic or aero elasticity movement regimes.*

Keywords: *analytical solutions, transonic aerodynamics, Tricomi-Hilbert problems.*
MSC2010: *35M10, 76H20.*

1. INTRODUCTION

Let us consider the Lavrentiev-Bitzadze equation [1], [7]:

$$\frac{\partial^2 U}{\partial x^2} + \operatorname{sgn} y \frac{\partial^2 U}{\partial y^2} = 0. \qquad (1)$$

The equation is of elliptic type in the upper half-plane $D^+(y>0)$ and of hyperbolic type in the inferior half-plane $D^-(y<0)$ so we have:

$$\begin{aligned} &\frac{\partial^2 U}{\partial x^2} + \frac{\partial^2 U}{\partial y^2} = 0; \\ &\frac{\partial^2 U}{\partial x^2} - \frac{\partial^2 U}{\partial y^2} = 0. \end{aligned} \qquad (2)$$

Let consider $A(-1,0)$ and $B(1,0)$ the intersections of the Ox axis with the characteristic curves that are passing through point $C(0,-1)$. We have:

$$(AC): x + y + 1 = 0;\ (BC): x - y - 1 = 0 \qquad (3)$$

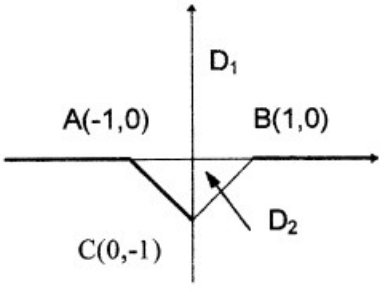


Figure 1.

We note $D_1 \equiv D^+$ and $D_2 \equiv D^-$ the interior of ABC triangle.

2. MAIN RESULTS

The Tricomi mixed boundary value problems for equation (1) require to find a function $U = U(x, y)$ of class $C^2(D)$, bounded at infinity in D_1 domain, continue on S and satisfying [5], [10];

$$U(x,0) = h_1(x),\ x \in (-\infty,-1);$$
$$U(x,0) = h_2(x).x \in (1,+\infty). \quad (4)$$

$$U|_{(AC)} = P(x,y) = P(x,-x-1) = P(x) = P^*(y) \quad (5)$$

The functions $h_1(x)$ and $P(x)$ are integrable. We are going to find the solution $U(x,y) = U^+$ in D_1 and $U(x,y) = U^-$ in D_2. On (AB) from the continuity we have $U^+(x) = U^-(x)$. In D_2 domain the Lavrentiev-Bitzadze equation become the wave equation and the solution can be write [2], [5]:

$$U^-(x,y) = \Phi(x+y) + \Psi(x-y) \quad (6)$$

where Φ and Ψ are arbitrary derivable functions. From the condition (5) on the characteristic (AC) we have:

$$P(x) = \Phi(-1) + \Psi(2x+1) \quad (7)$$

and because Ψ is an arbitrary function we get:

$$\Psi(x) = P\left(\frac{x-1}{2}\right) - \Phi(-1). \quad (8)$$

From (6) we can see the form of the solution:

$$U(x,y) = \Phi(x+y) + P\left(\frac{x-y-1}{2}\right) - \Phi(-1) \quad (9)$$

The continuity on (AB) impose:

$$U(x, y=0) = U(x,0) = \Phi(x) + P\left(\frac{x-1}{2}\right) - \Phi(-1) \quad (10)$$

Here the Symmetry Principle of Schwarz was applied knowing that the solution $F(z)$ can be prolonged analytically on the inferior half-plane.

In the D_2 domain using (9) we can write:

$$\frac{\partial U}{\partial y} = \Phi'(x+y) - \frac{1}{2}P'\left(\frac{x-y-1}{2}\right) \quad (11)$$

In order to find Φ let us determine the form of solution in D_1 domain where $U(x,y)$ is harmonic. In this case considering the harmonic conjugate $V(x,y)$ with $V(-1) = 0$ and the holomorphic function $F(z) = U(x,y) + iV(x,y)$ the Cauchy-Riemann relations hold true:

$$\frac{\partial U}{\partial x} = \frac{\partial V}{\phi}, \frac{\partial U}{\partial y} = -\frac{\partial V}{\partial x} \quad (12)$$

We make use of equations (11) and (12) together with Symmeny Principle applied to $F(z)$. From continuity we have on (AB):

$$\left.\frac{\partial V}{\partial x}\right|_{y-0} = -\left.\frac{\partial U}{\partial y}\right|_{y=0} = -\Phi'(x) + \frac{1}{2}P'\left(\frac{x-1}{2}\right) \quad (13)$$

and performing one integration,

$$V(x,0) = -\Phi(x) + P\left(\frac{x-1}{2}\right) + \Phi(-1). \quad (14)$$

Substitution of equation (14) in (10) yields on (AB):

$$U(x,0) + V(x,0) = 2P\left(\frac{x-1}{2}\right).$$

Thus in D_1 domain we must find a holomorphic function $F(z) = U + iV$ knowing on $x'Ox$:

$$U(x,0) = h_1(x),\ x \in (-\infty,-1);$$
$$U(x,0) = h_2(x),\ x \in (1,+\infty).$$

The last two equations can be rewritten in the form

$$aU(x) + bV(x) = g(x)$$

where

$$a=1,\ b=0,\ g(x)=h_{1,2}(x),$$
$$x\in(-\infty,-1)\cup(1,+\infty);$$
$$a=1,\ b=1,\ g(x)=2P\left(\frac{x-1}{2}\right),\ x\in[-1,1].$$

The problem to be solved in order to find $F(z)$ is of Hilbert type. If $U^-(x,0)$ is known then from the continuity condition $U^+(x,y=0)=U^*(x)=U^-(x,0)$ we obtain:

$$\Phi(x)=U^*(x)-P\left(\frac{x-1}{2}\right)+\Phi(-1)\ . \qquad (15)$$

Relation (15) is the general form of $\Phi(x)$ and substituting in (9) we find in D_2 the solution:

$$U^-(x,y)=U^*(x+y)+$$
$$+P\left(\frac{x-y-1}{2}\right)-P\left(\frac{x+y-1}{2}\right) \qquad (16)$$

In order to find $F(z)$ we split the Hilbert problem in two problems. Let be

$$F(z)=f(z)+f^*(z),$$

where

$$f(z)=u+iv,\ f^*(z)=u^*+iv^*,$$
$$U=u+u^*,\ V=v+v^*.$$

Problem 1. Find in D_1 domain the holomorphic function $f(z)$ knowing on x' Ox axis:

$$U(x,0)=h_1(x),\ x\in(-\infty,-1)\cup(1,+\infty)\ ;$$
$$U(x,0)=0,\ x\in[-1,1].$$

Problem 2. Find in D_1 domain the holomorphic function $f(z)$ knowing:

$$u^*(x,0)=0,\ x\in(-\infty,-1)\cup(1,+\infty)\ ;$$
$$u^*(x)+v^*(x)=g(x),\ x\in[-1,1].$$

The solution for the Problem 1 is given by Cisotti formula:

$$f^*(z)=u+iv=\frac{1}{\pi i}\int_{-\infty}^{-1}\frac{h_1(t)}{t-z}dt$$
$$+\frac{1}{\pi i}\int_{1}^{+\infty}\frac{h_2(t)}{t-z}dt+ik,\ k\in\mathbf{R}. \qquad (17)$$

If on segment $(-1,1)$ the substitution $t=\frac{1}{s}$ is considered then the evaluation of the integrals is much easier. The Hilbert Problem 2 is bring to a Dirichlet problem. Dividing the condition $au^*+bv^*=g(x)$ by $\sqrt{a^2+b^2}$, we obtain:

$$u^*\cos\mu x+v^*\sin\mu x=g(x);\ \mu=\frac{1}{4}.$$

According to [4] along with the irrational function

$$H(z)=(z+1)^{1-\mu}(z-1)^{\mu},$$

where analytic in D_1, we consider:

$$S(z)=R(z)+iI(z)=\frac{f^*(z)}{H(z)}\ . \qquad (18)$$

Let us determine in D_1 the analytic function $S(z)$ satisfying the boundary conditions:

$$Re\{S(z)\}=0,\ x\in(-\infty,-1)\cup(1,+\infty);$$
$$Re\{S(z)\}=\frac{g(x)\sqrt{2}}{(1+x)^{\frac{3}{4}}(1-x)^{\frac{1}{4}}},\ x\in(-1,1).$$

Using Cisotti formula and substituting t in (18), we get:

$$f^*(z)=u^*(x,y)+iv(x,y)=$$
$$=\frac{2\sqrt{2}(z+1)}{\pi i}\left(\frac{z-1}{z+1}\right)^{\frac{1}{4}}\int_{-1}^{1}\frac{P\left(\frac{t-1}{2}\right)}{(1+t)^{\frac{3}{4}}(1-t)^{\frac{1}{4}}}\frac{dt}{t-z}+ik$$

where k is a real constant. (19)

Thus with u(x, y) the real part of (17), (19) the solution is $U^+(x,y) = u(x,y) + u^*(x,y)$ in D_1 and for $y = 0$ we obtain $U(x, y = 0) = U^*(x)$ resulting $U^*(x)$ which is used in (16).

If the $h_i(x), i = 1,2$ and P(x) are rational functions, the integrals in (18) and (19) can be easily calculated using the residue theorem.

3. CONCLUSIONS

Thus we have found the two solutions $U^+(x,y)$ and $U^-(x,y)$ for D_1 and D_2 domains. These solutions satisfied the boundary conditions (4) and (5).

The general case when the frontier of D_1 domain is a Liapunov curve passing through A to B and the segment (AB) is readily amenable to the case solved by meaning of a conformal mapping of domain D_1 onto one of the following canonical domains: upper half-plane, semicircle, strip.

If D_1 domain is bounded by a semicircle $\{x^2 + y^2 = 1, y > 0\}$ and the segment AB, then the mapping of D_1 domain onto upper half-plane is:

$$Z = \frac{2z}{1+z^2}$$

If D_1 domain is bounded by an infinite quadrilateral MABN, where MA and NB are parallel with Oy, $x \in (-1,1), y \in (0,+\infty)$, the conform mapping of D_1 onto upper half-plane is:

$$Z = \sin\frac{\pi}{2}z.$$

Immediate applications are known in transonic aerodynamics [3], [4], [6], [8], [10] where in D_1 the flow is subsonic, in D_2 is supersonic and (AB) is the sonic line. Also immediate applications are known in the study of magneto dynamics.

REFERENCES

1. Bitzadze, *A mixed type equations* (in Russian), Moskva: Ed. A.N.S.U. (1959).
2. Gahov, F.D., *Boundary Value Problem*, Moscow Editions (1958).
3. Guderley, G., *Theorie Schallnaher Stromungen,* Berlin: Springer Verlag (1957).
4. Homentcovschi, D., *Functions of complex variable with applications in science and technique* (in Romanian), Bucureşti: Editura Tehnică (1986).
5. Iacob, C., *Introduction mathematique a la mecanique des fluides*, Bucureşti: Editura Academiei R.P.R., Paris: Gauthiers–Villars (1959).
6. Iacob, C., Sur quelques problems mathematiques de la dynamique des fluides compressibles, *Atti della 2ª Riunione del Groupement de Mathematiciens d'expression latine,* pp. 168-225 (1961).
7. Lavrentiev, M., Chabat, B., *Methodes de la theorie des functions d'une variable complexe*, Moscou: Editions MIR (1972).
8. Lupu, M., L'etude d'un probleme du type Tricomi au cas des mouvements transsoniques, *Mathematical Bulletin of Al.I. Cuza University*, Iaşi, 27, pp. 185-192 (1981).
9. Oswatitsch (ed), *Symposium Transsonicum II,* New–York: Springer Verlag (1976).
10. Tricomi, F., *Equazioni a derivate parziali*, Roma: Ed. Cremonede (1957).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

AN ORIGINAL AMR ARCHITECTURE USING A PLC PROTOCOL

Maleş Codrin*, Popa Valentin*, Lavric Alexandru*

*Stefan cel Mare University of Suceava, Romania

Abstract: *In this paper is presented architecture for an AMR (Automatic Meter Reading) system using the medium for transmitting data between meters and control center the LV (low voltage) and MV (medium voltage) power lines. Aspects of operating principles, system structure, communication module and last but not least the advantages introduced by the proposed architecture are presented. To validate the system a series of field tests are presented.*

Keywords: Architecture, AMR, PLC, PRIME, transformer, system

1. INTRODUCTION

Power Line Communications (PLC) is an alternative to the currently used solutions for data transfer. PLC applications have two main uses: broadband communication networks, used in indoor power networks for data transfer between computers, and narrowband communication networks used in outdoor power lines for automatic meter reading (AMR) of electricity, water or gas. Automation of meter reading is important for power network management due to reduction of time intervention and maintenance costs of equipment and power lines, providing precise control over the entire system. An AMR system can be implemented in a entire structure of a power network of distribution and supply using the LV (low voltage), MV (medium voltage) and HV (high voltage) power lines. Solutions developed to date, using PLC communication, mainly use LV and MV power lines [1].

Such systems have been implemented in many countries worldwide, some of them are: USA, Brazil, Germany, Spain, Denmark, France, Russia, Hungary, Nigeria, Algeria, Egypt, South Africa, China, Japan, India, Korea, England, Portugal and Sweden [2].

For an AMR system to be functional is necessary that all analog meters to replace with digital meters that can be administered via a modem. For this purpose many countries have developed extensive modernization programs of meters replacement in Europe. The aim of an AMR system is not the reading of power, water or gas meter's index, but to manage them remotely using various technologies such as: PLC, WiFi, GPRS, or ZigBee [3].

PLC was originally designed to control equipments in power stations and making measurements. The first reference to this technology was made by American Institute of Electrical Engineering (AIEE) in the report "Guide to Application and Treatment of Channels for Power Line Carrier" [7]. The use of power lines raised problems from the beginning due to electromagnetic noise interference induced by the starting and stopping of electric consumers. Electromagnetic interference can have

multiple sources and types such as: impulsive noise, Gaussian white noise, colored noise, quasi-synchronous noise, or synchronization noise [4]. Although this was a major disadvantage that has been identified and considered in the development of PLC, researchers have tried to find ways to increase communication distance and data speed transfer [1]. The PLC was chosen to serve two main needs: local network computer, or internet connection, and power meter reading and management. For this purpose international standards define separate communication frequency bands as follow: 1 MHz - 30 MHz (broadband) and 3 kHz - 500 kHz (narrowband). The most important bands used are: Europe - CENELEC A (3 kHz - 95 kHz), USA - FCC (10 kHz - 490 kHz), Japan - ARIBA (10 kHz - 450 kHz) and China - EPRI (3 kHz - 90 kHz).

AMR systems which use PLC have the main scope data transmission using only the power grid as a network, without the need of solutions provided by third parties. The main problem of the PLC on big distances is the presence of transformers that attenuates the transmitted signal by up to 40 dB and are a source of noise [5].

2. PROPOSED SYSTEM

Recent studies have shown the possibility of the communication over long distances, on LV and MV power lines. The problem of transformer crossing to achieve communication between the two type lines is still valid, although the use of OFDM (Orthogonal Frequency Division Multiplexing) can make communication perform successfully under certain circumstances [6,7,]. The proposed system aims to provide a solution to implement an AMR architecture that covers long distances using LV and MV power line with the possibility of transformer crossing without bypass components. With this the communication between control center and meters to be possible to be performed on power lines only as the propagation environment.

Architecture shown in Figure 1 illustrates the principle of communication between the PLC terminals installed at power meters and the control center using the data propagation environment of LV and MV power grid. The main components are: PLC modems connected to power meters, PLC concentrators with routing capability located near MV/LV transformers on MV power line and a control center connected via a PLC modem to a LV branch of power grid.

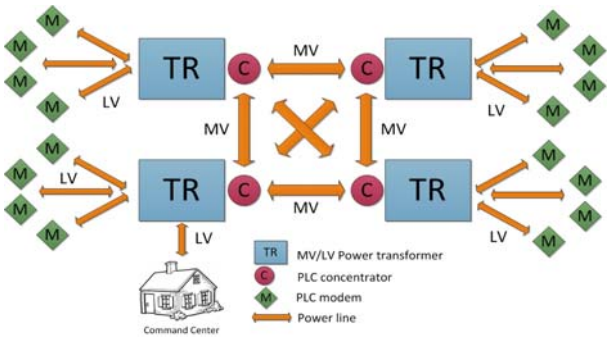


Figure 1 – Proposed architecture

Operating principle: data transfer is performed between power meters and concentrators that are located on the MV power line, between concentrators installed on MV power lines on long-distance, between command center and the nearest concentrator located on MV power line. Since the PLC can be realized on long distances using LV and MV power lines and also between them, the communication being made through the transformer's body, the installation of the concentrator on MV power line is important in terms of transfer of data between network nodes. While data transfer is achieved with difficulty through the transformer body [4], it is affordable enough to ensure communication between meters and the nearest concentrator at a time.

The existence of transformer between the concentrator and meter has the galvanic isolation effect of MV power line from noise present in the LV line. Because a concentrator can handle a high volume of meters, their number could reach 1.000 meters, it will send more easily and without loss to another concentrator located on the MV line because the power line has a lower level o f noise than the LV line. According to results presented in Chapter 3, communication can be achieved

between two LV branches of a power grid via a MV power line through two MV/LV transformers [8]. Because of these issues a backup solution will always be available if a concentrator will not work and communication with related counters of the concentrator can be achieved by another concentrator or directly from the command center. The command center manages PLC network equipments status, generate invoices to customers and issue alarms if concentrators and meters are not functional or have suffered damage.

The concentrator will act as a router, so it receives data from meters modems and forwards them to the command center applying a compression algorithm to reduce the size of transmitted data, and vice-versa. The concentrator will manage counters located in the transformer secondary on which is installed using the directives received from the command center or based on the routine implemented on it. Concentrators will make constant analysis of the power system in terms of perturbation and the levels recorded will be transmitted between them so that the transmission of data to and from the command center to be made on using the network segments where noise has the lowest values or at a hour time of the day when communication conditions are suitable.

Installation of concentrators on the LV side of the transformers is not the best solution because the distance between transformer and meter is much smaller, up to 1 km, than the distance between two transformers on the MV power line as is of many km [1]. This solution can be applied only if in the grid structure the distance between MV/LV transformers is reduced. Although installation costs may be higher for the proposed system as a coupling unit for MV power line is more expensive than a coupling unit for LV power lines, this disadvantage is balanced with the reliability and successful communication between the meters and command center.

If the concentrator would be installed on the LV side of transformer, communication with it can be affected by noise in LV network when the communication with meters is made, and additional to this noise the signal sent to another concentrator will be affected by the presence of the two transformers which attenuate de signal and induce additional noise.

3. TEST SETUP

In Figure 2 a schematic diagram of communication between two PLC modems connected to the secondary windings of two MV/LV transformers is presented. The two transformers are connected through the MV power line. The transformer 1 (TR1) has an active of 400 kVA and transformer 2 (TR2) one of 250 kVA.

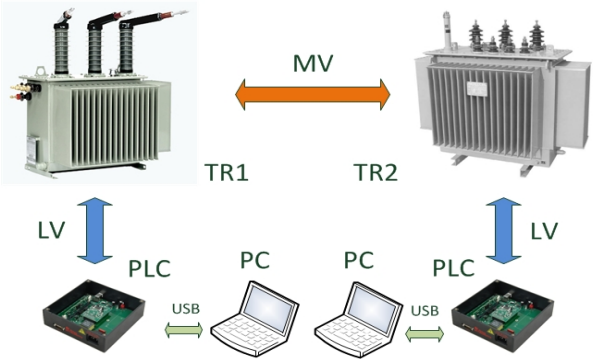


Figure 2 – PLC LV-MV-LV test

Each PLC modem is connected to a PC unit from which the data transfer is realized. The distance between the two transformers is 50m. Using PLC protocol PRIME [9] configured with FEC (Forward Error Correction) error correction type, values were obtained with data transfer and presented in

Table 2 as: modulation, SNR (Signal to Noise Ratio), BER (Bit Error Rate) and Tx (data speed transfer).

Modulation	SNR	BER	Tx
DBPSK	3 dB	0,14	5,2 kbps
DQPSK	3 dB	0,14	8,7 kbps
D8PSK	6 dB	0,17	11,8 kbps

Table 2. Test results

4. CONCLUSIONS

This paper proposes architecture for an AMR system that is based on PLC. This architecture aims to implement a management system for power meters remotely using exclusively the medium of communication of MV and LV power grid segments. Advantages of the proposed architecture are: the ability to easily expand AMR system because communication is achieved through the existing grid structure, the architecture allows integration of a large number of meters manageable by a single concentrator, standalone operating system can be made when a segment of the power grid is damaged, the architecture can be extended for control and supervision of problems that can occur in the power grid, monitoring of transformer and distribution lines, low cost because the power network is used and no third parties solution are necessary, reducing travel costs for meter reading by human operators, low error rate in automatic generation of invoices to customers.

ACKNOWLEDGMENT

This paper was supported by the project "Improvement of the doctoral studies quality in engineering science for development of the knowledge based society-QDOC" contract no. POSDRU/107/1.5/S/78534, project co-funded by the European Social Fund through the Sectorial Operational Program Human Resources 2007-2013.

REFERENCES

1. H. C. Ferreira, L. Lampe, *Power Line communications – Theory and Applications for Narrowband and Broadband Communications over Power Lines*, Ed. Wiley (2010).
2. T. Khalifa, K. Naik, A. Nayak, *A survey of Communication Protocols for Automatic Meter Reading Applications*, IEEE Survey & Tutorials (2011).
3. A. Mannikoff, H. Nilsson, *Sweden – reaching 100% 'smart meters' July 1, 2009*, IEEE Power & Energy Society General Meeting (2009).
4. *Report of Methods of Measurements for the Application of Power Line Carrier AIEE Committee Report*, Power Apparatus and Systems, Part III. Transactions of the American Institute of Electrical Engineers (2008)
5. Asier Llano, Alberto Sendin, *Quasi-synchronous Noise Interference Cancellation Techniques Applied in Low Voltage PLC*, ISPLC, 2011
6. K. Razazin, M. Umari, *G3-PLC Specification for Powerline Communications: Overview, System Simulation and Field Trial Results*, International Symposium on Power Line Communications (2010).
7. K. Razazian, A. Kamalizad, *G3-PLC Field Trials in U.S. Distribution Grid: Initial Results and Requirements*, ISPLC (2011)
8. K. Razazian, A. Kamalizad, *G3-PLC Field Trials in U.S. Distribution Grid: Initial Results and Requirements*, ISPLC, 2011.
9. PRIME Alliance, *Draft Standard for PoweRline Intelligent Metering Evolution*, Version 1.3E (2010).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

SCHWARZ METHOD FOR VARIATIONAL INEQUALITIES

Adriana PETRACHE *

* Faculty of Mathematics & Computer Science, University of Piteşti, Piteşti, Argeş, Romania

Abstract: *In this paper we want to bring into question the Schwarz overlapping domain decomposition method, taking into account that domain decomposition is a technique where the original domain is decomposed into a set of smaller sub- domains. We will talk about the additive Schwarz method for variational inequalities, presenting first the general framework where we expose the problem that we want to study. The purpose of this work s is to exploit a convergence theory for the specified method. The convergence results from the norm estimates for some error reduction operators. The additive Schwarz algorithm is formulated in a way which admits a nice recurrence for the errors between two consecutive steps. Through a study for projection operators onto closed and convex subsets of a Hilbert space, we will demonstrate a geometric convergence for our method. We have to mention that for simplicity, the theory will be demonstrated only for the obstacle problem.*

Keywords: *domain decomposition, admissible decomposition, error estimates*

1. Introduction

The additive Schwarz method, named after H. A. Schwarz, solves a boundary value problem for a partial differential equation approximately by splitting it into boundary value problems on smaller domains and adding the results.

The paper is organized as follows: firstly we will study the variational inequalities in an abstract framework, then the general result developed before will be applied to an obstacle problem in Sobolev spaces.

2. The Schwarz method for variational inequalities

2.1. General framework An iterative scheme

Let $(V,(\cdot,\cdot))$ be a Hilbert space and $a:V\times V\to\mathbf{R}$ a bilinear, symmetric, coercive and continuous form and $K\subset V$ a convex, closed subset. We consider the following variational inequality:

$$\begin{cases} u\in K \\ a(u,v-u)\geq f(v-u),\forall\, v\in K \end{cases},$$

(PI)

where f is a linear continuous functional on V (i.e. $f\in V'$).

From the properties of the bilinear form $a(\cdot,\cdot)$ it results that

$a(u,v)\cong(u,v),\forall u,v\in V$.

Furthermore, we have $a(u,v)=(u,v),\forall u,v\in V$. Let be $F:V\to\mathbf{R}$.

It is known that the problem (P1) is equivalent to the following minimization problem: $u \in K, F(u) \leq F(v), \forall v \in K$.
(P2)

We want to approximate the solution of (P1) by iterative procedures. Then, let V_i, $i = \overline{1,m}$ be subspaces of V such that $V = \sum_{i=1}^{m} V_i$. The interest is to define an algorithm for constructing a sequence $(u_n)_{n \in \mathbb{N}}$ to approximate the exact solution of the problem (P1), which is the minimum of the functional F . It is natural to impose that the solution from the step $n+1$ to decrease the value of the functional F , i.e. $F(u_{n+1}) \leq F(u_n)$.

Algorithm description

We proceed in two steps.

1. It is defined $u_{n,i} \in V_i$ such that:
$$F(u_n + u_{n,i}) \leq F(u_n + v_i), \forall v_i \in K_{n,i},$$
(P3)
where $K_{n,i} = \{v_i \in V_i;\ u_n + v_i \in K\}$.
2. It is defined
$$u_{n+1} = u_n + \rho \sum_{i=1}^{m} u_{n,i},$$ (*)
with ρ chosen such that $u_{n+1} \in K$.

Let be $\mu = \rho m \leq 1$. We have:

$$u_{n+1} = u_n + \rho \sum_{i=1}^{m} u_{n,i} = (1-\mu)u_n + \mu \sum_{i=1}^{m} \frac{1}{m}(u_n + u_{n,i})$$
.

Since $u_n \in K$ and $\sum_{i=1}^{m} \frac{1}{m}(u_n + u_{n,i}) \in K$, we observe that a sufficient condition to have $u_{n+1} \in K$ is that $\mu \leq 1$, i.e. $\rho \leq \frac{1}{m}$.

Obviously, the formulation of the problem (P3) is equivalent to the following variational inequality:

$$\begin{cases} u_{n,i} \in K_{n,i} \\ a(u_n + u_{n,i}, v_i - u_{n,i}) \geq f(v_i - u_{n,i}), \forall v_i \in K_{n,i} \end{cases}$$
. (P4)

Furthermore, we will make the following assumption which is necessary to demonstrate the convergence:

Assumption 2.1.

The problem (P4) is equivalent to the following problem:

$$\begin{cases} u_{n,i} \in K_{n,i} \\ a(u_n + u_{n,i}, v_i - u_{n,i}) \geq a(u, v_i - u_{n,i}), \forall v_i \in K_{n,i} \end{cases}$$
. *(P5)*

We can write the problem (P5) under the form:

$$\begin{cases} u_{n,i} \in K_{n,i} \\ a(u_{n,i}, v_i - u_{n,i}) \geq a(u - u_n, v_i - u_{n,i}), \forall v_i \in K_{n,i} \end{cases}$$
. *(P6)*

The correction is given by the solving the problem (P6).

Let $P_{n,i}: V_i \to K_{n,i}$ be the projection operator on the convex closed set $K_{n,i}$. From (P6) it results that:
$u_{n,i} = P_{n,i}(u - u_n)$ (**)
With these preliminary the iterative scheme is defined as follows:

Algorithm 2.1.

Let be $u_0 \in K$. We compute the sequence of approximations $\{u_n\}$ as follows:

1. *We compute $u_{n,i}$ from the problem (P4).*
2. *We compute u_{n+1} from (*).*
3. Let $e_n = u - u_n$ be the error at the step n . From (**) it results that:
$u_{n,i} = P_{n,i} e_n$.
Thus, from (*) it results that:
$e_{n+1} = (I - \rho T_n) e_n$,
where T_n is the additive operator
$$T_n = \sum_{i=1}^{m} P_{n,i}$$.

To demonstrate the convergence of the Schwarz method, we analyse the additive operator T_n.

2.2. Technical estimates

Let $K_i \subset V, i = \overline{1,m}$ be convex closed subsets such that $0 \in K_i, \forall i = \overline{1,m}$. We observe that this hypothesis is satisfied for $K_i = K_{n,i}$ because $u_n \in K$. Let be $f \in V$.

We consider the problem (P1) in the case $a(\cdot,\cdot) = (\cdot,\cdot)$, which is equivalent to $u = P_i f$, where $P_i : V \to K_i$ is the projection operator, or we can have:

$$\begin{cases} P_i f \in K_i \\ (P_i f, v - P_i f) \geq (f, v - P_i f), \\ \forall v \in K_i. \end{cases} \quad (2.1)$$

The corresponding additive operator is given by:

$$T = \sum_{i=1}^{m} P_i \quad . \quad (A)$$

Taking $v = 0$ in (2.1) we obtain:

$$\|P_i f\|^2 = (P_i f, P_i f) \leq (f, P_i f), \quad \forall f \in V. \quad (2.2)$$

From (2.1) we obtain:

$$(f, v - P_i f) \leq [(P]_i f, v), \forall v \in K_i. \quad (2.3)$$

Definition 2.1: A vector $f \in V$ is said to have an admissible decomposition with respect to $\{K_i\}$ and a fixed constant C_0, if there exists a partition of f:

$$f = f_1 + f_2 + \cdots + f_m, f_i \in K_i,$$

such that

$$\sum_{i=1}^{m} \|f_i\|^2 \leq C_0 \|f\|^2 \quad . \quad (2.4)$$

Lemma 2.1: If $w \in V$ has an admissible decomposition with respect to $\{K_i\}$ and the constant C_0, then we have the inequality:

$$(f, f) \leq (2 + C_0)(f, Tf).$$

Demonstration: We have:

$$\|f\|^2 = (f, f) = (f, \sum_{i=1}^{m} f_i) = \sum_{i=1}^{m} (f, f_i) = \sum_{i=1}^{m} [(f, f_i] \quad) = \sum_{i=1}^{m} [(f, f_i] - P_i f + P_i f) = \sum_{i=1}^{m} [(f, f_i] - P_i f) + \sum_{i=1}^{m} [(f, P_i f] \quad) \leq \sum_{i=1}^{m} (P_i f, f_i) + (f, T$$

,

Next, we investigate the boundedness of the operator T. Let be $C_{ij} \in [0,1]$ which satisfies the inequality:

$$|(P]_i f, P_j g)| \leq C_{ij} \|P_i f\| \|P_j g\|, \quad \forall f, g \in V \quad (2.5)$$

Let be $C = (C_{ij})_{i,j=\overline{1,m}}$ and let $|C|$ be the norm of the matrix C.

Lemma 2.2: Let T be defined as above. Then

$$\|Tf\|^2 \leq |C|(f, Tf), \forall f \in V.$$

Consequently, $\|Tf\| \leq |C| \|f\| \forall f \in V$. (2.6)

From the above two lemmas, we easily deduce the following properties of the operator T.

Theorem 2.1: Let $f \in V$ having an admissible decomposition with respect to $\{K_i\}$ and the constant C_0:

$$(2 + C_0)^{-1} \|f\|^2 \leq (f, Tf) \leq$$

$|C|\|f\|^2$. (B)

and

$(2+C_0)^{-2}\|f\|^2 \le \|Tf\|^2 \le |C|^2\|f\|^2$. (C)

Demonstration: For (B) we have:

• from lemma 2.1 we have:

$(f,f) \le (2+C_0)(f,Tf) \Rightarrow (2+C_0)^{-1}\|f\|^2 \le (f,Tf), \forall f \in V.$

•

$(f,Tf) \le \|f\|\|Tf\| \le \|f\|C|\|f\| = |C|\|f\|^2, \forall f \in V$

, where we used (2.6).

For (C) we have:

• from lemma 2.1 and the Cauchy- Schwarz inequality we have

$\|f\|^2 \le (2+C_0)(f,Tf) \le (2+C_0)\|f\|\|Tf\| \Rightarrow (2+C_0)^{-2}\|f\|^2 \le \|Tf\|^2, \forall f \in V.$

• from lemma 2.2, the relation (2.6), we have:

$\|Tf\|^2 \le |C|^2\|f\|^2, \forall f \in V$.

2.3. The convergence

Theorem 2.2: Let u_n be the solution given by algorithm 2.1 and let u be the solution of the problem (P1). We assume that the assumption 2.1 is satisfied. We also assume that $u_0 \in K$ is an element such that at each step n, $u - u_n$ has an admissible decomposition with respect to $\{K_{n,i}\}$ and a fixed constant C_0 independent of n. Then, for ρ chosen sufficiently small, $\exists \theta \in (0,1)$ such that:

$\|u - u_{n+1}\|^2 \le \theta\|u - u_n\|^2$.

Demonstration: We know that

$e_{n-1} = (I - \rho T_n)e_n$.

It results that:

$\|e_{n+1}\|^2 = \|e_n\|^2 - 2\rho(T_n e_n, e_n) + \rho^2\|T_n e_n\|^2$.

We use the relation (B) from theorem 2.1, i.e.:

$(2+C_0)^{-1}\|f\|^2 \le (f,Tf)$,

stating that in our case we have

$(2+C_0)^{-1}\|e_n\|^2 \le (e_n, T_n e_n)$.

So, $-(T_n e_n, e_n) \le -(2+C_0)^{-1}\|e_n\|^2$.

We also use the relation (C) from theorem 2.1. i.e.:

$\|Tf\|^2 \le |C|^2\|f\|^2$,

stating that in our case we have

$\|T_n e_n\|^2 \le |C|^2\|e_n\|^2$.

Replacing these two obtained relations in the above equality, we have:

$\|e_{n+1}\|^2 \le \left[1 - 2\rho(2+C_0)^{-1} + \rho^2|C|^2\right]\|e_n\|^2$, (D)

where C depends on n and $C_{ij}^n \in [0,1]$ such that:

$(P_{n,i}f, P_{n,j}g) \le C_{ij}^n\|P_{n,i}f\|\|P_{n,j}g\|, \forall f,g \in V$.

3.4. An application in the domain decomposition method

For simplicity, the idea will be illustrated only for obstacle problems. Let $\Omega \subset \mathbb{R}^n, n \in \mathbb{N}$, be an open bounded domain with Lipschitz continuous boundary $\Gamma = \partial\Omega$. We assume that $\partial\Omega = \Gamma_1 \cup \Gamma_2$, $\Gamma_1 \cap \Gamma_2 = \emptyset$, is a partition of the boundary such that $meas(\Gamma_1) > 0$. We consider the Sobolev space

$V = \{v \in H^1(\Omega): v = 0$ on $[\Gamma]_1\}$,

the convex set

$K = \{v \in V: v \ge 0$ in $\Omega\}$, (2.7)

and the problem:

$$\begin{cases} u \in K \\ a(u, v-u) \ge f(v-u), \forall v \in K, \end{cases} \quad (2.8)$$

where $a(\cdot,\cdot)$ is a symmetric, continuous and positive definite bilinear form on $V \times V$ and $f \in V'$, V' being the dual of the space V. For simplicity, the analysis can be restricted to the following bilinear form model:

$a(v,w) = \int_\Omega |\nabla v \cdot \nabla w dx$ on Ω,

$v, w \in V$. (2.9)

First, we decompose the domain into overlapping sub-domains:

$$\Omega = \bigcup_{i=1}^{m} \Omega_i ,$$ (2.10)

where Ω_i are open sub-domains with Lipschitz continuous boundary.

Secondly, we define $V_i = \{v_i \in V : v_i = 0$ in $\Omega - \Omega_i\}, i = \overline{1,m}$. Next, we apply the abstract theory that we exposed it before, to approximate the solution u of the problem (2.8).

Algorithm 2.2: Let be $u_0 \in K$. We compute the sequence of approximations $\{u_n\}$ as follows:

1. We assume that u_n is known. We consider the convex set:

$$K_{n,i} = \{v_i \in V_i; v_i + u_n \in K\}.$$ (2.11)

For each $i \in \{1, \dots, m\}$, we compute $v_{n,i}$ by solving the problem:

$$\begin{cases} v_{n,i} \in K_{n,i} \\ a(u_n + v_{n,i}, v - v_{n,i}) \geq f(v - v_{n,i}), \forall v \in K_{n,i} \end{cases}$$. (2.12)

We update the approximation by:

$$u_{n+1} = u_n + \rho \sum_{i=1}^{m} v_{n,i} ,$$ (2.13)

where ρ should be chosen such that $u_{n+1} \in K$.

The following lemma provides a useful criterion for choosing ρ.

Lemma 2.3: For any $x \in \Omega$, let $N(x)$ be the number of sub-domains containing x. If ρ is chosen as a smooth positive function such that:

$$\rho(x)N(x) \leq 1, \forall x \in \Omega,$$ (2.14)

then the approximation u_{n+1} from (2.13) is a function in the convex set K. Also, the convergence that results theorem 2.2 holds in this case if:

$$1 - 2\rho_1(1 - C_0)^{-1} + \rho_2^2|C|^2 \leq \theta < 1,$$

where $\rho_1 = \min_{x \in \Omega} \rho(x)$ and $\rho_2 = \max_{x \in \Omega} \rho(x)$.

Demonstration: First, for any $x \in \Omega$, $\sum_{i=1}^{m} [v_i(n,i)(x) \geq 0]$ $N(x)$ $\min_{i=\overline{1,m}} [v_i(n,i)](x)$.

So, from (2.13) and (2.14), we have:

$$u_{n+1}(x) \geq u_n(x) + \rho(x)N(x) \min_{i=\overline{1,m}} v_{n,i}(x).$$

If $\min_{i=\overline{1,m}} [v_i(n,i)](x) \geq 0$, then from the above inequality we have that $u_{n+1}(x) \geq 0$.

If $\min_{i=\overline{1,m}} [v_i(n,i)](x) < 0$, then from (2.14) we have:

$$u_i(n+1)(x) \geq u_i n(x) + \min_{i=\overline{1,m}} [v_i(n,i)](x) \geq 0,$$

where at the last step we have used the fact that: $u_n(x) + v_{n,i}(x) \geq 0, \forall i \in \{1, \dots, m\}$.

Regarding the second part of the lemma, we see that it results from the relation:

$$\|e_{n+1}\|^2 \leq \left(1 - 2\rho_1(1 - C_0)^{-1} + \rho_2^2|C|^2\right)\|e_n\|^2$$

, instead of (D).

To demonstrate the convergence by using the abstract result established above, we first have to show that the assumption 2.1 is satisfied for the model problem (2.8).

With $u_{n,i} = u_n + v_{n,i}$, we can rewrite the problem (P5) as follows:

$$\exists u_{n,i} \in K_{n,i} + u_n$$

$$a(u_{n,i}, v_i - u_{n,i}) \geq a(u, v_i - u_{n,i}), \forall v_i \in K_{n,i} + u_n .$$ (2.15)

Then, the assumption 2.1 is equivalent to the equivalence of the problems (2.12) and (2.15).

Lemma 2.4: Let u be the solution of the problem (2.8) and $u_{n,i}$ the solution of the problem (2.15). Then, we have the statements:

1. If the approximation from the step n satisfies the conditions $u_n \in K$ and $u - u_n \in K$, then $u_{n,i} \in K$ and $u - u_{n,i} \in K$.
2. If the inequalities (2.12) and (2.15) are equivalent in the sense that:

$\begin{cases} u_{n,i} \text{ verifies (2.15)} \\ v_{n,i} \text{ verifies (2.12)}, \end{cases}$

then $u_{n,i} = u_n + v_{n,i}$.

Demonstration: 1. Let be $\Omega_i^+ = \{x \in \Omega_i : [u]_i(n,i) > 0\}$.

Taking $v_i = u_{n,i} \pm \varepsilon w_i$ in (2.15) we have:

$a(u_{n,i} - u, \varepsilon w_i) = 0, \forall w_i \in V_i, w_i = 0$ on $\Omega - \bar{\Omega}_i^+$.

Since $\varepsilon \in (0,1)$, it results that:

$$a(u_{n,i} - u, w_i) = 0, \forall w_i \in V_i, w_i = 0 \text{ on } \Omega - \bar{\Omega}_i^+. \quad (2.16)$$

2.We show that $u - u_{n,i} \in K$. Let be $D_i = \{x \in K : u_{n,i} - u > 0\}$.

We claim that $D_i \subset \Omega_i^+$.

In fact, if $x \in D_i$, then $u_{n,i}(x) - u(x) > 0$,i.e.

$$u_{n,i}(x) > u(x) \geq 0. \quad (2.17)$$

Since in $\Omega - \Omega_i$ we have $u_{n,i} = u_n \leq u$, then (2.17) involves $x \in \Omega_i$ and $u_{n,i}(x) > 0$. Thus, $x \in \Omega_i^+$. We observe that $u - u_n \in K$ (i.e. $u_n \leq u$) and therefore, $u_{n,i} - u = u_n - u \leq 0$ on $\partial\Omega_i \cap \Omega$.

Since $D_i \subset \Omega_i^+$, the function

$$\Phi_i = \begin{cases} u_{n,i}(x) - u(x), x \in D_i \\ 0 \qquad\qquad , x \in \Omega - D_i, \end{cases}$$

is defined on V_i and vanishes in $\Omega - \bar{\Omega}_i^+$.

Replacing w_i in (2.16) by Φ_i we have:

$a(u_{n,i} - u, \Phi_i) = 0 \Rightarrow a(\Phi_i, \Phi_i) = 0 \Rightarrow \Phi_i = 0$.

Therefore, D_i must be the empty set. This shows that $u - u_{n,i} \geq 0$ and thus, $u - u_{n,i} \in K$.

We show now that the inequalities (2.15) and (2.12) are equivalent in the sense established in the theorem.

In fact, from (2.15) we have:

$$a(u_{n,i}, v_i - u_{n,i}) \geq a(u, v_i) - a(u, u_{n,i}),$$
$$\forall v_i \in K_{n,i} + u_n \subset K. \quad (2.18)$$

It is known that $a(u, v_i) \geq f(v_i)$, $\forall i = \overline{1,m}$ and since $u - u_{n,i} \in K$, we have:

$$-a(u, u_{n,i}) = a(u, u - u_{n,i} - u) \geq f(u - u_{n,i} - u) = f(-u_{n,i}).$$

Replacing the last two relations in (2.18), we obtain:

$a(u_{n,i}, v_i - u_{n,i}) \geq f(v_i - u_{n,i}), \forall v_i \in u_n + K_{n,i}$.

Taking $v_{n,i} = u_{n,i} - u_n$, we observe that $v_{n,i}$ provides a solution of the problem (2.12). This, together with the uniqueness of the solutions of the problems (2.15) and (2.12), goes to the wanted equivalence. By computing, we have:

$$a(u_n + v_{n,i}, v_i - v_{n,i}) - a(u_n + v_{n,i}, u_n) \geq f(v_i - v_{n,i}) - f(u_n)$$

.

From the demonstration of lemma 2.3 it results that the new approximation u_{n+1} lies in K as long as $u_n \in K$ and $\rho(x)N(x) \leq 1$. We assume that $u - u_n \in K$. We want to know if $u - u_{n+1} \in K$ is valid under the same constraint of ρ. The answer is positive. To see why this holds, we observe that from (2.13) we have:

$$u - u_{n+1} = u - u_n - \rho \sum_{i=1}^{m} v_{n,i}.$$

We observe that from lemma 2.4 we have:

$u_n + v_{n,i} = u_{n,i} \leq u \Rightarrow v_{n,i} \leq u - u_n$.

Therefore,

$$\sum_{i=1}^{m} v_{n,i}(x) \leq N(x)(u(x) - u_n(x)).$$

It results that

$$u - u_n - \rho \sum_{i=1}^{n} v_{n,i} \geq u - u_n - \rho N(u - u_n) = (1 - \rho N)(u - u_n) \geq 0.$$

Thus, $u - u_{n+1} \in K$.

The result can be summarized as follows:

Theorem 2.3: Let u be the solution of the inequality (2.8) and let $\{u_n\}$ be a sequence of approximations given by the algorithm 2.2, in which the parameter ρ is chosen according to the lemma 2.3. If the initial guess u_0 is selected such that u_0, $u - u_0 \in K$, then u_{n+1}, $u - u_{n+1} \in K$. Furthermore, the problem (2.12) is equivalent (2.15) in the sense that $u_{n,i} = u_n + u_{n,i}$.

2. Acknowledgement

This work was partially supported by the strategic grant POSDRU/88/1.5/S/52826, Project ID52826 (2009), co- financed by the European Social Fund- Investing in People, within the Sectoral Operational Programme Human Resources Development 2007- 2013.

References

1. Badea, L., Wang, J., *An additive Schwarz method for variational inequalities*, Mathematics of Computation, Volume 69, Number 232, Pages 1341- 1352.

2. Badea, L., *On the Schwarz alternating method with more than two sub-domains for nonlinear monotone problems*, SIAM J. Numer. Anal., 28 (1991), pp. 179- 320. MR 91m:65165.

3. Brezis, H., *Equations et inequations non lineaires dans les espaces vectoriels en dualite*, Ann. Inst. Fourier, Grenoble, 18, 1, 115- 175, (1968).

4. Cea, J., *Optimisation. Theorie et algorithmes*, Dunod, Paris (1971).

5. Ekeland,I., Temam,R., *Analyse convexe et problems variationells*, Dunod, Gauthier- Villars, Paris (1974).

6. Glowinski, R., *Numerical solution of partial differential equation problems by domain decomposition, Implementation on an array processors system*, In Proceedings of International Symposium on Applied Mathematics and Information Science, Kyoto University (1982).

7. Han, W., Sofonea, M., *Quasistatic Contact Problems in Viscoelasticity and Viscoplasticity*, American Mathematical Society and International Press, Providence, RI (2002).

8. Kinderlehrer, D., Stampacchia, G., *An introduction to variational inequalities and their applications*, Academic Press, New York (1980).

9. Laurent, P. J., *Approximation et optimisation*, Hermann, Paris (1972).

10. Lions, P. L., *On the Schwarz alternating method I*, In SIAM, editor, First international symposium on domain decomposition methods for partial differential equations (1988).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

OPTIMIZATION METHOD OF SIMPLEX ALGORITHM SOLUTION

Ioan POPOVICIU

Naval Academy "Mircea cel Batran", Constantza

Abstract : *When speaking about linear programming problems of big dimensions with sparse matrix of the system, resolved through simplex method, it is necessary, at each iteration, to calculate the inverse of the base matrix, which leads to the loss of the rarity character of the matrix. The article proposes the replacement of the calculus of the inverse of the base matrix with the solving through iterative parallel methods of a linear system with sparse matrix of the system.*

Keywords: *algorithm, matrix,, parallel, processor, simplex*
MSC 2010: *65Y05*

1. GENERAL PRESENTATION

Linear programs for large real systems are characterized by sparse matrixes, having a low percentage of non-void elements. The sparse character appears at each base matrix, but disappears at the inverse of this matrix. In its classical form, the simplex method uses a square matrix, the inverse of the base matrix, whose value is putting up-to-date at each iteration. The number non-void elements of the inverse matrix increase rapidly and depend on the number of iterations. Because of this, in the place of the calculus of the sparse matrix, one can solve the linear matrixes with the sparse matrix of the system through iterative parallel methods.

Let's take the linear programming problem under the standard form:

$$Ax = b$$
$$x \geq 0 \qquad (1)$$
$$\max(f(x) = c^T x) \qquad (2)$$

where A is a matrix with m lines and n columns, $x \in R^n, b \in R^m, c \in R^n$.

At each iteration, one takes a base, meaning a square matrix of order m, which can be inverted, extracted from matrix A, noted with A^I, where $I \subset N, |I| = m$. A so-called basic solution is associated to the base I defined by:

$$x_I^B = (A^I)^{-1} b$$
$$x_{\bar{I}}^B = 0$$

where $\bar{I}$ is the complement of I in N.

The bases which are being successively generated through simplex method are of the type $x_I^B \geq 0$, meaning the basic solutions considered are all admissible (they fulfill the conditions (1) and (2)).

An iteration consists of a change of the base I into an adjacent base I'; this is a base obtained through the changing of the index $r \in I$ with the index $s \in \bar{I}$:

$$I' = I - r + s. \qquad (3)$$

To determine r and s one has to calculate:

$$u = f^I (A^I)^{-1} \qquad (4)$$
$$d^{\bar{I}} = f^{\bar{I}} - uA^{\bar{I}} \qquad (5)$$

where $u, f^I, d^{\bar{I}}$ are line vectors. This allows that $s \in \bar{I}$ is selected by the condition $d^s > 0$. Then:

$$x_I^B = (A^I)^{-1} b \qquad (6)$$

$$T^s = (A^I)^{-1} a^s \qquad (7)$$

where a^s is column s of matrix A, and x_I^B, b, T^s, a^s are column vectors. One obtains $r \in I$ through condition:

$$\frac{x_r}{T_r^s} = \min\left\{ \frac{x_i}{T_i^s} \mid i \in I, T_i^s > 0 \right\} \qquad (8)$$

Once the values r and s are determined, there follows the updating of the inverse of the base matrix , meaning that $\left(A^{I'}\right)^{-1}$ is determined, which is obtained from the relation:

$$\left(A^{I'}\right)^{-1} = E_r(\eta)(A^I)^{-1} \qquad (9)$$

where $E_r(\eta)$ is the matrix obtained from the unit matrix of order n, by replacing the column e^r with the vector:

$$\eta = \left(-\frac{c_1}{c_r}, \cdots, -\frac{c_{r-1}}{c_r}, \frac{1}{c_r}, -\frac{c_{r+1}}{c_r}, \ldots, -\frac{c_n}{c_r} \right)$$

where $c = (A^I)^{-1} a^s$.

In this way the mathematical equations are represented by the relations (4-9), and the inverse of the base matrix appears in the relations (4), (6), (7). The last three relations can be replaced by:

$$uA^I = f^I \qquad (4')$$

$$A^I x_I^B = b \qquad (6')$$

$$A^I T^s = a^s \qquad (7')$$

In the first equation, the matrix is the transpose of the base matrix; in the last two equations even the base matrix appears and consequently these two systems benefit from the sparse character of matrix A, an efficient solution being possible through iterative parallel methods.

2. THE PARALLEL ALGORITHM OF THE CONJUGATED GRADIENT

In order to solve linear systems of large dimensions of the type (4'-7'), we are going to present a parallel implementation of the algorithm of the conjugated gradient, method where, in the first place, one has to make the operations of multiplication between a sparse matrix and a vector parallel.

Let's take the product $y = Ax$ where A is a sparse matrix $n \times n$, and x and y are vectors of n dimension. In order to accomplish a parallel execution of the product $y = Ax$ one has to perform a partitioning of the matrix A into a matrix distributed over many processors. In this view, a subset of the components of vector x and consequently a subset of the lines of matrix A are being allocated to a processor so that the components of vectors x and y can be divided into three groups:

-**internal** are those components which belong (and consequently are calculated) to the processor and do not take part into the communication between the processors. We say in consequence that y_j is an **internal component** if it is calculated by the processor which it belongs to and if the index j of the column corresponding to the element a_{ij} unlike zero from line i correspond to a component x_j which also belongs to the same processor;

-**border set** are those components which belong (and by consequence are calculated) to the processor, but they require a communication with other processors in order to calculate them. Thus, we may say that y_j is a **border set component** if it is calculated by the processor which it belongs to and if at least one column index j associated to the non-void elements a_{ij} from line i, corresponds to a component x_j which does not belong to the processor;

-**external** are those components which do not belong and by consequence are calculated) to the processor, but which correspond to column indexes associated to non-void elements from the lines belonging to the processor.

In conformity with this organisation, there corresponds to each processor a vector whose components are ordered as follows:

- the first components are numbered from 0 to N_i-1, where N_i is the number of internal components ;
- the next components are border set components and occupy the positions from N_i to N_i+N_f-1 , where

N_f is the number of border set components;

- the last components are external components and occupy the positions comprised between N_i+N_f and $N_i+N_f+N_e-1$, where N_e is the number of external components.

Within this vector associated with a processor, the external components are being ordered so that those which are used by the processor occupy successive positions.

For example let's take A(6, 6) and presuppose that x_0, x_1, x_2 and by consequence the lines 0, 1, 2 of matrix *A* are allocated to the processor 0; x_3 and x_4 and by consequence the lines 3 and 4 are allocated to the processor 2; x_5 and by consequence line 5 are allocated to the processor 1. The matrix *A* has the non-void elements marked by a * in the following description.

$$A=\begin{array}{c} \\ \text{proc.0} \\ \\ \\ \text{proc.2} \\ \\ \text{proc.1} \end{array}\begin{array}{c} \\ 0 \\ 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{array}\begin{pmatrix} 0 & 1 & 2 & 3 & 4 & 5 \\ * & * & * & 0 & 0 & 0 \\ * & * & * & 0 & 0 & * \\ * & * & * & * & * & * \\ & & & & & \\ & & & & & \\ & & & & & \end{pmatrix}$$

For processor 0 which has the lines 0, 1, 2 attached to the matrix *A* and respectively the components x_0, x_1, x_2, we have:

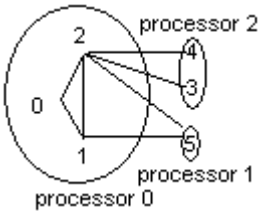
N_i=1: a sole internal component y_0 because in calculating the y_0 only there appears only those x_0, x_1, x_2 that belong to the processor 0.

N_f=2: two border set components y_1 and y_2 in whose calculus the elements belonging to other processors also appear:

- in the calculus of y_1 there also appears x_5 which belongs to the processor 1
- in the calculus of y_2 there also appears x_5 which belongs to the processor 1 and x_3, x_4 belonging to the processor 2

N_e=3: three external components because in the calculus of y_0, y_1, y_2 there appear three components x_5, x_3, x_4 which belong to other processors.

The communication graph corresponding to the processor 0 is defined in the following picture:



To the lines 0, 1, 2, the following vectors correspond, vectors in which the indexes of the columns corresponding to the external components are grouped and sorted into processors:

Line the indexes of columns with non-void elements

0 ⟶ 0 1 2

1 ⟶ 1 0 2 5

2 ⟶ 2 0 1 5 3 4

Each processor has to acknowledge on which of the processors the external components are being calculated: in the above example, processor 1 calculates the component y_5 and processor 2 calculates the components y_3 and y_4. At the same time, each processor has to acknowledge which of its internal components are being used by other processors.

Let's remind the schematic structure of the algorithm CG:

x=initial value
r=b-Ax …
p=r …initial direction

repeat
v=A*p
…multiplication matrix-vector
a=(r^T*r)/(p^T*v)
…product "dot"
x=x+a*p
…update solution vector
…operation "saxpy"
new_r=new_r-a*v
…update rest vector
…operation "saxpy"
g=(new_r^T*new_r)/(r^T*r)
…product "dot"
p=new_r+g*p
…update new direction
…operaţtion "saxpy"
r=new_r
until (new_r^T*new_r suficient de mic)

It is noticed that the following operations are necessary in the algorithm CG:

1. A product sparse matrix-vector
2. Three vector updatings (operations "SAXPY")
3. Two scalar products (operations "DOT")
4. Two scalar dividings
5. A scalar comparison for the testing of the convergence

For the parallel implementation of the algorithm CG, the following distinct parts appear:

a) Distribution of the date on processors

The date are being distributed on processors on lines so that each processor has a consecutive number of lines from the sparse matrix assignated:

```
typedef struct tag_dsp_matrix_t
{
  int N;              /* dimension matrix N×N */
  int row_i, row_f;   /* rank of beginninbg and ending line which belongs to the processor*/
  int nnz;            /* number of non-void elements from the local matrix */
  double* val;        /* elements of the matrix */
  int* row_ptr;       /* beginning of a matrix */
  int* col_ind;       /* column index*/
} dsp_matrix_t;
```

Each processor will store the rank of the lines belonging to it, the elements of the matrix and two pointers row_ptr and col_ind used in the storing of the compressed on lines of a matrix.

b) In/out operation

In/out operations comprise the reading of the matrix and its stiring in a compressed lines format.

c) Operations on vectors

The operations on vectors are of two types:

- operations "saxpy" for updating of the vectors, which do not require communication between processors;
- operations "dot" (scalar product) which do not require communication between processors with the help of function MPI_Allreduce.

d) Multiplication matrix-vector

Each processor uses at the calculus the lines from the matrix which belong to it, but needs elements of the vector *x* which belong to other processors. This is why a processor receives these elements from the other processors and sends at the same time its part to all the other processors. In this way, we can write schematically the following sequence:

new_element_x=my_element_x
for i=0, num_proces
- send my_element_x to the processor my_proc+i
- calculate locally with new_element_x
- receive new_element_x from the processor my_proc-i

Repeat

3. THE OPTIMISATION OF THE COMMUNICATION

A given processor does not need the complete part of *x* which belongs to other processors, but only the elements corresponding to the columns which contain

non-void elements. At the same time it sends to the other processors only the non-void elements of *x*. This is the reason why the structure presented above comprises the field *col_ind* which indicates the rank of the column that contains a non-void element. In this way, we can schematically write the following sequence:

- each processor creates a mask which indicates the rank of the columns of non-void elements from *A*
- communication between processors:

new_element_x=my_element_x
for i=0, num_proces
- if communication necessary between my_proc and my_proc+i
- transmite my_element_x la procesorul my_proc+i
endif
- calculate locally with new_element_x
- receive new_element_x from processorl my_proc-i
repeat

The algorithm implemented for a matrix of a dimension N×N=960×960, with 8402 non-void elements has given the following results:

* time is expressed in minutes.

Number of processors	Number of iterations	Calculus duration	Duration of communication between processors	Time for the memory allocation	Time for operations with vectors	Total duration
1	205	3.074	0.027	0.002	0.281	3.384
2	205	2.090	0.341	0.002	0.136	2.568
4	204	1.539	0.500	0.002	0.070	2.110

4. THE ANALYSIS OF THE PERFORMANCE OF ALGORITHM CG

The analysis of the performance of algorithm CG is done from the point of view of the time necessary for the execution of the algorithm. In this model the initiation times for the matrix *A* and of the other vectors used is neglectable. At the same time, the time necessary for the verification of the convergence is disregarded and it is presupposed that the initializations necessary for an iteration have been done.

4.1 Analysis of the sequential algorithm

Notations:

m=vectors dimension

N=total number of non-void elements of matrix *A*

k=number of iterations for which the algorithm is executed

T_{comp1s}=total calculus time for the vectors updating (3 operations SAXPY)

T_{comp2s}=total calculus time for the product *Ap* and for the scalar product (r, r)

T_{comp3s}=total calculus time for the scalar products (A, Ap) and (p, Ap)

T_{comp4s}=total calculus time for the scalars α and β

T_{seq}=total calculus time for the sequential algorithm

Then $T_{seq} = T_{comp1s} + T_{comp2s} + T_{comp3s} + T_{comp4s}$

Within the algorithm there are three operations SAXPY, each vectoir being of dimension *m*. If we suppose that t_{comp} is the total calculus time for the multiplication of two real numbers with double precision and

for the adding of the results, then

$$T_{comp1s} = 3 * m * k * t_{comp}$$

T_{comp2s} is the total calculus time for the product sparse matrix-vector and for the two scalar products. The product matrix-vector implies N elements and the scalar product implies m elements. Then

$$T_{comp2s} = (N + m) * k * t_{comp}$$

T_{comp3s} is the calculus time of two scalar products and can be written as

$$T_{comp3s} = 2 * m * k * t_{comp} .$$

The calculus for the scalars α and β implies two operations of division and a subtraction of real numbers. Let's take $t_{comp\alpha}$ calculus time for all these operations. Then $T_{comp4s} = 2 * k * t_{comp\alpha} .$

The total calculus time for the sequential algorithm CG is:

$$T_{seq} = (6 * m + N) * t_{comp} + 2 * k * t_{comp\alpha} .$$

4.2 Analysis of the parallel algorithm

Within the parallel algorithm each processor executes k iterations of the algorithm in parallel. We define:

b=dimension of the block from matrix A and from vectors x, r, p belonging to each processor

p=number of processors

T_{comp1p}=total calculus time for the vectors updating on each processor

T_{comp2p}=total calculus and communication time for the Ap and (r, r)

T_{comp3p}=total calculus time for the calculus of the scalar products and of the global communication

T_{comp4p}=total calculus time for the scalars α and β

Here T_{comp1p} is the total time for the calculus of 3b vectors updating. If matrix A is very sparse (the density is smaller than 5 percentages) the communication time exceeds the calculus time. This way T_{comp2p} is taken equal with t_{comm}, the communication time of a block of dimension b to all the p processors. T_{comp3p} implies the global calculus and communication time, noted with t_{glb}. Then:

$$T_{par} = T_{comp1p} + T_{comp2p} + T_{comp3p} + T_{comp4p}$$

where:

$$T_{comp1p} = 3 * b * k * t_{comp}$$

$$T_{comp2p} = t_{comm}$$

$$T_{comp3p} = 2 * b * k * t_{comp} + t_{glb}$$

$$T_{comp4p} = 2 * k * t_{comp\alpha}$$

Therefore, to estimate T_{seq} and T_{par} it is necessary to estimate the values of t_{comp}, $t_{comp\alpha}$, t_{comp} and t_{glb}.

REFERENCES

1. Axelsson O. *Solution of liniar systems of equations: iterative methods*. In: Barker [1] 1-51.

2. Bank R, Chan T. *An analysis of the composite step biconjugate gradient method*. 1992.

3. Bank R, Douglas C. Bank R, Dupont T. *Analysis of atwa-level scheme for solving finite element equations*. Univ. Texas, Austin, 1980.

4. Braess D. *Finite element*. Springer-Verlag 1992.

5. George J. *Solution of liniar systems of equations: Direct methods for finite element problems*. In Barker [1] 52-101.

6. Golub G, Van Loan. *Matrix computations*. Notrh Oxford Academic, Oxford 1983.

7. Ichim I, Marinescu G. *Methods of numeric approximation*. Ed. Acad. Bucureşti 1986.

8. Mandel J. *A multilevel iterative method for symmetric, positive definite problems*. Appl. Math. Optim. 1984.

9. Oden J, Reddy J. *An introduction to the mathematical theory of finite elements*. New Tork, 1976.

10. Ortega J.M.,Voigt R.G. *Solution of partial differential equation on vector and parallel computers*, SIAM Rev 27(1985),149-270

11. Ostrovski,A.M. *On the linear iteration procedures for symmetric matrices*, Rend. Math. Appl.. 14(1964)140-163

12. Samarski A, Nicolaev E. *Numerical methods for grid equations. Iterative methods*. Basel 1989.

13. Ştefanescu A, Zidăroiu C, *Operational research*, Ed. Didacticã şi pedagogicã, Bucureşti, 1981

14. Varga R., *Matrix Iterative Analysis*, Prentice Hall, Englewood Cliff, New Jersey, 1962.

15. Yong D.M. Iterative solution of large linear systems, Academic Press, New York, 1971.
16. ---- *An Introduction to MPI for C Programmers*, The University of Texax at Austin, 1999.
17. ---- *A User's Guide to MPI*, Departament of Mathematics, University of San Francisco, 1998.
18. ---- *MPI: A Message-Passing Interface Standard*,The University of Tennessee,2000

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

ON GENERAL CONFORMAL METRICAL N-LINEAR CONNECTIONS ON DUAL BUNDLE OF K-TANGENT BUNDLE

Monica A.P. PURCARU, Mirela TÂRNOVEANU, Olivia FLOREA

*Faculty of Mathematics and Computer Sciences, Transilvania University of Braşov, Romania

Abstract: *In the present paper we give the transformations for the coefficients of an N-linear connection on dual bundle of k-tangent bundle, $T^{*k}M$, by a transformation of a nonlinear connection on $T^{*k}M$, $k \geq 2, k \in N$. Starting from the notion of conformal metrical d-structure we define the notion of general conformal metrical N-linear connection on dual bundle of k-tangent bundle.We determine the set of all general conformal metrical N-linear connections,in the case when the nonlinear connection is fixed and we find important particular cases. Finally we find the transformations group of these connections.*

Mathematics Subject Classification 2010: *53B40,58B20,53C05,53C20,53C60*

***Keywords*:** *Dual bundle of k-tangent bundle, nonlinear connection,conformal metrical d-structure, conformal metrical N-linear connection, general conformal metrical N-linear connection, transformations group*

1. INTRODUCTION

The notion of Hamilton space was introduced by Acad. R. Miron in [5],[6].The Hamilton spaces appear as dual via Legendre transformation, of the Lagrange spaces.

The differential geometry of the dual bundle of $k-$osculator bundle was introduced and studied by Acad. R. Miron [10].

In the present section we keep the general setting from Acad. R. Miron [10], and subsequently we recall only some needed notions. For more details see [10].

Let M be a real n-dimensional $C^{\infty}-$manifold and let $(T^{*k}M, \pi^{*k}, M)$, $(k \geq 2, k \in N)$ be the dual bundle of k-osculator bundle (or k-cotangent bundle), where the total space is

$$T^{*k}M = T^{*k-1}M \times T^{*}M. \quad (1)$$

Let $(x^i, y^{(1)i}, ..., y^{(k-1)i}, p_i), (i = 1,2,...,n)$, be the local coordinates of a point $u = (x, y^{(1)}, ..., y^{(k-1)}, p) \in T^{*k}M$ in a local chart on $T^{*k}M$.The change of coordinates on the manifold $T^{*k}M$ *is*

$$\begin{cases} \widetilde{x}^i = \widetilde{x}^i\left(x^1,...,x^n\right), \det\left(\dfrac{\partial \widetilde{x}^i}{\partial x^j}\right) \neq 0, \\ \widetilde{y}^{(1)i} = \dfrac{\partial \widetilde{x}^i}{\partial x^j} y^{(1)j}, \\ ..... \\ (k-1)\widetilde{y}^{(k-1)i} = \dfrac{\partial \widetilde{y}^{(k-2)i}}{\partial x^j} y^{(1)j} + ... + (k-1)\dfrac{\partial \widetilde{y}^{(k-2)i}}{\partial y^{(k-2)j}} y^{(k-1)j} \\ \widetilde{p}_i = \dfrac{\partial x^j}{\partial \widetilde{x}^i} p_j, \end{cases} \quad (2)$$

We denote with N a nonlinear connection on the manifold $T^{*k}M$, with the coefficients

$$\left(\underset{(1)}{N}{}^{j}{}_{i}\left(x, y^{(1)},..., y^{(k-1)}, p\right),..., \underset{(k-1)}{N}{}^{j}{}_{i}\left(x, y^{(1)},..., y^{(k-1)}, p\right) \right. \quad (3)$$

$$\left. N_{ij}\left(x, y^{(1)},..., y^{(k-1)}, p\right)\right), (i, j = 1,2,...,n).$$

The tangent space of $T^{*k}M$ in the point $u \in T^{*k}M$ is given by the direct sum of vector spaces

$$T_u\left(T^{*k}M\right) = N_{0,u} \oplus N_{1,u} \oplus ... \oplus \\ \oplus N_{k-2,u} \oplus V_{k-1,u} \oplus W_{k,u}, \forall u \in T^{*k}M \quad (4)$$

A local adapted basis to the direct decomposition (4) is given by

$$\left\{ \frac{\delta}{\delta x^i}, \frac{\delta}{\delta y^{(1)i}},..., \frac{\delta}{\delta y^{(k-1)i}}, \frac{\delta}{\delta p_i} \right\}, (i = 1,2,...,n), \quad (5)$$

where

$$\begin{cases} \dfrac{\delta}{\delta x^i} = \dfrac{\partial}{\partial x^i} - \underset{(1)}{N}{}^{j}{}_{i} \dfrac{\partial}{\partial y^{(1)j}} - ... - \underset{(k-1)}{N}{}^{j}{}_{i} \dfrac{\partial}{\partial y^{(k-1)j}} + N_{ij} \dfrac{\partial}{\partial p_j} \\ \dfrac{\delta}{\delta y^{(1)i}} = \dfrac{\partial}{\partial y^{(1)i}} - \underset{(1)}{N}{}^{j}{}_{i} \dfrac{\partial}{\partial y^{(2)j}} - ... - \underset{(k-2)}{N}{}^{j}{}_{i} \dfrac{\partial}{\partial y^{(k-1)j}} \\ ..... \\ \dfrac{\delta}{\delta y^{(k-1)i}} = \dfrac{\partial}{\partial y^{(k-1)i}}, \\ \dfrac{\delta}{\delta p_i} = \dfrac{\partial}{\partial p_i}. \end{cases} \quad (6)$$

Let D be an $N-$linear connection on $T^{*k}M$, with the local coefficients in the adapted basis

$$D\Gamma(N) = \left(H^i{}_{jh}, \underset{(\alpha)}{C}{}^{i}{}_{jh}, C_i{}^{jh} \right), (\alpha = 1,...,k-1) \quad (7)$$

2.THE SET OF THE TRANSFORMATIONS OF $N-$LINEAR CONNECTIONS

Let $\overline{N}$ be another nonlinear connection on $T^{*k}M$, with the local coefficients

$$\left(\underset{(1)}{\overline{N}}{}^{j}{}_{i}\left(x, y^{(1)},..., y^{(k-1)}, p\right),..., \underset{(k-1)}{\overline{N}}{}^{j}{}_{i}\left(x, y^{(1)},..., y^{(k-1)}, p\right), \right.$$

$$\left. N_{ij}\left(x, y^{(1)},..., y^{(k-1)}, p\right)\right)(i, j = 1,2,...,n).$$

Then there exists the uniquely determined tensor fields $\underset{(\alpha)}{A}{}^{j}{}_{i} \in \tau_1^1\left(T^{*k}M\right)$, $(\alpha = 1,...,k-1)$ and $A_{ij} \in \tau_2^0\left(T^{*k}M\right)$, such that

$$\begin{cases} \underset{(\alpha)}{\overline{N}}{}^{i}{}_{j} = \underset{(\alpha)}{N}{}^{i}{}_{j} - \underset{(\alpha)}{A}{}^{i}{}_{j}, (\alpha = 1,...,k-1), \\ \overline{N}_{ij} = N_{ij} - A_{ij}, (i, j = 1,2,...,n). \end{cases} \quad (8)$$

Conversely, if $\underset{(\alpha)}{N}{}^{i}{}_{j}$ and $\underset{(\alpha)}{A}{}^{i}{}_{j}, (\alpha = 1,...,k-1)$, respectively N_{ij} and A_{ij} are given, then $\underset{(\alpha)}{\overline{N}}{}^{i}{}_{j}, (\alpha = 1,...,k-1)$, respectively $\overline{N}_{ij}$, given by (8) are the coefficients of a nonlinear connection.

Theorem 1 *Let N and $\overline{N}$ be two nonlinear connections on $T^{*k}M, (k \geq 2,\ k \in N)$, with local coefficients*

$$\left(\underset{(1)}{N}{}^{j}{}_{i}\left(x, y^{(1)},..., y^{(k-1)}, p\right),..., \underset{(k-1)}{N}{}^{j}{}_{i}\left(x, y^{(1)},..., y^{(k-1)}, p\right) \right.$$

$$\left. N_{ij}\left(x, y^{(1)},..., y^{(k-1)}, p\right)\right), \left(\underset{(1)}{\overline{N}}{}^{j}{}_{i}\left(x, y^{(1)},..., y^{(k-1)}, p\right),..., \right.$$

$$\left. \underset{(k-1)}{\overline{N}}{}^{j}{}_{i}\left(x, y^{(1)},..., y^{(k-1)}, p\right), \overline{N}_{ij}\left(x, y^{(1)},..., y^{(k-1)}, p\right) \right)$$

$i, j = 1,2,...,n$, respectively.

If $D\Gamma(N) = \left(H^i{}_{jh}, \underset{(\alpha)}{C}{}^{i}{}_{jh}, C_i{}^{jh} \right)$ and

$$D\overline{\Gamma}\left(\overline{N}\right) = \left(\overline{H}^i{}_{jh}, \underset{(\alpha)}{\overline{C}}{}^{i}{}_{jh}, \overline{C}_i{}^{jh} \right), \ (\alpha = 1,...,k-1)$$

are the local coefficients of two $N-$, respectively $\overline{N}$-linear connections, D, respectively $\overline{D}$ on the differentiable manifold $T^{*k}M, (k \geq 2, k \in N)$, then the transformation

$N \to \overline{N}$, given by (8) of nonlinear connections implies for the coefficients of the $\overline{N}$-linear connection $D\Gamma(\overline{N}) = \left(\overline{H}^i{}_{jh}, \overline{C}^i{}_{jh}, \overline{C}{}_i{}^{jh} \right)$, the following relations

$$\begin{aligned}
\overline{H}^i{}_{sj} &= H^i{}_{sj} + A^m{}_{(1)}{}_j \Big[C^i{}_{(1)}{}_{sm} + N^l{}_{(1)}{}_m C^i{}_{(2)}{}_{sl} + \ldots + \\
&+ N^l{}_{(k-2)}{}_m C^i{}_{(k-1)}{}_{sl} + N^l{}_{(1)}{}_m N^t{}_{(1)}{}_l C^i{}_{(3)}{}_{st} + \ldots + \\
&\left(N^l{}_{(1)}{}_m N^t{}_{(k-3)}{}_l + \ldots + N^l{}_{(k-3)}{}_m N^t{}_{(1)}{}_l \right) C^i{}_{(k-1)}{}_{st} + \ldots \\
&+ \underbrace{N \ldots N}_{(k-2)} \underbrace{(1) \ldots (1)}_{} C_{(k-1)} \Big] + \qquad (9) \\
&+ A^m{}_{(2)}{}_j \left[C^i{}_{(2)}{}_{sm} + N^l{}_{(1)}{}_m C^i{}_{(3)}{}_{sl} + \ldots + N^l{}_{(k-3)}{}_m C^i{}_{(k-1)}{}_{st} + \ldots + \underbrace{N \ldots N}_{(k-3)} \underbrace{(1) \ldots (1)}_{} C_{(k-1)} \right] + \\
&+ \ldots + A^m{}_{(k-2)}{}_j \left(C^i{}_{(k-2)}{}_{sm} + N^l{}_{(1)}{}_m C^i{}_{(k-1)}{}_{sl} \right) + \\
&+ A^m{}_{(k-1)}{}_j C^i{}_{(k-1)}{}_{sm} - A_{jm} C_s{}^{im}, \\
\overline{C}^i{}_{(1)}{}_{sj} &= C^i{}_{(1)}{}_{sj} + A^m{}_{(1)}{}_j \Big[C^i{}_{(2)}{}_{sm} + N^r{}_{(1)}{}_m C^i{}_{(3)}{}_{sr} + \ldots + \\
&+ N^r{}_{(k-3)}{}_m C^i{}_{(k-1)}{}_{sr} + \ldots + \underbrace{N \cdot \ldots \cdot N}_{(k-3)} \underbrace{(1) \ldots (1)}_{} C_{(k-1)} \Big] + \\
&+ \ldots + A^m{}_{(k-3)}{}_j \Big[C^i{}_{(k-2)}{}_{sm} + N^r{}_{(1)}{}_m C^i{}_{(k-1)}{}_{sr} \Big] + \\
&+ A^m{}_{(k-2)}{}_j C^i{}_{(k-1)}{}_{sm}, \overline{C}^i{}_{(k-2)}{}_{sj} = C^i{}_{(k-2)}{}_{sj} + A^l{}_{(1)}{}_j C^i{}_{(k-1)}{}_{sl}, \\
\overline{C}^i{}_{(k-1)}{}_{sj} &= C^i{}_{(k-1)}{}_{sj}, \overline{C}{}_s{}^{ij} = C_s^{ij}, \\
&\begin{cases} A^h{}_{(1)}{}_{i|j} = 0, \\ A_{ih|j} = 0, (i,j,h = 1,2\ldots,n), \end{cases}
\end{aligned}$$

where " $|$ " denotes the $h-$covariant derivative with respect to $D\Gamma(N)$.

Theorem 2 *Let N and $\overline{N}$ be two nonlinear connections on $T^{*k}M, (k \geq 2,\ k \in N)$, with local coefficients*

$$\left(N^j{}_{(1)}{}_i(x, y^{(1)}, \ldots, y^{(k-1)}, p), \ldots, N^j{}_{(k-1)}{}_i(x, y^{(1)}, \ldots, y^{(k-1)}, p) \right)$$

$$N_{ij}(x, y^{(1)}, \ldots, y^{(k-1)}, p)), \left(\overline{N}^j{}_{(1)}{}_i(x, y^{(1)}, \ldots, y^{(k-1)}, p), \ldots, \right.$$

$$\left. \overline{N}^j{}_{(k-1)}{}_i(x, y^{(1)}, \ldots, y^{(k-1)}, p), \overline{N}_{ij}(x, y^{(1)}, \ldots, y^{(k-1)}, p) \right)$$

$i, j = 1,2,\ldots,n,$ respectively.

If $D\Gamma(N) = \left(H^i{}_{jh}, C^i{}_{(\alpha)}{}_{jh}, C_i{}^{jh} \right)$ and

$$D\overline{\Gamma}(\overline{N}) = \left(\overline{H}^i{}_{jh}, \overline{C}^i{}_{(\alpha)}{}_{jh}, \overline{C}{}_i{}^{jh} \right), \quad (\alpha = 1,\ldots,k-1)$$

are the local coefficients of two $N-$, respectively $\overline{N}$-linear connections, D, respectively $\overline{D}$ on the differentiable manifold $T^{*k}M, (k \geq 2, k \in N)$, then there exists only one system of tensor fields

$$\left(\underset{(1)}{A}^{i}{}_{j},...,\underset{(k-1)}{A}^{i}{}_{j},A_{ij},B^{i}{}_{jh},\underset{(1)}{D}^{i}{}_{jh},...,\underset{(k-1)}{D}^{i}{}_{jh},D_{i}{}^{jh} \right)$$

such that

$$\underset{(\alpha)}{\overline{N}}^{i}{}_{j} = \underset{(\alpha)}{N}^{i}{}_{j} - \underset{(\alpha)}{A}^{i}{}_{j}, (\alpha = 1,...,k-1),$$

$$\overline{N}_{ij} = N_{ij} - A_{ij},$$

$$\overline{H}^{i}{}_{sj} = H^{i}{}_{sj} + \underset{(1)}{A}^{m}{}_{j}\left[\underset{(1)}{C}^{i}{}_{sm} + \underset{(1)}{N}^{l}{}_{m}\underset{(2)}{C}^{i}{}_{sl} + ... + \right.$$

$$+ \underset{(k-2)}{N}^{l}{}_{m}\underset{(k-1)}{C}^{i}{}_{sl} + \underset{(1)}{N}^{l}{}_{m}\underset{(1)}{N}^{t}{}_{l}\underset{(3)}{C}^{i}{}_{st} + ... +$$

$$\left. \left(\underset{(1)}{N}^{l}{}_{m}\underset{(k-3)}{N}^{t}{}_{l} + ... + \underset{(k-3)}{N}^{l}{}_{m}\underset{(1)}{N}^{t}{}_{l} \right)\underset{(k-1)}{C}^{i}{}_{st} + ... \right.$$

$$\left. + \underbrace{\underset{(1)}{N}...\underset{(1)}{N}}_{(k-2)}\underset{(k-1)}{C} \right] + \qquad (10)$$

$$+ \underset{(2)}{A}^{m}{}_{j}\left[\underset{(2)}{C}^{i}{}_{sm} + \underset{(1)}{N}^{l}{}_{m}\underset{(3)}{C}^{i}{}_{sl} + ... + \underset{(k-3)}{N}^{l}{}_{m}\underset{(k-1)}{C}^{i}{}_{st} + ... + \underbrace{\underset{(1)}{N}...\underset{(1)}{N}}_{(k-3)}\underset{(k-1)}{C} \right] +$$

$$+ ... + \underset{(k-2)}{A}^{m}{}_{j}\left(\underset{(k-2)}{C}^{i}{}_{sm} + \underset{(1)}{N}^{l}{}_{m}\underset{(k-1)}{C}^{i}{}_{sl} \right) +$$

$$+ \underset{(k-1)}{A}^{m}{}_{j}\underset{(k-1)}{C}^{i}{}_{sm} - A_{jm}C_{s}{}^{im} - B^{i}{}_{sj},$$

$$\underset{(1)}{\overline{C}}^{i}{}_{sj} = \underset{(1)}{C}^{i}{}_{sj} + \underset{(1)}{A}^{m}{}_{j}\left[\underset{(2)}{C}^{i}{}_{sm} + \underset{(1)}{N}^{r}{}_{m}\underset{(3)}{C}^{i}{}_{sr} + ... + \right.$$

$$\left. + \underset{(k-3)}{N}^{r}{}_{m}\underset{(k-1)}{C}^{i}{}_{sr} + ... + \underbrace{\underset{(1)}{N}\cdot...\cdot\underset{(1)}{N}}_{(k-3)}\underset{(k-1)}{C} \right] +$$

$$+ ... + \underset{(k-3)}{A}^{m}{}_{j}\left[\underset{(k-2)}{C}^{i}{}_{sm} + \underset{(1)}{N}^{r}{}_{m}\underset{(k-1)}{C}^{i}{}_{sr} \right] +$$

$$+ \underset{(k-2)}{A}^{m}{}_{j}\underset{(k-1)}{C}^{i}{}_{sm} - \underset{(1)}{D}^{i}{}_{sj},$$

$$\underset{(k-2)}{\overline{C}}^{i}{}_{sj} = \underset{(k-2)}{C}^{i}{}_{sj} + \underset{(1)}{A}^{l}{}_{j}\underset{(k-1)}{C}^{i}{}_{sl} - \underset{(k-2)}{D}^{i}{}_{sj},$$

$$\underset{(k-1)}{\overline{C}}^{i}{}_{sj} = \underset{(k-1)}{C}^{i}{}_{sj} - \underset{(k-1)}{D}^{i}{}_{sj}, \overline{C}_{s}{}^{ij} = C_{s}^{ij} - D_{s}{}^{ij},$$

$$\begin{cases} \underset{(1)}{A}^{h}{}_{i|j} = 0, \\ A_{ih|j} = 0, (i,j,h = 1,2...,n), \end{cases}$$

where " $|$ " denotes the $h-$covariant derivative with respect to $D\Gamma(N)$.

In the particular case when we have the same nonlinear connection N, that is $\underset{(\alpha)}{A}^{i}{}_{j} = 0$, $(\alpha = 1,...,k-1), (k \geq 2, k \in N)$ and $A_{ij} = 0$, we obtain the set of transformations of N-linear connections corresponding to the same nonlinear connection N given by

$$\begin{cases} \overline{H}^{i}{}_{sj} = H^{i}{}_{sj} - B^{i}{}_{sj}, \\ \underset{(\alpha)}{\overline{C}}^{i}{}_{sj} = \underset{(\alpha)}{C}^{i}{}_{sj} - \underset{(\alpha)}{D}^{i}{}_{sj}, (\alpha = 1,...,k-1), (k \geq 2, k \in N) \\ \overline{C}_{s}{}^{ij} = C_{s}^{ij} - D_{s}{}^{ij}. \end{cases} \qquad (11)$$

3. GENERAL CONFORMAL METRICAL N-LINEAR CONNECTIONS IN THE HAMILTON SPACE OF ORDER $k, k \geq 2, k \in N$

Let $H^{(k)n} = (M, H)$ be a Hamiltonian space of order $k, k \geq 2, k \in N$, and let N be the cannonical nonlinear connection of the space $H^{(k)n}$ ([10], p.192).

We consider the adapted basis $\left\{ \frac{\delta}{\delta x^{i}}, \frac{\delta}{\delta y^{(1)i}}, \frac{\delta}{\delta y^{(k-1)i}}, \frac{\delta}{\delta p_{i}} \right\}$ and its dual basis $\{\delta x^{i}, \delta y^{(1)i}, \delta y^{(k-1)i}, \delta p_{i}\}$ determined by N and by the distribution W_{k}. Let

$$g^{ij}(x, y(1),..., y^{(k-1)}, p) = \frac{1}{2}\frac{\partial^{2} H}{\partial p_{i}\partial p_{j}} \qquad (12)$$

be the fundamental tensor of the space $H^{(k)n}$ [10].

The d-tensor field g^{ij} being nonsingular on $\widetilde{T^{*k}M} = T^{*k}M - \{0\}$ (where 0 is the nul section of the projection π^{*k}) there exists a d-tensor field g_{ij} covariant of order 2, symmetric,

uniquely determined, at every point $u \in \overset{\sim\sim\sim}{T^{*k}M}$, by $g_{ij}g^{jk} = \delta_i^k$ (13)

Definition 1 ([10]) *An N-linear connection D is called compatible to the fundamental tensor g^{ij} of the Hamiltonian space of order k, $H^{(k)n} = (M, H)$, or it is metrical if g^{ij} is covariant constant (or absolute parallel) with respect to D, i.e.*

$$g^{ij}{}_{|h} = 0,\ g_{ij}\overset{(\alpha)}{|}_h = 0,\ g^{ij}\,|^h = 0, (\alpha = 1,...,k-1) \quad (14)$$

The operators of Obata's type are given by

$$\Omega^{ij}_{hk} = \frac{1}{2}(\delta^i_h\delta^j_k - g_{hk}g^{ij}),\ \Omega^{*ij}_{hk} = \frac{1}{2}(\delta^i_h\delta^j_k + g_{hk}g^{ij}) \quad (15)$$

Proposition 1 The operators of Obata's type are covariant constant with respect to any metrical N-linear connection, D

$$\Omega^{ir}_{sj|h} = 0, \Omega^{ir}_{sj}\overset{(\alpha)}{|}_h = 0, \Omega^{ir}_{sj}\,|^h = 0,$$
$$\Omega^{*ir}_{sj|h} = 0, \Omega^{*ir}_{sj}\overset{(\alpha)}{|}_h = 0, \Omega^{*ir}_{sj}\,|^h = 0,$$

where $_{|h}$, $\overset{(\alpha)}{|}_h$ *and* $|^h$, denote the $h-, v_\alpha -$ and $w_k -$ covariant derivatives with respect to D, $(\alpha = 1,...,k-1)$.

Let $S_2(T^{*k}M)$ be the set of all symmetric d-tensor fields, of the type (0,2) on $T^{*k}M$, $k \geq 2, k \in N$. As is easily shown, the relations for $a_{ij}, b_{ij} \in S_2(T^{*k}M)$ defined by:

$$(a_{ij} \approx b_{ij}) \Leftrightarrow$$
$$((\exists)\lambda(x, y^{(1)},..., y^{(k-1)}, p) \in F(T^{*k}M),$$
$$a_{ij}(x, y^{(1)},..., y^{(k-1)}, p) =$$
$$= e^{2\lambda(x, y^{(1)},..., y^{(k-1)}, p)} b_{ij}(x, y^{(1)},..., y^{(k-1)}, p)) \quad (16)$$

is an equivalence relation on $S_2(T^{*k}M)$.

Definition 2 *The equivalent class $\hat{g}$ of $S_2(T^{*k}M)/\approx$ to which the fundamental d-tensor field g_{ij} belongs, is called conformal metrical d-structure on $T^{*k}M$.*

Thus

$$\hat{g} = \{g' \mid g'_{ij}(x, y^{(1)},..., y^{(k-1)}, p) =$$
$$= e^{2\lambda(x, y^{(1)},..., y^{(k-1)}, p)} g_{ij}(x, y^{(1)},..., y^{(k-1)}, p), \quad (17)$$
$$\lambda(x, y^{(1)},..., y^{(k-1)}, p) \in F(T^{*k}M)\}.$$

Definition 3 *An N-linear connection, D, with local coefficients*

$$D\Gamma(N) = \left(H^i{}_{jh}, \underset{(\alpha)}{C}{}^i{}_{jh}, C_i{}^{jh}\right),\ (\alpha = 1,...,k-1),$$

is called general conformal metrical N-linear connection with respect to $\hat{g}$ if:

$$g_{ij|h} = K_{ijh},\ g_{ij}\overset{(\alpha)}{|}_h = \underset{(\alpha)}{Q}{}_{ijh},\ g_{ij}\,|^h = \dot{Q}_{ij}{}^h, \quad (18)$$

where $_{|h}$, $\overset{(\alpha)}{|}_h$ *and* $|^h$, denote the $h-, v_\alpha -$ and $w_k -$ covariant derivatives with respect to D and $K_{ijh}, \underset{(\alpha)}{Q}{}_{ijh}, \dot{Q}_{ij}{}^h$ are arbitrary tensor fields on $T^{*k}M$ of the types (0,3), (0,3) and (2,1) respectively, with the properties:

$$K_{ijh} = K_{jih}, \underset{(\alpha)}{Q}{}_{ijh} = \underset{(\alpha)}{Q}{}_{jih}, \dot{Q}_{ij}{}^h = \dot{Q}_{ji}{}^h, \quad (19)$$
$$(\alpha = 1,...,k-1).$$

Definition 4 *An N-linear connection, D, with local coefficients*

$$D\Gamma(N) = \left(H^i{}_{jh}, \underset{(\alpha)}{C}{}^i{}_{jh}, C_i{}^{jh}\right), (\alpha = 1,...,k-1),$$

for which there exists the 1-form ω,

$$\omega = \omega_i dx^i + \underset{(1)}{\dot{\omega}_i}\,\delta y^{(1)i} + ... + \underset{(k-1)}{\dot{\omega}_i}\,\delta y^{(k-1)i} + \ddot{\omega}^i \delta p_i,$$

such that

$$\begin{cases} g_{ij|h} = 2\omega_h g_{ij},\ g_{ij}\overset{(\alpha)}{|}_h = \underset{(\alpha)}{\dot{\omega}_h}\, g_{ij}, \\ g_{ij}\,|^h = 2\ddot{\omega}^h g_{ij}, \alpha = 1,...,k-1, \end{cases} \tag{20}$$

where $_{|h}$, $\overset{(\alpha)}{|}_h$ *and* $|^h$, denote the $h-, v_\alpha -$ and $w_k -$ covariant derivatives with respect to D, $(\alpha = 1,...,k-1)$ is called conformal metrical N-linear connection, with respect to the conformal metrical d-structure $\hat{g}$, corresponding to the 1-form ω and it is denoted by: $D\Gamma(N,\omega)$.

Proposition 2 *If* $D\Gamma(N,\omega)$

$$= \left(H^i{}_{jh}, \underset{(\alpha)}{C^i{}_{jh}}, C_i{}^{jh} \right) (\alpha = 1,...,k-1)$$ *are the local coefficients of a conformal metrical N-linear connection in* $T^{*k}M$, *with respect to the conformal metrical structure* $\hat{g}$, *corresponding to the 1-form* ω, *then*

$$g^{ij}{}_{|h} = -2\omega_h g^{ij},\ g^{ij}\overset{(\alpha)}{|}_h = -2\underset{(\alpha)}{\dot{\omega}_h}\, g^{ij},$$

$$g^{ij}\,|^h = -2\ddot{\omega}^h g^{ij}, \alpha = 1,...,k-1.$$

For any representative $g' \in \hat{g}$ we have

Theorem 3 *For* $g'_{ij} = e^{2\lambda} g_{ij}$, *a conformal metrical N-linear connection with respect to the conformal metrical structure* $\hat{g}$, *corresponding to the 1-form* ω *in* $T^{*k}M$, $D\Gamma(N,\omega)$, *satisfies*

$$g'_{ij|h} = 2\omega'_h g'_{ij},\ g'_{ij}\overset{(\alpha)}{|}_h = 2\underset{(\alpha)}{\dot{\omega}'_h}\, g'_{ij},$$

$$g'_{ij}\,|^h = 2\ddot{\omega}'^h g'_{ij}, \alpha = 1,...,k-1,$$

where $\omega' = \omega + d\lambda$.

Since in Theorem 3 $\omega' = 0$ is equivalent to $\omega = d(-\lambda)$, we have

Theorem 4 *A conformal metrical N-linear connection with respect to* $\hat{g}$, *corresponding to the 1-form* ω *in* $T^{*k}M$, $D\Gamma(N,\omega)$, *is metrical with respect to* $g' \in \hat{g}$, *i.e.* $g'_{ij|k} = g'_{ij}\overset{(\alpha)}{|}_k = g'_{ij}\,|^k = 0$ *if and only if* ω *is exact.*

We shall determine the set of all general conformal metrical N-linear connections, with respect to $\hat{g}$, corresponding to the same nonlinear connection N.

Let

$$\overset{0}{D}\Gamma(N) = \left(\overset{0}{H}{}^i{}_{jh}, \underset{(\alpha)}{\overset{0}{C}{}^i{}_{jh}}, \overset{0}{C}_i{}^{jh} \right), \quad (\alpha = 1,...,k-1)$$

be the local coefficients of a fixed N - linear connection $\overset{0}{D}$, where

$$(\underset{(\alpha)}{N^j_i}(x, y^{(1)},..., y^{(k-1)}, p), N_{ij}(x, y^{(1)},..., y^{(k-1)}, p)),$$

$$(\alpha = 1,...,k-1), (i, j = 1,2,...,n)$$

are the local coefficients of the nonlinear connection N. Then any N-linear connection, D, with the local coefficients $D\Gamma(N) = \left(H^i{}_{jh}, \underset{(\alpha)}{C^i{}_{jh}}, C_i{}^{jh} \right), (\alpha = 1,...,k-1)$, can be expressed in the form (11).

Using the relations (20), (11), (6) and the Theorem 1 given by R.Miron in ([4]) for the case of Finsler connections we obtain

Theorem 5 *Let* $\overset{0}{D}$ *be a given N -linear connection, with local coefficients* $\overset{0}{D}\Gamma(N)$

$$= \left(\overset{0}{H}{}^i{}_{jh}, \underset{(\alpha)}{\overset{0}{C}{}^i{}_{jh}}, \overset{0}{C}_i{}^{jh} \right)$$ $(\alpha = 1,...,k-1)$. The set of all general conformal metrical N-linear connections, with respect to $\hat{g}$, corresponding to the same nonlinear connection N with local coefficients

$$D\Gamma(N) = \left(H^i{}_{jh}, \underset{(\alpha)}{C^i{}_{jh}}, C_i{}^{jh} \right), (\alpha = 1,...,k-1)$$ is given by

$$\begin{cases} H^i{}_{jh} = \overset{0}{H}{}^i{}_{jh} + \frac{1}{2} g^{im}(\underset{(\alpha)}{g_{mj|h}} - K_{mjh}) + \Omega^{ir}_{sj} X^s_{rh}, \\ \underset{(\alpha)}{C^i{}_{jh}} = \underset{(\alpha)}{\overset{0}{C}{}^i{}_{jh}} + \frac{1}{2} g^{im}(g_{mj}\overset{0}{|}_h - \underset{(\alpha)}{Q_{mjh}}) + \Omega^{ir}_{sj}\, \underset{(\alpha)}{Y^s{}_{rh}} \\ C_i{}^{jh} = \overset{0}{C}_i{}^{jh} + \frac{1}{2} g^{mj}(g_{mj}\overset{0}{|}^h - \dot{Q}_{mi}{}^h) + \Omega^{jr}_{si} Z^{sh}_r, \end{cases} \tag{21}$$

$(\alpha = 1,...,k-1)$

where $\overset{0}{|h}$, $\overset{(\alpha)}{\overset{0}{|}}{}_h$, and $\overset{0}{|^h}$ denote the $h-, v_\alpha-$ and w_k- covariant derivatives with respect to $\overset{0}{D}$, $X^i{}_{jh}, \underset{(\alpha)}{Y}{}^i{}_{jh}, Z_i{}^{jh}$ are arbitrary d-tensor fields and $K_{ijh}, \underset{(\alpha)}{Q}{}_{ijh}, \dot{Q}_{ij}{}^h$ are arbitrary d-tensor fields of the types (0,3), (0,3) and (2,1) respectively, with the properties (19), $(\alpha = 1,...,k-1)$.

Particular cases

1. If we take

$$K_{ijh} = 2\omega_h g_{ij}, \underset{(\alpha)}{Q}{}_{ijh} = 2\underset{(\alpha)}{\dot{\omega}}_h g_{ij}, (\alpha = 1,...,k-1),$$

$$\dot{Q}_{ij}{}^h = 2\ddot{\omega}^h g_{ij}$$

in Theorem 5, we obtain

Theorem 6 *Let $\overset{0}{D}$ be a given N -linear connection, with local coefficients* $\overset{0}{D}\Gamma(N) = \left(\overset{0}{H}{}^i{}_{jh}, \underset{(\alpha)}{\overset{0}{C}}{}^i{}_{jh}, \overset{0}{C}_i{}^{jh}\right)$ $(\alpha = 1,...,k-1)$. *The set of all conformal metrical N-linear connections with respect to $\hat{g}$, corresponding to the 1-form ω, with local coefficients* $D\Gamma(N,\omega) = \left(H^i{}_{jh}, \underset{(\alpha)}{C}{}^i{}_{jh}, C_i{}^{jh}\right), (\alpha = 1,...,k-1)$ *is given by*

$$\begin{cases} H^i{}_{jh} = \overset{0}{H}{}^i{}_{jh} + \frac{1}{2}g^{im}(g_{mj\,|h} - 2\omega_h g_{mj}) + \Omega^{ir}_{sj} X^s_{rh}, \\ \underset{(\alpha)}{C}{}^i{}_{jh} = \underset{(\alpha)}{\overset{0}{C}}{}^i{}_{jh} + \frac{1}{2}g^{im}(g_{mj\,\overset{(\alpha)}{|}h} - 2\underset{(\alpha)}{\dot{\omega}}_h g_{mj}) + \Omega^{ir}_{sj} \underset{(\alpha)}{Y}{}^s_{rh}, \\ C_i{}^{jh} = \overset{0}{C}_i{}^{jh} + \frac{1}{2}g^{mj}(g_{mi\,|^h} - 2\ddot{\omega}^h g_{mi}) + \Omega^{jr}_{si} Z_r^{sh}, \end{cases} \quad (22)$$

$(\alpha = 1,...,k-1), (i,j,h = 1,2,...,n),$

where $\overset{0}{|h}$, $\overset{(\alpha)}{\overset{0}{|}}{}_h$, and $\overset{0}{|^h}$ denote the $h-, v_\alpha-$ and w_k- covariant derivatives with respect to $\overset{0}{D}$, $X^i{}_{jh}, \underset{(\alpha)}{Y}{}^i{}_{jh}, Z_i{}^{jh}$ are arbitrary d-tensor fields, $(\alpha = 1,...,k-1)$, $\omega = \omega_i dx^i + \underset{(1)}{\dot{\omega}}_i \delta y^{(1)i} + ... + \underset{(k-1)}{\dot{\omega}}_i \delta y^{(k-1)i} + \ddot{\omega}^i \delta p_i$, is an arbitrary 1-form and Ω is the operator of Obata's type given by (15).

2. If $X^i{}_{jh} = \underset{(\alpha)}{Y}{}^i{}_{jh} = Z_i{}^{jh} = 0$, in Theorem 5 we have an example of general conformal metrical with respect to $\hat{g}$:

Theorem 7 *Let $\overset{0}{D}$ be a given N -linear connection, with local coefficients* $\overset{0}{D}\Gamma(N) = \left(\overset{0}{H}{}^i{}_{jh}, \underset{(\alpha)}{\overset{0}{C}}{}^i{}_{jh}, \overset{0}{C}_i{}^{jh}\right)$ $(\alpha = 1,...,k-1)$. Then the following N-linear conection K, with local coefficients

$$K\Gamma(N) = \left(H^i{}_{jh}, \underset{(\alpha)}{C}{}^i{}_{jh}, C_i{}^{jh}\right), (\alpha = 1,...,k-1),$$

given by (23) is general conformal metrical with respect to $\hat{g}$.

$$\begin{cases} H^{i}_{\ jh} = \overset{0}{H}{}^{i}_{\ jh} + \dfrac{1}{2} g^{im}(g_{mj\ |\overset{0}{h}} - K_{mjh}), \\ \underset{(\alpha)}{C}{}^{i}_{\ jh} = \overset{0}{\underset{(\alpha)}{C}}{}^{i}_{\ jh} + \dfrac{1}{2} g^{im}(g_{mj\ \overset{(\alpha)}{|}\overset{0}{}_{h}} - \underset{(\alpha)}{Q}_{\ mjh}), \\ C_{i}^{\ jh} = \overset{0}{C}{}_{i}^{\ jh} + \dfrac{1}{2} g^{mj}(g_{mi}\overset{0}{|}{}^{h} - \dot{Q}_{mi}{}^{h}), \end{cases} \quad (23)$$

$(\alpha = 1,...,k-1)$,

where $\overset{0}{|h}$, $\overset{(\alpha)}{\overset{0}{|}}{}_{h}$, and $\overset{0}{|}{}^{h}$ denote the $h-$, $v_\alpha -$ and $w_k -$ covariant derivatives with respect to $\overset{0}{D}$, and $K_{ijh}, \underset{(\alpha)}{Q}_{\ ijh}, \dot{Q}_{ij}{}^{h}$ are arbitrary d-tensor fields of the types (0,3), (0,3) and (2,1) respectively, with the properties (19), $(\alpha = 1,...,k-1)$.

3. If we take a general conformal metrical N-linear connection with respect to $\hat{g}$ as $\overset{0}{D}$, in Theorem 5 we have

Theorem 8 *Let $\overset{0}{D}$ be on $T^{*k}M$ a fixed general conformal metrical N-linear connection with respect to $\hat{g}$, with the local coefficients* $\overset{0}{D}\Gamma(N) = \left(\overset{0}{H}{}^{i}_{\ jh}, \overset{0}{\underset{(\alpha)}{C}}{}^{i}_{\ jh}, \overset{0}{C}{}_{i}^{\ jh} \right) \quad (\alpha = 1,... \quad k-1)$.

The set of all general conformal metrical N-linear connections, with respect to $\hat{g}$, with local coefficients

$D\Gamma(N) = \left(H^{i}_{\ jh}, \underset{(\alpha)}{C}{}^{i}_{\ jh}, C_{i}^{\ jh} \right), (\alpha = 1,...,k-1)$ is given by

$$\begin{cases} H^{i}_{\ jh} = \overset{0}{H}{}^{i}_{\ jh} + \Omega^{ir}_{sj} X^{s}_{\ rh}, \\ \underset{(\alpha)}{C}{}^{i}_{\ jh} = \overset{0}{\underset{(\alpha)}{C}}{}^{i}_{\ jh} + \Omega^{ir}_{sj} \underset{(\alpha)}{Y}{}^{s}_{\ rh}, (\alpha = 1,...,k-1), \\ C_{i}^{\ jh} = \overset{0}{C}{}_{i}^{\ jh} + \Omega^{jr}_{si} Z_{r}^{\ sh}, \end{cases} \quad (24)$$

where $X^{i}_{\ jh}, \underset{(\alpha)}{Y}{}^{i}_{\ jh}, Z_{i}^{\ jh}$ are arbitrary d-tensor fields, $(\alpha = 1,...,k-1)$.

4. If $K_{ijh} = \underset{(\alpha)}{Q}_{\ ijh} = \dot{Q}_{ij}{}^{h} = 0, (\alpha = 1,...,k-1)$ in Theorem 5 we obtain the set of all metrical N-linear connection in the case when the nonlinear connection is fixed, result given in ([10]).

Theorem 9 *The mappings determined by* (24), $D\Gamma(N) \to \overline{D}\Gamma(N)$ *together with the composition of these mappings is an abelian group.*

REFERENCES

1. Atanasiu, Gh., Târnoveanu, M., *New Aspects In The Differential Geometry Of The Second Order Cotangent Bundle,* Univ. De Vest Din Timişoara, No.90, 2005, 1-65.
2. Matsumoto, M., *The Theory Of Finsler Connections*, Publ. Of The Study Group Of Geometry 5, Depart. Math. Okayama Univ., 1970, Xv + 220 Pp.
3. Matsumoto, M., *Foundations Of Finsler Geometry And Special Finsler Spaces*, Kaiseisha Press, Otsu, 1986.
4. Miron, R., Hashiguchi, M., *Metrical Finsler Connections,* Rep. Fac. Sci. Kagoshima Univ., (Math., Phys., Chem.), 12, 1979, 21-35.
5. Miron, R., *Hamilton Geometry, Seminarul De Mecanică*, Univ. Timişoara, 3, 1987.
6. Miron, R., *Sur La Geometrie Des Espaces Hamilton,* C.R. Acad., Sci. Paris, Ser Ii, 306, No.4, 1988, 195-198.
7. Miron, R., *Hamilton Geometry*, Analele Şt. Univ. Iaşi, S -I Mat. 35, 1989, 35-85.
8. Miron, R., *On The Geometrical Theory Of Higher-Order Hamilton Spaces, Steps In Differential Geometry*, Proceedings Of The Colloquium On Differential Geometry, 25-30 July, 2000, Debrecen, Hungary, 231-236.
9. Miron, R., *Hamilton Spaces Of Order K Greater Than Or Equal To 1*, Int. Journal Of Theoretical Phys., 39, 9, 2000, 2327-2336.
10. Miron, R., *The Geometry Of Higher-Order Hamilton Spaces. Applications To Hamiltonian Mechanics*, Kluwer Acad. Publ., Ftph, 2003.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

FPGA - DISRUPTIVE TECHNOLOGIE FOR MILITARY APPLICATIONS

Michal TURČANÍK*

*Department of Informatics, Armed Forces Academy, Liptovský Mikuláš, Slovak republic

Abstract: *The paper deals with important topic of nowadays - using FPGA in military applications. The FPGA are used in the defence industry instead of ASIC circuits for the same reason as in the civilian sector currently. The main advantages of the FPGA are presented in the paper. Base on these advantages we can define several military applications of the FPGA. The implementations of these applications are compared with traditional way and benefits of these solutions are presented.*

Keywords: *Programmable Logic Arrays, Field Programmable Gate Arrays.*
MSC 2010: *68-04.*

1. INTRODUCTION

At present, the armed forces are dependent on technology. The technology is used to ensure domestic security and success in the deployment of troops abroad. To make the armed forces always at least one step ahead of opponents, it is necessary to use the latest technology.

Types of ASIC circuits were previously the dominant choice for military and defence industry, which is not at all surprising. The armed forces have increased requirements for resistance, temperature tolerance and reliability. However, at present FPGA circuits are also beginning to pursue this particular market segment. The FPGA circuits did not represent comparable alternative to ASIC circuits in 80-ies. FPGA contained only a few hundred gates and their operating frequency was 15 to 20 Mhz. The change was the defining principle of "do more with less" in 2009. Monetary limiting for defence and permit the use commercial technologies (COTS - commercial off the shelf) paves the way for PLD in military applications. The use of COTS technology whenever possible (resulting in a reduction in prices), resulted in increased use of FPGA in military applications [1].

2. WHY FPGA

Currently, the FPGA are used in the defence industry instead of ASIC circuits for the same reason as in the civilian sector: If the number of circuits that will be needed to implement the project, less than 100,000, the cost advantages are in using FPGA circuits. Also, the design cycle for FPGA circuits is shorter than the ASIC one. However, there is a group of applications where cost is not the most important parameter. One example is the area of intelligence and espionage, where, for example ASIC circuits will be chosen as a solution for the spy satellite, although the number of circuits are made up of tens, while the price for development can not exceed $ 50 million [2].

Configuration of the FPGA in field conditions is another advantage for military applications.

FPGA in the military communications device can be automatically deleted if device was lost or was captured by enemy. This is becoming less vulnerable in terms of reverse engineering and communications connection (or weapons systems). The main goal of the reverse engineering is to obtain information about the internal structure and modes of operation of the analyzed system.

Although there are no statistics that would monitor the FPGA circuit used in military applications (the market is small compared to the commercial use FPGA), the main FPGA manufacturers declare a significant increase in the use of these devices in military applications in the last decade. According to [2] defence industry is the fastest growing sector with an annual increase of 30 percent.

Equipment resistant to radiation is important for space applications. Radiation can cause changes in the status of the state flip-flop from logic 1 to logic 0 (or vice versa) and thus cause undesired change the behaviour of the circuit. Currently, the most important manufacturers offer devices resistant to radiation.

Manufacturers do not seek to produce special circuits for the defense industry, but offer improved properties that are required for military applications. One example is the operational temperature range. Range of industrial applications from -40 to 100 degrees Celsius, but for military applications range is from -55 to 125 degrees Celsius. This approach allows using the latest technologies in the defence industry and achieving the lowest prices compared with the approach which uses a product that was designed exclusively for military use. The two largest producers of circuit type PLD (Altera and Xilinx) bring new products to the commercial market and later a military version of the same type of product [3, 4].

An example would be 5Q Virtex from Xilinx, which is designed for aerospace and defence applications. It offers the possibility of implementing cryptography in one district (SCC - Single Chip Cryptography), which provides space for the development of secure communications systems for new generation. Given the circuit offers high performance, large capacity and rugged encapsulation. The main use of the circuit includes the following applications: secure communications systems, electronic warfare, aviation technology, C4ISR (Command, Control, Communications, Computer, Intelligence, Surveillance and Reconnaissance) systems, radars, missiles and smart munitions.

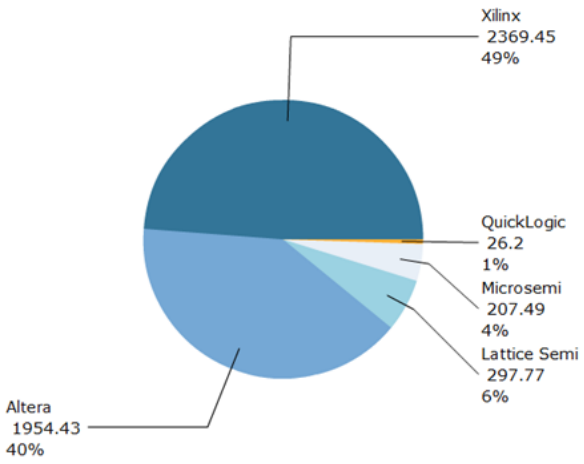


Fig. 1. FPGA producers and market share

3. ADVANTAGES OF THE FPGA

3.1 Possibility to adapt to any standard. In the case of modernization of the armed forces are always undergoing some risk. The armed forces are forced to in order to ensure interoperability using standards, but it is not always possible to correctly predict which standard will be dominant. The advantage of systems based on programmable circuits FPGA is flexibility and the ability and capacity to adapt to any standard. This can eliminate the losses incurred by the introduction incorrectly selected technologies and standards into the armed forces [5].

3.2 The length of the design process. Flexibility and adaptability offered by FPGAs are directly related to the length of the design process. ASIC circuits require a long design process - typically 14 to 24 months. The average time needed to implement the design for FPGAs is 6 to 12 months, which includes the specification, implementation, verification,

validation and prototype production. This is a significant time savings, which is important in the implementation of the critical applications and length of the design process sensitive applications and adaptation to new standards. Necessary design changes during the phase of using the device are implemented by reconfiguration of the FPGA. In the case of ASIC circuits, it is necessary to implement the complete design process from the beginning, which also includes the specification and verification [6].

3.3 Changing behaviour of the digital system without exchange of the hardware. FPGA can change the behaviour of the digital system without replacing hardware. All changes can be implemented through software means alone and reconfiguration can be performed even in field conditions. The flexibility is inherent in the FPGA, can reduce the price of the design and the price of used hardware. The ability to change the behaviour of the circuit and field conditions allows for a design with extremely flexible life cycle. The result is the possibility of rapid assimilation of new standards, allowing the armed forces fulfilment of set tasks and implementation of innovation with minimal delay. FPGA can be updated at any time, locally or via remote access. With partial reconfiguration can provide support, service, and an update on field conditions.

3.4 Increased performance of the computer system. Although part of the FPGA circuit is reconfigured, the rest of the circuit performs a defined action. This can eliminate the shortfall in functionality and performance of the circuit, which is reconfigured. Partial reconfiguration can allow implementation of multiple applications in a single FPGA. The implementation of multiple applications is switched at the time.

3.5 Sharing hardware. The implementation of multiple applications performing partial reconfiguration of one FPGA is a condition for allowing the sharing of hardware. The benefits that flow from it are as follows: reduce the number of necessary facilities, reduced power consumption, smaller size of the necessary circuit boards and lower overall financial costs of implementing the periphery.

3.6 The shorter the time needed for reconfiguration. The time required to configure the FPGA is directly proportional to the size of the configuration bitstream. Partial reconfiguration allows for a small modification of FPGA functionality without reconfiguring the entire circuit. Change only part of the configuration bitstream compared with reconfiguring the entire circuit can produce shorter total configuration time.

4. USE OF THE FPGA IN THE MILITARY APPLICATIONS

4.1 Unmanned aerial vehicles. FCS (Future Combat System) is one of the many modernization programs. Its aim is to provide cutting edge technology to the armed forces to enable them to dominate in complex environments of the modern battlefield. Part of this program includes a family of modular UAVs, which can be linked to a common network [7]. Unmanned is intended to carry out activities that pose a potential threat to people and save lives. These devices must be capable of performing search, survey and also must have the ability active influence to the

enemy. An example would be the situation when pilotless means gets into unexpected situations and remote operator needs to evaluate the video and audio in order to correctly assess the situation and to choose the right choice. To ensure that it is necessary to implement audio and video processing, which requires high-speed digital signal processing. Effective implementation of operations such "robots" is subject to the ability of listening and seeing, but also the ability to perform many orders. The abilities need to do intensive signal processing and use principles of artificial intelligence and require powerful hardware. Using conventional DSP processors to provide these capabilities has some limitations.

Conventional DSP processors have a fixed and unchanging architecture that contains one to four units of MAC (Multiply and Accumulate) with a fixed width of the data. Architecture then defines throughput, which determines the speed of processing. To increase computational efficiency of conventional DSP is required to increase their operating frequency to the maximum, which reduces the requirements for system design. Subsequently, several DSP processors must be included in processing, causing problems with energy and space on the target platform. The biggest advantage of using FPGA is its flexibility. For the application circuit can be configured so that the processing was carried out in parallel with the desired degree of parallelism. This may increase the maximum data throughput and optimize system performance. FPGA reconfigurability is a feature that is in demand for unmanned aerial vehicles. Plan prepared in advance for the use of UAVs in touch with the reality of the environment in which it is used, it must be changed frequently. FPGA has an ability to adapt to changes in behaviour flexibly and quickly to increase the probability of survival on the battlefield. FPGA reconfigurability enables end users to upload a new configuration for carrying out certain tasks within a specified time. Instead of implementing the system with a dedicated hardware for each specific task, it is possible to design a system with a single FPGA, which is used to implement multiple applications or tasks.

4.2 Unattended Ground Sensors. Unattended Ground Sensors are represented by the family of devices for implementation of remote sensing, that are interconnected by wireless network. Autonomous ground sensors (APS) can be used in defence of the designated perimeter for detecting and identifying targets and early warning. The size (the smallest size) and minimum power consumption resulted in a high degree of integration. Some sensors (sensor type FLIR - Forward Look Infrared) require intensive processing of information received, as opposed to requirements that are not asked. The amount of information that is sent to the communication line is also limited, and its compression is required. Information is processed before receiving, to avoid sending image that has not been changed. Flexible customization of computer performance can affect power consumption and system size. The solution to these requirements is a system with a high degree of integration. The last generation FPGA on-chip contains many features that were previously performed by software (soft core). High-speed I / O are a good example and some FPGA manufacturers integrate on-chip banks gigabit transmitters / receivers, Ethernet interface and PCI Express. Using these circuits can be integrated with external devices and sensors can be realized with a minimum of discrete components. Internal sources that would be used to implement these functions can be used to implement other parts of the design. FPGA can be implemented as an integrated solution. For most sensors is sufficient to capture the periodic "snapshots" over a defined period of time. It is necessary to generate a continuous stream of information from these sensors, which can represent movement of persons or vehicles. We also use the hardware (implemented FPGA) may be staggered partial tasks of data collection, processing and transmission of data. This allows the consolidation of a single device, resulting in a reduced size printed circuit boards, cost and power consumption.

4.3 Software Defined Radio. U To secure voice, data and video communications for U.S. forces, coalition forces and allies unit was defined vision of the Ministry of Defence to implement unified communications in real time. Transformation programs (JTRS - Joint Tactical Radio System) was created to eliminate the constraints and gaps between communication systems that can prevent the fulfilment of that vision. JTRS system is designed to ensure interoperability between modern and older systems through software programmable radios designed to ensure modularity, scalability, backwards compatibility and networking capability. Software-defined radio (SDR) includes a software programmable operating environment and can support multiple waveforms, made by a single system. The main constraint for the practical implementation of such systems are costs and requirements for power consumption.

The SDR is currently implemented in a dedicated model, which requires a set of sources for each implemented channel. Each channel represents one type of modulation defined radio. Each modulation (waveform) is realized by sources to carry out processing. Typical single-channel SDR modem includes AD and DA converters, FPGA, DSP and versatile processor (GPP - General Purpose Processor). This represents at least four discrete devices, which must be multiplied by the number of channels SDR. The result is increasing costs and demands on energy consumption with increasing the number of channels. This implementation of the SDR is not effective for general use. Another way is to implement a model of shared resources. This model is able to implement several modulations that are using one set of equipment for processing. This method is fundamentally different from the previous method, which required appropriations for each channel. FPGA, which is partially reconfigurable, allows the sharing of hardware. Partial reconfiguration can allow reprogram selected parts of the FPGA circuit to implement the operations defined in user-defined time after the initial configuration of the circuit. Accordingly, it is possible to implement several modulations in one FPGA. These circuits allow the user to dynamically change the modulation used without damaging the current modulation. Using the FPGA reduces the two main constraints that prevent the spread of the use of SDRs. Funding is investigated by integrating the components required to implement multi-channel SDR. Power consumption is also lower because the unused computing resources are eliminated. The result is longer battery life, which is used to power mobile SDR system.

5. CONCLUSIONS

The modernization process of the armed forces may accelerate the use of FPGA. The length of the design process FPGA is shorter by 55% compared with the design process of ASIC circuits. FPGA permit to integrate user-defined logic functions, DSP functions and multi-processors of GPP (General Purpose Processor) and requirements to reduce energy consumption and cost. Reducing power consumption allows the use of such systems in field conditions, where electricity supply is carried out with the batteries. By integrating multiple discrete devices into a single FPGA can be made portable systems that are lightweight and relatively small size.

REFERENCES

1. Davis, J. : FPGAs storm military spending - The benefits of field programmability hold some appeal for military applications. EDN, July 14, 2009.
2. Kao, C. : FPGAs remove roadblocks from military applications. Defense Electronics. Aug 2, 2006, pp. 16-20.
3. XILINX.: Product selection guide. Xilinx, 2011. http://www.xilinx.com/publications/matrix/Product_Selection_Guide.pdf
4. XILINX.: Xilinx company overview. Xilinx, 2011. http://www.xilinx.com/about/company-overview/index.htm
5. ALTERA.: Altera About us. Altera, 2011. http://www.altera.com/corporate/about_us/abt-index.html
6. ALTERA.: Altera product catalog. Altera, 2011. http://www.altera.com/literature/sg/product-catalog.pdf
7. Grega, M., Schober, T., Nečas, P.: Overenie postupov krízového štábu prostriedkami simulačných technológií (in Slovak). Edukacja a poczucie bezpieczeństwa, Rzeszów, Poland, 2012.

4. ENGINEERING SCIENCES

4.1 *ELECTRICAL AND ELECTRONICAL ENGINEERING*

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

MANAGEMENT OF ELECTRIC POWER SOURCES FOR SMALL AIRCRAFT

Viktor FERENCEY*, Martin BUGÁR*, Vladimír STAŇÁK*, Juraj MADARÁS*
* Faculty of Electrical Engineering and Information Technology, IPAEE, Department of Applied Mechanics and Mechatronics, Ilkovičova 3, 812 19 Bratislava 1

Abstract: *The paper describes a possible solution of electric propulsion for small plane with a hybrid power supply. The energy source consists of the battery and fuel cell system requires the electronic management of this resource. The article shows the physical-mathematical model of management of hybrid power source for electric propulsion of aircraft.*

Keywords: *aircraft, electric propulsion, battery, fuel cell, hybrid power supply, management.*

1. INTRODUCTION

Aircraft manufacturers are looking for possibilities to produce cleaner engines for aircraft. For small aircraft there is one of the options to change gasoline engines by electric motors. One of promising technology is electric powered of aircraft with hybrid power supply. The hybrid power supply electronic control system requires cooperation of the elements according to the needs of the aircraft flight operations.

2. ELECTRIC PROPULSION FOR SMALL AIRCRAFT

Propeller of the small aircraft would be powered by an electric motor through a corresponding reduction in the maximum speed of propeller. The electric motor draws energy from the lithium-ion battery and fuel cell.

Operation of the fuel cell requires water tank and the tank with pure hydrogen, which is fuel for a fuel cell. Figure 1 shows the arrangement of elements of electric power in the trunk of a small aircraft.

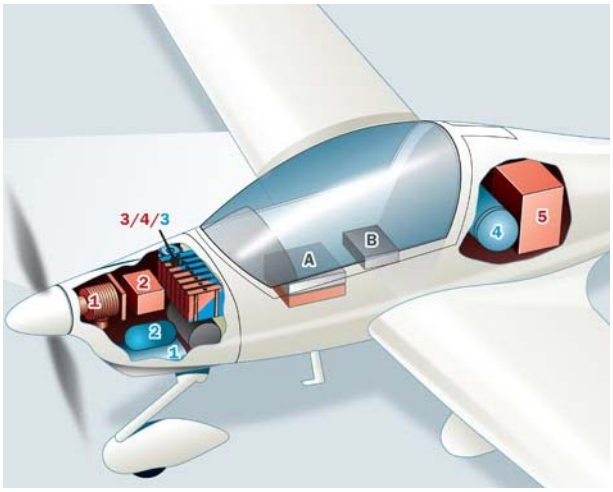


Fig. 1 The arrangement of elements of electric power in the trunk of small aircraft [1].

Blue- Fuel cell systems: 1- radiators, 2- water reservoirs, 3- PEM fuel cell, 4- hydrogen tank,
red- energy storage system and propulsion system:
1- electric motor, 2- electric motor controller,
3- battery, 4- other energy back-up system,
5- alternate battery location
A- Power management and distribution system, B- Motor controller / inverter

Fuel cells and batteries are both galvanic cells and therefore have many similarities. Both devices generate electrical energy by

converting chemical energy from a high energy state to lower energy state using an electrochemical reaction. Fuel cells differ from batteries in the nature of their anode and cathode. Fuel cells also differ from batteries in the fundamental method in which the chemical reactants are stored. In a battery, the anode and cathode form an integral part of the battery structure and are consumed during use. In a fuel cell, the chemical reactants are supplied from an external source so that its materials of construction are never consumed and do not need to be recharged. A fuel cell continues to operate as long as reactants are supplied and the reaction products are removed.

The fuel cell produces electricity through an electrochemical reaction of fuel (pure hydrogen) and oxidant (oxygen from the air). This reaction produces the water as the output product. The fuel cell produces no harmful emission and is relatively quiet during operation. Electric-powered aircraft is generally very quiet. Fuel cell with the proton Exchange membrane PEM operates at a low temperature around 100 °C and working at full power shortly after starting to work.

Figures 2,3 shows the operation of fuel cell with PEM membrane.

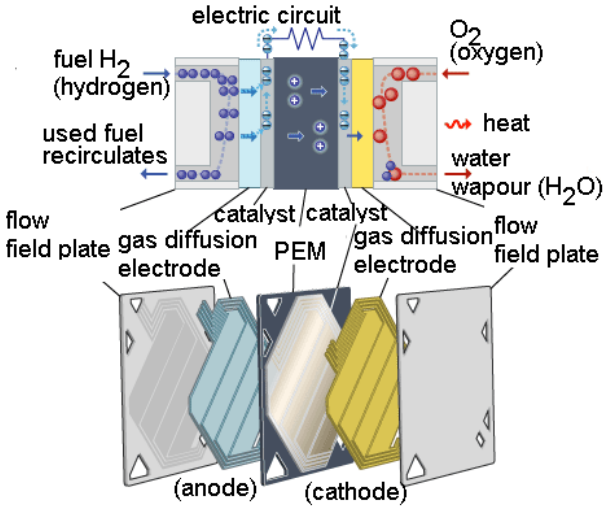


Fig. 2 The operation of fuel cell with PEM membrane [2].

In steady mode of flight is expected to use energy of the fuel cell. For extreme operating modes, eg. start of the aircraft and other difficult modes will be necessary to use electric traction power of fuel cell together with the energy of lithium-ion batteries.

Fig. 3 Fuel cell system with PEM membrane for mobile applications [3].

3. CONTROL OF HYBRID ENERGY SYSTEM

Hybrid energy management system is based on knowledge of the future conditions, as provided by scheduled flying time and flying conditions. Therefore, they are not suitable for real-time control, but they still have an acknowledged importance as a basis of comparison for the evaluation of the quality of real-time control strategies. In this approach, often referred as “local optimization”.

Model is based on Lithium-Ion battery. Battery pack is to size on voltage - 400 volts and their capacity is 120Ah. Battery will put performance about 50 kW in the continuous terms (Fig. 4).

The model of fuel cell for simulation is a 650 cells, 400 Volts - direct current, with maximal peak power - 50 kW Proton Exchange Membrane (PEM) fuel cell stack. Weight of fuel cell engine system with battery pack is 270 kg and depends on hydrogen storage in hydrogen tank.

The model of hybrid energy source for aircraft is based on local optimization of dynamics loads with primary energy source – PEM fuel cell. Batteries are used to assist PEM fuel cell in the critical parts of dynamic loads during flying with peak power energy demand. The fuel cell and its power is design for charging battery pack, when battery power is on low level. This feature is provided by inverter (Fig. 4).

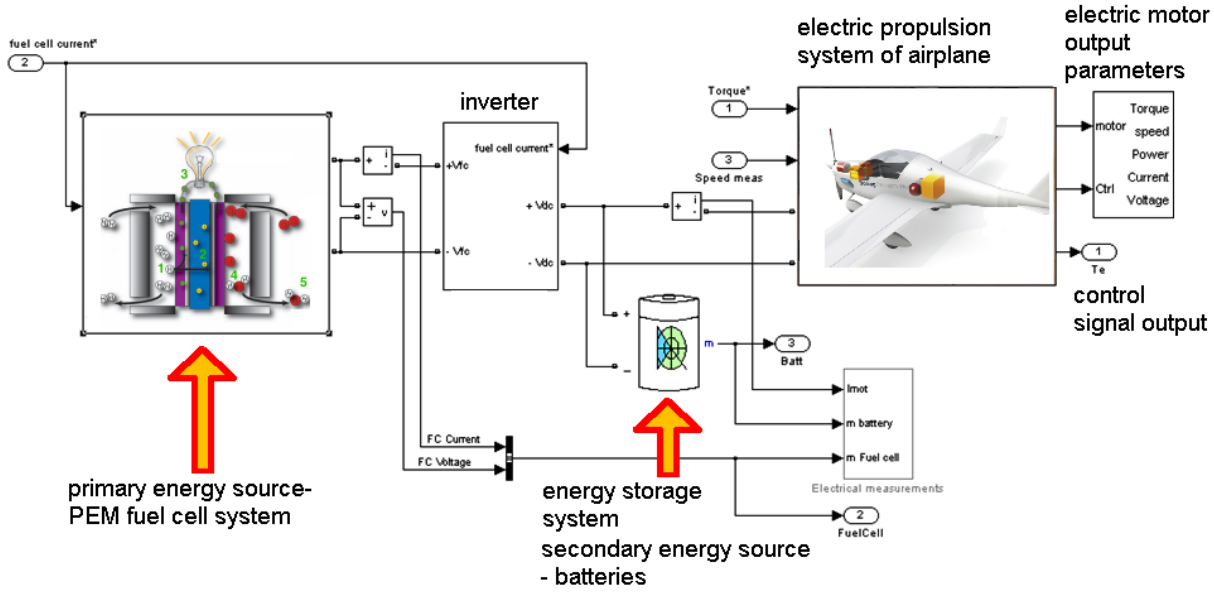


Fig. 4 Hybrid energy storage system (PEM fuel cell –battery) with aircraft propulsion system and control signal output in the simulation software Matlab/Simulink.

4. CONCLUSIONS & ACKNOWLEDGMENT

Fuel cell stack can operate only if provided with pressurized air and hydrogen and flushed with coolant. Practical fuel cell systems require additional equipment to regulate the gas and fluid streams, provide lubrication, operate auxiliary equipment, manage the electrical output and control the process. Some systems include reformers for fuel processing. All of this equipment introduces losses and reduces the total efficiency of the system from its theoretical ideal.

For a fuel cell power plant operating on pure hydrogen, an overall system efficiency breakdown at the output of the propeller is roughly 30 to 40 %. Batteries have electrochemical efficiencies comparable to fuel cells.

More difficult to quantify is the effect of overall system weight. Fuel cell systems including fuel storage are heavier than small internal combustion engine systems. Batteries as a means of power storage are heavier than fuel cells although this is offset somewhat by the elimination of other components.

Work presented energy management model of fuel cell vehicle model with battery storage system which can predict the effect of sizing parameters on the system efficiency characteristics, overall efficiency of fuel cell system.

The combined optimization results show that the optimality lies in:

- increasing degree of hybridization and
- employing corresponding control strategy of hybrid energy system in military applications.

If fuel cell and battery applications go into production in the near future in aircraft systems, their degree of hybridization and design of energy management strategy will significantly impact on the operational time, combat deployment time, vehicle equipment costs of fuel cells, batteries and aircraft weight.

This work was supported by the Ministry of Defence of the Slovak Republic under contract No. SEOP – 17 – 21 / 2011 – OdPP.

REFERENCES

1.http://www.flightglobal.com/news/articles/boeing-phantom-works-to-fly-all-electric- light-aircraft-213060/
2. http://m.eb.com/assembly/100899
3.http://www.h2fcfair.com/hm09/images/exhibitors/proton-motor001.jpg
4. Kono, K.: Implementing Agreement IEA Advanced Fuel Cells. Annual Report 2002
5. Fuel Cell Handbook. Virginia. Nov. 2004

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

ARM DEVELOPMENT KIT FOR DATA COMMUNICATION

Tomas MAZUREK*, Zbynek BURES*, Petr KUNETA**

*Department of Communication and Information Systems, University of Defence, Brno, Czech Republic
**MESIT pristroje spol. s r. o., Uherske Hradiste, Czech Republic

Abstract: *The paper deals with the project whose aim was to create new development kit with 32-bit ARM microprocessor. Kit is intended as a learning tool as well as a development platform to design simple or highly complex applications. The biggest advantage of presented kit is the ability to use any microprocessor pin because all input/output pins of microprocessor and pins of AD/DA converters are carried out into two stacking pin connectors, though which our kit can be connected for example to a universal PCB. This development kit offers great level of flexibility - by using of jumpers we can switch operating modes of microprocessor, connect/disconnect the real-time clock, peripherals, etc.*

Keywords: *32-bit, ARM, Cortex-M3, Data Communication, Development Kit, LPC17xx, Microprocessor.*

1. INTRODUCTION

In the last few years the development of electronics has been greatly increased. Mainly using of microprocessor technology, micro-electro-mechanical systems, smart sensors, signal processing, nanotechnology, and special integrated circuits have come into prominence.

Electronics are now appearing in various fields of human activities. Electronic systems can be found in homes, in the automotive industry, engineering, agriculture, health and electronics had to undoubtedly penetrate into the most advanced military applications.

Nowadays, microprocessors (processors, microcontrollers, CPU, etc.) are part of almost every non-trivial electrical equipment from the radios, through kitchen appliances and mobile phones to a central units in passenger cars. Microprocessors themselves have almost no value, perhaps only the cost. The value comes up in the conjunction with a program that breathes life into them.

It used to be usual that at previous microprocessor series each manufacturer had a different type of core which caused a problem when the developer or programmer had to change the manufacturer of used microprocessor. Such change means that the programmer must learn to think in terms of the new core literally from the beginning and start writing programs that are optimal for that new core. Many problems occur when the original programs are written in assembly language. In this case, there is usually no other way than to manually rewrite the most important parts of the programs. If programs were established for many years, this problem is usually key issue which significantly affects the choice of a new microprocessor.

One of the first microprocessor which overcame this drawback was legendary 8-bit 8051 from Intel. It achieved great popularity and due to the promotion by manufacturers it

is still in use. It has been produced by a number of leading international manufacturers such as Philips, Siemens and Dallas Semiconductor. All these manufacturers have different processors with different parameters, peripherals and performance, but they have compatible core. It means that programs written for one processor can be also simply used for the processors from other vendors. However, this core is already obsolete.

High demands on numerical performance led primarily to an increase in clock frequency. Increasing of frequency above 100 MHz brings substantial price increases, and therefore the manufacturers were looking for better ways to significantly improve performance. One way to increase processor performance is to increase the word size with which microprocessors work. Therefore they put on the market 16-bit microprocessors and then 32-bit microprocessors.

At first it looked like at all other microprocessor series where each manufacturer has a different type of core. It was a matter of time until someone brings a unifying element into the field. And that company was ACORN with its core marked ARM7TDMI. Due to the appropriate licensing policy this company has made significant expansion of its core, which can be used by many microprocessor manufacturers around the world such as NXP, ST Microelectronics and Atmel.

ACORN is not a company producing microprocessors. The company is focused on the development of types of cores, and it then offers them to other manufacturers, which according to their needs to the core add additional peripherals, improvements etc. and produce them. Especially for smaller manufacturers it is vitally important because they cannot dictate terms and force using of own processor core, which cannot be used for standard written source codes. The company developed the core marked ARM (Advanced RISC Machines). According to the computing power, consumption and the other parameters ACORN designed several ARM cores (Sadasivan, 2006).

2. NEW DEVELOPMENT KIT - ARGUMENTS AND REQUIREMENTS

2.1 Arguments about new development kit. Today's microprocessors have a JTAG interface, which, among other things, allows us to "control" the microprocessor so it is a possible way to debug software on a microprocessor without expensive hardware emulator. However, the interface itself may not be enough for novice users; so many manufacturers directly offer development boards for familiarization with their microprocessors. These development boards do not usually have any free pins of microprocessor, so their usage for learning purposes or development of new devices is very limited. Presented development kit removes this defect, along with other improvements and modifications.

With this kit a novice user has a chance to start immediately familiarizing with the microprocessor instruction set and style as well as writing programs. User does not have to create any testing board with microprocessor and detect whether the first draft of his construction with a new microprocessor works correctly or not. On the other hand, for the advanced user this development kit represents a powerful tool for the development of highly complex devices and applications.

2.2 General requirements for new development kit. The aim is to offer a universal kit which would be suitable for teaching purposes and familiarization with the features of microprocessors, as well as for the development of more demanding applications, such as using RTOS (Real-Time Operating System) and other advanced features.

The development kit should contain the most modern communication and other elements, or it should be prepared for their additional installation and usage at least. Also a stabilized DC voltage source should be a part of the designed board. Of course, it is necessary that the board must be equipped with several communication buses like I^2C, SPI, CAN, UART, Ethernet, CAN, RS-232, RS-485, USB, audio in/out etc. Some

configurable buttons, LEDs or even a slot for SD card etc. could be placed on the top of the board. The board should also include several configuration pins through which we can choose different wiring configurations, switch operating modes of microprocessor or connect/disconnect the real-time clock, peripherals and so on. It is also appropriate to connect various sensors (temperature, pressure, etc.). JTAG (TRACE) interface should be used as a programming and debugging interface.

3. New DEVELOPMENT KIT - DESCRIPTION

3.1 Used microprocessor and its architecture. The designed development kit uses 32-bit ARM processor from Cortex-M3 series, namely LPC1766 from the manufacturer NXP Semiconductors. Cortex-M3 processor was developed as a modern replacement of the older type ARM7TDMI. Cortex processor family is built on the ARMv7 architecture and it represents one of the most powerful series of processors for embedded systems. Probably the most popular representative of the Cortex architecture is Cortex-M3. It is suitable as a core for high-performance 32-bit microprocessors. To compare with older ARM7TDMI architecture it provides significantly higher performance (1.25 DMIPS/MHz), a simpler programming model and a smaller consumption due to the deployment of new technologies, signal processing and power management (NXP, 2010).

As was written, NXP LPC17xx family of microprocessors is built on a 32-bit ARM Cortex-M3 core. These microprocessors are able to operate at maximum frequency 100 MHz and have two wait states. The core works with three levels of the pipeline. For the program is available up to 256 kB flash memory. There is a large number of peripherals such as 100 Mbit Ethernet, JTAG, USART, SPI, I^2C, USB Full Speed, CAN, RS-232, RS-485, RTC, 12-bit A/D and 10-bit D/A converters, four 32-bit counter/timer, the unit generating PWM and up to 100 general input/output pins with the possibility of generating interruption from 70 of them (Olimex, 2009).

3.2 Description of the development kit. The basic building block of the presented development kit is microprocessor NXP LPC1766. This powerful microprocessor supports various communication interfaces (mentioned in the previous chapter) which are incorporated into the board with appropriated supporting elements. On the board are also available pins for audio output, LCD display, power supply and so on. This enables multiple use of the development kit in a wide range of applications.

As mentioned before, microprocessor directly integrates on the chip a complete communication blocks and also programming/debugging interface ISP or JTAG (TRACE). All these interfaces are available either directly through the appropriate connector, pin connectors carried out on top of the board (see Fig. 1) or through two stacking pin connectors located on the bottom of the board (see Fig. 2). In addition, the board is also equipped with onboard level converter and basic communication UART interface pins are available as a RS-232 port connector D-Sub 9F (female type of connector allowing direct connection with either a PC or even USB/RS232 converter without the usage of crossover cables). The other special incorporated connectors serve for Ethernet,

USB communication and for SD/MMC card (see Fig. 1).

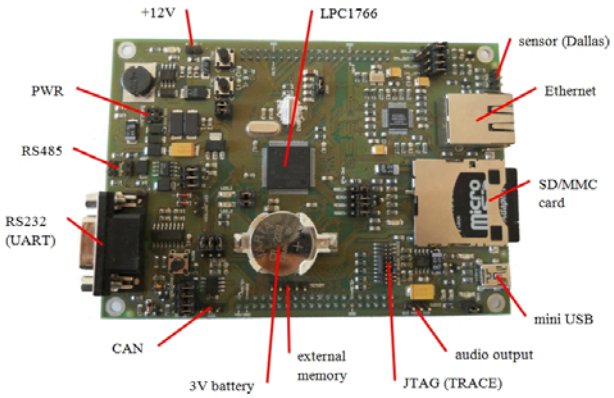


Fig. 1. Blocks of the development kit (top side)

Some signals of other communication interfaces are also available on configuration jumpers. By their removal/involvement is possible to ensure disconnection/connection or the user configuration of these communication interfaces. It means that almost every input/output pins of microprocessor are easily available, so the integrated functions can be used outside of the development kit board, which represents the biggest advantage of presented development kit and it fulfills all the requirements.

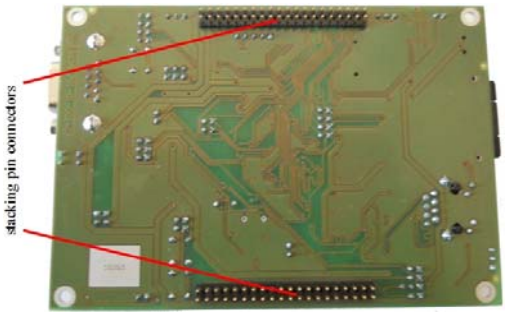


Fig. 2. Stacking pin connectors of the development kit (bottom side)

4. CONCLUSIONS & ACKNOWLEDGMENT

The development kit was primary designed as a tool to become familiar with the issue of 32-bit ARM microprocessors. Kit enables development of software and hardware for a subset of the Cortex-M3 microprocessor architecture. It can be used both for teaching and demonstration of the capabilities of microprocessor as well as for the design of simple or highly complex applications. The biggest advantage of presented board is the ability to use every pin of CPU, because all input/output pins and pins of AD/DA converters are carried out into two stacking pin connectors. This kit can be easily connected to a universal PCB. To start a new application is only needed to connect the supply voltage (through mini USB connector - directly from a computer or an external voltage supply), JTAG programmer and a development environment.

With this kit users can start to develop embedded systems for a wide range of applications taking advantage of the support from numerous communities associated with ARM microprocessors.

This paper was prepared as a part of the research project at the Department of Communication and Information Systems at the University of Defence and in cooperation with the company MESIT pristroje spol. s r.o. In addition, the project also includes the design and construction of a suitable JTAG programmer, including the reduction to the TRACE interface. Further, the complete product documentation for all parts of this project was created and prototypes were made. The software support for each peripheral of the development kit was also created, including practical examples.

BIBLIOGRAPHY

1. NXP. (2010). LPC1769/68/67/66/65/64/63 Datasheet. [online]. Available: http://www.nxp.com [16/03/2012].
2. NXP. (2010). LPC17xx User manual. [online]. Available: http://www.nxp.com [16/03/2012].
3. Olimex. (2009). LPC1766-STK development board. [online]. Available: http://www.olimex.com [16/03/2012].
4. Sadasivan, S. (2006). An Introduction to the ARM Cortex-M3 Processor. [online]. Available: http://www.arm.com [16/03/2012].

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

SUPERCAPACITORS, A BATTERY REPLACEMENT

Constantin Daniel OANCEA

Faculty of Electrical Engineering, "Politehnica" University of Bucharest, Bucharest, Romania

Abstract: *Finding alternatives to current energy storage solutions is related to weight reduction, increase the lifetime of the devices and reduce environmental impact. Supercapacitor can be an alternative but must take in consideration some aspects. For example, even if, there are no problem with current limiting to charge or discharge (it is a perfect solution for high power transfer in a small time interval), must stabilize the output voltage.*

Keywords: *supercapacitor, buck-boost converter, charge and discharge.*

1. INTRODUCTION

In clasical energy storage systems, usually are used battery (lead-acid, Li-ion, Ni.Cd, etc.). There are some disadvantages of using this type of battery: adverse impact on the environment, short life service (1000-1500 charge and discharge), weight, need to maintain the level of charge (if discharge below a certain limit is possible to deteriorate). Figure 1 present an example of using battery in a photovoltaic (PV) panels system (Oancea, Naumof, Nedelcu, Ciulinaru, 2009:485-489).

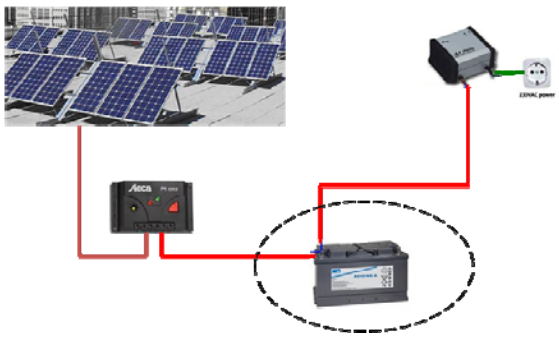


Fig. 1. Placement of battery in a PV system

One solution is to use *supercapacitors* with alternative names: pseudocapacitors, electrochemical double layer capacitors (EDLCs electrochemical double-layer capacitors) or ultracapacitor.

Instead two electrodes separated by a substance like conventional dielectric capacitors have, these capacitors use electrodes which are two layers of the same substrate and their electrical property called electric double layer leads to effective separation of duties in spite of nanoscale separation between layers. The very small distance between layers and the presence of a electrochemical double-layer allows the electrodes to have a much larger area, resulting in large capacities. The main component is carbon.

This work follows an assessment of how to replace of existing storage systems with *supercapacitor* systems, which have primarily benefit a longer use of a higher discharge power.

Because of very large capacity, will develop a method for measuring it. It is important to be able to know capacity

precisely because of energy storage, depending of it. Another problem is to analyse how to get a constant voltage from a significant variable voltage across the *supercapacitor*. Applications that can use *supercapacitors*, apart of photovoltaic systems are: aerospace (supply emergency equipment), transport (directly or hybrid; Capa Vehicle, diesel-electric systems, fast braking energy storage), applications in which a rapid charge and discharge energy, defense industry.

2. SUPERCAPACITOR

For *supercapacitors*, current energy density is about 30 W·h/kg and recent research provides a 60 W·h/kg shortly. Other sources provide a perspective of energy density about 400 W·h/kg.

For comparison, conventional lead-acid batteries typically store 30 to 40 W·h/kg and lithium-ion about 160 W·h/kg.

The main advantages of *supercapacitor* are: long life (more than 300000 charging and discharging, but the *supercapacitor* can aging by environmental conditions), good reversibility, high rates of discharge / charge, very low internal resistance, high efficiency (more 90%), high power output, it is safe, possibility of use in remote locations (no maintenance), simple loading methods, maintenance free operation. The discharge curve is a disadvantage (gradient is, initially, to high).

The *supercapacitor* voltage is confined to 2.5–2.7V. Voltages of 2.8V and higher are possible but they would reduce the service life.

Fig. 1. Example of supercapacitor battery (2x400/5F, 13.5V)

To achieve higher voltages, several *supercapacitors* are connected in series. This has disadvantages. Serial connection reduces the total capacitance, and strings of more than three *supercapacitors* require, theoretically, voltage balancing to prevent any cell from going into over-voltage. In practice, it was found that the difference between the capacitor voltages is less than 0.1V if the *supercapacitors* are from the same batch.

2.1 Principle of measurement. Block diagram of measurement system is presented in figure 2 (Oancea, Florescu, 2011:661-665). Central proccessing unit can be a computer system with multifunction board or a micontroller based system. The second option can increase the portability of equipment.

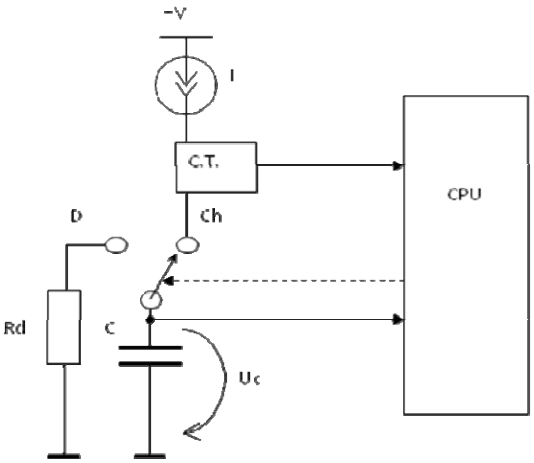


Fig. 2. Principle of operation

Main components are constant current supply (I) and command unit (which switch from charge to discharge the *supercapacitor*. To discharge was choose a simple resistor because the measurement is effective only on charging phase.

This schematic generates *supercapacitor* charge and discharge stages like in figure 3.

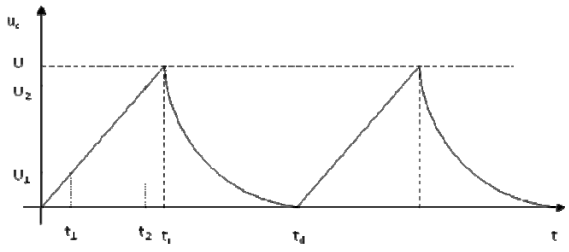


Fig. 3. Variation of supercapacitor voltage

$$C = \frac{\Delta Q}{\Delta U} = \frac{I \cdot \Delta t}{\Delta U} \quad (1)$$

Figure 4 is presented principle design of constant current source. The final schematics is more complex, to achieve better performances (Oancea, Oancea, 2002:32). Relation 2 and 3 present estimation of schematics parameters.

$$R_2 = \frac{R_1 \cdot I_1}{I_2} = \frac{R_1}{I_2} \cdot \frac{Vcc - V_{BE} - V_{CEsat}}{R_1 + R_3} \quad (2)$$

$$I_2 = \frac{R_1}{R_2} \cdot \frac{Vcc - V_{BE} - V_{CEsat}}{R_1 + R_3} \quad (3)$$

The schematic has disadvantages of high power dissipation per transistor and using PNP type bipolar power transistors. The solution is to use an NPN bipolar transistor scheme, cascodă assembly (increase stability).

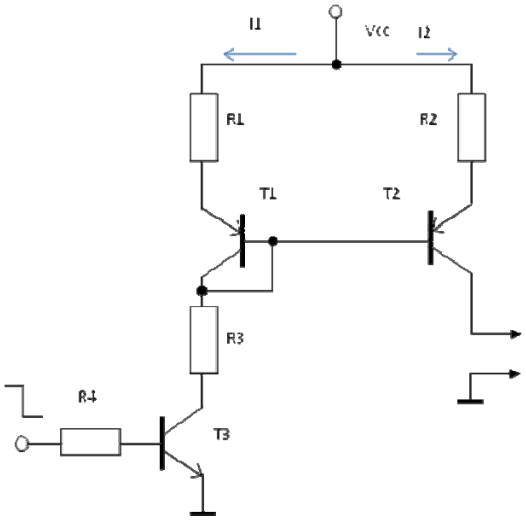


Fig. 4. Example of constant current supply

Example of quantities in this schematic are:

If we have Vcc = 12V, V_{BE} = 0.7V, V_{CEsat} = 0.2V, R1 = 270 ohms R3 = 430 ohms. Intermediar quantitie is I_1 = 0.0158 A = 15.8 mA. If impose I_2 = 1 A => R2 = 4.28 ohms.

The power dissipated in resistor $P_{R2}=R_2 \cdot I_2^2=4.28$ W. Maximum power dissipation per transistor P_{T2} has aproximately 7.72 W. The value of curents are not critical, important is to be steady in time (it is measured by a transducer). Figure 5 is the aspect of constant current supply.

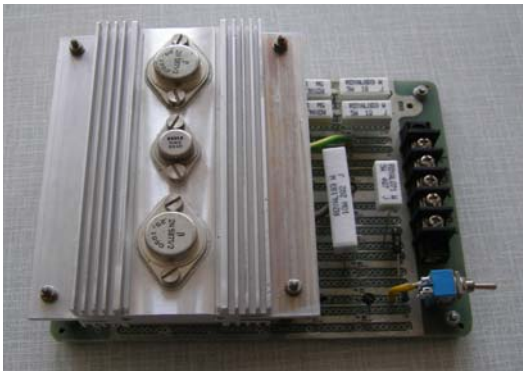


Fig. 5. Aspect of constant current supply module

To have a convenable way to use this principle of operation was develop software which works in conjunction with this hardware and an USB multifunction interface (Oancea, Oancea, 2002:61). The front panel of application is in figure 6.

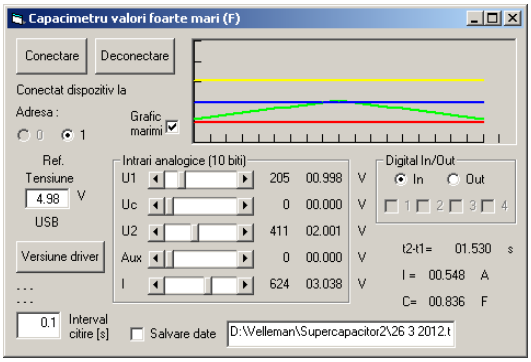


Fig. 6. Front panel of application

On front panel are displayed measured quantities and time evolution of them.

2.2 Constant output voltage. Need to provide a constant voltage and the fact that the supercapacitor voltage has important variation (Fig. 7), it is neccessary to use of a buck-boost type converter, Cúk or SEPIC (Single-Ended Primary-Inductor Converter). Choosing this type of converter, according with the operating principle, can provide an output voltage higher or lower than the input, have not restricted only achieve high efficiencies. In this case the interest is to obtain a constant output voltage when input voltage varies in large limits. When is necessary to have a constant output voltage, it is mandatory to have *supercapacitor* battery coupled with such a converter. Thus the solution chosen is to use the integrated converter with input voltage range as high is possible. An example which was study is MC 34063 (Nomad, 2001).

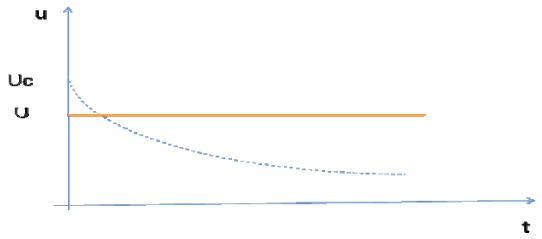


Fig. 7. Variation of output voltage of supercapacitor

One of were studied schematics is present in figure 8, and computed parameters are presented in table 1.

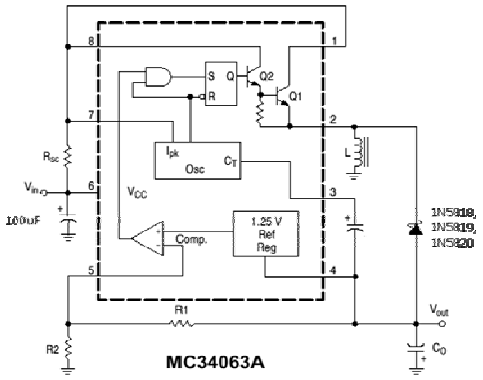


Fig. 8. Designing schematics of buck-boost converter

The values are for input voltage limits. To extend output capabilities it is possible to use a power transistor.

Table 1. Example of parameters computed

Vin=+5V, Vout=-12V	Vin=+14V, Vout=-12V
Ipk=2050 mA	Ipk=977 mA
Lmin=10 µH	Lmin=43 µH
R1=1.5k;R2=13k (12.08V)	R1=1.5k;R2=13k (12.08V)
Ct=202 pF	Ct=130 pF
Rsc=0.146 Ohm	Rsc=0.307 Ohm
Co=1134 µF	Co=732 µF

3. CONCLUSIONS & ACKNOWLEDGMENT

The *supercapacitor* can be an alternative to storage energy. Even its can be used in renewable energy systems or in automotive applications, *supercapacitors* are future competitors of classic battery. At the time of writing this paper, is not a problem to buy supercapacitors of 3000 F or more. The energy storage in *supercapacitor* is huge and is the best solution when is neccessary to transfer large energy in a short time.

The work has been funded by the Sectorial Operational Programme Human Resources Development 2007-2013 through the Financial Agreement POSDRU/89/1.5/S/62557.

REFERENCES

1. Oancea, C.D., Naumof, M., Nedelcu, A., Ciulinaru, L., Improvements on Data Acquisition Systems Performances, *International Review of Modelling and Simulations (IREMOS)*, vol. 2, n. 4, August, (2009).
2. Oancea, C.D., Oancea, C., *Computer Aided Measurements*, Bucharest, Printech Publishing House (2002).
3. Oancea, C.D., Florescu, A., Virtual Instrument to Evaluate Parameters of Photovoltaic Panels, *International Review on Computers and Software (IRECOS)*, vol. 6, n. 5, September, (2011).
4. Nomad Systems MC34063A design tool. *http://www.nomad.ee/micros/mc34063a/*. [online]. Available: http://www.nomad.ee (2001).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

ENERGY POTENTIAL EVALUATION FOR A WIND TURBINE USED FOR PUMPING

Vasile RACHIER

* Energy Faculty, Technical University of Moldova, Chisinau, Moldova

Abstract: *Strong growth of the role of renewable sources in global energy systems has served as the basic reason for the development of methodologies for determining and predicting the energy content, for one or another area, to increase the accuracy and confidence of investors. Precisely for this reason was started the development and implementation of various programs to calculate the wind power potential. Currently one of the most widely used programs in the world and especially in Europe, is Wind Atlas Analysis and Application Program (WAsP) developed by RISO, Denmark. The aim of this work is to determine wind energy potential in the actual location of a wind turbine integrated in a pumping system of a village and identify new location with a higher wind energy potential in the same zone radius using WAsP program. Also were determined: the wind rose, the amount of energy that can be produced in the old and the new site by a 10 kW wind turbine for a year based on data from a weather station nearby, were obtained maps of: annual energy production, power density, the average wind speed, Weibull A and k coefficients and altitudes.*

Keywords: *wind atlas, WAsP program, wind energy potential, wind turbine, weather station.*

1. INTRODUCTION

Once the idea came to integrate a wind turbine in pumping system of a village, arose the question, how much energy will produce this turbine in a year or the extent to which the turbine will supply electricity pumping system. The reply to this question and others such as calculating the average wind speed, power density, wind rose, probability density function of wind speed can be given by using the model developed by EU countries, known as WAsP (Wind Atlas Analysis and Application Programs) developed by RISO, Denmark - under which in the 80s of the last century was calculated the potential for wind energy of the 15 states from Europe and (made) Wind Atlas based on the theory of air currents was made [1].

High efficiency WAsP program, the optimum price / performance has led several countries in Central and Eastern Europe to use it, and to estimate wind energy potential, drawing their own atlas, like the European one.

That is why for the determination of wind energy potential for our site and to make a preliminary forecast we will use WAsP programs.

2. WAsP PROGRAM METHODOLOGY

WAsP methodology applied for calculating wind energy potential is based on four main blocks such as:

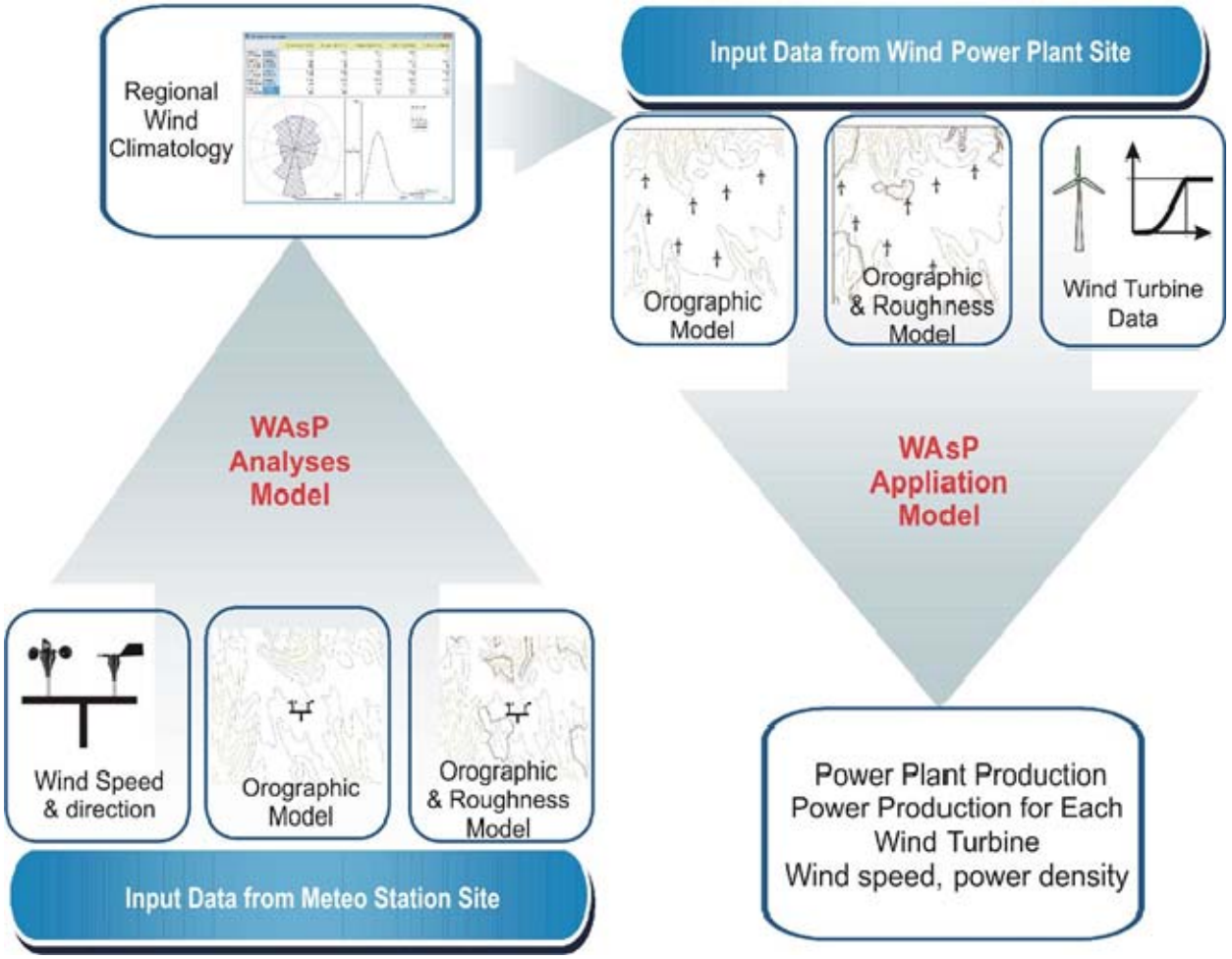


Figure 1. The schematic presentation of the wind atlas methodology of WAsP.

1. **Analysis of raw data**: This option enables an analysis of any time-series of wind measurements.
2. **Generation of wind atlas data**: Analyzed wind data can be converted into a wind atlas data set. In a wind atlas data set the wind observations have been "cleaned" with respect to site specific conditions and reduced to standard conditions.
3. **Wind climate estimation**: Using a wind atlas data set calculated by WAsP or one obtained from another source - eg the European Wind Atlas - the program can estimate the wind climate at any particular point by performing the inverse calculation as it is used to generate a wind atlas.
4. **Estimation of wind power potential**: The total energy content of the mean wind is calculated by WAsP. Furthermore, an estimate of the actual, yearly mean power production of a wind turbine can be obtained by providing WAsP with the power curve of the turbine in question.

In Figure 1 is a schematic presentation of the wind atlas methodology of WAsP. The program contains an analysis and an application part which may be summarized in the following way:

Analysis (↑): time-series of wind speeds and directions →wind statistics;
Wind statistics + site description→ wind atlas data.

Application (↓): wind atlas data + site description → estimated wind climate;
Estimated wind climate + power curve → estimated power production.

To calculate the electricity production of wind turbine or wind farm should be taken into consideration the following steps: first you need to create digital map by using the WAsP Map Editor 9, then create wind atlas by using the OWC Wizard option or WAsP Analyst Climate using raw data from weather station and also we need to build turbines feature by using the WAsP Turbine Editor. (Will be developed further describe each part including obtaining WAsP program entirely). Further descriptions will be developed for each part, entirely obtaining WAsP program.

2.1 Using the Map Editor. Map Editor option is used broadly in order to build a map format which would allow its use in calculations like power, power density, wind speed and other parameters of importance for wind applications.

Special attention should be drawn to Dead-Ends, Cross Points, LFR-Errors cells, especially after loading the map in this program and introducing roughness and orography these values must be zero otherwise the map will not be understood by WAsP program.

How is the orography presented?

- Orography is represented by height contour lines as on a paper map Figure 2.
- Each contour has the elevation above mean sea level as attribute.
- Each contour is represented by a number of points: connected line segments or polygons.

How roughness is presented, Figure 3?

- Roughness is represented by roughness-change-line;
- Each line has a pair of right- and left-hand roughness lengths (m) as attributes;
- Roughness change lines are also represented by a number of points.

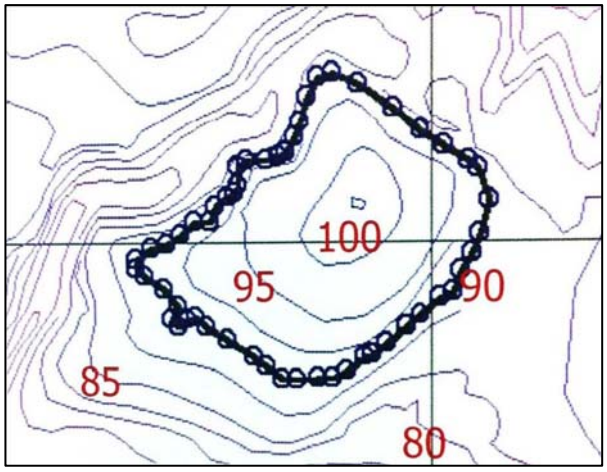


Figure 2. Representation of orography in the Map Editor

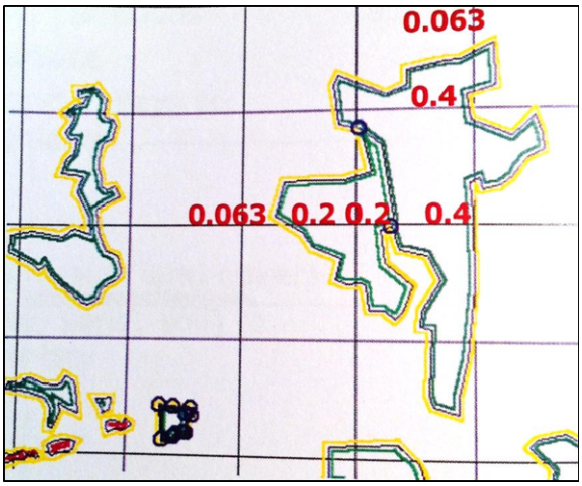


Figure 3. Representation of roughness in the Map Editor

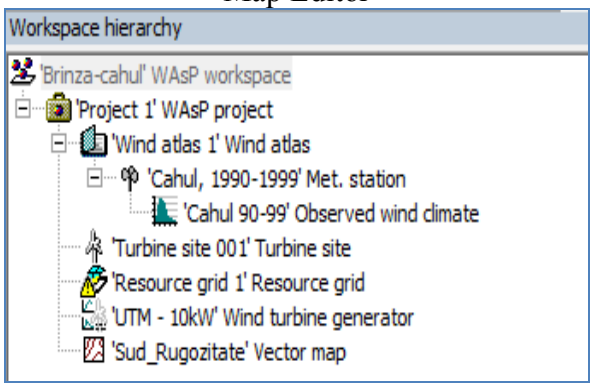


Figure 4. How to locate the map in the WAsP program

Next will be shown how to insert a folder in WAsP

- A folder is numbered as a member of the WAsP program in any of the following items, can be seen in Figure 4.
- It is possible to use one or more maps.
- It is possible not to use maps.

2.2 Using OWC Wizard and create wind climate. When you calculate the wind atlas based on meteorological data of a site WAsP program cannot use these data directly from the measuring device, but needs a certain format of the data. WAsP supported format can be obtained by processing data in OWC Wizard program or WAsP Climate Analyst.

OWC Wizard program is intended to create wind climate observation files *. tab, which would include wind speed and direction, based on raw data obtained from station observations, by turning them into data tables. In addition to this the program creates data in a format understood by WAsP, also has the trim function allowing the necessary data to remove or introduce some data sets, allows adjustment linearized.

2.2 Using WAsP Turbine Editor and turbines modeling. To calculate the power that might produce a wind turbine on a site should be known the turbine characteristic. In addition we need to know in what form we should have this feature that can be read by the WAsP program. All these requirements can be achieved with additional program WAsP Turbine Editor.

This program allows modeling wind turbine of any type and any size. The WAsP Turbine Editor makes it easy to establish the power and thrust-curve file needed by WAsP for calculating wind turbine power production, as well as the wake loss if the turbine is situated in a wind farm. The Turbine Editor can read and convert old Park *.trb files to a valid WAsP *.pow format and is further capable of reading and writing the new *.wtg format.

3. THE OBTAINED RESULTS

We have built wind turbine features of the village Brînza Cahul using the WAsP Turbine Editor, based on known data. Format issued by this program is understood by WAsP.

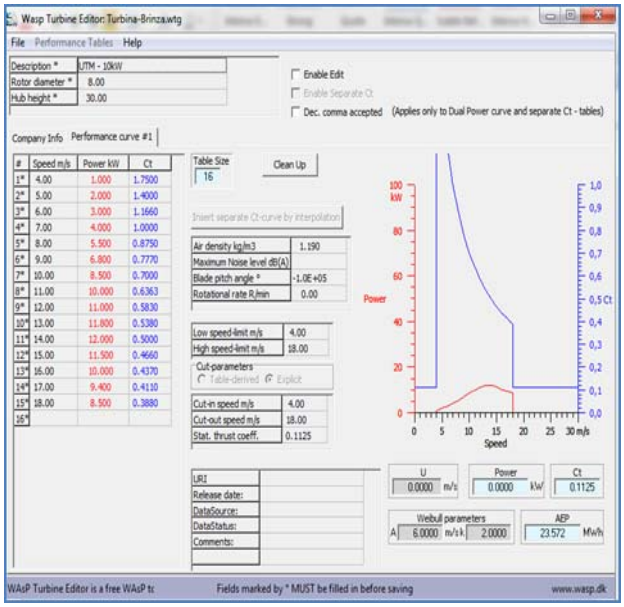


Figure 5. Wind turbine characteristic in WAsP Turbines Editor.

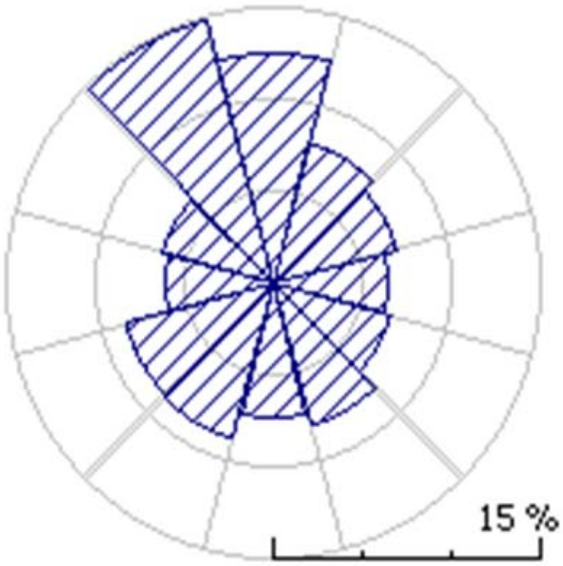


Figure 6. Wind rose for station Cahul

Using the OWC Wizard (observed wind climates) we got wind climate, which contains its speed and direction, based on raw data obtained from meteorological observation station. This program allows converting data obtained directly from measuring instruments or Microsoft Excel in an accessible format WAsP program. This program also allows the creation of a report on the processed data.

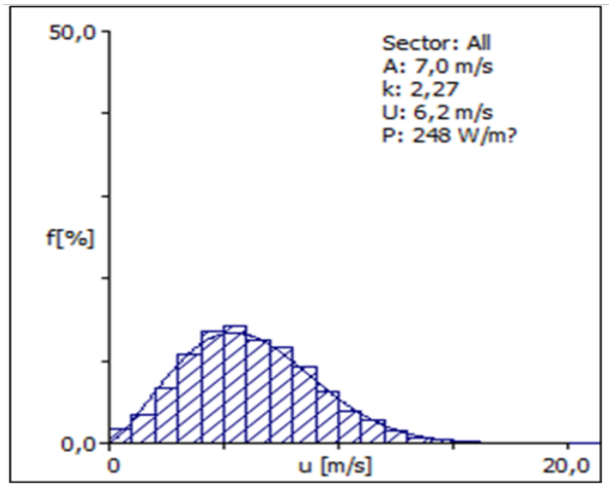


Figure 7.Weibull distribution for station Cahul

To enter the village Brînza roughness on the map and bring us a compatible format for WAsP we use WAsP Map Editor program.

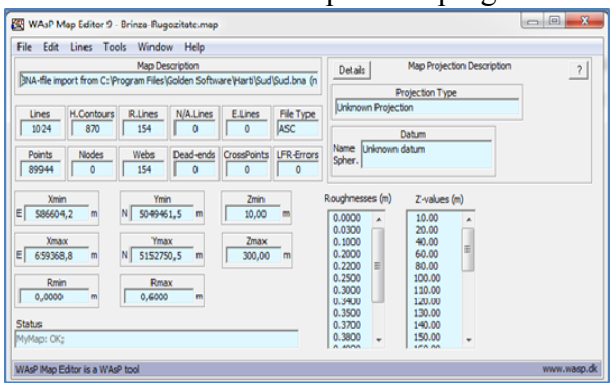


Figure 8. WAsP Map Editor program menu

Table 1 Amount of energy produced by wind turbine from village Brînza, every month during one year at 12 m height for the actual and new site.

Month	January	February	March	April	May	June	Julie	August	September	October	November	December	Annual
The amount of energy produced for the actual site, kWh	558,254	980,69	1022,75	1243,76	743,15	565,643	305,07	302,248	557,342	503,559	585,698	1135,45	9044
The amount of energy produced for the new site, kWh	562,41	1141,1	1141,3	1514,2	1104,6	1039,4	814,66	1057,1	924	606,4	1141,8	1270,9	14089

Table 2 Amount of energy produced by wind turbine for the actual and new location for a period of one year, at different heights.

Height	12	20	30	40
The amount of energy produced for the actual site, MWh	9,044	12,905	16,811	20,08
The amount of energy produced for the new site, MWh	14,09	17,93	21,06	23,8

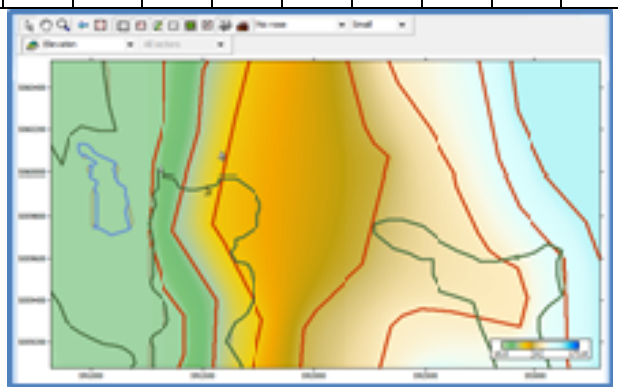


Figure 9. Map geographic height

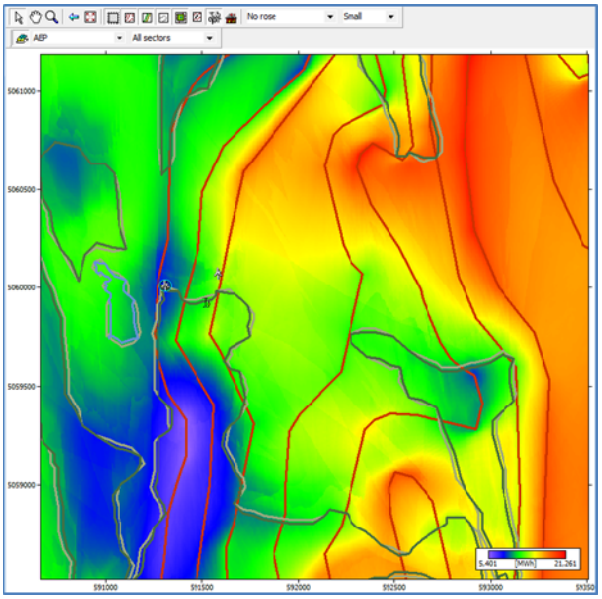


Figure 10. Annual electricity production map

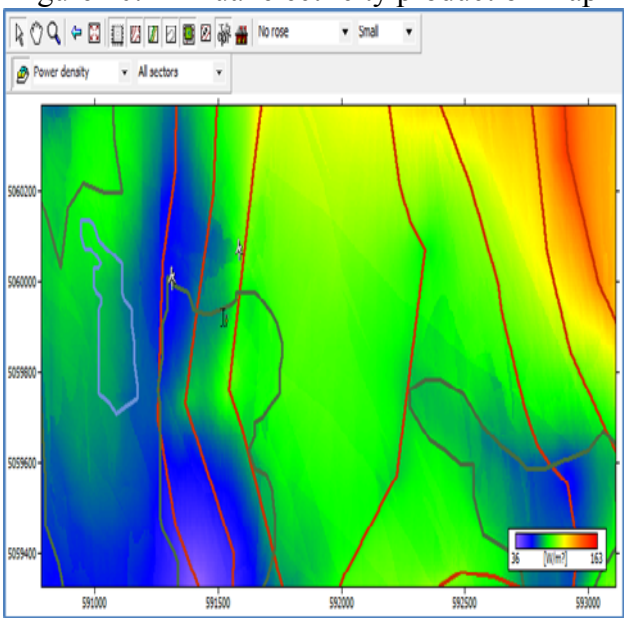


Figure 11. Power density map

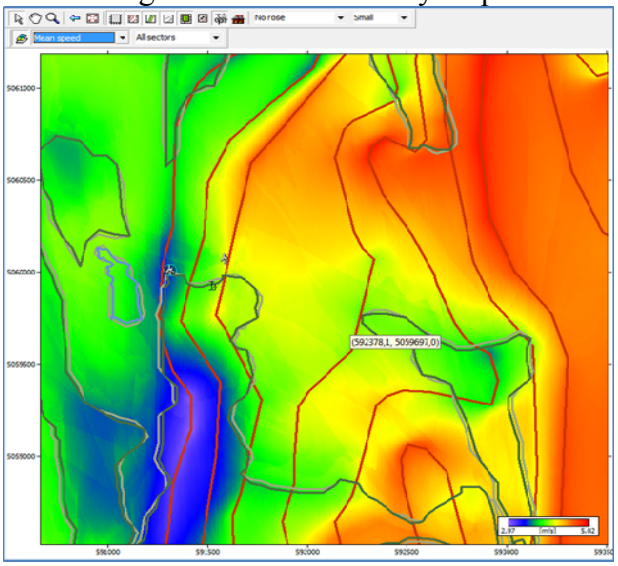


Figure 12. Average wind speed map

4. CONCLUSIONS

Theoretical and experimental investigations reveal the following conclusions:

a) Statistical data showed that Republic of Moldova has a wind energy potential that could cover to some extent energy requirements of pumping system that supplies an isolated rural area or a consumer.

b) Using the WAsP program we obtained the following results:

1. Wind rose for wind turbine site;
2. Annual amount of energy produced by wind turbine;
   - For existing real location - 9044 kWh;
   - For a new site – 14089 kWh;
3. Map of annual production of electricity;
4. Power density map;
5. Average wind speed map;
6. Geographic heights map.

c) Was determined to what extent the energy produced by wind turbine cover the needs, obtaining:

- For actual real site - 36,42 %;
- For a new site - 56,75 %;

ACKNOWLEDGEMENT

The work has been performed with the financial support of the Supreme Council for Science and Technological Development, project "Wind Energy Resource Atlas of Moldova"

REFERENCES

1. Troen, I. and E. L. Petersen, European Wind Atlas, Ris0 National Laboratory, Roskilde, Denmark 1989.
2. N. G. Mortensen, L. Landberg, I. Troen and E. L. Petersen, Wind Atlas Analysis and Application Program (WAPP). Vol. 2: User's Guide, Ris0-I- 666(v.2)(EN), Ris0 National Laboratory, Roskilde, Denmark 1993.
3. I. Bostan, V. Dulgheru, I. Sobor, V. Bostan, A. Sochirean. Sisteme de conversie a energiilor regenerabile. Editura "TEHNICA-INFO".Chişinău,- 2007, 592 p.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

THE PROCESSES USED IN PROTECTION OF SYNCHRONOUS GENERATORS IN NAVAL ELECTRICAL NETWORKS

Serghei RADU *, Gheorghe SAMOILESCU **

*"Barklav", Constanta, Romania, ** "Mircea cel Batran" Naval Academy, Constanta, Romania

Abstract: *The paper presents the possibilities of synchronous generators protection from electro-energetic naval system. These four processes are analyzed: differential-longitudinal protection; protection against rotor short circuits; maximal protection with current cutting; protection through reactance coils. Specific conditions are analyzed on board a ship, any defects that occur to a synchronous generator and ways to reduce their effects.*

Keywords: *synchronous generator, short circuit, protection, reactance coils, relay, transformer*

1. INTRODUCTION

Essential feature of electric plants on ships is complexity. Each ship should have its own source of electricity. On the ship there are an electric distribution network, power consumers of the most diverse types, lighting installations, electric heaters, radio-communication equipment, signaling and automation, various mechanisms and devices and other electrical installations with special designation (degaussing plant, cathodic protection installation, installation of radioactive detection, rolling stabilizing plant, and so on) [1,2,3].

Electrical installations of ships must have a big robustness and a greater running safety conditions in operation due to the climatic and technical conditions on-board and the fact that during the voyage the ship becomes an isolated system.[4,5]

Effect of listing and oscillations upon the ship is the appearance of strong supplementary shear forces as a result of the strong gyroscopic and components of the gravitational force. To minimize this effect, all the electric motors with horizontal shaft mount so that the shaft is parallel to the ship, because in contrast the tilting in the longitudinal plane is less than that in the transverse plane.

2. WAYS OF PROTECTION OF MARINE GENERATORS

Normal operation of a synchronous generator can be perturbed by inner defects or abnormal external network. Internal defects in particular are due to short circuits in the stator or rotor windings (des-excitation). Quick elimination of these defects is necessary in order to avoid destroying the generator by thermal effects of electro-dynamic currents short circuit [6,7,8,9,10,11,12].

Quick disconnection of the generator is carried out: by main switch; by reducing the induced electro-motor voltage in the stator; by reducing or interrupting excitation current; by rapid des-excitation switch in rotor circuit.

Longitudinal differential protection of a synchronous generator is based on comparing the meanings and values of the entry and exit currents of each phase of the generator.

Principle mono-line diagram of such protections is presented in Figure 1. In order to achieve that scheme synchronous generator grounding must be accessible, and the two current transformers TC_1 and TC_2 of each phase must have equal transforming reports and identical characteristics.

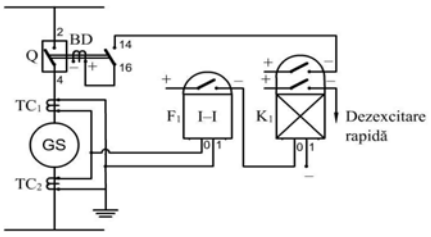


Fig. 1 Longitudinal differential protection and command of a synchronous generator
GS –synchronous generator; Q –switch; BD – release coil; K_1 –intermediate relay; TC_1, TC_2 –current transformers; F_1 –current differential relay.

In the event of a short circuit inside the generator secondary coil's currents of the two current transformers sums through maximum relay F_1, it acts and excite the intermediate relay K_1 those trigger main switch Q and des-excitation quick automat (A.D.R.). Diagram ensures a snapshot switch in case of a short circuit in the synchronous generator's stator windings.

The diagram for the protection against rotor short circuits of synchronous generators, Figure 2, includes a maximum current relay F_1, an intermediate relay K_1, a transformer T having one of secondary winding terminals connected to the ground and a capacitor C in order to separate the rotor DC circuit of an AC circuit bounded to the ground.

In case rotor winding grounding of synchronous generator GS, it closes the AC circuit consisting of the secondary side of the transformer T, maximal relay F_1, condenser C and Earth, which determine the switching of relay F_1. Through normally open contact of the relay F1 is that excites the intermediary relay K_1 through its contacts command triggering generator and rapid des-excitation of excitation coil.

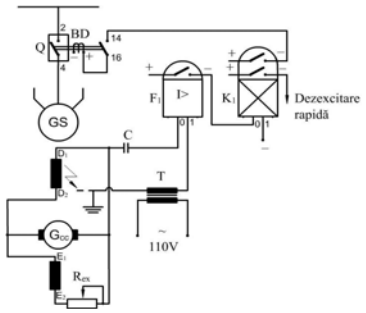


Fig. 2 Protection and command against rotor short circuits electric diagram
GS –synchronous generator; Q –switch; BD – release coil; Gcc –excitatrice; Rex – rheostat to adjust excitation; F_1 –maximum current relay; K_1 – intermediate relay; T – transformer; C – condenser.

Maximal protection with current cutting of a synchronous generator is used against multi-phased short circuits and external of generator overload. In Figure 3, is shown wiring diagram of a maximum protection with current cutting. Maximum current relays F_1 ...F_4 acts on the external short circuits and excite the time relay K_1T, which for reasons of protection selectivity has the largest timing from the system. Time relay K_1T excite intermediate relay K_2 only if previous protection (of networks and transformers) does not act, causing to trigger generator with adjusted timing.

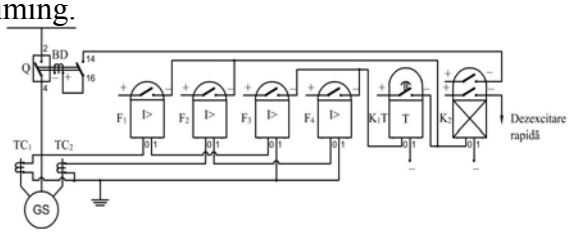


Fig. 3 The maximal protection and command wiring diagram with the current cutting of a synchronous generator
GS –synchronous generator; TC_1, TC_2 –current transformers; Q –switch; BD –release coil;
F_1 ...F_4 –maximum current relays;
K_1T – timing relay; K_2 –intermediate relay.

Violent short circuits are signaled by the maximum current relays F_1 and F_2 (set to a start value greater than of the maximum current relay F_3, F_4) causing instantaneous switching of K_2 relay which command

generator triggering from network and its rapid des-excitation. These relays provide so-called cutting intense short-circuit currents.

Protection of synchronous generators can be achieved through reactance coils. Reactance coils are appliances which serve to limit the short circuit currents in the electrical circuit of high power and to maintain voltage at the bars, in an emergency, to an acceptable level, which ensures the operation without interruption of unaffected consumers. Limiting value of short circuit currents is by installing the reactance coils at the collectors bars of power plants and also at the lines that goes from these bars, (placed as in Figure 4), which performed the suitable operation conditions for the most sensitive items of equipment in case of those breakdowns: cables (in terms of thermal stability), switches (in terms of power breaking), allowing the choice of equipment for lower values of short circuit current.

Reactance coil is a coil without iron core (in order to have a constant inductivity) under 35 kV voltages is accomplished in the air. Hardening windings against electro-dynamic forces can be done by partial coverage of it in concrete or epoxy resins.

For voltages exceeding 35 kV, reactance coils of exterior type, cooling medium is mineral oil contained inside a tank in which lies and a screen.

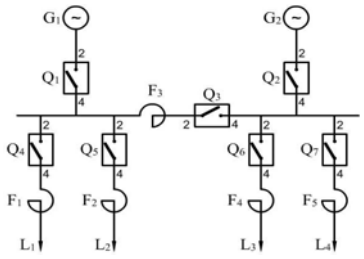


Fig. 4 Connection in the network of the reactance coils wiring diagram
F_1 ...F_5–reactance coils; Q_1 ...Q_7– switches;
G_1, G_2–synchronous generators.

Main parameter of reactance coil is bobbin reactance (X_r) whose main effect is the voltage drop on the coil. Percentage reactance (reported) X_r * [%] is an indicator of the current limitation possibilities and is usually (6-8)% for outgoing cables and (8-12)% for reactance coils designated for collectors bars.

To highlight the effect of reactance coil in protected circuit Figure 5, it was presented the voltage drop in a wire, at the nominal and in the short-circuit regimes. Note that the size of the voltage drop on the reactance coil in short-circuit regime, ensure the U_{rem} voltage with the value nearest with nominal and short-circuit current is limited.

Reactance coils, in air constructive model are without iron core and embedded in concrete. For embedding the current ways, made of aluminum or copper, 6-10 columns of concrete are used. Between the turns of the coil is let empty for cooling air access. Concrete coil is treated in order to not worsen the dielectric stiffness of coated insulation, after drying being covered by a non-hygroscopic varnish. The coils of the 3 phase can be installed both vertically and horizontally.

Disadvantages of reactance coils, usually recessed in the concrete are: complicated processing and drying technology as well as gross weight and dimensions.

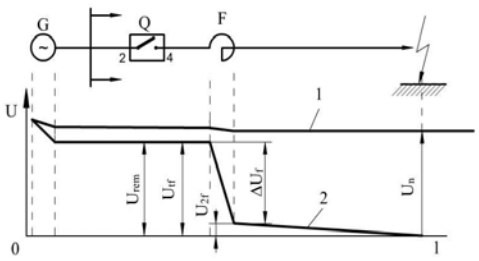


Fig. 5 The role of reactance coil in short circuit protection

At the reactance coils mounted in oil tank, measures must be taken to limit the magnetic flux through the tank walls to avoid as a result both the oil and the tank to be overheated. Because of this, inside the tank it is mounted a ring made of copper or aluminum, fixed on the walls of the tank.

Compensation is even better with the electric lower resistance of the screen

Conditions imposed by normative rules to reactance coils are: overvoltage must not produce grounding or breakdowns in coils; thermal and electrodynamics stability –to be high; voltage drops in normal running mode must not exceed (1–3)% of nominal voltage; loss of power at the coil to be between (0,2 – 0,5)% of the power passing through the coil.

3. CONCLUSIONS

The vast majority of defects are damaging of the insulation which leads to the appearance of short-circuits.

Short-circuit current of a large value impose to electrical equipment and consumers important thermal and electrodynamics effects and at the same time leads to an increase of tension drops on all impedances passed, causing a general voltage drop in the network.

Electrical protection equipment is designed to limit the effects of emergency (damaged) running mode to protect consumers, electrical equipment and electric generators. Protection devices must sense the appearance of an abnormal regime and to isolate the damaged area by means of commutation. In order to be effective protection must be fast, sensitive, selective and more reliable in operation.

REFERENCES

[1] Andrei, D. – *„Protecţia sistemelor electrice”*, Editura Matrisc Rom, Bucureşti, 1999.

[2] Barbu, M. – *„Exploatarea şi întreţinerea echipamentelor electrice de la bordul navelor”*, Editura Militară, Bucureşti, 1966.

[3] Delesega, I. – *„Aparate electrice”,* Editura Orizonturi Universitare, Timişoara, 1999.

[4] Hortopan, Gh. – *„Aparate electrice de comutaţie” vol I*, Editura Tehnică, Bucureşti, 2000.

[5] Ivaşcu, C. E. – *„Automatizarea şi protecţia sistemelor electroenergetice”*, Editura Orizonturi Universitare, Timişoara 1999.

[6] Leonte, T., Ivanov, T., Samoilescu, Gh. – *„Noţiuni fundamenale privind teoria aparatelor electrice navale”*, Editura Academiei Navale „Mircea cel Bătrân” Constanţa, 1996.

[7] Mircea, I. – *„Instalaţii şi echipamente electrice”*, Editura Didactică şi Pedagogică, Bucureşti, 2002.

[8] Moldovan, L. – *„Echipamente electrice”,* Editura Universităţii Tehnice Timişoara, Timişoara, 1994.

[9] Popescu, C. L. – *„Aparate electrice. Tehnici de încercare şi măsurare”,* Edituara ICPE, Bucureşti, 1998.

[10] Popescu, D., Sgârcea, V. – *„Echipamente pentru măsurarea şi controlul parametrilor de proces”,* Editura Elecra – ICPE, Bucureşti, 2002.

[11] Samoilescu, Gh., Leonte, T., Ivanov, T. – *„Construcţia şi funcţionarea aparatelor electrice navale”*, Editura Academiei Navale „Mircea cel Bătrân” Constanţa, 1998.

[12] Vasilievici, A., Andrea, P. – *„Aparate şi echipamente electrice”,* Editura Orizonturi Universitare, Timişoara, 2000

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

REACTIVE POWER DISTRIBUTION BETWEEN SYNCHRONOUS GENERATORS OF A SHIP

Gheorghe SAMOILESCU *, Serghei RADU **

*"Mircea cel Batran" Naval Academy, Constanta, Romania, ** "Barklav"Mar.Ag., Constanta, Romania

Abstract: *This paper explores the realization of uniform distribution of reactive power when synchronous generators run in parallel. It presents the role of voltage automatic regulators within the electro energetic naval system. It analyzes various situations in case of generator parallel running: when both equipment have the same or different voltages; when the excitation value of the generator is increased; when generator power is similar or different.*

This work aims to establish constructive solutions for technical equipment which is designed to provide a more complete automation of the engine compartment on board a vessel.

Keywords: *synchronous generators, reactive power, parallel running, excitation current, statism degree, auto voltage regulator, electro energetic naval plant*

1. INTRODUCTION

The following factors characterize the operation of a naval electrical equipment [1,2,8,9,10]:

- ship roll and pitch shall be determined depending on the weather;
- hull vibrations, whose values are determined by the number of blades and the frequency of rotation of the propeller;
- dynamic vibrations created by waves and ice;
- trim constants (longitudinal and athwart-ship) whose value is determined by the loading degree of the ship and compartment flooding;
- relative humidity on the vessel;
- petroleum vapors;
- water spashes, ice formation and solar radiation affecting the deck plants.

According to the international requirements in force all installations and systems that make up the electrical equipment of a ship are calculated with: a normal air humidity of 75%; temperature between - 25°C and + 35°C; athwart-ship inclination of up to 22.5° and longitudinal inclination of up to 5° or rolling up to 22.5°; pitching up to 10° from the vertical axis; vibrations with a frequency ranging from 5 to 30 Hz (with a magnitude of 5mm at 5 ~ 8Hz frequencies and $5m/s^2$ acceleration at frequencies from 8~30Hz); dynamic blows with $30m/s^2$ and frequency of 40 ~ 80 strokes per minute.

Naval electric power plants are designed for producing electric power and for conversion and distribution of electric energy.

Generators ensure electric energy aboard the ship. Transformers, rectifiers, inverters etc. are used as electric power converters.

The first phase of designing a naval power plant involves calculating the power required

by the consumers in different running regimes. The power consumed by a naval power plant depends on: the nominal power of the consumers; the number of consumers in operation; the running mode (cruise, maneuver, stopped with or without loading-discharging operations, damage condition, fire or flooding).

Depending on the total power factor (cos φ) of the chosen generators and electric motors, the ship's energy balance is calculated. Electric generators allow an overloading of 10% for up to two hours, 25% for 30 min and 50% for 5 min.

2. THE OPERATION OF THE TWO GENERATORS IN PARALLEL

For synchronous generators coupled in parallel, the active and reactive loads must be proportionally distributed according to their nominal power [35]. Because the winding reactance is much greater than its resistance, in case of a difference between the electro-motor voltages of the two generators, an equalization current with 90º angle of deviation from ΔE – the difference between the two electro-motor voltages - will appear between their secondary windings.

Consider two generators coupled in parallel with the electro-motor voltages E_1 and E_2, the currents I_1 and I_2, equal voltages $U_1 = U_2=U$, δ_1 and δ_2 the phase angle deviation between the voltages, Xd_1 and Xd_2 the synchronous reactance and ρ_1 and ρ_2 the phase angle deviation between currents. When coupling a load of a certain reactive power, if the external characteristic of the two generators does not have the same degree of droop as the system does, then there are no differences between E_1 and E_2 and $\Delta E=0$. considering two generating sets with E_1 and E_2 as total output voltages, $E_1>E_2$ and $\Delta E=E_1-E_2$, then this difference causes an equalization current between generators having a direction for a generator, I_{e1}, and a contrary direction for the second generator, I_{e2}. The active load distribution between the two generators is modified by changing the electro-motor voltage and the current equalization.

If, in the case of two generators running in parallel, the excitation current for one of the generators is increased, then it will charge with a reactive load. The connector voltage will stay constant and the other generator will discharge the same reactive load [1,3].

The change of the reactive load can be achieved manually or automatically by arousing the equalization circuit between the excitation windings of the two generators; or by the existence of the active power circuit or transducer of the two regulators. Theoretically, the reactive load distribution between coupled generators in parallel and whose external characteristics have degrees of droop of the system s_1 and s_2 can not be achieved.

At a U_N voltage, if an additional reactive load I_{gr} is coupled, the first generator will load with ΔI_{gr1} and second one with I_{gr2} so that:

$$\Delta I_g = \Delta I_{gr1} + \Delta I_{gr2} \tag{1}$$

By coupling a consumer, the voltage drops to U_1, where:

$$U_1 = U_N - \Delta U \tag{2}$$

Than:

$$\begin{aligned} tg\alpha_1 &= \frac{\Delta U}{\Delta I_{gr1}} = s_1 \\ tg\alpha_2 &= \frac{\Delta U}{\Delta I_{gr2}} = s_2 \end{aligned} \tag{3}$$

from where:

$$\begin{aligned} \Delta I_{gr1} &= \frac{\Delta U}{s_1} \\ \Delta I_{gr2} &= \frac{\Delta U}{s_2} \end{aligned} \tag{4}$$

generaly resulting:

$$\Delta U = \frac{\sum_{i=1}^{m} \Delta I_{gr1}}{\sum_{i=1}^{m} \frac{1}{s_i}} \tag{5}$$

Reactive load is distributed inversely proportional to the degree of droop of the characteristic.

For synchronous generators with same power, that run in parallel, in order to load them with the same reactive load, it is necessary that both have overlapping characteristics. If the generators are of different powers, their external characteristics should have such a degree of droop of the system that they will load with a reactive power proportional to the nominal power in the limits allowed by international naval registers which require an allocation of reactive power with a deviation of less than 10% of the nominal power of the largest generator.

Onboard the vessel each synchronous generator is equipped with an independent automatic voltage regulator system. In case of load variation from idle to the nominal load, with nominal power factor, the voltage will change between $U_N \pm$ 2.5% values.

For naval synchronous generators is allowed a variation of voltage not exceeding 3.5% if power factor (cos φ) takes values between 0.6 and 0.9, other than nominal.

3. THE ROLE OF AUTOMATIC VOLTAGE REGULATOR

Automatic voltage regulator accomplishes the following functions [3, 4, 6, 7]:

- limit the maximum value of generator voltage output;
- distribute evenly the reactive power between coupled generators in parallel;
- adjusts the excitation current value depending of active and reactive load;
- increases generators running stability in case of short circuit and so on.

Maintaining the generator's voltage constant at the load change is made by:

a) maintaining phase electro-motor voltage constant and modifying reactance of the connecting elements between the generator and the main distribution board with power factor and revolution constant;
b) modifying the phase electro-motor voltage on the reactance of the connecting elements between the generator and the main distribution board with power factor and revolution constant.

When a consumer is connected with a load of a certain value, the phase angle deviation between voltages, δ, will tend to a limited value in terms of the static stability, $\delta_{\lim} = \frac{\pi}{2}$. When the load changes with a certain value, the values for current and voltage increase, so the reactive power grows also.

The advantages of using the automatic voltage regulator onboard the vessels consist of:

- increasing the reserve stability;
- increasing dynamic growth stability;
- increasing the maximum power that can be produced in static running mod.

Automatic voltage regulator, through its component blocks: starting, supplying, control, ignition, interference suppressor, the equalization corrector and current limiter, allows the equipment on board a vessel to operate in the prescribed parameters.

If the reactive load has the tendency to grow (when generators run in parallel), at the main switchboard bars, along with the increase of the φ angle, the value of the resulting voltage proportionally increases. The automatic voltage regulator, by increasing the amount of signal applied at the entrance; issue a command to decrease excitation current value. With the aim of maintaining constant the coupled electric power, the droop of the system degree increases. Therefore, the

regulator ensures the stability of reactive power by increasing the droop of the system degree. A reactive load distribution between the generators that run in parallel, without a change in the level of droop of the system, can achieve if the primary of a transformer windings, of a voltage automatic regulator, are made of two halves connected in opposition and the circuit has an equalization switch.

4. CONCLUSIONS

Uniform distribution of the reactive power of synchronous generators connected in parallel, can be done by performing electrical connections which equalize the exciting currents, or by linking in parallel the output windings of the compensation transformers in case of systems with auto-excitation.

Automatic voltage regulator allows the stabilization of reactive power by increasing the degree of droop of the system. The equalization corrector of reactive power between two generators coupled in parallel introduces corrections to the control voltage of the ignition oscillator block. In case of incorrect adjustment of reactive power equalization on the two generators a equalization current appears. The fall of voltage, due to this current, will be added to the obtained signal. The excitation current will be corrected, so the automatic equalization of reactive power on the two generators will be achieved.

This paper presents the functional particularities of naval electric power systems containing a large diversity of consumers. The veracity of the methods used in the analysis of the processes taking place on board a vessel and the synthesis of parameters allows developing electric power plants that meet the required needs.

REFERENCES

[1.] Samoilescu Gheorghe –„Centrale electrice navale”, Ed. Leda & Muntenia, Constanta, 1999.

[2.] Samoilescu Gheorghe – „Perturbatiile electromagnetice ale sistemului electroenergetic naval”, Ed. Academiei Navale „Mircea cel Batran”, Constanta, 2000.

[3.] Samoilescu Gheorghe – „Exploatarea sistemelor electroenergetice navale”, Ed. Academiei Navale „Mircea cel Batran”, Constanta, 2004.

[4.] Nanu Dumitru – „Sisteme lectroenergetice navale”, Ed. Muntenia, Constanta, 2004.

[5.] Alf Kare Adnanes – „Maritime electrical instalations and Diesel electrical propulsion”, Oslo, ABB As, Marine, 2003.

[6.] Gheorghe Silviu, s.a. – „Masini si sisteme de actionari electrice navale”, Ed. Academiei Romane, Bucuresti, 2004.

[7.] Stefanescu Lucica – „Masini electrice”, Ed. Academiei Navale „Mircea cel Batran”, Constanta, 1995.

[8.] xxx Veritas.

[9.] xxx Loyd’s ship manager.

[10.] xxx Manualul ofiterului mecanic, Ed. Muntenia, Constanta, 1997.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

TIMING COMPUTING IN ASYNCHRONOUS DIGITAL AUTOMATA

Mihai TIMIS, Alexandru VALACHI

Technical University „Gh.Asachi" Iasi, Automatic Control
and Computer Science Faculty, Computer Science departament
mtims@cs.tuiasi.ro, avalachi@cs.tuiasi.ro

Abstract: *In present paper, the authors has proposed a new idea for synthesis of an asynchronous digital system, using locally clock method . Driving an asynchronous digital system is much complex than a synchronous one. The authors has proposed a new method for synthesis of an asynchronous digital system using Verilog HDL Hardware Description Language, and also, the implementation into FPGA (Field Programable Gate Arrays) devices, [1-4]. The proposed method presented in this paper has many features like: execution speed much better, maximize the combinational/sequential digital logic, maximize the design performances (speed, low power, size).The CK and the output signals must be free of logic hazard;The minimum propagation delay of CK signal through the digital combinational system must be greater than the maximum propagation delay for every logic circuit which implements the input/output signals. Once the CK signal is triggered it can be reseted without digital hazard. Using the improved design described above, the entire asynchronous digital system will work with work correctly.*

Keywords: *Digital logic, FSM, Verilog HDL, Transition Table, ModelSim, Timing computations.*

1. INTRODUCTION

Driving an asynchronous digital system is a such complex task instead synchronous systems. The authors propose a method for synthesis of the asynchronous digital systems using Verilog HDL, and implement them into a FPGA devices, [1,2,3]. The proposed method presented in this paper has many features like:

- execution speed much better;
- maximize the combinational/sequential digital logic
- maximize the design performances (speed, low power, size)

A such of system is presented in figure 1. It contains the combinational logic modules, D type latches, input signals named input1,input2...inputN, output signals named output1,output2.....outputM, state variables named s1,s2...sk. The combinational system which implements an internal drive in signal, it is used for control the states of the digital system, disposal the hazard phenomenon from the digital systems. The entire system transit into a new state driving by the input signals which need to be stabile a period of time before changed and by the present states of the system.

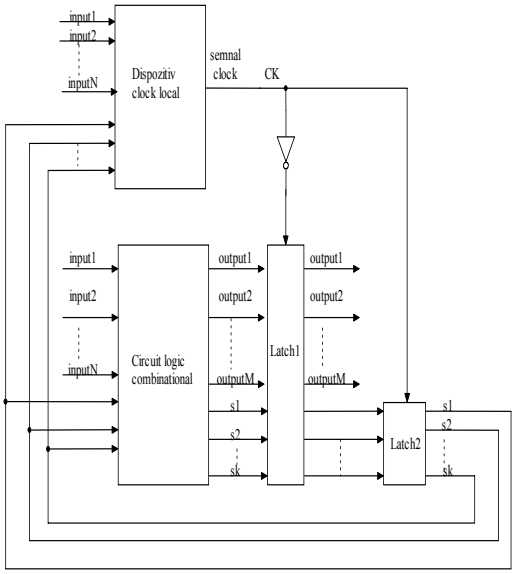


Fig.1. Digital Asynchronous System

In figure 1 it's shown the consist modules of the digital system:

- drive in signal device;
- combinational system who implements the system states equation ;
- D type latch1, latch2 are used to memorise the state of the system and also the outputs of the system;

The drive in signal (1) depends by the system's states notated with Q_i, input signals notated with X_j, where i=1,2,…n-1, j=1,2,…m-1; (n- states number variables, m-input number variables).

$$CK = F(Q_i, X_j) \qquad (1)$$

If signal CK=1 the system will go onto a new state, if CK=0 the system will stay in present state, it will can read the output values signals. While the states and outpus signals are computed, the input signals will not be changed, the system will work in fundamental mode.

2. DESIGN OF ASYNCHRONOUS DIGITAL SYSTEM WITH LOCALLY CLOCK METHOD

Let's consider an asynchronous digital system with functionality described by the fluence graph, figure 2:

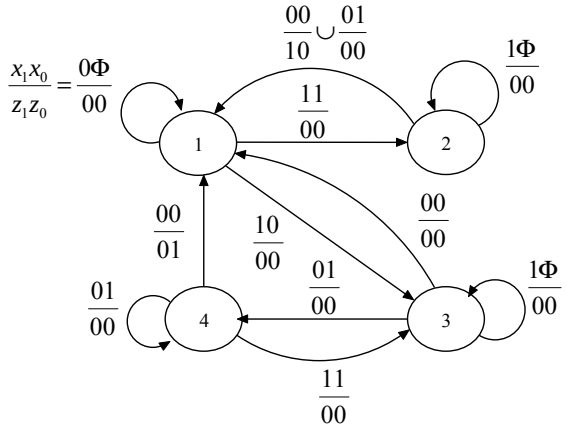


Figure 2. Graph table

The fluence table is described in figure 3.

Q_{n+1}/z_1z_0

$(x_1x_0)_n$ / Q_n	00	01	11	10
1	1/00	1/00	2/00	3/00
2	1/10	1/00	2/00	2/00
3	1/00	4/00	3/00	3/00
4	1/01	4/00	3/00	-/--

Fig.3. Fluence graph table

The equations are like, (2):

$$D_1 = y_{1,n+1} = [y_1(x_0 + x_1) + \overline{y_0}x_1\overline{x_0}]_n$$
$$D_0 = y_{0,n+1} = x_{1,n}$$
$$z_{1,n} = (\overline{y_1}y_0\overline{x_1}\overline{x_0})_n \qquad (2)$$
$$z_{0,n} = (y_1\overline{y_0}\overline{x_0})_n$$

The CK truth table is deducted from fig.3, like in fig.4:

y_1y_0 / $(x_1x_0)_n$	00	01	11	10
00	0	0	1	1
01	1	1	0	0
11	1	1	0	0
10	1	0	1	-

Fig. 4. CK truth table

Using the Veitch-Karnaugh, method it will compute the CK's equation (3):

$$CK = \overline{x_1}y_0 + x_1\overline{y_0} + \overline{x_0}y_1\overline{y_0} \qquad (3)$$

The D flip-flop circuits are described in fig.5:

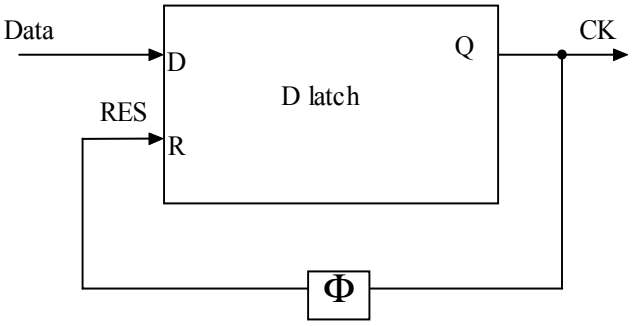


Fig.5. D flip-flop

z_1, z_0 - represents the outputs of the system
y_1, y_0 – represents the state of the system

The output signals z_1, z_0 and state signals y_1, y_0, has attached a D flil-flop latch. The D flip-flop latch1 stores the output signals while the latch2 stores the states signals. They are triggered on the positive clock signal – CK.
After a delay time, the CK signal is reseted who let the latch1 to be triggered.
The design of the proposed system is like in fig. 6.

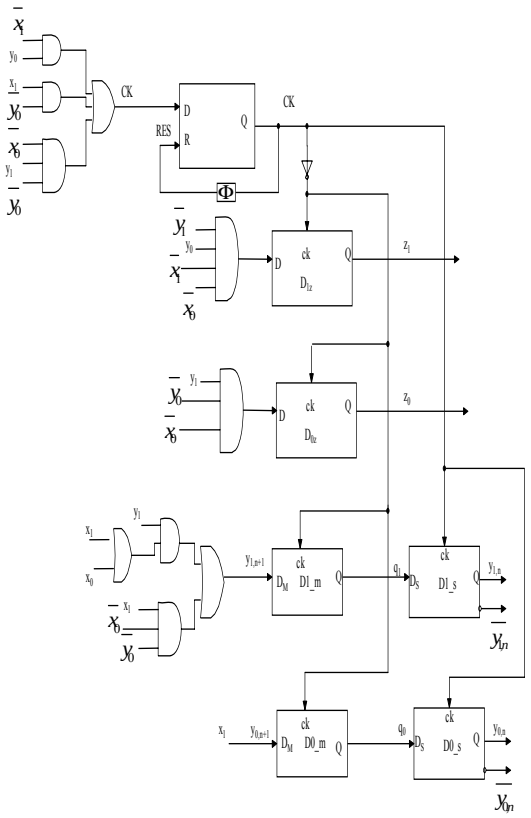


Fig 6. Design with D flip-flop

The entire digital system must meet the following restrictions:

- The minimum propagation delay of CK signal through the combinational system must be greater than the maximum propagation delay for every logic circuit which implements the input/output signals.

- Once the CK signal is triggered it can be reseted without digital hazard.

- Using the improved design described above, the entire asynchronous digital system will work concordant with the specifications.

- For a corect functionality, the following conditions must meet, fig.7.

$$\Phi << T$$
$$\Phi + \Delta = T$$
$$\Delta \le T$$
$$\Delta > \Phi$$

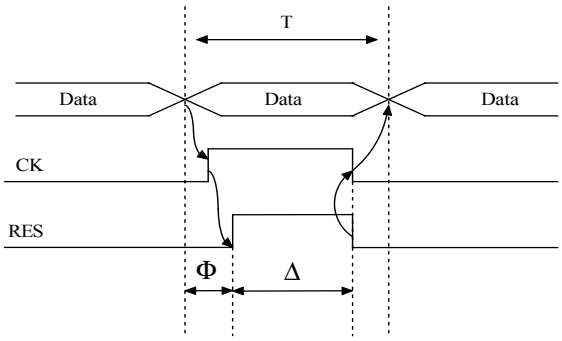


Fig 7. Functionality diagram

- If we set the value of delay time for the Q to Res signal $\Phi = 314ns$, we can use a RC circuit like:

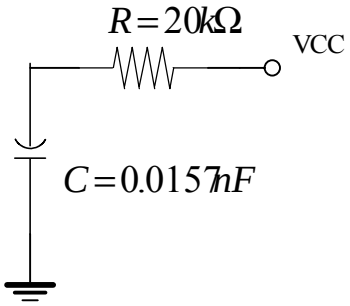


Fig. 8. RC circuit

Using the Fairchild Semiconductor Data Book, for the logic gates AND, OR, INV, D latch, can be deducted the following time requirements, fig.6:

Gate type	TP_{LH}	TP_{HL}
AND 2 inputs	7.6ns	8.8ns
AND 3 inputs	18ns	14ns
AND 4 inputs	7.6	8.8ns
OR 3 inputs	11.4ns	7.4ns
OR 2 inputs	10ns	14ns
D latch	8.5ns	13ns
Inverter	9.0ns	13ns

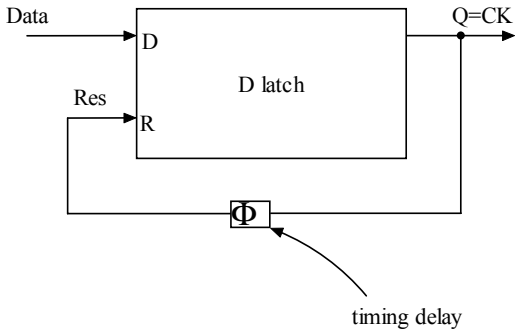


Figura 9. D latch logic cell

When TP_{LH} propagation time is taken into consideration, we have:

D_CK - the combinational digital logic implementation:

$$2 \cdot AND(2in) + 1 \cdot AND(3in) + 1 \cdot OR(3in) + 2 \cdot INV = \\ = 2 \cdot 7.6 + 1 \cdot 1.8 + 1 \cdot 11 + 2 \cdot 9 = 44.2 + 18 = 62.2ns \quad (4)$$

D_1 - the combinational digital logic implementation:

$$1 \cdot AND(4in) + 2 \cdot INV = 7.6 + 18 = 25.6ns \quad (5)$$

D_0 - the combinational digital logic implementation:

$$1 \cdot AND(3in) + 2 \cdot INV = 18 + 18 = 36ns \quad (6)$$

$y_{1,n+1}$- the combinational digital logic implementation:

$$1 \cdot AND(2in) + 2 \cdot OR(2in) + 3 \cdot AND(3in) + 1 \cdot INV = \\ = 1 \cdot 7.6 + 2 \cdot 10 + 3 \cdot 18 + 9 = 81.6 + 9 = 90.6ns \quad (7)$$

The Φ delay is compted with the next propagation delays,

$$\Phi = T_{p(D\_CK)} + T_{p(DI)} + T_{p(DO)} + T_{p(yl,n+1)} + T_{p(DIz)} + T_{p(DOz)} + T_{p(DI\_m)} + T_{p(DI\_s)} + T_{p(DO\_m)} + T_{p(DO\_s)} =$$
$$= 622 + 256 + 36 + 906 + 8.5 + 8.5 + 8.5 + 8.5 + 8.5 + 8.5 = 2654 ns \quad (8)$$

3. CONCLUSIONS

- The CK signal and the output signals must be free of logic hazard inorder to met the system run like within the specifications;

- The minimum propagation delay of CK signal through the combinational system must be greater than the maximum propagation delay for every logic circuit which implements the input/output signals.

- Once the CK signal is triggered it can be reseted without digital hazard.

- Using the improved design described above, the entire asynchronous digital system will work like in the specifications.

4. REFERENCES

[1] Steven Mark Nowick . Automatic Synthesis of Burst-Mode Asynchronous Controllers. Technical Report, December 1995.

[2] C. Roth. Principles of Fundamental Logic Design. New York, 1995.

[3] Chris J. Myers. Asynchronous Circuit Design. John and Soons, Inc. 1995.

[4] Alexandru Valachi, Radu Silion, Mihai Timiş . Improvement of FSM Synthesis using MSI and LSI circuits. 8th International Symposium on Automatic Control and Computer Science, Iasi, 2004.

[5] Douglas J. Smith. HDL Chip Design. The Doone Publications 2001.

[6] Verilog HDL Synthesis. A practical Primer. J.Basker, Doone Public.2000.

4.2 *MECHANICAL ENGINEERING MATHERIALS AND TECHNOLOGY*

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

INVESTIGATION OF THIN FILM DEPOSITION BY MEANS OF MICROSCOPY

Adina AGACHE*, Marius Dan BENȚA**

*Technical College of Transport Brasov** Transilvania University of Brasov

Abstract: *The article presents the scanning technology based on scanning with the sensor-surface interaction.It shows the scanning possibilities given by applying such a method within technologies, allowing a measurement at a nano-level, as well as the advantages of implementing this type of investigation method.*

Keywords: *microscopy, investigated, SEM, TEM.*

1. INTRODUCTION

Wire-bonding is a main interconnection process in the packaging industry. Wires are bonded to Al pads using combined thermal and ultrasonic activation. Gold wires are the widely used and well characterized media for this process [1].

Recently, the use of copper wires is of interest to the industry due to its electrical and mechanical properties. Since copper is relatively hard and readily oxidized, the use of copper wires in industrial interconnection processes requires special bonding procedures and equipment. Moreover, due to the relatively slow formation of Al-Cu intermetallics, examination of the as bonded Al-Cu interface by conventional characterization such as optical microscopy (OM) and scanning electron microscopy (SEM) with energy dispersive spectroscopy (EDS), provide almost no information related to the deterioration of the wire-bonds as a function of the bond life.

2. PARTICLES SYNTHESYS AND APPLICATIONS

Until today, the Al-Cu wirebond interface was investigated by OM and SEM in samples which were mechanically polished, making it difficult to distinguish between the different Al-Cu intermetallics. Attempts were also made to resolve the intermetallic composition of the bonds via EDS incorporated in SEM [2]. In the present study, transmission electron microscopy (TEM), scanning transmission electron microscopy (STEM) and TEM-EDS were used for quantitative analysis of the intermetallic composition of as-bonded and heattreated Al-Cu wire-bonds. A dual beam focused ion beam (FIB) was used to prepare sitespecific TEM samples. FIB was also used for preliminary analysis of cross-sections by ion-beam and high-resolution SEM. In order to understand the processes that occur at the Al-Cu interface, as-bonded samples and samples annealed in air and argon were prepared. The channeling effect may occur for incident ions if a crystal in the sample is oriented in a low index zoneaxis. In these conditions, the ion beam will penetrate deeper into the target before significant inelastic scattering occurs,

resulting in a lower probability of secondary electrons escaping from the sample due to their limited mean-free-path. As a result, grains oriented in a low index zone-axis will have a darker contrast than randomly oriented grains (Figure 1).

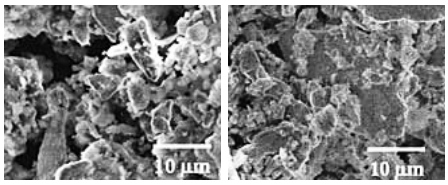


Figure 1: (a) Secondary electron SEM micrograph of the as-bonded Al-Cu interface and (b) ion induced secondary electron micrograph of the same specimen, showing the Cu grain morphology.

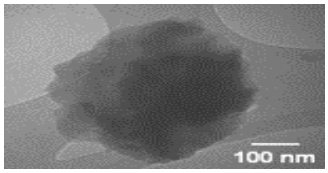


Figure 2: HAADF-STEM micrograph of the asbonded Al-Cu wire-bond cross-section. A nonuniform intermetallic region is evident.

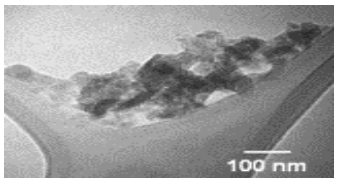


Figure 3: Bright field TEM micrograph of a central region of a Al-Cu wire-bond annealed for 24 hours in argon at 175°C. The inset diffraction pattern is of the dark intermetallic grain.

Figure 2 presents high angle annular dark field (HAADF) STEM micrograph of an area of the as-bonded Al-Cu wire bond, indicating that intermetallic phases are formed in the as bonded samples [3]. EDS analysis confirmed the presence of Al-Cu intermetallics, and that changes in the Cu concentration in the large intermetallic region was not monotonic as a function of a distance from the copper layer.The composition of the intermetallic regions in heat-treated samples was evaluated by TEM-EDS and, wherever possible, confirmed by selected area electron diffraction patterns (Figure 3). 2.Tape Automated Bonding (TAB). They will accommodate the flat TAB tape lead and provide the proper material for a reliable connection to the tape [4]. The bump fabrication process uses a metal deposition and plating process. First a series of barrier and seed layers of metal are deposited over the surface of the wafer. A layer of photoresist is deposited over these barrier and seed ayers. A photomask is used to pattern the locations over each of the pads that will be bumped. An etching process exposes the pads, and the open resist hole defines the shape and height of the bump. The bump, which is typically gold, is then electroplated over the pad and the deposited barrier metals. Once the plating s complete, a series of etching steps are used to protects the underlying materials from being etched. While gold bumping is the most common, copper, tin-lead, as well as layered combinations of these materials are used for bumping. An alternative to die bumping is to create bumps on the tape. For high leadcounts, wafer bumping is more common. Figure 4. illustrates a completed bump and a TAB tape lead.

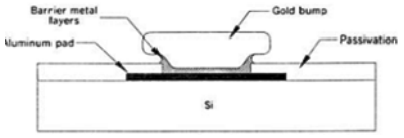


Figure 4. Tab with wafer bumping

Gold top wafer metallurgy had been practiced in the past. With exception of GaAs and TAB, gold had been replaced by aluminum interconnects and then by advanced copper interconnects. Lower material cost plus ultra-fine line capabilities of both aluminum and copper were reasons for the displacement of gold as interconnect. However, to enter high temperature IC applications, to achieve superior reliability or to dissipate greater power, the resurrection of gold as the top metal is both practical and effective. This protective gold top is coined Power Au for the ability of gold to increase power capabilities of ICs, packages and systems. Au wire bonded to aluminum forms many Au-Al intermetallics. This interdiffusion of Au atoms into Al bond pads is well studied. At higher temperature, diffusion and growth rate of intermetallics also accelerate. If the entire thickness of aluminum

bond pad were converted into Au4 Al intermetallic, then the poor adhesion of Au4 Al to barrier metal between aluminum layers can result in wire bond separation and electrically open failure. Even as Au4 Al intermetallic is growing, Kirkendall's voids coalesce into hairline crack at intermetallics interface. These weakened interfaces are susceptible to stress failure and again result in electrically open failure. The metal between Power Au and Al is not a perfect barrier however. Under higher temperature testing, barrier metal does eventually break down. Above 250°C plus self heating from 860mA current, gold atoms punch through the barrier metal and then gold diffuse into aluminum. Rapid diffusion of Au into Al Power Au line immediately above contact to aluminum.

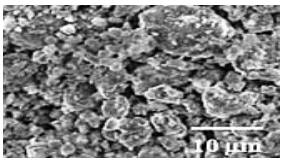


Figure 5. Power Au line with void above contact to aluminum after extremely high temperature testing and 860mA current. Gold diffused into aluminum and left a void.

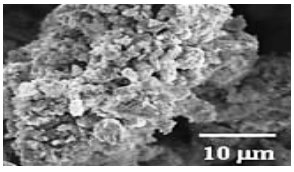


Figure 6. Shows a cross section of a Au-Al bond

The wire pull test is used to measure the strength and failure mode of the wire bond. A small hook is bond to gauge the strength of the 1st bond or next to the wedge at the 2 nd bond to ensure a reliable weld. Generally, if the hook is placed at the mid span of the wire, then the test will show the weakest link of the bond. This is typically either the neck of the ball bond (right above the ball) or at the heel of the wedge bond. The Pull test is basically a function of the wire diameter. Loop height & wire span are the most significant factors that determines the strength of a wire for a given wire diameter. Shorter span & a lower loop will result in a lower pull strength. As opposed to a longer span & a higher loop height which will result in higher pull strength. Copper wire bonding is normally formed by a copper ball onto an aluminum based bond pad in microelectronic package. However, copper oxidation at the interface of Cu- Al bonding area causes the cracks, decreases the interfacial shear strength, and weakens the Cu-Al bonding. Surface analysis of ball-peeled pad of Cu-Al bonding using XPS demonstrates the copper oxidation in the Cu-Al interface after autoclave test (at 121oC and 100% relative humidity). The binding energy scans for Cu 2p on the specimen after 0, 192, 384, and 576 hours in autoclave test chamber is carried out. After 576 hours corrosion, the chemical change of copper in a few atomic layers of surface from Cu to CuO. Furthermore, there are two major copper oxides peaks observed in the study, CuO and Cu(OH)2. Cu2O is not table in air and change to CuO immediately. Therefore, CuO2 is not expected to be detected at the specimen [7].

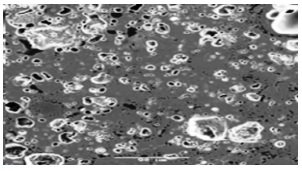


Figure 7. SEM pictures show corrosion and a crack after test hour increase (X1000)

Low cost, high thermal and electric conductivity, easy fabricating and joining, and wind rang of attainable mechanical properties

have made copper widely used in electronic packaging, such as lead frames, interconnection wires, foils for flexible circuits, heat sinks, and WPB traces. However, unlike the aluminum oxide, the copper oxide layer is not self-protect. Therefore, copper is readily oxidized, especially at elevated temperature. Copper oxidationinterface of Cu-Al bonding area causes the cracks, decreases the interfacial shear strength, and weakens the Cu-Al bonding. Also, Copper oxidation in the area of the lead frames die pad and mold compound causes the delamination of packages. Furthermore, the moisture penetrates through the crevices because copper oxidation induces poor adhesion in the area of the copper lead frames and molding compound, creating corrosion problem in the packages.

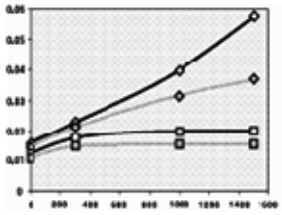


Figure 8. Intermetallic thickness vs. exposure for 6 hrs at respective temperature b) effect of wire material & substrate metallization on electrical resistance after aging

Tests show that, after exposure at various temperatures, intermetal I ic growth is significantly slower in copper wire bonds than in gold wire bonds. and device performance. Tests also show that despite a lower amount of intermetallic penetration, pull force and shear testing show values that are equivalent to, or greater than, those obtained with gold wire. Potential for maximum conductivity, device performance (tact frequencies of <500 MHz) and resistance to degradation in a mono-metallic system are the driving forces for the use of Cu wire in packages with Cu pads. DHF and iCu wire have been successfully ball-bonded to bare Cu lead frames and also AlSiCu metallized pads [8].

3. CONCLUSIONS

Recent studies have shown that, in many applications, copper wire bonding can provide better performance and reliability than gold wire bonding. While copper wire and ribbon have been used in discrete and power devices for many years, these latest studies also show that successes in ball bonding thin copper wire to aluminum, silver-nickel plating and even bare copper, provide the potential for its use in high-end, fine-pitch packages with higher lead counts and smaller pad sizes. For these reasons, along with the lower inherent cost of copper material, Kulicke & Soffa Bonding Wire [8] has developed and optimised two copper wire products: DHF copper wire for ball and wedge bonds in power devices and discrete packages; and iCu for fine-pitch or high-end IC applications.

REFERENCES

1. **M. Drozdov, G. Gur**, **Z. Atzmon**, and **W.D. Kaplan** *Microstructural Evaluation of Al-Cu Intermetallic Phases in Wire-Bonding;*

2. **G. Harman**, *"Wire Bonding in Microelectronics Materials, Processes, Reliability and Yield", 2 ed., Electronic Packaging and Interconnection,* ed. C.A. Harper. 1997: McGraw-Hill;

3. **F.W. Wulff, C.D. Breach, D. Stephan, Saraswati** and **K.J. Dittmer**, *Characterization of Intermetallic Growth in Copper and Gold Ball Bonds on Aluminum Metallization, Proceedings of Electronics* Packaging Technology Conference, 6th, Singapore, Dec. 8-10, 2004: 348-353, 2004.

4. **** Semiconductor Packaging Module II;*
5. **James J. Wang** and **Bob Baird** *Power gold for 175°c Tj max ;*

6. **** Semiconductor Packaging Assembly Technology 2000 National Semiconductor Corporation;*

7. **Ying Zheng** *Study Of Copper Applications And Effects Of Copper Oxidation In*

Microelectronic Package In Partial Fulfillment of MatE 234 2003;

8. **Kulicke** & **Soffa** *Complete Connection DHF &iCu Copper Bonding Wire for Power Devices and High-End ICs.*

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

DETERMINING THE COORDINATES OF A HOSTILE GUNFIRE BY USING THE SOUND RANGING METHOD

Silviu BĂLUȚĂ*, Gheorghe ANDREI **

* The Military Equipment and Technology Research Agency, Bucharest, Romania
** „Lumina" The University of South-East Europe, Bucharest, Romania

Abstract: *In land warfare, sound ranging is a method of determining the coordinates of a hostile artillery battery using data derived from the sound of its guns (rockets or mortars) firing, and therefore, these known coordinates can be used to direct own artillery fire to the enemy position. This article describes the method of source location based on the relative arrival times of an acoustic signal; there are also presented the advantages and disadvantages of such method, and some aspects regarding the acoustic detection systems' performances.*

Keywords: *acoustic detection, gunshot location system, sound ranging*

1. INTRODUCTION

Sound ranging was one of three methods of locating hostile artillery that rapidly developed in World War I. The others were air reconnaissance (visual and photographic) and flash spotting.

In land warfare, sound ranging is a method of determining the coordinates of a hostile artillery battery using data derived from the sound of its guns firing. Sound ranging using aural and stop-watch methods had emerged before World War I. Stop-watch methods involved spotting a gun firing, measuring the bearing to it and the length of time it took the sound to arrive. Aural methods typically involved a man listening to a pair of microphones a few kilometres apart and measuring the time between the sound arriving at the microphones. This method was quickly discarded as ineffective and replaced by a scientific methods of sound ranging.

The basis of scientific sound ranging is to use pairs of microphones to produce a bearing to the source of the sound. The intersection of these bearings gives the location of the battery. The bearings are derived from the differences in the time of arrival at the microphones.

2. ARTILLERY LOCATION POBLEM

2.1. Principle of Source Location. Acoustic Emission (AE) signals can be broadly divided into two classes: a) burst type emission which is detected as decaying sinusoids and b) continuous emission (resembling white noise). AE source location is based on measurements of the relative arrival times of an AE signal at several transducers and is therefore confined to applications where the sources generate burst type signals. Furthermore, the wave velocity is normally assumed to be uniform throughout the medium.

In the 1-dimensional case, where the source is known to lie somewhere along a straight line between a pair of transducers, a difference in measured arrival times at the

transducers uniquely determines the source location.

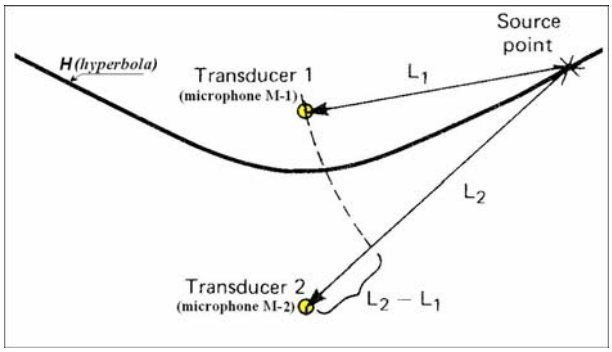


Figure 1. *The AE wave is detected by 2 transducers at different times*

In the 2-dimensional case shown in Fig. 1, where the source is known to lie at a point in a plane, the difference in distance traveled by the wave to a pair of transducers can be calculated from the measured time difference:

$$\tau = v \cdot \Delta t ,$$

where τ is the path difference, v is the wave velocity and Δt is the measured time delay. The same path difference is obtained if the source lies at any point along a hyperbola (H), with the transducers at the focuses. Using additional transducers the coordinates of the source can be determined from the intersection of hyperbolas defined by measured time differences at other transducer pairs.

In general, a number of *N* transducers will yield *N-1* time differences and coordinates. Therefore, the minim number of transducers required is two for linear location, three for a plane and four for a volume.

Ambiguous solutions sometimes arise when are used the minimum number of transducers. In order to resolve the ambiguity, additional information must be collected. This can be done by measuring the time delay to an extra transducer and comparing it with the calculated value for the source location.

2.2. Basic equipment setup. A scientific method of sound ranging system requires the following equipment.

- An array of 4 to 6 microphones
- A system capable of measuring the sound wave arrival time differences between the microphones.
- A means of analyzing the time differences to compute the position of the sound source.

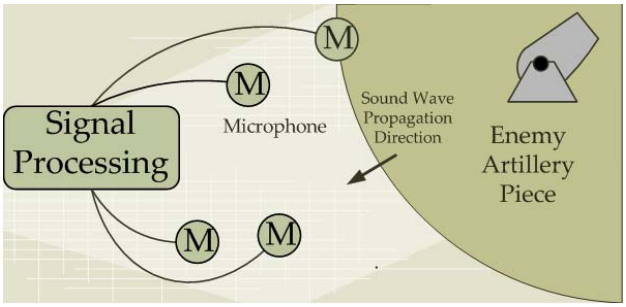


Figure 2. *Basic equipment of a sound ranging system*

The basic method is to use microphones in pairs and measure the difference in the time of arrival of a sound wave at each microphone in the pair (inner microphones are members of two pairs). From this a bearing to the origin of the sound can be found from the point mid-way between the two microphones. The intersection of at least 3 bearing will be the location of the sound source.

Some systems may not allow arbitrary placement of the microphones. For example, they may require the microphones to be placed on a straight line. These constraints would be imposed to simplify the calculation of the artillery position and are not a characteristic of the general approach. The microphones also may be designed to pick up only the sound of the gun firing. There are three types of sounds that can be picked up by the microphone.

- the gun firing (the desired signal)
- the sound of the shell moving through the air
- the impact of the shell

During World War I it was discovered that the gun firing makes a low rumbling sound that is best picked up with a microphone that is sensitive to low frequencies and rejects high frequencies.

2.3. Determining the range to the artillery piece. There are a number of ways to determine the range to the artillery piece.

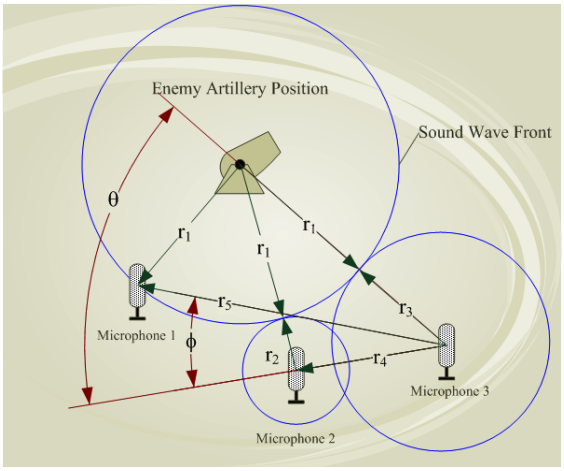


Figure 4. *Example of a sound ranging operation*

One way is to apply the law of cosines twice:

$$\begin{cases}(r_1+r_2)^2=(r_1+r_3)^2+r_4^2-2\cdot(r_1+r_3)\cdot r_4\cos\theta\\ r_1^2=(r_1+r_3)^2+r_5^2-2\cdot(r_1+r_3)\cdot r_5\cos(\theta-\phi)\end{cases}$$

This is a nonlinear system of two equations with two unknowns (θ, r_1) which can be solved using numerical methods.

The ranges r_2 and r_3 can be expressed by the relations:

$$\begin{cases}r_2=v\cdot\tau_2\\ r_3=v\cdot\tau_3\end{cases}$$, where $v\cong 330$ m/s and represents the speed of sound.

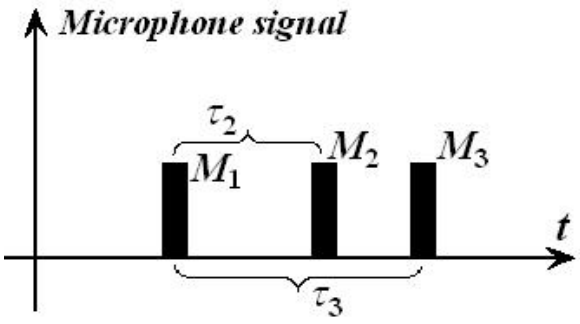


Figure 3. *The signals' delays detected by microphones.*

The two time durations τ_2 and τ_3 represent sound wave front delays assigned to microphones 2 and 3, relative to microphone 1.

3. ADVANTANGES AND DISADVANTAGES OF THE METHOD

2.3. Advantages and disadvantages of the method. Sound ranging has a number of *advantages* over other methods:

- Sound ranging is a passive method, which means that there are no emissions traceable back to the sound ranging equipment. This is different from radar, which emits energy that can be traced back to the transmitter.
- Sound ranging equipment tends to be small. It does not require large antennas nor large amounts of power.

Sound ranging also has a number of *disadvantages* such as:

- the speed of sound varies with temperature. Wind also introduces errors. There are means by which to compensate for these factors.
- at a distance, the sound of a gun is not a sharp crack but more of a rumble (this makes it difficult to accurately measure the exact arrival time of the wavefront at different sensors)
- guns cannot be located until they fire
- artillery is often fired in large numbers, which makes it difficult to determine which wavefront is associated with which artillery piece
- every microphone has to be emplaced and very accurately surveyed to find its coordinates, which takes time
- each microphone has to have a communication channel to the recording apparatus, before effective radio links appeared this meant field cable, which had to be laid and maintained to repair breaks from many causes.

Military forces have found various ways to mitigate these problems, but nonetheless they do create additional work and reduce the accuracy of the method and the speed of its deployment.

4. ASPECTS REGARDING THE SYSTEM ARCHITECTURE

Different system architectures have different capabilities and are used for specific applications. In general there are 2 architectures:

- *stand-alone systems* with local microphone arrays, and
- *distributed sensor arrays* ("wide-area acoustic surveillance").

The former are generally used for immediate detection and alerting of a nearby shooter in the vicinity of the system; such uses are typically used to help protect soldiers, military vehicles and craft, and also to protect small open-space areas (e.g., parking lot, park). The latter are used for protecting large areas such as cities, municipalities, critical infrastructure, transportation hubs, and military operating bases.

Most stand-alone systems have been designed for military use where the goal is to immediately alert human targets so they may take evasive and/or neutralization action. Such systems generally consist of a small array of microphones separated by a precise small distance. Each microphone hears the sounds of gunfire at minute differences in time allowing the system to calculate the range and bearing of the origin of the gunfire relative to the system. Military systems generally rely on both the muzzle blast and projectile shockwave "snap" sounds to validate their classification of gunfire and to calculate the range to the origin.

Distributed sensor arrays have a distinct advantage over stand-alone systems in that they can successfully classify gunfire with and without hearing a projectile "snap" sound, even amid heavy background noise and echoes. Such systems are the accepted norm for urban public safety as they allow law enforcement agencies to hear gunfire discharges across a broad urban landscape of many square miles. In addition to urban cityscapes, the distributed array approach is intended for area protection applications, such as critical infrastructure, transportation hubs, and campuses.

REFERENCES

1. H. J. Rindorf, M.Sc.: "*Acoustic Emission Source Location in Theory and in practice*". Technical Review, No.2 -1981.
2. Harry Bateman: "*Mathematical Theory of Sound Ranging*", Monthly Weather Review. Source : online. Available: http://docs.lib.noaaa.gov/rescue/mwr/046/mwr-046-01-0004.pdf.
3. *Gunfire locator*. Source : online. Available: http://en.wikipedia.org/wiki/Gunfire_locator.
4. J.B. Calvert: "*Ranging*". Source : online. Available: http://www.du.edu/~tech/ranging/ranging.htm. Retrieved 2006-05-15.
5. *State of the Art Shooter Detection*. Source : online. Available: http://www.bbn.com/products_and_services/boomerang/

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

OVER TEMPERING OF ARMOX ARMORED STEELS AT THEIR SECONDARY PROCESSING

Igor BARÉNYI*, Ondrej HÍREŠ*, Peter LIPTÁK*

* Faculty of Special Technology, Alexander Dubcek University of Trencin, Slovakia

Abstract: *ARMOX steels are made by specific production process finished with rolling ant then quenching and tempering. This specific treatment brings excellent mechanical properties of these steels as are high hardness, tensile strength and good toughness. The producer of ARMOX steels recommend their secondary processing (cutting, welding, shaping) at temperatures lower than 200°C due to over tempering and degradation of mechanical properties in heat affected areas. The paper describes the mechanism and reason of this degradation.*

Keywords: *Armox armoured steels, over tempering, degradation of mechanical properties*

1. INTRODUCTION

Armox steels production process consists of few important steps to reach their required mechanical properties. First step is continuous casting of slabs with using of ore with high chemical purity. The next step is rolling of the slabs at temperature about 1250°C to refine its microstructure – austenitic grains. Then the slabs are solution annealed at temperature about 850°C. Most important are two final steps – quenching and tempering. The slabs are quenched in continuous furnace from the temperature about 1000°C to harden the steel and finally low tempered at 200°C – 500°C in order to make the hardened steel tougher [1].

The microstructure resulting from this treatment is fine tempered martensite (fig. 1).

The producer of ARMOX steels recommend their secondary processing (cutting, welding, bending and others) at temperatures lower than temperature of tempering (usually 200°C) due to accidental over tempering and degradation of mechanical properties in heat affected areas.

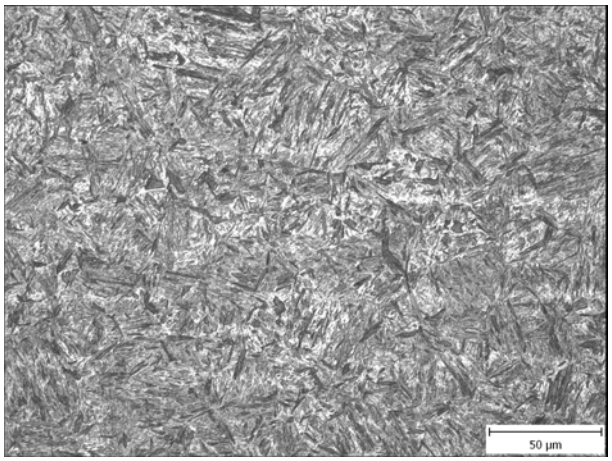


Fig. 1 Microstructure of Armox 440

2. OVER TEMPERING OF ARMOX STEELS

Break the recommendation of the producer described before leads to over tempering and therefore to creation of heat affected zones

(HAZ) with degraded mechanical properties, hardness mainly.

The reason of degradation lies in microstructure change and could be described with help of tempering theory of steels.

The tempering process has four stages according to occurred temperature [2].

For low tempering are important first two mainly. First stage (about 200°C) is characterized with coherent carbon precipitation from martensite in a form of ε phase (Fe_2C, $Fe_{2,4}C$). Decrease of over saturation of martensite with carbon leads to hardness decrease. This change is noticeable at steel with relative higher carbon content.

Also diffusion process of some alloying elements start at that temperature and these may start precipitating from martensite and then make the steel less hard.

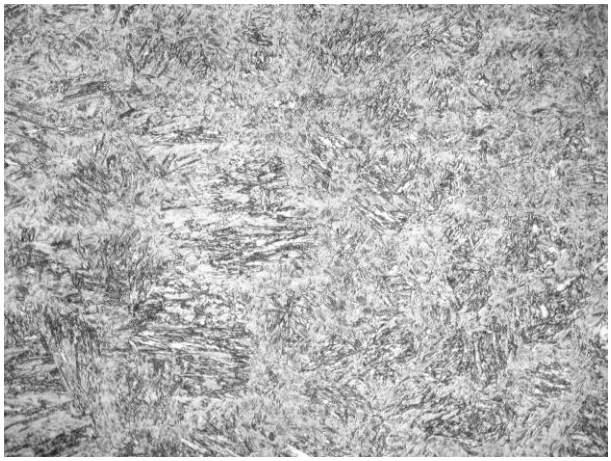


Fig. 2 Microstructure of Armox 440 affected by over tempering with temperature below A_1 (mg. 500x)

There is shown a microstructure of Armox 440 affected by over tempering with temperature below A_1 (app. 500°C) on fig. 2. The microstructure is prepared from the sample of welding joint and shown the area in the middle of HAZ (heat affected area).

Scientific sources indicate a decrease of hardness from 47.6 HRC to 28.6 HRC (40%) by exposure the ARMOX 440 armored steel with temperature about 650°C for 5 minutes. Tensile strength decreases from 1476 MPa to 451 MPa (70%) at the same conditions [3].

3. EXPERIMENT REALIZATION

There was realized experimental measurement to describe the affection of origin Armox 440 with temperature over tempering temperature specified by producer. For experiment was used Vicker's Hardness Test according to EN ISO 6507-1. Parameters of test were chosen as follows: Load F=4,903 N, Time of indentation t = 4 s.

Microhardness HV0,5 was measured on the cross section of the welded joint through HAZ (heat affect area), weld metal and back to HAZ on the opposite side of the sample. The hardness of base material was measured outside the HAZ in the area unaffected by temperature. Measured values are shown in table 1 and graphically presented in fig. 3.

Tab. 1 Values of HV0,5 in cross section of Armox 400 weld joint and base material

Measurement no.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Sample 1	430	410	386	377	367	346	301	486	520
Sample 2	429	427	400	386	351	342	329	415	482
Sample 3	389	366	351	321	306	400	476	588	506
Measurement no.	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Sample 1	501	206	187	506	438	387	324	345	367
Sample 2	594	249	239	484	518	316	397	400	331
Sample 3	387	201	489	524	303	336	327	353	398
Measurement no.	**19**	**20**	**21**	**22**	**23**	**24**	**25**	Base material	
Sample 1	397	400	425	446	451	457	454	458	
Sample 2	358	381	404	426	436	460	457	465	
Sample 3	394	413	425	441	453	462	468	472	

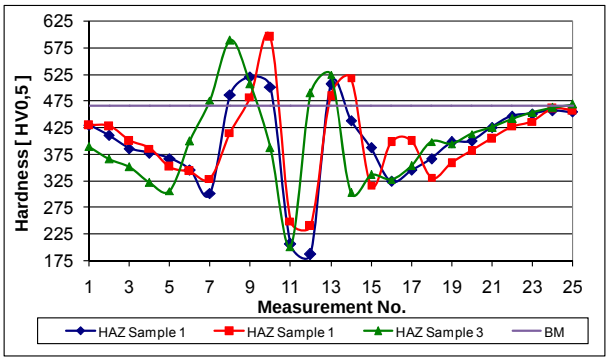


Fig. 3 Graph of micro hardness HV0.5 through HAZ in comparison with the hardness of BM

Imprints from 1 to 7 (and 15 to 25) were made in area of HAZ affected by temperatures below A_1 (without recrystallization). Hardness decreases slowly in proportion to affecting temperature.

Imprints from 8 to 10 (and 13 to 14) were made in area of HAZ by temperature over A1. The recrystallization occurs in this area; therefore the microstructure became very coarse martensitic structure. Hardness increases very noticeably, but the area of material became brittle by this change in microstructure.

Imprints 11 and 12 were made in area of welded metal; therefore the hardness is very low with values about level of hardness of used consumable material.

Values in the brackets show numbers of imprints in corresponding areas on the other side of welded joint.

4. CONCLUSIONS

The study of microstructure and also Vicker's micro hardness test provides results confirming noticeable degradation of mechanical properties (hardness, tensile strength) in areas of material affected by over tempering. Parameters of tempering (temperature and time) are chosen very carefully by the producer of ARMOX 440 to achieve specific required high mechanical properties. Additional exposure of the material to temperatures over tempering temperature causes the accidental continue of tempering process and therefore the degradation of mechanical properties of the material. The intensity of degradation rises proportionally with increase of temperature level and time of exposure.

This effect certainly occurs in others armored steels of ARMOX kind or steels produced by similar way like ARMOX steels are (e.g. SECURE steels). These steels are used in military and civil areas to provide more security to protect human life and valuable vehicles, devices or buildings. Therefore there is important need for further research in this area to find the way how to minimize described negative effect.

REFERENCES

1. SSAB Oxelosund Sweden: *The steel book*. Sweden, 2008. [online]. Available: http://www.ssab.com
2. Skočovský, P. a kol..: *Náuka o materiáli pre odbory strojnícke.*. Universitiy of Zilina (2006).
3. Kulmann, N.A.: *Metallurgical Characterization of Armor Alloys for the Development and Optimization of Induction Bending Procedures.* The Ohio State University, USA, 2011.
4. Híreš, O., Barényi, I., Bačík, S., Vavrík, R., Útly, M.: *Welding of ARMOX Steels: Microhardness Tests*. Výskumná správa č. 8, Trenčín, 2011

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

MODELING OF AIRCRAFT FUEL SYSTEM

Vladimír BEŇO*, František ADAMČÍK*

*Faculty of Aeronautics, Technical University, Košice, Slovakia

Abstract: *Measurement of fuel temperature is one of task fuel-measurement system of aircraft. Determination of the fuel temperature is necessary, because temperature change as modifications are made to the fuel properties. Influence these changes is change the fuel flow in the fuel line and thus the supply of fuel to the engine. This may be a little change, but for large temperature changes fuel already experiencing significant changes in fuel flow. Temperature changes and therefore the density of the fuel can be measured directly or also compile model of fuel system and simulate these changes fuel properties in the software simulation environment. For the implementation such simulations is now available amount of software applications. These applications can be divided into applications that only specialize in flow measurement of liquids in pipes and change their properties and the software applications that allow simulate other systems and change in their properties.*

Keywords: *Simulation, Aircraft, Fuel, Fuel Flow, Density.*

1. INTRODUCTION

The primary task of aircraft fuel systems is the fuel supply to the engine and ensuring the necessary thrust for the aircraft. In this process is of course necessary to achieve optimum fuel flow through the fuel line. The optimum flow rate of fuel through the fuel line depends on several factors such as fuel density, performance of fuel pumps, fuel pipe diameter, their length etc. The first factor, which is the density of aircraft fuel can dramatically affect fuel flow in pipes. Variation in density of the fuel causes a change in temperature, it is necessary to ensure thermal stability of the fuel. Before there is build of aircraft as well as fuel system aircraft, it is necessary to test the functionality of the system. The ideal way to offer software simulation testing environment. One is the software Matlab. Although it is a general simulation software contains a number of libraries that offer many features and tools for building and modeling of aircraft fuel system. It is also possible using these tools to verify the aforementioned behavior the change of fuel to change its density as well as changes to the fuel flow in the fuel line.

2. FUEL PROPERTIES

2.1 Fuel Viscosity

The viscosity of aircraft fuel the rate its ability to flow and increases with decreasing temperature. Although the general relationship between the freezing point and viscosity can lead to large scatter in the measured temperature when the temperature approaches the freezing point. Standard tests for aircraft fuel viscosity is happening in the capillary. If a too high viscosity, it leads to degradation of the burner. Therefore, engine manufacturers require that the viscosity of fuel that flows into

the engine does not exceed a predefined threshold 12 cm^2/s it typically a limit. Figure 1 shows a graph of change kinematic viscosity with temperature for fuel JP-4 and Jet A.

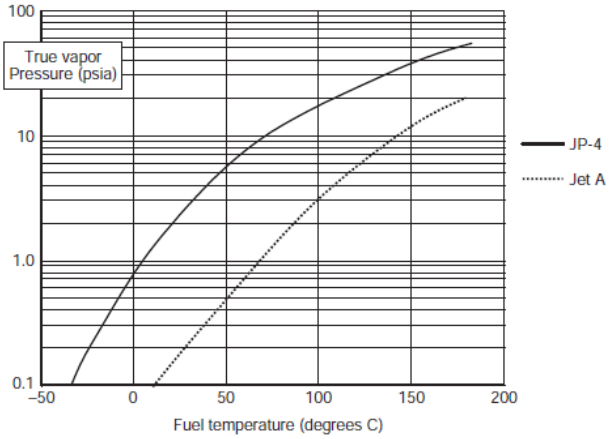


Fig.1 The Dependence of fuel temperature on vapor pressure

2.2 Diagrams and charts

Since the fuel is a mixture of different hydrocarbons, where each has a different freezing point, the entire fuel does not solidify at a specific temperature. They form the place of wax, which is composed of crystals hydrocarbon of fuels, which have a higher freezing point. The next decrease of temperature causes changes in the fuel mixture similar to snow, eventually fuel solidifies completely. As for the fuel system of an aircraft must ensure that this did not occur in the tanks of the aircraft because it can avoid the defuel of the fuel tank. Also, the wax and the emerging crystals can block entry to the fuel pump. Testing the freezing point of a particular type of fuel consist of heated in the fuel samples and determine the temperature at which it disappears the last solid crystal. Engine manufacturers also specify the minimum temperature of fuel supply due to the freezing point.

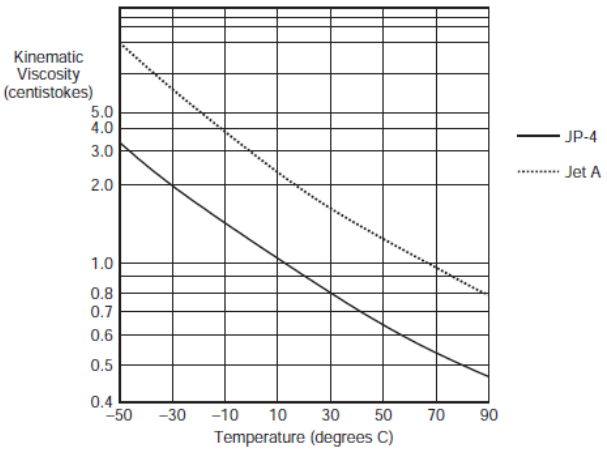


Fig.2 The Dependence of kinematic viscosity on fuel temperature

2.3 Density

The density of fuel is an important property, because her size may differ depending on temperature. The size of its change may be in the range up to 25% for most types of transport aircraft. Fuel quantity is proportional to his weight, which determines the amount of energy conservation. Due to the large changes in the density range under the influence of temperature may be a smaller refuel volume of fuel especially in areas where the climate is hot. Just in these conditions the amount of fuel is lower due to higher temperatures. Of course contrast, if the temperature is low the aircraft can refuel more fuel.

2.4 Stability of Temperature

When the fuel is exposed to high temperatures may oxidized and create as it were the rubber coating. This can cause blockage of fuel filters, fuel dispensers, nozzles, fuel-oil heat exchanger. The requirement for high temperature stability is a major challenge especially in the engine fuel system, where the occurrence of high temperatures. Thermal stability of the fuel is important especially for aircraft that can fly at supersonic speeds, this concerns mainly military aircraft. While flying at supersonic speeds occurs to aerodynamic heating and therefore ensure the thermal stability is very important. Aircraft fuel can also be used for

cooling oil or some of the systems which can ultimately lead to the next thermal instability.

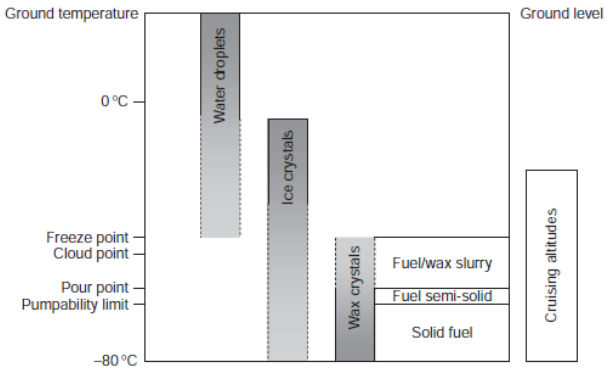


Fig.3 The Dependence of fuel temperature on vapor pressure

3. MODELING & SIMULATION

Change in density of the fuel, depending on the temperature and the change of flow is the easiest show at the one branch of the fuel system, which is between two tanks.

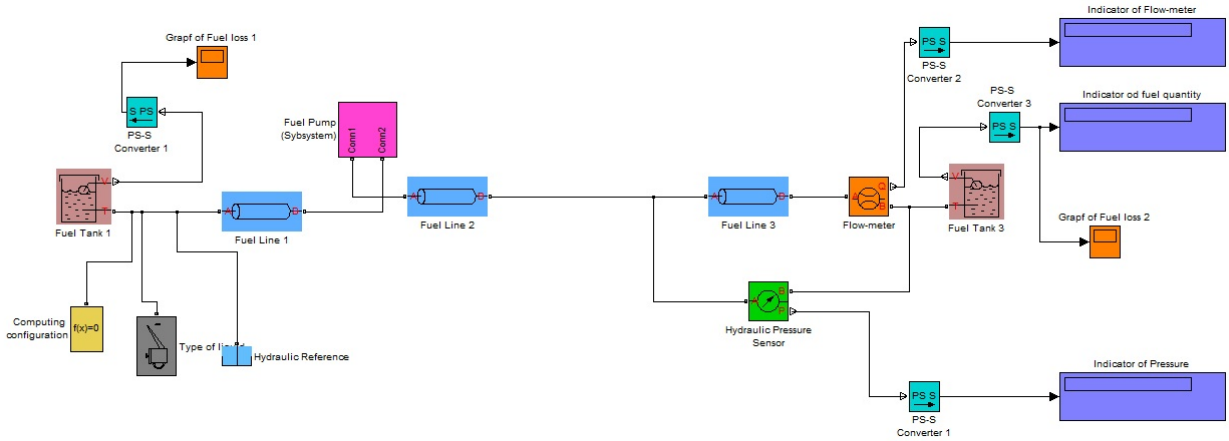
The length of fuel line between the fuel tanks is 10m, internal diameter of the fuel line is 10mm. Fuel pump is set at 6000ot/min and time of flow is always 60s. Is used aircraft fuel JET A. There have been 10 simulations for changing the temperature from -40°C to +50°C, each graded after 10° degrees Celsius.

Temp. (°C)	Fuel Flow (m^3/s)	Pressure (Pa)
-40	0,00302145	1590486,861
-30	0,00306727	1573107,298
-20	0,00310032	1556506,468
-10	0,00312447	1540455,109
0	0,00314237	1524789,293
10	0,00315585	1509397,169
20	0,00316617	1494201,231
30	0,00317419	1479148,232
40	0,00318051	1464200,179
50	0,00318555	1449330,631

Fig.4 Table of measure values

Of these 10 simulations, we have compiled a table of 10 measured values the fuel temperature depending on variation in density and thus also change the fuel flow.

It is possible also simulate the change in fuel pressure in the fuel line. Based on these measured values was compiled graph of fuel flow depending to his temperature, as shown in Figure 4 As seen in this graph the flow rate is increased exponentially. The greatest increase of flow was observed in the temperature range from -40°C to + 30°C. At higher temperatures, flow with increasing temperature to grow only slightly. Of course, as already mentioned, value of density change with temperature is given by a specific type of



aircraft fuel, thus liquid.

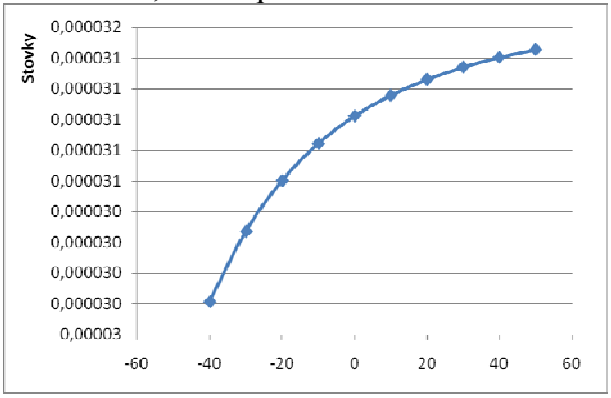


Fig.5 The Graph dependence of fuel flow on temperature

The second graph shows the change in pressure in the fuel line in the temperature dependence pumped fuel.

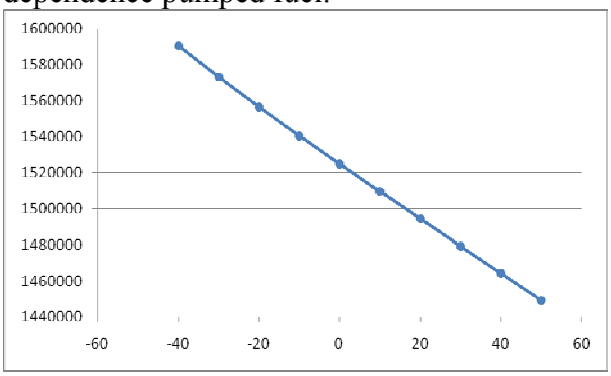


Fig.6 The Graph dependence of fuel pressure on temperature

On the graph is to see the exponential decrease in pressure with increasing temperature of the fuel. This decrease is almost directly-proportional to the increasing temperature.

3. CONCLUSIONS

As shown in the waveform obtained dependence of, in the change in temperature ranging from -40°C to +60°C (which is a total change of 100°C), occurs an increase in fuel flow rate by approximately 5%. This increase can be documented as an error that occurs by changing the fuel temperature. This value is relatively high, at concrete an increase in flow rate of 0.18 dm^3/s, respectively 0.18 l/s. On this example can illustrate the importance of maintaining thermal stability of aviation fuel. Described change of raises change flow fuel in operation of aircraft in flight. This change of flow could cause such large changes in fuel supply and thus the loss of the required thrust. The benefit of this method of modeling and simulation of aircraft systems in the software Matlab-Simulink is also concluded that in this way can make the analysis and synthesis of the fuel system before its actual design and verify its functionality and the eventual operational problems.

REFERENCES

1. FAR/JAR 25. *Airworthiness Standards: Transport Category Airplanes.* Part 25 of "Code of Federal Regulations, Requirements — large aeroplane" for the Joint Aviation Authorities.
2. Sopata, M. - Soták, M.- Bréda, R.: Overovanie presnosti matematických model pri vývoji lietadlových systémov:, Měření, diagnostika a spolehlivost palubních soustav letadel: sborník příspěvků ze 6. odborného semináře : Brno, 18.-19.10.2006. - Brno 2006: Univerzita obrany, 2006. - ISBN 80-7231-155-7. - P.
3. Soták, M.: Determining stochastic parameters using an unified method,.:In: Acta Electrotechnica et Informatica. - ISSN 1335-8243. - Vol. 9, No. 2 (2009), p. 59-63.
4. Čižmár, J. - Trubač, M.: Přístrojové vybavení. skriptum. 1. Brno (Česká republika): Akademické nakladatelství CERM, s.r.o., Brno, 2006, 230 s. ISBN: 80-7204-445-1.
5. Bréda, R. – Čižmár, J. – Soták, M. – Beňo V.: Letecké prístroje, Vysokoškolská učebnica, Technická Univerzita Košice, Letecká Fakulta, 2011, ISBN: 987-80-553-0626-1.
6. Adamčík, F. – Adamčík, F. jr: Spacecrafts electrical power systems,. Acta Avionica 2010. ISSN 1335-9479. – Roč. 12, č. 20 (2010), S. 76-78.
7. Langton, R. - Clark, Ch. - Hewitt, M. - Richards, L.: Aircraft Fuel Systems , Wiley, 2009. ISBN: 978-0-470-05708-7
8. Totten, G.: Fuels and Lubricants Handbook: Technology, Properties, Performance, and Testing. ASTM, USA. 2003. ISBN: 0-8031-2096-6

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

WAYS OF WORKING THE DATA OBTAINED THROUGH AFM TECHNOLOGY

Marius Dan BENȚA*, Adina AGACHE**

*Transilvania Universitz of Brasov ** Technical College of Transport Brasov

Abstract: *The article presents a series of methods of working the data obtained through Atomic Force Microscopy technology.It shows the way in which the obtained data can be used and read through the Labview programming language. Emphasis is also laid on a series of advantages resulting from scanning by the direct contact or the non-contact method. AFM consists of a sharp microfabricated tip attached to a cantilever, which is scanned across a sample. The deflection of this cantilever is monitored using a laser and photodiode and is used to generate imaging or spectra of the surface. The AFM works in a number of different modes*

Keywords: *technology, Atomic Force Microscopy*

1. INTRODUCTION

Atomic Force Microscopy is a powerful surface analytical technique used in air, liquid or vacuum to generate very high-resolution images of a surface and can provide some topographic, chemical, mechanical, electrical information [15]. An AFM consists of a sharp microfabricated tip attached to a cantilever, which is scanned across a sample. The deflection of this cantilever is monitored using a laser and photodiode and is used to generate imaging or spectra of the surface. The AFM works in a number of different modes [15]. These include: Contact mode The tip is kept in constant contact with the sample (with a force range of 1-1000 nN, it may be used with hard materials) and provides the basic mode for topography [15]; Force modulation mode The tip is kept in contact but a modulated signal is also applied which gives information on dynamic responses from surfaces. Phase and stiffness imaging are extracted from the modulated response signal. This is conducted in the frequency ranges of 10-20 kHz and 400-1000 kHz and modulation forces of around 100 pN - 500 nN [5]; Intermittent and non-contact imaging The tip is oscillated normal to the surface enabling soft materials to be imaged for topography. This eliminates much of the shear force involved in the contact mode. Phase images are also taken in this mode [15]; Force versus distance spectroscopy The AFM applies forces from 50 μN to 5 pN newtons to one spot on a surface to analyse material mechanical properties at surfaces. It either pushes into the surface to measure nanomechanical properties of a surface such as modulus and adhesion or pulls away from the surface for example to measure the forces associated with unfolding of proteins or the breaking of individual

covalent bonds [15]. The hysteresis of the scanner can be controlled by use of closed-loop sensors. The deflection of the cantilever is measured using a laser and a position sensitive diode. The force acting on the sample is calculated from the product of the cantilever spring constant and the cantilever deflection. The example below is a simple force-distance curve on a piece of silicon wafer [15].

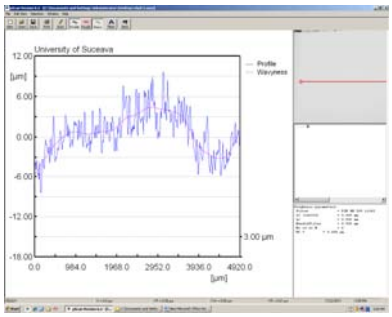


Fig. 1 a simple AFM force-distance curve on a silicon wafer

When a tip is far away from the surface no forces act, as the tip approaches a sample it experiences an attractive van der Waals force until it snaps onto the surface. [15]. For studies in ambient conditions this is promoted by a small neck of water, which condenses at very small separations. As the tip moves further the cantilever is deflected by the sample. As the tip is withdrawn, the small capillary layer of water and organics on the sample surface hold the tip longer than expected until the snap-out point is reached. This snap-out displacement is dependent on several factors such as the tip size, and the nature of the surface and ambient environment [15].

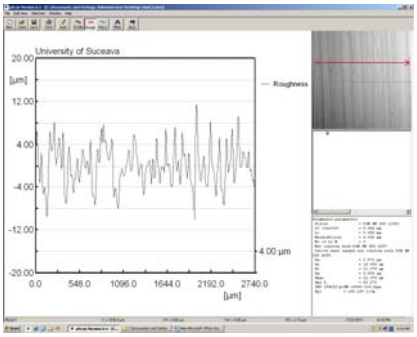


Fig. 2 zoomed in region of a force-distance curve showing the snap-in event.

Thermally sprayed coatings are now used extensively in a variety of applications. However, their application has often preceded detailed knowledge or understanding of their corrosion mechanisms or rates. Previous studies involving plasma sprayed coatings [15] have shown that good quality coatings, in terms of low porosity, are essential to protect the substrate from corrosion.There are many thermal spray processes available to date: the high velocity oxygen fuel (HVOF) process, which uses higher exhaust velocities and lower flame temperatures than other processes, can produce coatings of low porosity levels (1%) and avoids alteration of the mechanical properties of the substrate [7]. The corrosion characteristics of thermal sprayed coatings in static saline environments are extremely important where the flow of aqueous solution over components intermittently ceases. It has been established [1; 2] that where coatings are applied by a high-quality process and under stringent quality control procedures, the coatings can provide a very effective barrier to thesubstrate and prevent any corrosion from occurring. In this situation, however, it is very important to appreciate that corrosion of the coating can occur and that initiation and propagation of corrosion, associated with microstructural features of the composite system, are a real issue. For improvements to the coating corrosion resistance to be made, a full understanding of the corrosion rates and mechanisms, and in particular theresistance of the metallic binder (in cermet systems), is required. In addition, an understanding of static corrosion behavior can help reveal the mechanisms of the coating degradation in erosion-corrosion environments. [9,10]. This article investigates the corrosion rates and mechanisms of two HVOF coatings (WC-Co-Cr and WC-Co).

2. EXPERIMENTAL PROCEDURE

Two HVOF sprayed coatings are studied in this work: a WCCo-Cr coating with nominal composition 86%WC10%Co-4% Cr, and a WC-Co coating with a nominal composition 86% WC-14% Co. The coatings were applied to a stainless steel substrate (UNS S31603).

Specimens were soldered on the rear side to an electrical conducting wire and subsequently encapsulated in nonconducting resin. The exposed coated face of the specimen was then ground with silicon carbide abrasive papers and polished to a 6 µm diamond finish. The main seawater constituents were 19300 ppm chloride, 11 000 ppm sodium, 2700 ppm sulfate, 1300 magnesium, 400 ppm calcium, 400 ppm potassium, and 150 ppm bicarbonate ions. The specimen-resin interfaces were sealed using Lacomit varnish (Agar Aids, UK) to prevent interference from the substrate. Electrochemical monitoring was carried out with a standard three-electrode cell, comprising a platinum auxiliary electrode and a saturated calomel reference electrode (SCE). Direct current (DC) anodic polarization tests were carried out after 1 h immersion in the seawater at 18 and 50 °C.The seawater was left open to the atmosphere. Fig.1. Anodic polarization curves in static artificial seawater at 18 °C on WC-Co-Cr and WC-Co HVOF sprayed coatings The potentiostat was used to scan the electrode potential of the coating samples from the free corrosion potential (Ec o r r) in the positive (anodic) direction until a current in the range of 500-700 µA/cm2. In addition, an atomic force microscope (AFM) was used to map the topography of the coatings during accelerated corrosion tests. The AFM was configured to probe the surface under water and to record images during anodic polarization n tests. Each image took 6 min to produce, during which time the potential had shifted by approximately 90 mV.

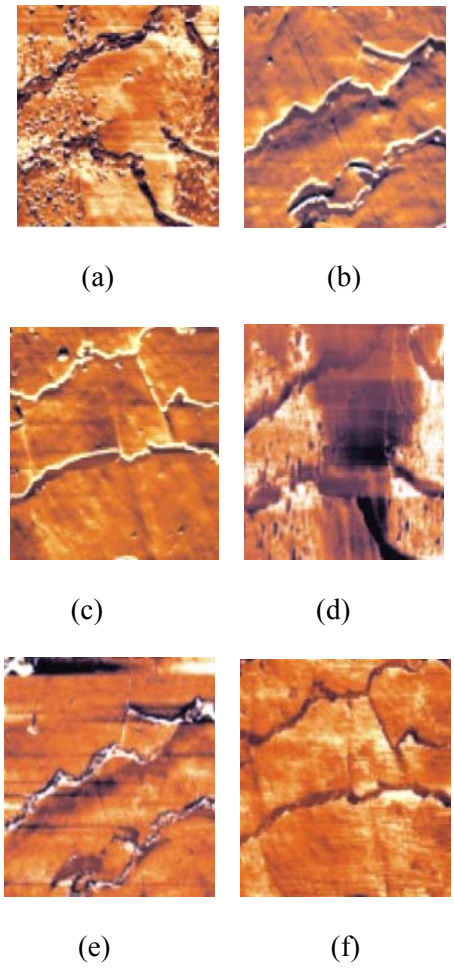


Fig 3. In situ AFM images (a) Polished coating prior to polarization; (b) points A to B; (c) points B to C; (d) points C to D; (e) points D to E; and (f) end of anodic polarization.

During the decrease in current (points B to C), the matrix is dissolving at a steady rate, defining the hard phase particles more clearly (Fig. 3c). As the current increases (points C to D in Fig. 3d), the matrix dissolves further, revealing the smaller hard phases from point D to E (Fig. 3e). At the end of the anodic polarization, areas where the matrix has dissolved in some regions and areas of attack around the matrix-hard phase interface can be seen (Fig. 3f).

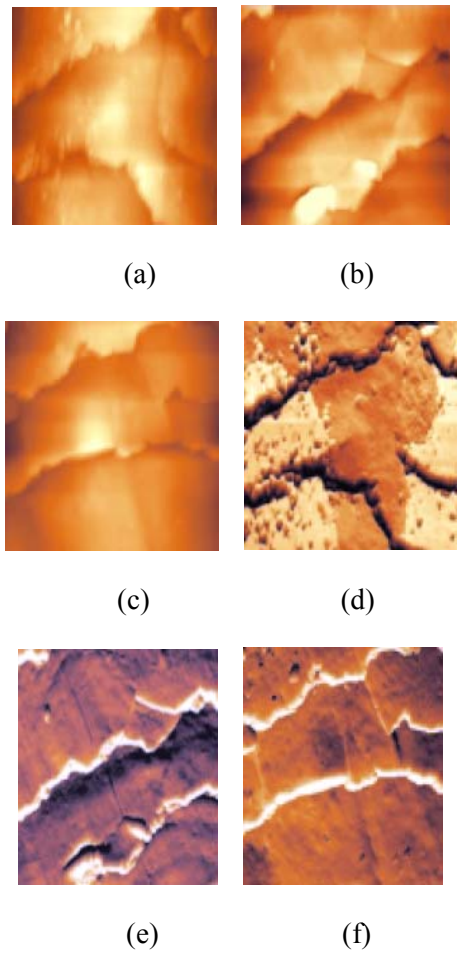


Fig. 4. In situ AFM images (a) Polished coating prior to polarization; (b) point B; (c) point C; (d) point D; and (e) end of anodic polarization.

In a similar manner, the corrosion mechanisms during anodic polarization of the WC-Co-Cr coating were examined. Figure 4(a) shows the coating at the free corrosion potential with the light grey hard phases encased in the darker grey matrix. The rapid increase in current with the potential corresponds to dramatic matrix dissolution and leaves the hard phase protruding from the matrix (Fig. 4c). As the current stabilizes at point D, carbides begin to fall out from the matrix and leave voids behind (Fig. 4d). This progresses until the end of the scan at point E, where the matrix consists mainly of voids left by the carbide particles and a few carbides on the next layer are visible (Fig. 3e). After immersion in seawater for 1 h at 50°C, the kinetics of the anodic polarization processes are accentuated on both coatings.

3. CONCLUSION

The use of an AFM can aid the determination of orrosion mechanisms on a microscale.The addition of chromium to a cobalt matrix increases the corrosion resistance of a WC-based HVOF sprayed cermet coating and its extent of this has been quantified. Although the WC-Co-Cr coating ndergoes more localized attack at 18 °C, accentuated at the hard phase-matrix interface, the WC-Co has more uniform corrosion affecting the entire matrix. An increase in emperature results iextensive. dissolution of the cobalt matrix, whereas on the CoCr matrix more severe attack is further localized in regions not associated with any specific microstructural features.

REFERENCES

[1]. S.T. Tsai and H.C. Shih: *"The Use of Thermal-Spray Coatings for Preventing Wet H2S Cracking in HSLA Steel Plates,"* Corros. Prev. Control, 1997, 44, pp. 42-48;

[2]. R.J. Duncan and C.B. Thompson: *"A Guide to Weld and Thermal Spray Hardfacing in the Pulp and Paper Industry.* Part 2: Applications," Mater. Des., 1991, 11, pp. 71-75;

[3]. C.B. Thompson and A. Garner: *"Identification and Control of Wear in the Pulp and Paper Industry,"* Pulp Paper Can., 1986, 87, pp. 53-56;

[4]. L. Pejryd, J. Wigren, D.J. Greving, J.R. Shadley, and E.F. Rybicki: *"Residual Stresses as a Factor in the Selection of Tungsten Carbide Coatings for a Jet Engine Application,"* J. Therm. Spray Technol., 1995, 4, pp. 268-74;

[5]. *G. Binnig, C.F. Quate, and Ch. Gerber, Atomic force microscope, Phys.* Rev. Lett. 56,930-933 (1986).

[6]. *G. Binnig, H. Rohrer, Ch. Gerber, and E. Weibel, Surface studies by scanning tunneling microscopy,* Phys. Rev. Lett. 49, 57-61 (1982);

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

EXPERIMENTAL RESEARCH CONCERNING THE WEAR OF THE MILLING EDGES UPON THE QUALITY OF WOOD SURFACES

Luminița-Maria BRENCI*, Camelia COSEREANU*, Adriana FOTIN*

* Faculty of Wood Engineering, Department of Wood Processing and Wood Products Design, Transilvania University of Brasov, Romania

Abstract: *The objective of the present paper is to present some experimental results regarding the behavior of the profiled milling edges geometry during the milling process. The both phenomena regarding the processing surfaces quality and the edges milling geometry depends on the milling wear process. Five species of wood were analyzed, namely fir (Abies), poplar (Populus), oak (Quercus), maple (Acer Pseudoplatanus) and beech wood (Fagus Sylvatica). They were, subjected to profiled milling using various cutting conditions. For each of the three rotation speeds of the cutting tool, three feeding speeds were applied. The roughness of the samples was measured using laser beam method, the measuring direction being perpendicular to the wood grain. The results presented in the present paper were analyzed on the convex surface of the profile in three stages of the cutting edge wear. The obtaining conclusions on the experimental data regarding the profile surface quality could be extended on defining the milling edges geometry evolution in milling processing.*

Keywords: *profile milling, milling edges, roughness, surfaces quality, wood species, cutting conditions, cutter head, laser beam.*

1. INTRODUCTION

Milling is one of the most important wood processing operations. This fact leads the researchers to consider studies and analysis of the quality of the wooden components after milling straight or profiled surfaces.

Profiled milling of the wood involves numerous peculiarities compared to classical milling (of plane surfaces), so it can be classified as a special milling operation.

One of the factors of influence upon the quality of the profiled surfaces obtained by milling operation is represented by the wear degree of milling cutting edges.

The difficulty in analyzing the roughness of the profiled surfaces occurs because of the required specialized equipment, not enough developed in this field and the lack of technical specifications for wooden surfaces analysis. A multitude of studies are also oriented to analyze the quality of the flat sanded surfaces (Brenci et al., 2011:21-29) or coated ones. A distinct particularity when analyzing the wooden surfaces is defined by the non-homogenous structure of the wood in comparison with other materials (as metal), fact that make the process of the surface quality assessment and the interpretation of the results more difficult to be done. The most difficult problem in assessing the roughness of the wooden surfaces occurs in the case of complex profiles (concave or convex ones), formed in the connection of various sizes of shapes and surfaces (Brenci

et al. 2008:67-74), (Brenci et al., 2009:0413-0415) and (Fotin et al., 2009:45-52). Other factors that have influence on the quality of the wooden surfaces are represented by the depth of the chip removal, direction of processing (depending on the direction of the grains orientation), wood moisture content, the non-homogenous anatomy of the wood, the parameters of the milling conditions (Fotin et al., 2010:269-274), etc.

The problem of an accurate analysis of the wooden surfaces quality is also connected to the type of equipment used to measure the roughness, appropriate for a more accurate determination. If the measurement of the roughness of the flat surfaces could be done both by the roughness equipment with mechanical contact (diamond peak) and by those without mechanical contact (laser beam and light beam), is not the case of the profiled surfaces measurement, where only equipment without mechanical contact can be used.

In order to study this influence in the case of profiled milling of wood, the behaviour of five different wood species was analyzed under different cutting conditions.

2. MATERIAL AND METHOD

The aim of this paper was orientated to the following research work:

- qualitative analysis of the roughness of the profiled surfaces obtained by milling five samples made of different wood species. The assessment was performed in three processing stages, as function of the profile shape and position:
  - at the beginning of processing;
  - in wear conditions after cutting over 600 linear meters of wood;
  - in wear conditions after cutting over 1000 linear meters of wood;
- study of the behaviour of the cutter edge geometry (clearance angle, hook angle, sharpness angle, profile angle, backing-off angle and side relief angle) under conditions of gradually increasing wear.

The material used within the experiments consisted of samples cut from five different wood species: fir (Abies), poplar (Populus), oak (Quercus), maple (Acer pseudoplatanus) and beech (Fagus sylvatica). These specific wood species were chosen considering the following criteria:

- fir, beech and oak are the most widely spread wood species within the Romanian forest areal (Zlate, 1990);
- poplar was selected due to its short growth period (25÷30 years) (Zlate, 1990), in comparison with other wooden species (beech 120÷130 years, oak and fir 120÷140 years).
- maple was choosed to create a comparison criteria for beech, taking into consideration that both species are hardwoods with uniform structure and close density values.

The machine used within the experiments to process the wooden species was a vertical milling machine, endowed with a mechanical feed device. A milling cutter head with four profiled cutters was used in the experiments, having the following characteristics: outer diameter D = 178 mm, width B = 40 mm, clearance angle $\alpha = 25^0$, sharpness angle $\beta = 47^0$, hook angle $\gamma = 18^0$ and side relief angle $\alpha' = 3^0$.

The value of the side relief angle was adopted according to reference literature (Dogaru, 2003), so to eliminate friction between the processed part and the cutter edges.

The processed samples had the following characteristics: radial section, humidity between 8÷10 %, length 1000 mm, thickness 50 mm and cutting was performed along the grains.

For a more precisely comparison analysis, the authors considered that it is necessary for each processed sample to accomplish to the different cutting conditions, according to the indications in Table 1.

The variable parameters within the research were: wood species, cutting speed, feed speed (see Table 1), wear of the cutting edges and values of the side relief angle. The roughness of the processed surfaces was

chosen as reference parameter, defined as the average value of the maximum height of the irregularities, H_m.

Tabel 1. The cutting condition for all five wooden species

Wooden species	Rotation speed n = 3300 [rot/min] n = 4852 [rot/min] n = 6594 [rot/min]		
	Feed speed [m/min]		
Fir	6.5	12.7	23.7
Poplar			
Beech			
Oak			
Maple			

According to the literature in the field (Dogaru, 2003), the average value of the deviation of the maximum height of irregularities H_m, equals with the maximum irregularities average which was measuring from the top to the bottom of the profile.

$$H_m = \frac{H_{\max 1} + H_{\max 2} + \ldots + H_{\max n}}{n} \quad [\mu m]$$

After milling processing the samples were cut into test samples with the following dimensions: length 60 mm, width 50 mm and weight 20 mm (Fig. 1).

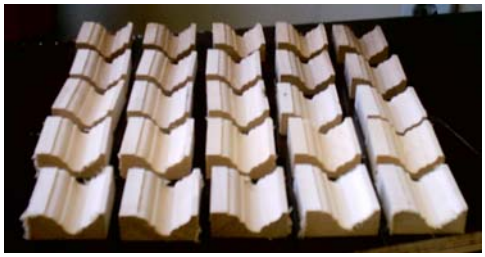


Fig. 1. Test samples for measuring the roughness

Using the laser beam equipment for the qualitative assessment of the irregularities height H_m placed on the surfaces situated perpendicularly to the laser beam direction and assessing the quality of all profiled surfaces, the fidelity of roughness comparison for the same profile type was maintained.

The laser beam equipment works with the following technical specifications:

- laser beam moving angle: 0.036 degree;
- frequency for each measuring operation: 750 Hz.

For an accurate analysis of the roughness of the processed surfaces, five samples were measured from each species of wood and five measurements were done for each sample.

The measurements were carried out in three stages: at the beginning of milling process, when the cutting edges compiled with the best quality conditions; after the wear of the milling cutter occurred by processing over 600 linear meters of wooden material and after the wear of the milling cutter occurred by processing over 1000 linear meters of wooden material.

The profiled surface of the test samples was scanned by the laser beam in 3045 points, over a length of 40 mm and 16 mm in depth. After this operation was performed, the measured data were downloaded and processed by the computer and transformed the obtained results into two types of files: DXF files and TXT files for defining the position and the coordinates of the points defining the profile; coordinates of the laser beam, as well as its relative angle to the test sample.

3. RESULTS AND DISSCUSSION

The experimental results regarding the influence of the cutting conditions and tool

wear upon the quality of the profiled surfaces are presented in figure 2. All three diagrams refer to the same convex surface, represented by point "e" (Fig. 3). As noticed, the ordinate-axis (Y) in the diagram presented in Fig. 2. shows the relative roughness H_m. This is because the laser beam scanned inevitably under a certain angle (not perpendicular) to the analysed surfaces. Therefore, was considered that "relative roughness" is the most appropiate term for this case. The coclusions of this work were not influenced by this term because they were set out by comparison of the same types of profiles.

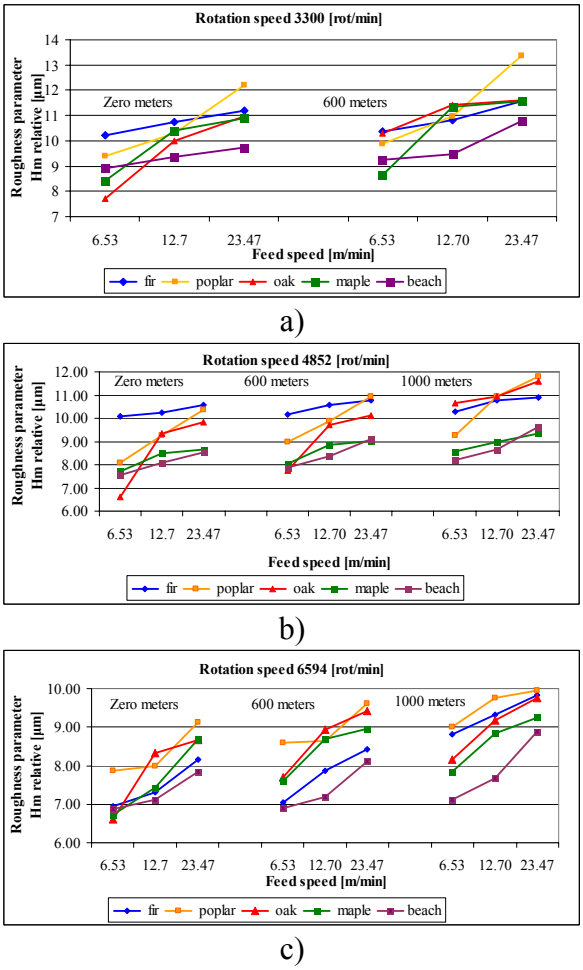


Fig. 2. Influence of the cutting conditions upon the roughness of a convex surfaces
a – processing with a rotation speed of 3300 rot/min; b - processing with a rotation speed of 4852 rot/min; c - processing with a rotation speed of 6594 rot/min

Analyzing the diagrams presented in Fig. 2, in the situation of using wear cutters for milling operation ($\rho_0 \geq 40$ µm), the roughness of the surfaces increases drastically for all species of wood, being more evident for resinous wood and especially for poplar wood (having a high pilling degree – Fig. 4 and Fig. 5). In the area of the profile with a contour angle $\varepsilon<10^0$ resulted after milling operation, the roughest surfaces were obtained, together with grains tearing and failures and even small marks of wood burns. The grains tearing and failures were observed especially to the soft species of wood and the burn marks were observed especially to hardwood.

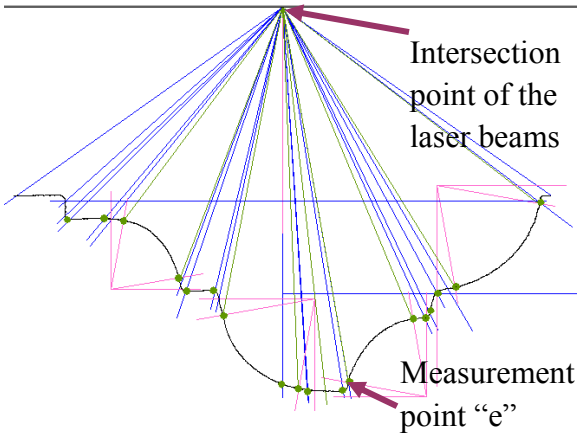


Fig. 3. Indication on the sample drawing of the measuring and roughness evaluation area

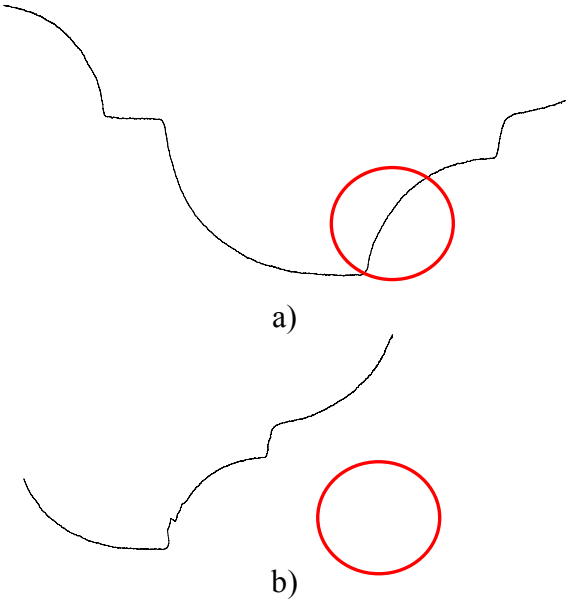


Fig. 4. Convex surface of poplar (rotation speed = 4852 rot/min and feed speed = 23.74 m/min)

a – after processing over 600 linear meters of wooden material; b – after processing over 1000 linear meters of wooden material

Due to the wear of the milling cutter, high values of the roughness were registered for oak wood, which also has apart structure.

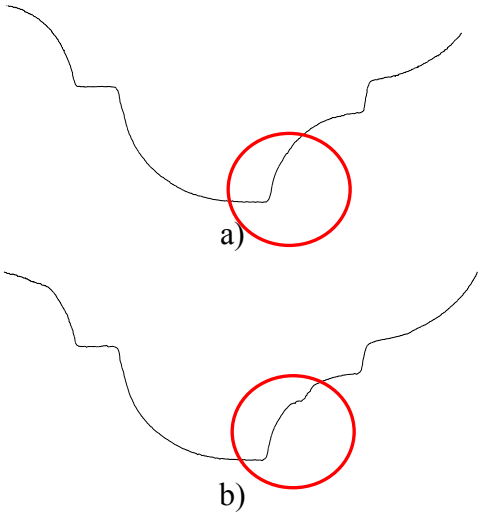


Fig. 5. Convex surface of fir
(rotation speed = 4852 rot/min and
feed speed = 23.74 m/min)
a – after processing over 600 linear meters of wooden material; b – after processing over 1000 linear meters of wooden material

The most stable behavior (identified by low values of the roughness) was registered for beech wood compared with the other species of wood, no matter of the wear stage of the milling cutters or of the processing conditions, due to its homogeneous structure.

Another factor of influence regarding the roughness of profiled surfaces is the variation of the clearance and hook angles over the profile height. Having a view to the tool design, the angular values of the cutter edges in case of profiled cutters should vary with the profile shape and according to the processed wood species.

It was also concluded that the tools sharpening has to be done in case of profiled milling of over 600 meters of soft species of wood if low values of the roughness are to be obtained (for cutters made of rapid steel).

4. CONCLUSIONS & ACKNOWLEDGMENT

As the results of the experiments made on the five species of wood processed using various cutting parameters, it was concluded that the side relief angle of the profile angle have influence upon the quality of the profiled surfaces. After analysing the diagrams, the following conclusions regarding the geometrical characteristics of the profiled milling cutters are to be emphasized:

- If a modification of the wooden profile is not possible within the areas where the profile angle ranges between 0^0 and 8^0, it becomes compulsory to back-off the edges: $\tau > 2^0$, higher values being indicated only for soft species;
- In order to maintain unmodified the clearance and the hook angle over the height up to 30mm should be processed;
- The side relief angle α', with profile angles $\varepsilon < 10^0$ specific to surfaces which lie perpendicularly to the rotation axis, must range between 5^0 to 9^0, depending on the wood species (higher values for soft hardwoods and resinous woods);
- For high or deep profiles, the following values of hook and clearance angle are recommended: $\gamma_{max} = 15^0\text{-}20^0$ (depending on wood species and the material the tool in made of) and $\alpha = 10^0 – 16^0$.

REFERENCES

1. Brenci, L., Cismaru, I., Boieriu, C. *The Roughness Of Wood Surfaces Interpreted Through Two Measuring Methods*. Pro Ligno. Issue 4(3): 67-74 (2008).
2. Brenci, L., Cismaru, I., Cosereanu, C., Curtu, I., Lica, D., Fotin, A. *The influence of the profiled milling parameters to the Quality of the surfaces.* In: Proceedings of The 20th INTERNATIONAL DAAAM SYMPOSIUM "Intelligent Manufacturing & Automation: Theory, Practice & Education", Viena, Austria. Katalinic, B. (Ed.):0413-0415 (2009).
3. Brenci, L.M., Cismaru, I., Coşereanu, C. *Experimental research upon the quality of the sanded surfaces of some decorative composite panels.* ProLigno. Issue 7(2): 21-29 [online]. Available: http://proligno.ro/ro/articles/2011/2/brencifull.pdf (June, 2011).
4. Dogaru, V. *Wood milling*. Braşov: Editura Universității Transilvania (2003).
5. Fotin, A., Cismaru, I., Salcă, E.A., Cismaru, M. *Influence of the variable parameters of the machining regims upon the surface quality obtained by straight milling*. Pro Ligno. Issue 5(4):45-52 (2009).
6. Fotin, A., Cismaru, I., Cismaru M., Cosereanu, C., Brenci L.M., Curtu, I. *The tool influence on the quality of birch wood strainght milled surfaces*. In: Proceedings of The 7th International Conference of DAAAM Baltic Industrial Engineering, 22-24th Aprilie 2010, Tallinn, Estonia, ISSN 978-9985-59-982-2, p. 0269-0274 **(**2010).
7. Zlate, Ghe., Brendörfer, D. *Production and wood mechanical processing bases.* Bucureşti: Editura CERES (1990).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

THE INFLUENCE OF THE ANATOMY STRUCTURE UPON THE STACKING CAPACITY OF WOODEN BOXES

Ivan CISMARU*, Adriana FOTIN*

*Faculty of Wood Engineering, Transilvania University of Brasov, Brasov, Romania,

Abstract: *Wooden boxes are products designed for storage and transport of various goods between the producer and the beneficiary, with or without intermediate storage. The functional characteristic of the wooden boxes is that of ensuring the protection and integrity of the products, both in storehouses and during the transport phases. The safe capacity depends mainly on the accurate sizing of the boxes with the type, size and weight of the loads and also of their correct stacking during storage.*
The sizing (or the dimensional checking by calculation) in the conditions of storage should take into account also the orientation of the anatomic structure against the forces subjected by the stack to the platform. According to this condition it can be said that the elements of the structure (lamellas, frameworks, frame stiles, etc.) are differently participated to the forces loading the vertical stack of wooden boxes.

Keywords: *wooden boxes, stacking, storage*

1. INTRODUCTION

The wooden boxes industrial processed have different orientations of the lamella grains in their constructive structure related by the position and sizes of the panels where they are included as components – top panel, side panel or end panel. Lamellas can be oriented along the length or width of the panels in the structure, contributing to a different design and in the same time to a different behavior as functional strength (handling) and stacking conditions.

The boxes with longitudinal elements (Fig.1.a) have the lamellas oriented along the length of the panels, taking into consideration that the dimensional relation between the interior sizes of the boxes is L>B>H and the boxes with transversal elements have the lamellas oriented along the width of the component panels of their structure (Fig.1.b.).

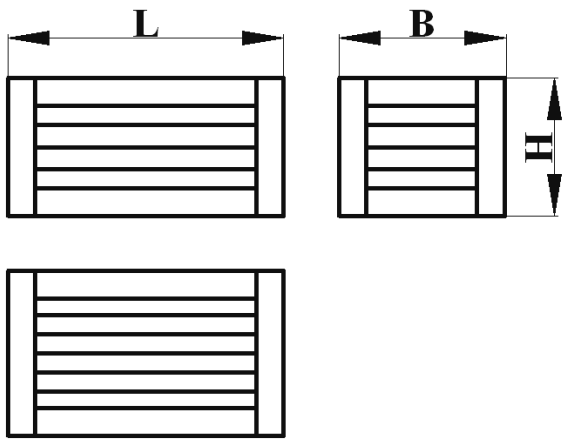


Fig.1.a. The longitudinal orientation of the lamellas in the panels of the box structure

Structures in which the lamellas are oriented both along the longitudinal and transversal direction are also possible (Fig.1.c.).

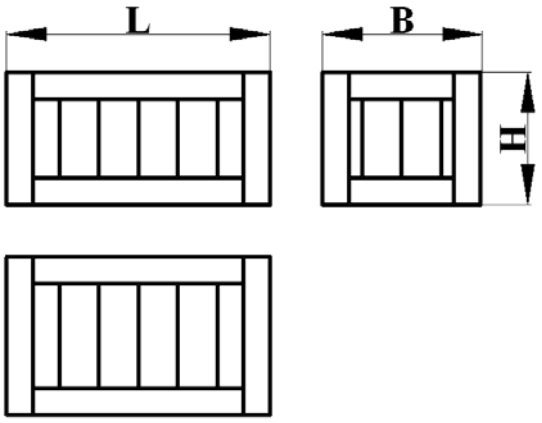


Fig.1.b. The transversal orientation of the lamellas in the panels of the box structure

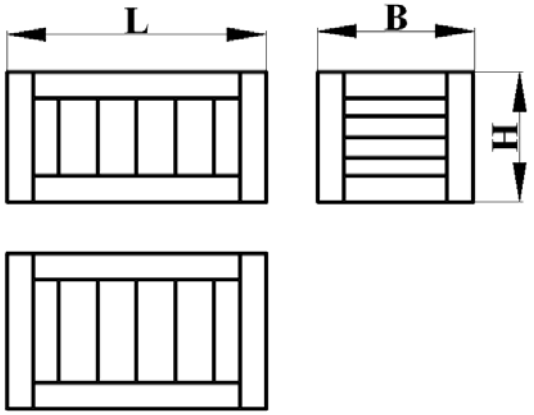


Fig.1.c. The longitudinal orientation of the lamellas on the end panel and the transversal orientation on the top, bottom and side panels of the wooden box

In order to calculate the sizes of the lamellas we have to consider the bending load of the panels in the conditions of the cargo weight. The lamellas resulted after calculation are characterized by the following:

- Lenght (l_0) depending on the type of the panel in the box structure and on its orientation;
- Width (b_0) depending on the dimensional ratio between the size of the panel and the size of lamellas (so to have an integer number of the identical lamellas);
- Thickness (g_0) depending on the size of the strains induced by the cargo load and the species of wood the lamellas are made of (the thickness is the result of bending strength calculation).

In case of wooden boxes with longitudinal orientation of the lamellas (Fig.1.a.), the results are as follows:

- for the top panel lamellas:

$$l_{0_1} = L;\ b_{0_1} = \frac{B}{n_1};\ g_{0_1} = g_{c_1}$$

- for the side panel lamellas:

$$l_{0_2} = L;\ b_{0_2} = \frac{H}{n_2};\ g_{0_2} = g_{c_2}$$

- for the end panel lamellas:

$$l_{0_3} = B;\ b_{0_3} = \frac{H}{n_3};\ g_{0_3} = g_{c_3}$$

where:

- n_1, n_2, n_3 – are the integer numbers of the lamellas for each panel;
- g_{c1}, g_{c2}, g_{c3} –are the thicknesses of lamellas resulted after calculation (in mm) and rounded up.

In case of wooden boxes with transversal orientation of the lamellas (Fig.1.b.), the results are as follows:

- for the top panel lamellas:

$$l_{0_1} = B;\ b_{0_1} = \frac{L}{n_1'};\ g_{0_1} = g_{c_1}$$

- for the side panel lamellas:

$$l_{0_2} = H;\ b_{0_2} = \frac{B}{n_2'};\ g_{0_2} = g_{c_2}$$

- for the end panel lamellas:

$$l_{0_3} = H;\ b_{0_3} = \frac{B}{n_3'};\ g_{0_3} = g_{c_3}$$

where:

- n_1', n_2', n_3' şi g_{c1}, g_{c2}, g_{c3} have the same meaning as mentioned before.

In case of stacking for storing or transport purpose, the following issues are to be considered: the wooden boxes at the base of the stack are subjected to the maximum strains and the forces applied by the weight of the boxes (the load and their own weight) are subjecting only on the vertical elements.

2. STACKING – STRESSES AND WAYS OF DOWNLOADING

The general scheme of defining the level of stresses when stacking the wooden boxes is presented in figure 2, where Q is the total force

that has to be takeover by the box situated at the bottom of the stack. If the boxes are considered to be identical, than Q is defined as (Cismaru&Fotin, 2010):

$$Q=(n-1)\cdot Q_l \qquad (1)$$

in which:

- Q_l is the load introduced in each box, defined as:

$$Q=Q_0+Q_M \qquad (2)$$

in which:

- Q_0 – is the own weight of the box;
- Q_M – represent the weight of the load in the box;
- n – is the number of the boxes stacked one top to the other, generally imposed by the ratio $\frac{H_s}{H}$, where H_s is the storing height (the height of the stack) and H is the box height.

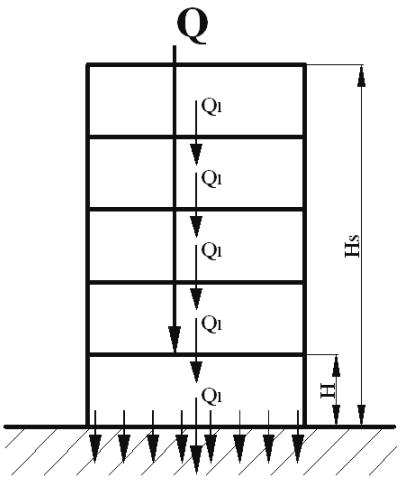


Fig.2. The scheme of the stack downloaded forces on the platform

The stresses that occur and develop in the vertical elements of the boxes (the stiles of the frame – when the lamellas are longitudinally orientated on the side panels and end panels or the stiles of the frame and the lamellas on the side panels and end panels in case of transversal orientation of the lamellas) (Fig.3) are combined stresses of compression and buckling.

The calculations have to take into account the fact that the box is functional and is safe for the integrity of the goods inside, as long as its shape remains unchanged (so no buckling for vertical elements) and that fact constitutes the input data for the proposed paper.

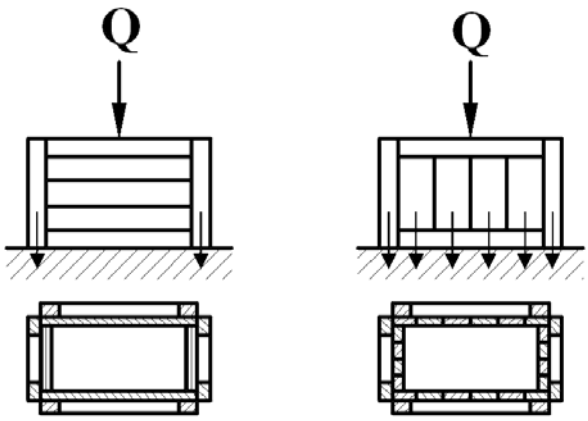


Fig.3. The downloaded stacking forces on the platform
a. at the wooden boxes with longitudinal elements
b. at the wooden boxes with transversal elements

2.1. Elements for a comparative study. In case of calculation the parallel compression along the wood grains (calculation applied to vertical elements) the relationship of defining the maximum force applied until buckling the structural element will be considered. The general calculation scheme is shown in Fig.4.

In this case the next equation is used:

$$Q_{\max}=b\cdot\delta\cdot\varphi\cdot\sigma_{c_{II}} \qquad (4)$$

in which:

- $\sigma_{c_{II}}$ is the admitted strain to the parallel compression along the grains (depending on the species of wood), in N/m^2;

- b and δ are the sizes of the crosscut section of the vertical element, in m;

- φ is the coefficient of reducing the compression strain depending on the suppleness coefficient of the vertical element.

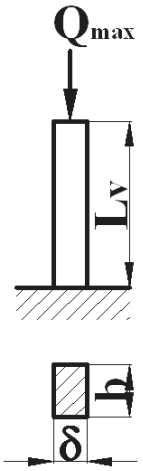


Fig.4. General calculation scheme

The φ coefficient has a complex action according to the suppleness coefficient λ, as resulted from table 1.

Table 1

The values of φ coefficient against λ (Cotta, 1983)

φ	**10**	**30**	**50**	**80**	**100**
λ	0,99	0,93	0,80	0,48	0,31
φ	**130**	**150**	**180**	**200**	
λ	0,18	0,14	0,1	0,08	

The calculation of the suppleness coefficient is made using the equation:

$$\lambda = \mu \cdot \frac{L_v}{i} \qquad (5)$$

where:

- L_v is the length of the element, [m]

- μ is the stiffness coefficient (due to the rigid fixing in the structure), having the following values:

μ=0,5 for rigid joints of the elements;

μ=0,75 for half-rigid joints with nails of the elements;

μ=1, for the mobile joints.

- i, is the radius of inertia of the crosscut section, calculated with the next equation:

$$i = \sqrt{\frac{I}{S}} \text{ [m]} \qquad (6)$$

in which:

- I – is the moment of inertia calculated with the equation: $I = \frac{b \cdot \delta^3}{12}, [m^4]$, depending of the sizes of the crosscut section;

- S – is the crosscut section of the vertical element calculated with equation: $S = b \cdot \delta, [m^2]$.

The value of the radius of inertia of the vertical elements resulted after substituting is as follows:

$$i = \sqrt{\frac{b \cdot \delta^3}{12 \cdot b \cdot \delta}} = 0{,}289\delta, [m]$$

When taking into account the submitted data and the data shown in figures 3 and 5, than the maximum force taken over by the box, without buckling ([Curtu & Ghelmeziu, , 1984), at the basis of the stack will be differently determined, as follows:

- for the boxes with longitudinal lamellas on the side panels and end panels:

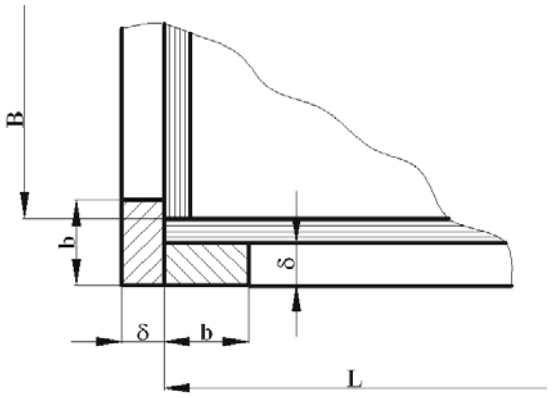


Fig.5a. Elements that download the stacking forces. Boxes with longitudinal lamellas on side panels and end panels

$$Q_{\max_1} = n_0 \cdot b \cdot \delta \cdot \varphi_0 \cdot \sigma_{cII}, \text{ [N]}, \qquad (7)$$

in which:

- n_0, is the number of stiles of the frames of the side and end panels – depending on the constructive solution of the box (4, 6, 8 pcs).

- φ_0 – is the specific coefficient to the sizes of the stile crosscut section.

- for boxes with transversal lamellas on the side panels and end panels:

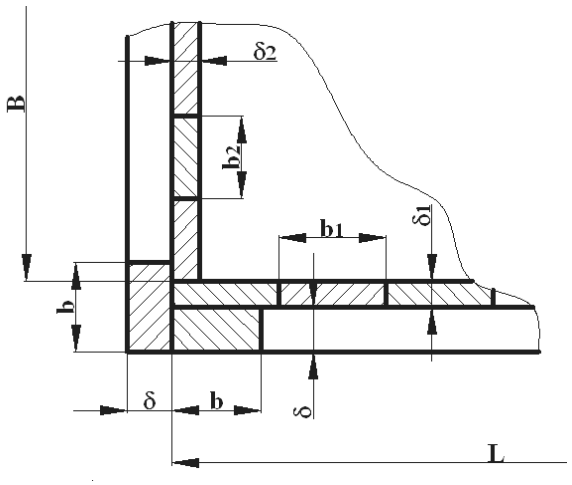


Fig.5b. Elements that download the stacking forces. Boxes with transversal lamellas on side panels and end panels

$$Q_{\max_2} = n_0 \cdot b \cdot \delta \cdot \varphi_0 \cdot \sigma_{cII} + n_1 \cdot b_1 \cdot \delta_1 \cdot \varphi_1 \cdot \sigma_{cII} + + n_2 \cdot b_2 \cdot \delta_2 \cdot \varphi_2 \cdot \sigma_{cII}\text{, [N]}, \quad (8)$$

in which:

- n_0 and φ_0, are described above
- n_1, b_1, δ_1, φ_1- are elements specific to the lamellas of the side walls, where $n_1 = \frac{2L}{b_1}$ and φ_1, calculated depending on the lamellas section (b_1, δ_1), n_1 being an even number;
- n_2, b_2, δ_2, φ_2- are elements specific to the lamellas of the end panels of the box, in which $n_2 = \frac{2B}{b_2}$ and φ_2 is calculated depending on the lamellas section (b_2, δ_2), n_2 being an even number.

Analyzing equations (7) and (8), it can be said that the boxes with transversal elements can download a higher stacking load.

The ratio:

$$\frac{Q_{\max_2}}{Q_{\max_1}} \cdot 100 = c \ , \quad [\%] \quad (9)$$

- is the coefficient of the percentage increasing of the capacity of downloading the stacking forces, in case of boxes with transversal lamellas (on side panels and end panels) against the case of the boxes with longitudinal lamellas.

If the strength condition is imposed:

$$Q_{\max_1} \le (n-1) \cdot Q_l \quad (10)$$

- for the wooden boxes with longitudinal elements

$$Q_{\max_2} \le (n-1) \cdot Q_l \quad (11)$$

- for the wooden boxes with transversal elements

It can be said that the limits of equations (10) and (11) may be used for sizing the stiles of the resistance frames (from the structure of the panels), knowing that the sizes of the lamellas resulted from the bending strength condition.

3. CONCLUSIONS & ACKNOWLEDGMENT

The use of wooden boxes with transversal lamellas of the panels (top, side, end panels) related to panel's sizes bring some advantages, as:

- allow the use of small sized wood, as long as the relation between the interior sizes of the box is L>B>H;
- ensure a smaller amount of wood to be used, the required thicknesses of the transversal lamellas being smaller than that of the longitudinal ones;
- the stacking capacity is higher in case of transversal lamellas, these ones downloading higher weights on the

platform by the vertically oriented lamellas;
- boxes weight - for the same load it is smaller for transversal elements, increasing the stacking capacity.

In order to have benefit of the advantages presented in the present, the sizing of the boxes (depending on the orientation of the structural elements – the lamellas) must be fully achieved, in terms of:

- bending strength – for the thickness value and then the width is calculated depending on the ratio between the interior dimensions of the boxes and the widths of the lamellas, so to obtain integer numbers for each panel;
- combined compression with buckling - when the dimensions of the stiles of the frames are obtained, the frames being used in the structure of the panels and to consolidate the structures.

REFERENCES

1. Cotta, N.,. [1983] *Proiectarea şi tehnologia fabricării produselor industriale din lemn*. City: Bucureşti, Editura Didactică şi Pedagogică
2. Curtu, I., Ghelmeziu, N. [1984], *Mecanica lemnului şi materialelor pe bază de lemn*. City: Bucureşti, Editura Tehnică.
3. Cismaru, I., Fotin, A. [2010]. *Notițe de curs* platforma elearning, *Source.* [online]. Available: http://elearning.unitbv.ro/mdl9/course/ City: Braşov Universitatea Transilvania din Braşov.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

STUDY ON THE QUALITY OF THE SURFACE IN CASE OF MIXED WOOD PANELS

Camelia COSEREANU*, **Ivan CISMARU****, **Luminita-Maria BRENCI*****

* Faculty of Wood Engineering, Department of Wood Processing and Wood Products Design, Transilvania University of Brasov, Romania, ** Faculty of Wood Engineering, Department of Wood Processing and Wood Products Design, Transilvania University of Brasov, Romania, *** Faculty of Wood Engineering, Department of Wood Processing and Wood Products Design, Transilvania University of Brasov, Romania

Abstract: *The paper presents the quantitative assessment of the surface quality in case of new structures (decorative) of panels obtained from finger-jointed panels made of mixed wood lamellas. The particularity of the research is that the assessment of the quality is made on the cross-cut section of the wood lamellas. Consequences of using some of the actual composite materials have occurred because of the binding materials properties, namely the formaldehyde emission, which has proved to be dangerous for health. On the other hand, the behavior of some of these materials in aggressive environment has been proved to be unsatisfactory and of a reduced durability. In order to scan the topography of the panels' surfaces, the contact-less method was used to analyze the representative roughness parameters of wood: Ra, Rz, Rk, Rpk and Rvk. The measurements were performed in the frame of the Laboratory of Testing the Processing Accuracy in Wood Industry. The present paper is an experimental study that focuses on the evolution of surface quality in case of mixed decorative panels, made of wood lamellas randomly arranged in the structure of the panels, having the crosscut section on the panels' faces. The grit sizes used for sanding operation are the most usual ones for a technological process, namely 80, 100 and 120 ones.*

Keywords: *mixed panels, crosscut section, roughness, surfaces quality, wood species, light beam.*

1. INTRODUCTION

From the architectural point of view, the simple lines imposed by the processing technology of the composite materials as melamine faced or veneered boards have limited the creative work of the designers, so finally, people have reached the conclusion that ecological materials with their natural jointing solutions are required. That's why, a great importance was given to the use of small sized wood for wooden panels, in order to increase the utilization rate of wood into the product, obtaining thus finger – jointed and edge – jointed panels.

Within the present background of attempting to use and reuse the ecological materials by specialists, various concepts of approaching techniques and technologies of using wood waste were developed by specialists. Branches resulted from wood exploitation process were used to design new panels with aesthetical functions (Cionca et al., 2006:35-42), different hardwood species as beech, oak, maple, cherry, ash and nut wood were mixed and used as wood lamellas in

finger-jointed panels in order to obtain new design of the panels together with good properties as: stiffness, stability, flatness and liability (Coşereanu et al. 2009/2010).

Due to the fact that composite panels proposed in the present paper contain in their structure various species of wood, randomly arranged in the panel and having the crosscut section of wood on their faces, it can be said that the results of sanding operations (including calibration) are reflecting in the quality of surfaces.

The research work on the milled surfaces, performed so far (Brenci et al. 2008:67-74), (Brenci et al., 2009:0413-0415), (Salcă et al., 2008:57-68) and on the sanded surfaces (Fotin et al., 2009:45-52), had as results the optimum processing work parameters, so that the sanding operation to be removed, obtaining thus a lower manpower and electric power consumption. But these studies were performed on the longitudinal section of wood and the particular thing of the decorative panels studied in this paper is the appearance of wood crosscut section on the faces of the panel. The presence of two different species of wood in the same panel (nut and cherry wood on a panel and poplar and spruce wood on the other one, as proposed in the present paper) brings also new variables to be study.

In order to scan the topography of the panels' surfaces, the contact-less method (light beam method) was used to analyze the representative roughness parameters of the wood: Ra, Rz, Rk, Rpk and Rvk. The measurements were performed in the frame of the Laboratory of Testing the Processing Accuracy in Wood Industry

The experimental study presented herein is focused on the evolution of the quality of the surface in case of mixed decorative panels made of wood lamellas randomly arranged in the structure of the panels, having the crosscut section on the panels' faces.

The grit sizes used for sanding operation are the most usual ones for a technological process, namely 80, 100 and 120 ones.

2. MATERIAL AND METHOD

The composite panels are made of lamellas of two different wood species each (nut-cherry wood for the first panel and spruce-poplar wood for the second one). First, the lamellas are finger-jointed on length and than rotated with 90º, as can be seen in Fig. 1, for the first stage of the process.

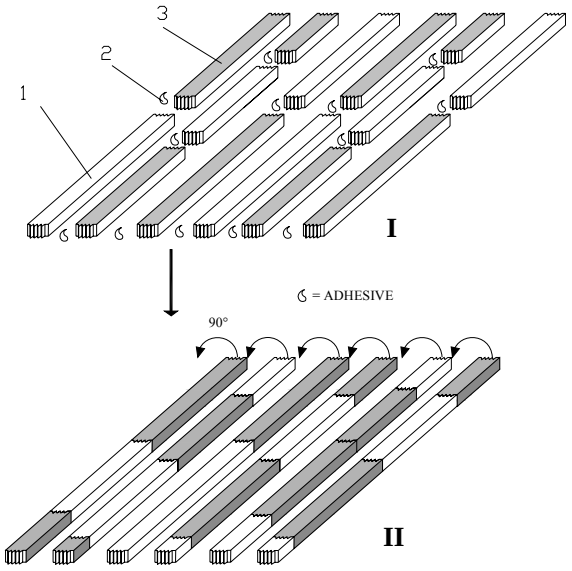


Fig. 1. The first stage: mixed finger –jointed lamellas; 1 – cherry - spruce wood, 2 – adhesive, 3 – nut - poplar wood

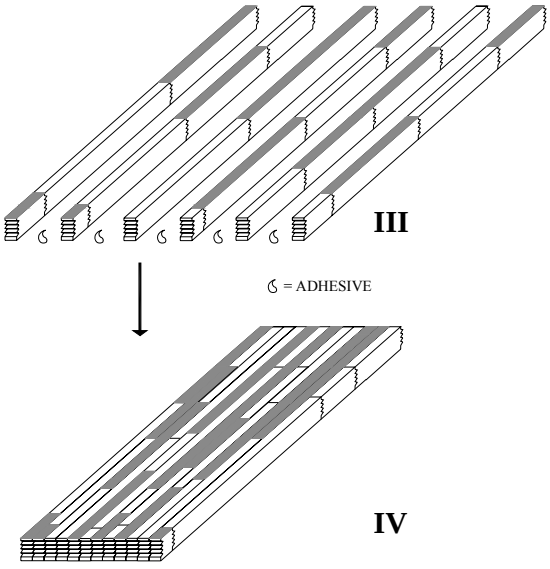


Fig. 2. The second stage: mixed finger –jointed panels

On the second stage of the process, the finger-jointed lamellas are glued together on

their faces and mixed panels are obtained, as seen in Fig. 2.

The arrangement of the lamellas in the structure of the panels is random, just for their innovative design. The wood strips obtained after finger-jointing the lamellas are machined on the four faces and than edge-jointed into the panel shape. After drying the adhesive, the panels are calibrated to a constant thickness.

On the third stage of the process, several mixed panels are overlapped and glued together in order to obtain a wooden block, as seen in Fig. 3. The panels resulted in this way are glued on their faces and overlapped so a "reconstructed block" is obtained, or better said, a "reconstituted core of rectangular section" is obtained.

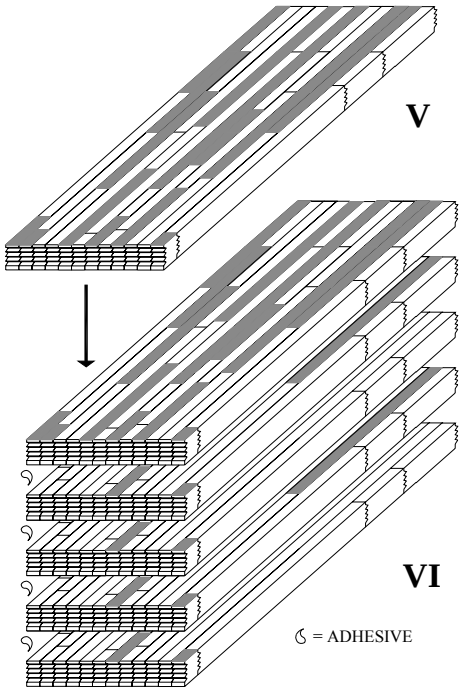


Fig. 3. The third stage: obtaining of wooden "reconstructed blocks"

On the fourth stage of the technological process of obtaining the decorative panels proposed in the present study, the wooden block will be transversally cut (Fig. 4). After the adhesive is dried, the core is cross-cut, so to obtain panels with crosscut structure of wood on the panel's faces. The design of the panel is defined by the participation rate of the two constitutive species of wood and by their placement into the panel.

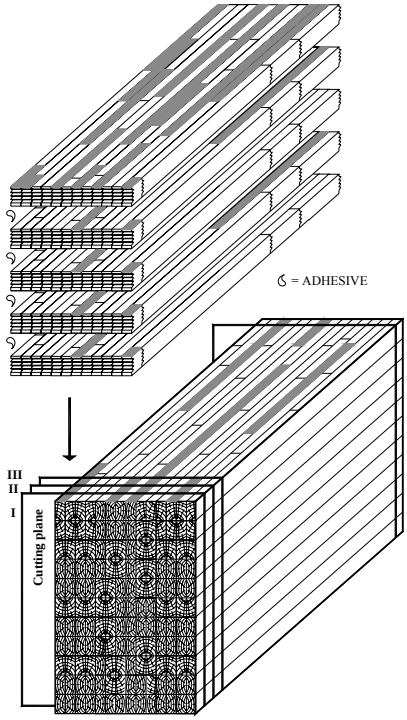


Fig. 4. The fourth stage: obtaining of "wooden structural tiles" which are the samples studied in the paper

The panels obtained this way are than calibrated and sized to the final dimensions, resulting "wooden structural tiles" that can be used as industrial floors or floors for civilian buildings, where high traffic is required. The final calibration of the panels brought them to 22 mm thickness, resulting thus the mixed panels presented in Fig. 5, studied in the present paper from the quality of the surface point of view.

Fig. 5. Processing and roughness measuring directions

Being made of lamellas of two different materials (two species of wood with different structure and properties) glued together, they form composite materials with new properties and new quality of the surface after calibrating and sanding the faces.

The panels were subjected to a sanding process, where grit sizes of 50, 80, 120 and 150 were used. The roughness measurements were done perpendicular to the sanding direction (Fig.5), in order to obtain the accurate values of the roughness parameters Ra, Rk, Rpk and Rvk.

The roughness of the surface was investigated using MicroProf FRT German equipment with light beam, which scaned the samples. Each sample was measured on five areas in order to calculate the average values.

The work parameters of the equipment set by the user in the measurement software, were as follows:

- scan speed of 750 µm/s;
- 10.000 scanned points on a line;
- measured length of 50 mm ;
- cut-off of 2.5 mm;
- resolution of 5 µm.

The roughness profile was obtained after filtering the data with Gaussian filter, automatically applied by the software. The roughness parameters analyzed in this paper are Ra and Rz according to ISO 4287 :2001), Rk, Rpk and Rvk according to ISO 13565-2:1999 (Gurău, 2007). The Ra roughness parameter is considered to be the most common one used for the assessment of the surface quality, but for a more accurate analysis it will be accompanied by Rz parameter. The other three roughness parameters are used as follow:

- Rk is a parameter that assesses the processing roughness;
- Rpk is a parameter that assesses the raised fiber of wood;
- Rvk is a parameter that assesses the anatomic structure.

3. RESULTS AND DISSCUSSION

Because the section of the jointed lamellas is smaller than 50 mm (which is the length of the scanned square), the assessment process detected either segments of the same species of wood and different species of wood, or different orientation of the wood grains.

In Fig. 6 and Fig. 7 the diagrams of roughness variation against the grit size are presented. The results are obtained after sanding operation applied on each type of composite panel.

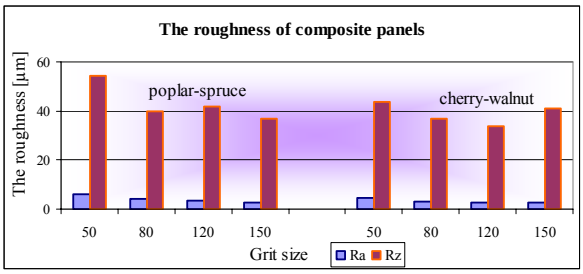


Fig. 6. The influence of grit size upon the average roughness parameters Ra and Rz, for the poplar-resinous and cherry-walnut composite panels

From Fig. 6 the following issues are noted: values of Ra roughness parameter decreases for the two types of panels with the increasing of grit sizes used for sanding operation; the most significant differences are recorded for Rz roughness parameter.

For the composite panel made of mixed poplar and resinous wood, when sanded with 120 grit size, the roughness value increases compared with the situation when sanded with 80 grit size. It can be explained by the wood grain orientation depending on the perpendicular scanning direction and also by the anatomic structure of poplar wood.

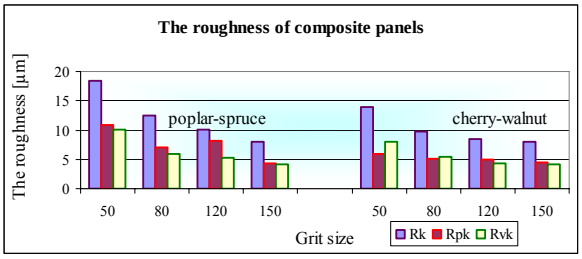
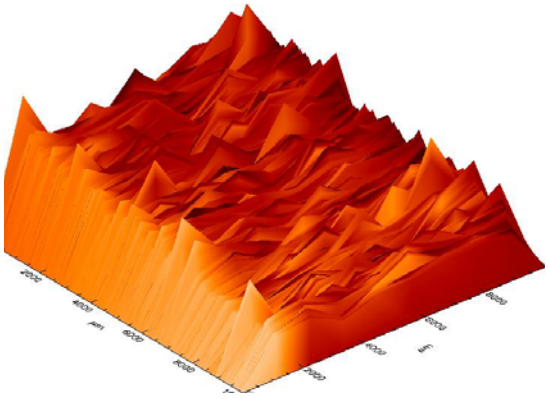


Fig. 7. The influence of grit size upon the average roughness parameters Rk, Rpk and Rvk, for the poplar-resinous and cherry-walnut composite panels

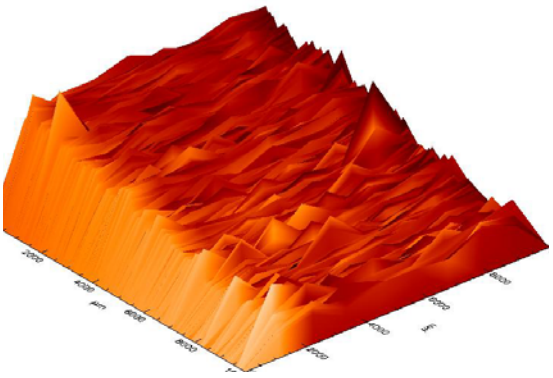
In Fig. 7, Rk, Rpk and Rvk parameters decrease with the increasing of grit size used for sanding operation. The presence of pile fibers in the resinous-poplar wood composite panel is shown by Rpk parameter which increases when sanding with 120 grit size, compared with 80 grit size.

Rk roughness parameter decreases when the grit size is higher. For the cherry-walnut wood composite panel the recorded values of Rk, Rpk and Rvk roughness parameters are lower than those of poplar-resinous wood composite panel, fact that leads to a better behavior of the first one when finishing it.

In order to highlight the differences in the quality of the resinous - poplar wood panel surface, sanded with 80 and 120 grit sizes, a 3D scan of the surface was done (Fig. 8).



a)



b)

Fig. 8. The 3D scan for resinous-poplar panel sanded with: a –80 grit size; b –120 grit size

4. CONCLUSIONS & ACKNOWLEDGMENT

The results show that the roughness parameters are not in the range of the recommended values for the transparent finishing of panels (Rz=10-16µm). With the increasing of grit size used for sanding operation, the decreasing of roughness is observed, but different for the two types of panels (more for the poplar-resinous wood panel). The results of measuring Rz roughness parameter after the final sanding (36.76µm for poplar-resinous wood panel when sanding with 150 grit size and 33.92µm after sanding the cherry-walnut wood panel with 120 grit size) lead to the conclusion that an extra-sanding operation is needed. The final sanding system used for the longitudinal structure of wood is not valid for the studied panels that have a transversal structure of wood on their faces.

The future research directions on these types of decorative panels will go to the study of the final sanding technology of the transversal structure of wood on the faces of these composites, by introducing, eventually, a "wet" sanding method that allows the Rz

roughness parameter to be at the required values for the transparent finishing of wood.

REFERENCES

1. Brenci L., Cismaru I., Boeriu C. *The roughness of wood surfaces interpreted through two measuring*. Pro Ligno. Issue 4(3):67-74 (2008).
2. Brenci, L., Cismaru, I., Cosereanu, C., Curtu, I., Lica, D., Fotin, A. *The influence of the profiled milling parameters to the Quality of the surfaces*. Proceedings - 20th International DAAAM Symposium Intelligent Manufacturing & Automation: Theory, Practice & Education", Viena, Austria. Katalinic, B. (Ed.):0413-0415 (2009).
3. Cionca, M., Badescu, L., Zeleniuc, O., Gurau, L. Panels made of crosscut branches. Pro Ligno no. 2(4): 35-42 (2006).
4. Cosereanu, C., Brenci, L., Lica, D. *Testing the flatness of some composite panels designed for furniture manufacturing.* Pro Ligno. Issue 5(1): 31-46 (2009).
5. Cosereanu, C., Lica, D., Curtu, I., Lunguleasa, A., Cismaru, I., Brenci L.M., Fotin, A. *Mechanical testing of beech veneer sandwich composites.* Proceeding of the 7th International Conference of DAAAM Baltic Industrial Engineering, 22-24th Aprilie 2010, Tallinn, Estonia. ISSN 978-9985-59-982-2. p. 0417-0422. (2010).
6. Fotin, A., Cismaru, I., Salcă, E.A., Cismaru, M. *Influence of the Variable Parameters of the Machining Regims upon the Surface Quality obtained by straight milling.* Pro Ligno. Issue 5(4): 45-52 (2007).
7. Gurău, L. *Quantitative evaluation of the sanding quality in furniture manufacturing*. Editura Univesrsitații Transilvania Braşov. (2009).
8. Salca, E.A., Fotin, A., Cismaru, I. *Evaluation of surface quality after profiled milling of alder and birch wood.* Pro Ligno. Issue 4(2): 57-68 (2008).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

DEVELOPMENT OF A COANDĂ EFFECT LIFT-THRUST INTEGRATED SYSTEM: CELTIS

Valeriu DRĂGAN

Aerospace Engineering Faculty, "Politehnica" University of Bucharest, Bucharest, Romania

Abstract: *This paper's scope is to present the development of a new form of Upper Surface Blown super circulation aircraft. The novelty refers to maximizing the influence of the Coanda effect on the USB aerodynamic lift by integrating an oblique circular curvature ramp which provides both lift and thrust. The study uses Computational Fluid Dynamics to estimate the performance of the system. It is shown here that the CELTIS system provides not only substantial additional lift and thrust but also improves the reliabilty of the turbofan engine by making it less prone to wear associated with USB configurations.*

Keywords: *Coanda Effect, CFD, Upper Surface Blown wing, Circulation Control, super circulation*

1. INTRODUCTION

Short take off and landing aircraft using the Coanda effect have been in use since the advent of the Antonov An 72 and the Boeing YC 14 (Blessing, 2011) and (Riddle and Eppel, 1986). These aircraft however make little use of the Coanda effect in cruise mode, relying on it just in the take off and landing phases. This is a major dissadvantage since the loses in fan flow enthalpy are quite high for the entire duration of the flight without adding any benefit.

Another problem with the conventional Upper Surface Blowing (USB) wing is that the presence of the wing surface near the fan flow leads to an uneven pressure distribution on the turbine exhaust section which in turns leads to asymetrical loadings to the turbine causing vibration and wear (Dragan, 2012).

This paper proposes a different USB wing in which a high by pass ratio turbofan engine provides a flow of air to a Coanda ramp with a 45° slant. Due to the Coanda effect, the ramp will produce a pressure drop which will produce a force. Because the ramp is inclined to 45°, the force will have two components: lift and thrust, hence the name : Coanda Effect Lift-Thrust Integrated System (CELTIS).

In addition to obtaining these forces, the system also provides a more homogenous pressure distribution over the LP turbine stage.

2. THE CELTIS CONCEPT AND TESTING

2.1 The CELTIS concept

In this section describes the Computational Fluid Dynamics (CFD) simulation of a super circulation wing in which the exhaust of the turbofan engine is passed over a Coanda ramp.

One of the problems generated by the use of a high by-pass turbofan engine is that the two flows influence eachother i.e. if the nozzle of the core flow is left untreated, the pressure distribution will become uneven and will

generate vibrations on the Low Pressure (LP) shaft.

The design tested is presented in Fig. 1, in cross section, the engine nacelle is modeled after a General Electric GE 90 turbofan engine. Figure 1 also serve as an integration study within a conventional wing.

One of the advantages of the CELTIS system presente here is that it places the engine nacelle in a lower – more familiar – position as oposed to other super circulation aircraft designs which require the engines to be placed on top of the wing. The over the wing nacelle generates complications in maintenance due to its decreased accessibility.

The Coanda ramp consists of a 45º circular arc onto which the turbofan flow is discharged.

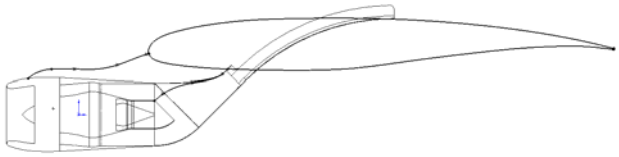


Fig. 1. Proposed way to integrate a CELTIS system using a high by-pass turbofan engine within a supercritical wing

As a benchmark for the further simulations, a large diameter high by-pass turbofan engine not unlike the General Electric GE 90 was simulated and the following results obtained:

Initial parameters (Kroo and Alonso, 2000) and (EASA, 2004)
Maximum Diameter: 3124 mm
By pass ratio: 8.4
total mass flow: 1350 kg/s
Exhaust Gas Temperature: 1100 K

From which we deduce:
Fan mass flow 1206 kg/s
Core mass flow 143,6 kg/s

Simulation results:
Calculated core thrust: 114184.4 N
Calculated full Thrust: 499261.3 N
Certiffied full thrust: 500000 N
deviation: 0.147746268 %

2.2 The CFD test. All simulations were carried out without aerial velocity in order to asses the lift and thrust associated only with the Coanda effect.

Because the flow has a high, compressible velocity, the boundary conditions were mass flow related instead of the more simple pressure related inlets and outlets. This is because pressure boundary conditions in this case could lead to computational errors such as negative gauge pressures

Knowing the by-pass ratio and the total mass flow it is easy to deduce the mass flows of the core and fan using the relations:

$$\dot{m}_{ip} = \frac{k}{k+1}\dot{m}_{total} \quad (1)$$

$$\dot{m}_{ic} = \frac{1}{k+1}\dot{m}_{total} \quad (2)$$

The viscosity model chosen is k-epsilon realizable (Fernandez et al., 2007) while the computational mesh was carthesian – due to the fact it is inherentlly structured (Aftosmis, 1997). The computational mesh is presented in Fig. 2.

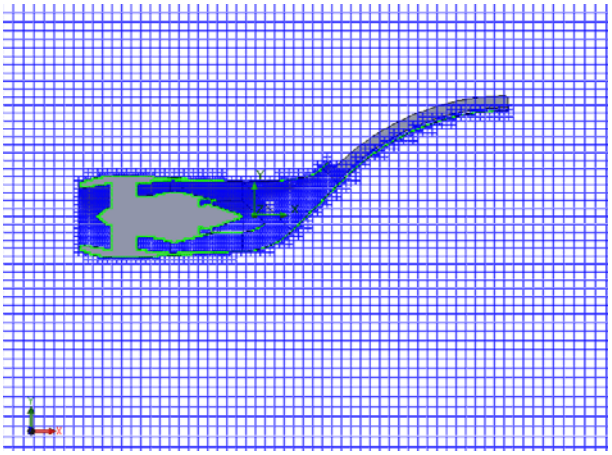


Fig.2 The Carthesian mesh used

The simulation results are as follows:
Engine thrust (without considering the CELTIS ramp thrust) =506808.9106 N
CELTIS ramp thrust = 24892.2 N
Total thrust =531701.1106
Representing: 106.34 % of the thrust of the bare engine

CELTIS lift = 38638.9 N
Representing: 7.72778 % of the thrust of the bare engine

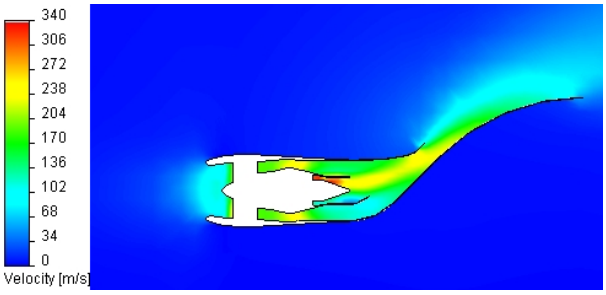


Fig. 3 Velocity distribution accross the CELTIS system, it can be seen that the top of the core flow accelerates to higher velocities due to the fact that it is almost directlly in front of the discharge nozzle.

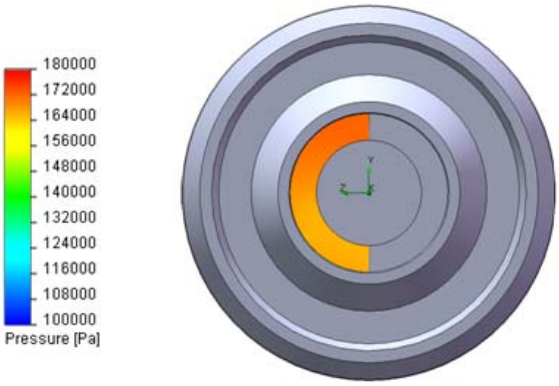


Fig.4 Pressure distribution at turbine exhaust, as opposed to conventional USB designs, the pressure distribution at this section is quite homogenous

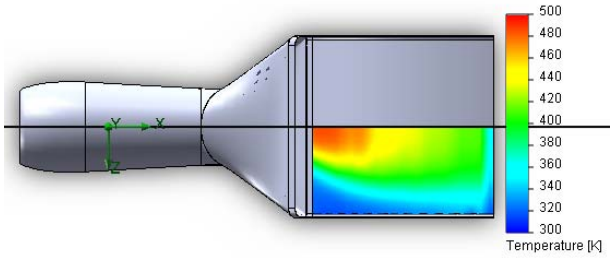


Fig.5 Absolute temperature distribution over the ramp

3. CONCLUSIONS & ACKNOWLEDGMENT

A Computational Fluid Dynamics study was carried out in order to estimate the effectiveness of a proposed Coanda Effect Lift-Thrust Integrated System. The simulation of a large diameter high by-pass turbofan engine was used as a benchmark for the results, with a calculated margin of error of 0.148 % of the real (certiffied) similar engine thrust.

The influence of the CELTIS ramp appears to be benefficial, in the sens that the thrust of the engine increased by 6kN, representing a little over 1% of the total thrust of the normal engine. This influence can be explained by the fact that the ambient pressure at which the engine flows are discharged is lower than in the conventional case due to the Coanda effect and the fact that the nozzle has a high aspect ratio (it is in the shape of a narrow slot.

In this case, the Coanda effect produced by the ramp lowers the local static pressure which leads to the expansion of the core and fan flows to higher velocities hence increasing the thrust of the engine

However, we must exercise caution, in the absence of experimental results since the

increase can be attributed to the computational inaccuracies.

The CELTIS ramp however provides additional thrust due to its 45º orientation. On the Ox axis, the thrust component due to the ramp is of ~32 kN –which cannot be explained away as a computational error, representing 6% of the total thrust of the engine.

The lift component obtained due to the ramp is 38638.9 N, representing ~7.73% of the total estimated thrust of the engine

As with all super circulation aircraft, it is important to study the temperature distribution over the surface of the ramp. In this case, the duct linking the engine to the ramp acts as a flow mixer, cooling the turbine exhaust flow. Thus, the fluid temperature at the ramp surface becomes reasonable, the hottest regions registering under 130°C. Offcourse, this aspect will have to be confirmed with further experimental testing in order to confirm that there is no need for heavy thermal insulators between the ramp and the integrated wing fuel tanks.

The orientation of the exhaust gases is along Ox therefore all of the thrust they provide will be used for propulsion. In the case of a ramp with a larger arc, say 90°, the fluid will be deviated from this axis, decreasing the thrust component while enhancing lift.

Such a device may be considered as a continuation of this study in the sense of a CELTIS-flap system for use on take-offs and landings.

From an aero-acoustic stand point, the system may prove to be quieter than conventional engines since the air exiting the CELTIS ramp has a higher turbulent kinetic energy, hence less prone to the Kelvin-Helmhotlz phenomenon causing most of the jet noise.

REFERENCES

1. Aftosmis M.J.,Solution Adaptive Cartesian Grid Methods for Aerodynamic Flows with Complex Geometries, *von Karman Institute for Fluid Dynamics Lecture Series*, (1997)
2. Blessing Bryan H, A COMPUTATIONAL STUDY OF ENGINE DEFLECTION USING A CIRCULATION CONTROL WING, *Thesis of Master of Science Faculty of California Polytechnic State University*, (2011).
3. Dragan Valeriu, A study of conventional Upper Surface Blowing wing configurations, submitted to the *Review of the Airforce Academy* (2012).
4. European Aviation Safety Agency, Engine Type Certificate Data Sheet EASA.IM.E.002,Issue: 2, GE90 Series Engines (2004)
5. Fernández J.A., J C Elicer-Cortés, A Valencia, M Pavageau, S Gupta, Comparison of low-cost two-equation turbulence models for prediction flow dynamics in twin-jets devices, *International Communications in Heat and Mass Transfer* (2007)
6. Riddle D.W., J C Eppel, A Potential Flight Evaluation of an Upper-Surface-Blowing/Circulation-Control-Wing Concept, *Proceedings Of The Asme Turbo* Expo (1986)
7. Kroo Ilan and Juan Alonso http://adg.stanford.edu/aa241/propulsion/largefan.html (2000)

(December, 2009).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

COUPLING SURFACE FLOW WITH POROUS MEDIA

Constantin Albert DUMITRACHE

Mathematics Faculty, Piteşti University, Argeş, Romania

Abstract: *Simulations of flow in porous media can even help modeling tsunami interactions on a shore-line. A modeling of filtration processes would require introducing different systems of partial differential equations in the free fluid and in the porous medium regions. Such equations must be coupled through physically continuity conditions at the interface separating the two domains. We will use the well-known Beavers-Joseph interface and propose iterative methods to solve the coupling of the Navier-Stokes and Darcy equations.*

Keywords: *Navier-Stokes equations, Darcy's law, Interface conditions, iterative*

1. INTRODUCTION

A modeling of filtration processes would require introducing different systems of partial differential equations in the free fluid and in the porous medium regions. The difficulty in finding effective coupling conditions at the interface between the fluid domain and the porous layer lies in the fact that often the orders of the corresponding differential operators are different, e.g. when using Navier-Stokes and Darcy's equation. The model we consider, which is similar to the one in [1] is based on imposing the correct local equation in each region, coupled with appropriate interface conditions.

2. MODEL PROBLEM

The aim of our research is to begin the study of the following problem: an incompressible fluid in a region who can flow both ways across an interface into a domain which is a porous medium saturated with the same fluid same as [7,8, 10-15,18].

Let $\Omega \subset \mathbb{R}^d$ $(d=2,3)$ be a bounded domain, decomposed into two non intersecting subdomains Ω_f and Ω_p separated by an interface Γ, i.e. $\overline{\Omega} = \overline{\Omega}_f \cup \overline{\Omega}_p$, $\Omega_f \cap \Omega_p = \varnothing$ şi $\overline{\Omega}_f \cap \overline{\Omega}_p = \Gamma$. We suppose the boundaries $\partial\Omega_f$ şi $\partial\Omega_p$ to be Lipschitz continuous. From the physical point of view, Γ is a surface separating the domain Ω_f filled by a fluid, from a domain Ω_p formed by a porous medium. We assume that the fluid contained in Ω_f has a fixed surface (i.e. we do not consider the free surface fluid case) and can filtrate through the adjacent porous medium.

In order to describe the motion of the fluid in Ω_p, we introduce the Navier–Stokes equations: $\forall t > 0$,

$$\partial_t u_f - \nabla \cdot T(u_f, p_f) + (u_f \cdot \nabla) u_f = f \text{ în } \Omega_f$$

$$\nabla \cdot u_f = 0 \text{ în } \Omega_f \qquad (1)$$

where $T(u_f, p_f) = \nu(\nabla u_f + \nabla^T u_f) - p_f I$ is the Cauchy stress tensor, $\nu > 0$ is the kinematic viscosity of the fluid, while u_f and p_f are the fluid velocity and pressure.

∇ and $\nabla\cdot$ are, respectively, the gradient and the divergence operator with respect to the space coordinates. Moreover,

$$\nabla \cdot u = \left(\sum_{j=1}^{d} \partial_j u_{ij} \right)_{i=1,\ldots,d}$$

Finally, we recall that

$$(v \cdot \nabla) w = \sum_{i=1}^{d} v_i \partial_i w$$

for all vector functions $v = (v_1, \ldots, v_d)$ and $w = (w_1, \ldots, w_d)$

In the domain Ω_p we define the piezometric head $\varphi = z + \dfrac{p_p}{\rho_f g}$ where z is the elevation from a reference level, p_p is the pressure of the fluid in Ω_p, ρ_f its density and g is the gravity acceleration.

The fluid motion in Ω_p is described by the equations:

$$\nabla \cdot u_p = 0 \text{ in } \Omega_p \qquad (2)$$
$$u_p = -K \nabla \varphi \text{ in } \Omega_p$$

where u_p is the fluid velocity, and K is the hydraulic conductivity tensor $\mathbf{K} = diag(\mathbf{K}_1, \mathbf{K}_2, \mathbf{K}_3)$ with $\mathbf{K} = (\mathbf{K}_{ij})_{i,j=1,\ldots,d} \in L^{\infty}(\Omega_p)$

The first equation is Darcy's law. In the following we shall denote $K = \mathbf{K} / n$

Darcy's law provides the simplest linear relation between velocity and pressure in porous media under the physically reasonable assumption that fluid flows are usually very slowed all the inertial (nonlinear) terms may be neglected.

For the sake of clarity, in our analysis we shall adopt homogeneous boundary conditions. In particular, for the Navier–Stokes problem we impose the no-slip condition $u_f = 0$ on $\partial\Omega_f \setminus \Gamma$, while for the Darcy problem, we set the piezometric head $\varphi = 0$ on Γ_p and we require the normal velocity to be null on Γ_p $u_f \cdot \tau_j = 0$. $\mathbf{n}_p$ and $\mathbf{n}_f$ denote the unit outward normal vectors to the surfaces Ω_f and Ω_p and we have $\mathbf{n}_f = -\mathbf{n}_p$ on Γ. We suppose $\mathbf{n}_p$ and $\mathbf{n}_f$ to be regular enough. In the following we shall indicate $n = \mathbf{n}_p$ for simplicity of notation.

We supplement the Navier–Stokes and Darcy problems with the following conditions on Γ:

$$u_f \cdot n = u_p \cdot n, \qquad (3)$$

$$-n \cdot T(u_f, p_f) \cdot n = g\varphi \qquad (4)$$

$$-\tau_j \cdot T(u_f, p_f) \cdot n = \frac{\nu \alpha_{BJ}}{\sqrt{K}} (u_f - u_p) \cdot \tau_j \text{ on } \Gamma \qquad (5)$$

where $\tau_j (i = 1, \ldots, d-1)$ are linear independent unit tangential vectors to the boundary Γ, and α_{BJ} is the characteristic length of the porous medium.

Conditions (3) and (4) impose the continuity of the normal velocity on Γ, as well as that of the normal component of the normal stress, however they allow pressure to be discontinuous across the interface. The so-called Beavers–Joseph condition (5) is used here instead of Beavers–Joseph-Saffman that were mathematically proven in [17].

The coupled Navier-Stokes/Darcy model is as follows:

$$\partial_t u_f - \nabla \cdot T(u_f, p_f) + (u_f \cdot \nabla) u_f = f \text{ in } \Omega_f$$
$$\nabla \cdot u_f = 0 \text{ in } \Omega_f$$
$$u_p = -K \nabla \varphi \text{ in } \Omega_p$$
$$\nabla \cdot u_p = 0 \text{ in } \Omega_p \qquad (6)$$
$$u_f \cdot n = u_p \cdot n \text{ pe } \Gamma$$
$$-n \cdot T(u_f, p_f) \cdot n = g\varphi \text{ on } \Gamma$$
$$-\tau_j \cdot T(u_f, p_f) \cdot n = \frac{\nu \alpha_{BJ}}{\sqrt{K}} (u_f - u_p) \cdot \tau_j \text{ on } \Gamma$$

We define the following spaces:

$$H_f = \{v \in H^1(\Omega_f)^d : v = 0 \text{ on } \partial\Omega_f \setminus \Gamma_f\}$$
$$H_f^0 = \{v \in H_f(\Omega_f) : v \cdot n = 0 \text{ on } \Gamma\} \quad (7)$$
$$Q = L^2(\Omega_f),\ Q_0 = \left\{q \in Q : \int_{\Omega_f} q = 0\right\}$$
$$H_p = \{\psi \in H^1(\Omega_p) : \psi = 0 \text{ on } \Gamma_p^D\},$$
$$H_p^0 = \{\psi \in H_p : \psi = 0 \text{ on } \Gamma\}$$

We denote by $|\cdot|_1$ şi $\|\cdot\|_1$ the H^1-seminorm and norm and by $\|\cdot\|_2$ the L^2-norm; it will always be clear form the context whether we are referring to spaces on Ω_f and Ω_p. Finally, we consider the trace space $\Lambda = H_{00}^{1/2}(\Gamma)$ şi $\|\ \|_\Lambda$ and its subspace.

Then, we introduce the bilinear forms

$$a_f(v,w) = \int_{\Omega_f} \frac{\upsilon}{2}(\nabla v + \nabla^T v)\cdot(\nabla w + \nabla^T w)$$
$$+\int_\Gamma \sum_{j=1}^{d-1} \frac{\nu\alpha_{BJ}}{\sqrt{K}}\left[(u + K\nabla\varphi)\cdot\tau_j\right](v\cdot\tau_j)$$
$$\forall v, w \in (H^1(\Omega_f))^d$$
$$b_f(v,q) = -\int_{\Omega_f} q\nabla\cdot v \quad \forall v \in (H^1(\Omega_f))^d \quad \forall q \in Q$$
$$a_p(\varphi,\psi) = \int_{\Omega_p} \nabla\psi\cdot K\nabla\varphi \quad \forall \varphi,\psi \in H^1(\Omega_p)$$
$$a_\Gamma(v,w) = \int_\Gamma g\varphi(w\cdot n) - g\int_\Gamma \psi(v\cdot n)$$
$$a_\Omega(v,w) = a_f(v,w) + a_p(\varphi,\psi)$$

and the trilinear form

$$c_f(w;z,v) = \int_{\Omega_f}[(w\cdot\nabla)z)]\cdot v = \sum_{i,j=1}^{d}\int_{\Omega_f} w_j \frac{\partial z_i}{\partial x_j} v_i$$
$$\forall v, w, y \in (H^1(\Omega_f))^d \qquad (8)$$

By integration by parts as in [20], the weak formulation for the above coupled Navier-Stokes/Darcy problem reads:

Fiind $u = (\mathbf{u},\varphi) \in W$, $p \in Q$ *that*

$$\begin{cases} A(u,v) + C(u;u,v) + B(u,p) = F(v) \ \forall v = (\mathbf{v},\psi) \in W \\ B(u,q) = 0 \ \forall q \in Q \end{cases} \quad (9)$$

where $A(v,w) = a_\Omega(v,w) + a_\Gamma(\varphi,\psi)$

$C(\underline{v};w,\underline{u}) = c_f(v;w,u)$

$B(u,p) = b_f(w,q)$

$F(v) = \int_{\Omega_f} fv$

The weak formulation for the above coupled (stationary) Stokes/Darcy problem reads:

Fiind $u = (\mathbf{u},\varphi) \in W$, $p \in Q$ *that*

$$\begin{cases} A(u,v) + B(u,p) = F(v) \ \forall v = (\mathbf{v},\psi) \in W \\ B(u,q) = 0 \ \forall q \in Q \end{cases} \quad (10)$$

Similar to [6], it is easy to verify that A(·, ·) is continuous and coercive on W and B(·,·) is continuous on $W \times Q$ and satisfies the well-known Brezzi - Babuska condition:

there exists a positive constant $\beta > 0$ *such that* $\forall q \in Q$, $\exists w \in W$ *such that*

$$b(w,q) \geq \beta \|w\|_W \|q\|_Q$$

The well-posedness of the model problem (10) then follows from Brezzi's theory for saddle-point problems [4]. The continuity is obvious, while the coercivity is still a consequence of the well-known Poincare inequality and Korn inequality and using Lemma 3.2 from [9]. The bilinear functional A(·, ·) is continuous and coercive on $W \times W$ (W-elliptic) when the coefficient in the Beavers-Joseph interface boundary condition α is small enough.

3. ITERATIVE FINITE ELEMENT SOLUTION OF THE COUPLED PROBLEM

In this section, we introduce and analyze an iterative method to compute the solution of a conforming finite element approximation of (16)–(18). For the easiness of notation, we will write the algorithms in continuous form. However, they can be straightforwardly translated into a discrete setting considering conforming internal Galerkin approximations of the spaces (7).

Moreover, the convergence results that we will present hold in the discrete case without any dependence of the convergence rate on the grid parameter *h*, since they are established by using the properties of the operators in the continuous case.

We consider a triangulation T_h of the domain $\overline{\Omega_f} \cup \overline{\Omega_p}$, depending on a positive parameter $h > 0$, made up of triangles if d = 2, or tetrahedra in the three-dimensional case. We assume that the triangulations induced on the subdomains Ω_f and Ω_p are compatible on Γ, that is they share the same edges (if $d = 2$) or faces (if $d = 3$) therein.

The crucial issue concerning the finite dimensional spaces, say V_h and Q_h, approximating the spaces of velocity and pressure is that they must satisfy the discrete compatibility condition:

there exists a positive constant $\beta^* > 0$, *independent of h, such that*

$$\forall q_h \in Q_h, \quad \exists v_h \in V_h, \quad v_h \neq 0: \qquad b_h(v_h, q_h) \geq \beta^* \|v_h\|_1 \|q_h\|_0 \tag{30}$$

Spaces satisfying (30) are said *inf-sup stable*.

Several choices can be made in this direction featuring both discontinuous pressure finite elements (e.g., the $P_2 - P_0$ elements or the Crouzeix-Raviart elements defined using cubic bubble functions) and continuous pressure finite elements: among the latter we recall the Taylor-Hood (or $P_2 - P_1$) elements and the $P_1 iso P_2$ elements.

We have indicated by the subscript *h* the finite element approximations of u_f, p_f and φ.

The following error estimates hold. There exist two positive constants *C*1 and *C*2 such that

$E_S^h \leq C_1 h^r \left(\|u_f\|_{r+1} + \|p_f\|_r \right), \ r = 1, 2.$ If $u_f \in H^{r+1}(\Omega_f)$ and $p_f \in H^r(\Omega_f)$ where $E_S^h = \|\nabla u_f - \nabla u_{fh}\|_0 + \|p_f - p_{fh}\|_0$ while $E_D^h \leq C_2 h^l \|\varphi\|_{l+1}$, $l = \min(2, s-1)$.

If $\varphi \in H^s(\Omega_p), \ s \geq 2$ with $E_D^h = \|\varphi - \varphi_h\|_l$

3.1 Fixed – point iterations

Fixed-point iterations to solve the coupled problem (9) can be written as follows

find $u_f \in H_f, p_f \in Q, \varphi \in H_p$ such that

$$a_f(u_f^n, v) + b_f(v, p_f^n) + c_f(u_f^{n-1}, u_f^n, v) + \int_\Gamma g\varphi^n (v \cdot n)$$

$$+ \int_\Gamma \sum_{j=1}^{d-1} \frac{\nu \alpha_{BJ}}{\sqrt{K}} \left[(u_f^n + K \nabla \varphi^n) \cdot \tau_j \right] (v \cdot \tau_j) = \int_{\Omega_f} fv$$

$$b_f(u_f^n, q) = 0$$

$$a_p(\varphi^n, \psi) = \int_\Gamma \psi (u_f^n \cdot n)$$

for all $v \in H_f, q \in Q, \psi \in H_p$

3.2 Newton-like methods

Let us consider now the Newton method to solve (the discrete form of) (9).

find $u_f^n \in H_f, p_f^n \in Q, \varphi^n \in H_p$ such that

$$a_f(u_f^n, v) + b_f(v, p_f^n) + c_f(u_f^n, u_f^{n-1}, v) + \int_\Gamma g\varphi^n (v \cdot n)$$

$$+ \int_\Gamma \sum_{j=1}^{d-1} \frac{\nu \alpha_{BJ}}{\sqrt{K}} \left[(u_f^n + K \nabla \varphi^n) \cdot \tau_j \right] (v \cdot \tau_j)$$

$$= c_f(u_f^{n-1}, u_f^{n-1}, v) + \int_{\Omega_f} fv$$

$$b_f(u_f^n, q) = 0$$

$$a_p(\varphi^n, \psi) = \int_\Gamma \psi (u_f^n \cdot n)$$

for all $v \in H_f, q \in Q, \psi \in H_p$

We consider the computational domain $\Omega = (0, 1) \text{ x } (0, 2)$ with and $\Omega_f = (0, 1) \text{ x } (1, 2)$ and $\Omega_p = (0, 1) \text{ x } (0,1)$ and uniform regular triangulations characterized by a parameter h. We use Taylor-Hood elements for the Navier-Stokes equations and quadratic Lagrangian elements for the Darcy equation .

In a first test, we set the boundary conditions in such a way that the analytical solution for the coupled problem is

$$u_f = (x^2y^2 + e^{-y}, -\frac{2}{3}xy^3 + [2 - \pi\sin(\pi x)])$$

$$p_f = -[2 - \pi\sin(\pi x)]\cos(2\pi y)$$

$$\varphi = [2 - \pi\sin(\pi x)][-y + \cos(\pi(1-y))]$$

In order to check the behavior of the iterative methods that we have studied with respect to the grid parameter h, to start with we set the physical parameters (v, K, e, g) all equal to 1.

The algorithms are stopped as soon as $\|x^n - x^{n-1}\|_{L^2} / \|x^n\|_{L^2} \le 10^{-10}$, where $\|\cdot\|_{L^2}$ is the L^2 norm and x^n is the vector of the nodal values of $(u_f^n, p_f^n, \varphi^n)$ Our initial guess is $u_f^0 = 0$.

The number of iterations obtained using the fixed-point algorithm, the Newton method are displayed in Table 1.

h	Fixed-point	Newton
2^{-2}	23	11
2^{-3}	23	11
2^{-4}	23	11
2^{-5}	23	11

All methods converge in a number of iterations which does not depend on h.

We present the CPU times. Table 2 shows the CPU times for the Navier-Stokes/Darcy model and the three methods. It is very clear that Newton algorithm is with significant reduction in computational time.

h	Fixed-point	Newton
2^{-2}	1.30×10^{1}	0.60×10^{1}
2^{-3}	1.343×10^{2}	1.021×10^{2}
2^{-4}	1.343×10^{3}	$1\,0.43\times10^{3}$

3. CONCLUSIONS & ACKNOWLEDGMENT

The numerical algorithms for solving the coupled system of free fluid and porous media are separated into three major categories:

- the first group of methods uses different equations in different domains, e.g., the Navier–Stokes equation in the liquid region and the Darcy model in the porous zones and couples them through suitable interface conditions. These kind of algorithms use domain decomposition techniques
- the second group consists of those algorithms, that solely uses one system of equations in the whole domain obtaining the transition between both fluid and porous regions through continuous spatial variations of properties ('single-domain approach').
- the two method grid by decoupling the mixed model by a coarse grid approximations to the interfaces conditions

It is very clear that Newton algorithm is with significant reduction in computational time. This algorithm is very good.

This work was partially supported by the strategic grant POSDRU/88/1.5/S/52826, Project ID52826 (2009), co-financed by the European Social Fund – Investing in People, within the Sectoral Operational Programme Human Resources Development 2007-2013.

REFERENCES

1. Adams, R.: Sobolev Spaces. Academic Press, New York (1975)
2. L. Badea, M. Discacciati, and A. Quarteroni, "Mathematical analysis ofthe Navier-Stokes/Darcy coupling," Numerische Mathematik, vol. 115, no. 2, pp. 195–227, 2010.

3. Berninger, H.: Domain decomposition methods for elliptic problems with jumping nonlinearities and application to the Richards equation. Ph.D. thesis, Freie Universität Berlin (2007)
4. Brezzi, F., Fortin, M.: Mixed and Hybrid Finite Element Method. Springer, New York (1991)
5. Brezzi, F., Rappaz, J., Raviart, P.: Finite dimensional approximation of nonlinear problems. Part I. Branches of nonlinear solutions. Numer. Math. **36**, 1–25 (1980)
6. Brezzi, F., Rappaz, J., Raviart, P.: Finite dimensional approximation of nonlinear problems. Part II. Limit points. Numer. Math. **37**, 1–28 (1981)
7. Brezzi, F., Rappaz, J., Raviart, P.: Finite dimensional approximation of nonlinear problems. Part III. Simple bifurcation points. Numer. Math. **38**, 1–30 (1981)
8. Brinkman, H.: A calculation of the viscous force exerted by a flowing fluid on a dense swarm of particles. Appl. Sci. Res. A **1**, 27–34 (1947)
9. Caloz, G., Rappaz, J.: Numerical Analysis for Nonlinear and Bifurcation Problems. In: Handbook of Numerical Analysis, vol. V, pp. 487–637. North-Holland, Amsterdam (1997)
10. Discacciati, M.: Domain decomposition methods for the coupling of surface and groundwater flows. Ph.D. thesis, Ecole Polytechnique Fédérale de Lausanne, Switzerland (2004)
11. Discacciati, M., Miglio, E., Quarteroni, A.: Mathematical and numerical models for coupling surface and groundwater flows. Appl. Numer. Math. **43**, 57–74 (2002)
12. Discacciati, M.,Quarteroni, A.: Analysis of a domain decompositionmethod for the coupling of Stokes and Darcy equations. In: Brezzi, F., Buffa, A., Corsaro, S., Murli, A. (eds.) Numerical Mathematics and Advanced Applications, ENUMATH 2001, pp. 3–20. Springer. Milan (2003)
13. Discacciati, M., Quarteroni, A.: Convergence analysis of a subdomain iterative method for the finite element approximation of the coupling of Stokes and Darcy equations. Comput. Visual. Sci. **6**, 93– 103 (2004)
14. Discacciati, M., Quarteroni, A.: Navier–Stokes/Darcy coupling: modeling, analysis, and numerical approximation. Rev. Mat. Complut. **22**(2), 315–426 (2009)
15. Forchheimer, P.: Wasserbewegung durch Boden. Z. Ver. Deutsch. Ing. **45**, 1782–1788 (1901)
16. Giorgi, T.: Derivation of the Forchheimer law via matched asymptotic expansions. Transp. Porous Media **29**, 191–206 (1997)
17. Girault, V., Raviart, P.: Finite Element Methods for Navier–Stokes Equations. Theory and Algorithms. Springer, Berlin (1986)
18. Jäger, W., Mikelic A.: On the boundary conditions at the contact interface between a porous medium and a free fluid. Ann. Scuola Norm. Sup. Pisa Cl. Sci. **23**, 403–465 (1996)
19. Jäger,W., Mikeli´c, A.: On the interface boundary condition of Beavers, Joseph and Saffman. SIAM J. Appl. Math. **60**(4), 1111–1127 (2000)
20. Jäger, W., Mikeli´c, A., Neuss, N.: Asymptotic analysis of the laminar viscous flow over a porous bed. SIAM J. Sci. Comput. **22**(6), 2006–2028 (2001)
21. Kantorovich, L., Akilov, G.: Functional analysis in normed spaces. Translated from the Russian by Brown, D.E., In: Robertson, A.P. (ed.) International Series of Monographs in Pure and Applied Mathematics, vol. 46. The Macmillan Co., New York (1964)
22. Layton, W., Schieweck, F., Yotov, I.: Coupling fluid flow with porous media flow. SIAM J. Num. Anal. **40**, 2195–2218 (2003)
23. Lions, J., Magenes, E.: Problèmes aux Limites Non Homogènes et Applications, vol. 1. Dunod, Paris (1968).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

EFFECT OF HETEROGENEITY OF MATERIAL ON BALLISTIC RESISTANCE

Ondrej HÍREŠ*, Peter LIPTÁK*, Igor BARÉNYI*, Mária LIČKOVÁ*, Dušan BEDNÁRIK*

* Alexander Dubček University of Trenčín, Trenčín, Slovak Republic

Abstract: *The aim of this paper is to investigate the influence of chemical heterogeneity of high-strength steels on the course of high-speed plastic deformation. The experiment was carried out on armor plate made of the Armox Advance armoured steel, which have undergone of high-speed plastic deformation at ballistic test by action of shots with caliber 7,62x39 mm. For this purpose, was made engineering shooting target in accordance with the standard.*

Keywords: *high-strength steel, ballistic resistance, hardness, chemical heterogeneity*

1. INTRODUCTION

The advance in armor protection technology development is closely connected with improving of mechanical characteristics of materials. We are constantly working on improving the chemical homogeneity and to minimize the amount of harmful elements in steel. New production technology of materials leads to a significant increase in their strength and hardness, and thus allows reducing the wall thickness of armored plate to a minimum. Reducing the wall thickness of armored plate leads to weight reduction of technique, material savings and thus the overall cost savings and in mobile technique to improve patency.

Important factor and indicator of quality of steels is their chemical homogeneity and exact compliance with the contents of alloy elements. To the uneven distribution of some elements often comes already during solidification of molten metal, or segregation in subsequent heat treatment.

One of the world leaders in production of high strength steels is a Swedish company *SSAB Oxelösund*, a member of *SSAB Svenskt Stal*. The company produces several types of high-strength steel plates, among which are the most important ARMOX plate type for special technique.

2. REALIYATION OF THE EXPERIMENT

An experiment was targeted on armor plate made of a material Armox Advance, which was part of ISO 1C container (Fig. 1) mounted with additional ballistic protection made up from material Armox Advance with thickness 7 mm of the walls of the container and 4 mm from the ceiling container. The floor is not armored. The container is produced by *Vývoj,*

a.s. Martin and serves as special mobile communication workplace.

Manufacturers reported the chemical composition and mechanical properties of the material Armox Advance are listed in Table 1. According to manufacturer is this material the hardest material on the world. Its disadvantage is that when it is heated above 100 °C, leads to a thermally affected by a change in mechanical properties.

Table 1: Indicative chemical composition and mechanical properties of the material ARMOX ADVANCE

Indicative chemical composition [wt. %]			Mechanical properties		
C	max %	0,47	Hardness	[HRC]	58-63
Si	max %	0,7	KV -40°C	[J]	14
Mn	max %	1	Yield strength	[MPa]	min. 1600
P	max %	0,01			
S	max %	0,005	Tensile strength	[MPa]	2250
Cr	max %	1,5			
Ni	max %	3	Tensibility	A5	9
Mo	max %	0,7			
B	max %	0,005		A50	-

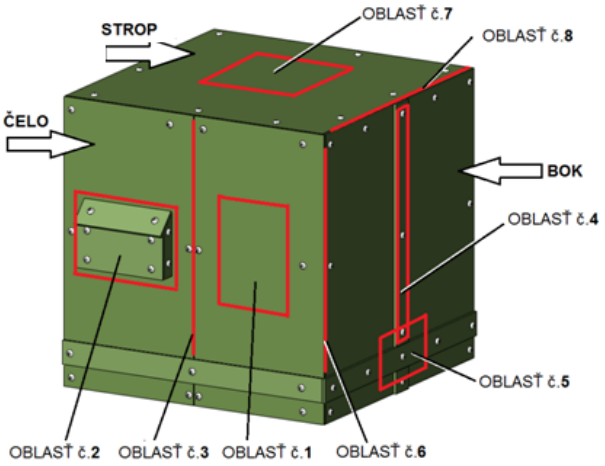


Fig. 1: 3D view of ISO 1C container showing the sample sites for ballistic testing

Ballistic tests were carried out on *VTSÚ Záhorie* and their purpose was to assess and recommend the provision of ballistic resistance at level STANAG 4569 Level 2 ISO 1C container. For tests were used 7.62 x39 mm (43 vz. PZ) ammunition. For each of taken targets 22 shots were fired, and their muzzle and impact velocities were measured. The terms of STANAG 4569 Level 2 meet all samplings, except for SS-3 samples taken from the front of container (Fig. 1, area 1).

The engineering target (SS-3) shown in Fig. 1 analyzes were performed, which aimed to determine the values of hardness and chemical composition of the material. As a first hardness test was performed and after the chemical analysis of material.

Fig. 2: Sample SS-3

According to the report of the ballistic analysis was on target in terms of requirements of STANAG 4569 Level 2 fired 22 shots, Impact speed of shot no. 14 was 714.7 m / s and penetration occurred. The same was also with shot no. 18, which is 51 mm away from no. 14. In the area of shots no. 14 and 18 (Fig. 3) was taken a sample with size 270x160 mm with angle grinder. The cut was made at a sufficient distance from both of breakdowns, as not to thermal influence the structure in

their area. At the same time the sample was therefore also cooled.

Fig. 3: The locations of the sample target shots

The sample was also hand-sanded with sandpaper on the back and hardness measurement was performed.

2.1 Hardness test. The hardness measurement was performed on the measuring device INSTRON WOLPERT TESTOR 930 on different areas of sample. A total of 18 measurements were carried out. The fields of measurements are shown on Fig. 4. and measurements results are shown in Table 2.

Before measuring of hardness of the sample was carried out verification of correct calibration of measuring equipment on a standard, which upheld the device.

Characteristics of the test:

- Vickers hardness test, STN EN ISO 6507-1
- Test equipment: Multipurpose hardness tester Instron Wolpert Testor 930
- Testing Methodology: HV5, loading F = 49,03 N, t = 8 s, indentor - tetrahedral diamond pyramid 136°

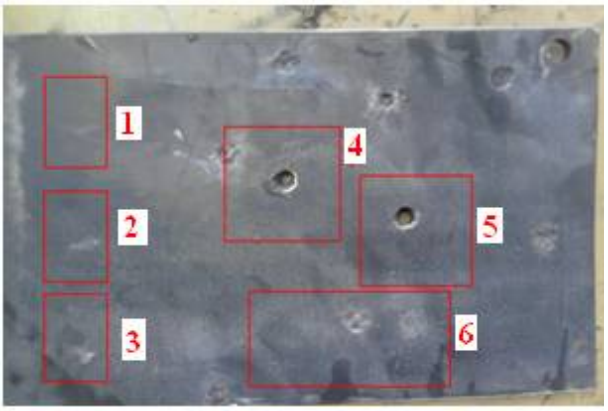


Fig. 4: Areas of hardness measurements on a sample

2.2 Analysis of chemical composition. Analysis of chemical composition was performed on the device **SPECTROLAB, Jr CCD.** Before chemical analysis of sample was carried out verification of correct calibration of measuring equipment on a standard, which upheld the device.

Characteristics of the test:

- Spectral analysis of chemical composition by atomic emission spectrometry (AES), STN EN 10351: Chemical analysis of ferrous materials. Optical emission spectrometric analysis with inductively coupled plasma

carbon, low and medium alloy steels. ISO 14700:2000: Surface chemical analysis - Glow discharge optical emission spectrometry (GD-OES).

A total of 3 measurements were made where sites are marked in Fig. 5. First measurement point M1 is located 86 mm from nearest penetration.. The second measurement M2 was performed directly on the projection caused by plastic deformation of bullet that don't break the target and is located 65 mm from from nearest penetration. Measuring point M3 is only 22 mm from nearest penetration. The results of measuring are shown in Table 3. All final values are given in wt. %.

Fig. 5: Location of the chemical analysis (M1, M2, M3)

2.3 Evaluation of analyzed material

Table 2: Results of HV5 hardness measurements

Area	Hardness HV5	The average value
1	477	458,7
	442	
	457	
2	484	460
	460	
	436	
3	435	442,5
	450	
4	407	410,5
	414	
5	393	400
	397	
	402	
	408	
6	453	457,3
	457	
	503	
	416	

Table 3: Observed chemical composition at the M1, M2 and M3 [wt. %]

Chemical composition	The number of measurement		
	M1	M2	M3
C %	0,2094	0,3896	0,2046
Si %	0,1640	0,1590	0,1320
Mn %	0,5910	0,5540	0,5730
P %	0,0075	0,0045	0,0091
S %	0,0042	0,0075	0,0080
Cr %	0,4900	0,4700	0,4900
Ni%	2,3500	2,3700	1,9500
Mo %	0,3664	0,3459	0,3613
B %	0,0003	0,0040	0,0015

3. CONCLUSIONS

From the results of spectral analysis shown in Table 3 we can see significant fluctuations of value of carbon and heterogeneity of the chemical composition of steel. Compared to the manufacturer dictated values of carbon (max. 0.47%) are below our measured values up to more than 50% (instead of measuring M3 and M1, the amount of carbon 0.2046% and 0.2094%). On the measuring point M2, the value of C was permissible and in this case there were no penetration of bullet.

Chemical heterogeneity of material caused a considerable scatter of hardness values, while the largest decrease in hardness was observed especially in the area of penetrations. In neither case was our measured value of hardness in accordance with the manufacturer entered values. It follows that the effect of chemical heterogeneity on the ballistic resistance of the material is very strong, and materials, involving a failure to comply with the percentage of alloy elements is necessary excluded from the manufacturing process and to eliminate from use for ballistic protection.

REFERENCES

1. Híreš, O., Barényi, I., Ličková, M., Bednárik, D.,. *Expertíza material ARMOX ADVANCE po balistických skúškach*. Výskumná správa, Trenčín, 2012
2. HÍREŠ, O.: *Fyzikálna metalurgia ocelí a ich tepelné spracovanie.* Trenčín: GC TECH, 2006. ISBN 80-8075-099-8
3. STANAG 4569 – Protection levels for occupants of logistic and light armoured vehicles, 2004
4. SSAB Oxelösund AB, Sweden: *General Product Information WELDOX, HARDOX and ARMOX.. Source.* [online]. Available: <http://www.oxycoupage.com/FichiersPDF/English/brochure_information_en.pdf>

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

INTEGRAL EQUATION FOR ELASTIC CONTACT BETWEEN A PROJECTILE - RIGID BODY AND A TARGET - ELASTIC SURFACE

IVĂNICĂ, Mihai

Military Technical Academy, Bucharest, Romania

Abstract: *This paper theoretically treats, using a complex mathematical model, the elastic contact between bodies, taking into consideration a rigid body named projectile and an elastic one with a plane surface contact (target surface). After the contact has been produced and the projectile deforms the elastic surface in a certain unknown depth, the initial considered contact point will be transformed in a contact domain, and the stresses appeared on this contact domain will equilibrate the system forces which acts over the projectile. From this point of view, the paper offers solutions both for the contact domain form and integral equation for elastic contact.*

Keywords: *elastic contact, rigid body, elastic surface.*

1. INTRODUCTION

Is assumed, in all that follows, that one of the bodies in contact is an elastic semispace, and the other one is a hard body called projectile.

It is considered semispace $z \geq 0$, subjected to a normal charge $p(\xi,\eta)$ distributed over a finite domain ***D*** situated at its boundary $z = 0$. Current point coordinates in ***D*** are ξ and η (fig. no 1). Newmann's problem for elastic semispace consists in finding a solution which describes the displacement field inside the semispace in the following limit conditions:

$$\begin{cases} \sigma_z\big|_{z=0} = \begin{cases} -p(\xi,\eta) & (\xi,\eta) \in D \\ 0 & (\xi,\eta) \notin D \end{cases} \\ \tau_{zx}\big|_{z=0} = \tau_{zy}\big|_{z=0} = 0 \end{cases} \quad (1)$$

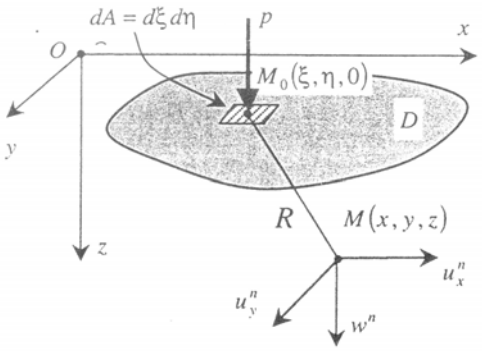


Fig. no 1

The solution for this problem can be obtained either from the classic Boussinesq's problem, or Neuberg-Papkovici representation.

2. THE TEXT OF THE PAPER

2.1 Boussinesq's problem for elastic semispace. Boussinesq's problem for elastic semispace consists in describing the action of a force concentrated in a point on the boundary of an elastic semispace, normal to this boundary. Usually, this point is chosen as being the origin of an orthogonal reference system with axes ***Ox*** and ***Oy*** in the semispace boundary plan. ***M(x,y,z)*** point displacements inside the semispace under the ***P*** force action are:

$$\begin{cases} u_x = \dfrac{1+\nu}{2\pi E} P\left[\dfrac{xz}{R'^3} - (1-2\nu)\dfrac{x}{R'(R'+z)}\right] \\ u_y = \dfrac{1+\nu}{2\pi E} P\left[\dfrac{yz}{R'^3} - (1-2\nu)\dfrac{y}{R'(R'+z)}\right] \\ w = \dfrac{1+\nu}{2\pi E} P\left[\dfrac{z^2}{R'^3} + 2(1-\nu)\dfrac{1}{R'}\right] \end{cases} \quad (2)$$

with $R' = \sqrt{x^2+y^2+z^2}$ (3)

Replacing in this formula the concentrated charge ***P*** with $p(\xi,\eta)d\xi d\eta$, x with $\xi - x$ and y with $\eta - y$, respectively distance R' with:

$$R = \sqrt{(x-\xi)^2 + (y-\eta)^2 + z^2} \quad (4)$$

with integration on D will lead to ***M(x,y,z)*** point displacement as in fig. no 1

Neuberg-Papkovici representation assumes seeking displacement vector as:

$$\overline{U} = \overline{B} - \frac{1}{4(1-\nu)} grad\left(\overline{r}\cdot\overline{B} + B_0\right) \quad (5)$$

where $\overline{B}$ is a harmonic vector function $\left(\Delta\overline{B} = 0\right)$, $\boldsymbol{B_0}$ is a scalar vector function ($\Delta B_0 = 0$), and $\overline{r}$ is the position vector.

In both situations the solution is written using potential simple layer functions (harmonic functions in ***D***),

$$\begin{aligned} \Omega(x,y,z) &= -\frac{1+\nu}{2\pi E}\iint_D p(\xi,\eta)\frac{1}{R}d\xi d\eta \\ \omega(x,y,z) &= -\frac{1+\nu}{2\pi E}\iint_D p(\xi,\eta)\ln(R+z)d\xi d\eta \end{aligned} \quad (6)$$

which allows the characteristic

$$\Omega(x,y,z) = \frac{\partial\omega}{\partial z}(x,y,z) \quad (7)$$

This solution is:

$$\begin{cases} u_x^n = z\dfrac{\partial\Omega}{\partial x} + (1-2\nu)\dfrac{\partial\omega}{\partial x} \\ u_y^n = z\dfrac{\partial\Omega}{\partial y} + (1-2\nu)\dfrac{\partial\omega}{\partial y} \\ w^n = z\dfrac{\partial\Omega}{\partial z} - 2(1-\nu)\Omega \end{cases} \quad (8)$$

A more compact representation of those equations can be made by introducing complex displacement:

$$u_c^n = u_x^n + iu_y^n \quad (9)$$

and differential operator $\Lambda = \dfrac{\partial}{\partial x} + i\dfrac{\partial}{\partial y}$ (10)

This operator satisfies the relation:

$$\Lambda\overline{\Lambda} = \overline{\Lambda}\Lambda = \Delta = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} \quad (11)$$

being its complex adjoint. With those notations equations (8) become:

$$\begin{cases} u_c^n = -\dfrac{1+\nu}{2\pi E}\left[z\Lambda\dfrac{\partial I_n}{\partial z} + (1-2\nu)\Lambda I_n\right] \\ w^n = -\dfrac{1+\nu}{2\pi E}\left[z\dfrac{\partial^2 I_n}{\partial z^2} - 2(1-\nu)\dfrac{\partial I_n}{\partial z}\right] \end{cases} \quad (12)$$

where

$$I_n(x,y,z) = \iint_D p(\xi,\eta)\ln(R+z)d\xi d\eta \quad (13)$$

2.2 Paraboloidal projectile case with central action.

The classic theory of elastic contact admits that the surface projectile body is curved, the contact with semispace is produced in an initial considered point ***O*** (fig. no 2) in which two cartesian reference systems are built: ***Oxyz*** attached to the elastic semispace and ***OXYZ*** attached to the projectile. If $Z = \varphi(X,Y)$ is the boundary projectile equation, with φ a C2 class function on parts, where point ***O*** is considered to be an elliptic one of this surface. Also, the plan $OXY \equiv Oxy$ is a tangent plan in point ***O*** at the projectile boundary:

$$\varphi(0,0) = \frac{\partial\varphi}{\partial X}(0,0) = \frac{\partial\varphi}{\partial Y}(0,0) = 0 \quad (14)$$

Is assumed that the projectile is subjected to the action of a forces system, reducible to a force and a couple (because the projectile is a rigid, hard body), which allow it penetrate in the elastic semispace. Projectile – semi space system equilibrium is established when the

projectile will be penetrated to a certain depth (unknown) in semispace, when the initial considered contact point will be transformed in a contact domain (unknown) on which the projectile comes in touch with the deformed boundary of the semispace and when the stresses (also unknown) on this domain will reach the equilibrium of the forces applied to the projectile. In the absence of friction it can be assumed that the projectile is subjected to a vertical force ***P***, which support go through the point (ξ_0,η_0) from the plan $z=0$. The displacements and deformations that occur are assumed to be small enough to allow using the linear theory. In this way the limit conditions can be expressed on the nondeformed boundary of the semispace [2].

Thus, although the real contact domain has the projectile's shape, contact domain is referred as being the ***D*** domain of plan $z=0$ which after deformations gets in contact, point by point, with boundary projectile. So the equilibrium conditions for projectile are:

$$\iint_D p(\xi,\eta)d\xi d\eta = P,\ \iint_D \xi p(\xi,\eta)d\xi d\eta = \xi_0 P,$$
$$\iint_D \eta p(\xi,\eta)d\xi d\eta = \eta_0 P \qquad (15)$$

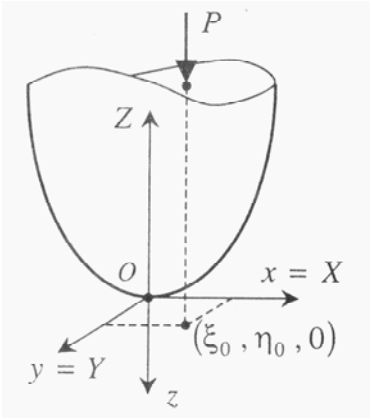


Fig. no 2

The limit conditions on the semispace boundary are given by (1), being specific to a contact surface without friction. Not considering the tangential displacement u_x^n and u_y^n in relation to ***w*** displacement on the contact domain from fig. no 3 [2], the following equation is obtained:

$$w=\delta-\varphi(x,y),(x,y)\in D \qquad (16)$$

which combined with equation $(12)_2$ for $z=0$ leads to:

$$\frac{1-\nu^2}{\pi E}\iint_D \frac{p(\xi,\eta)}{\sqrt{(x-\xi)^2+(y-\eta)^2}}d\xi d\eta = \delta-\varphi(x,y),\ (x,y)\in D \qquad (17)$$

called integral equation for elastic contact. Distance δ is the maxim depth where the projectile penetrates semispace and is called interpenetration. Equation (17) has an extreme complexity having $p(\xi,\eta), D, \delta$ unknown.

In paraboloidal projectile case with central action, characterized by:

$$\varphi(X,Y)=\frac{1}{2}\left(\frac{X^2}{\rho'}+\frac{Y^2}{\rho''}\right) \qquad (18)$$

equation (17) is written

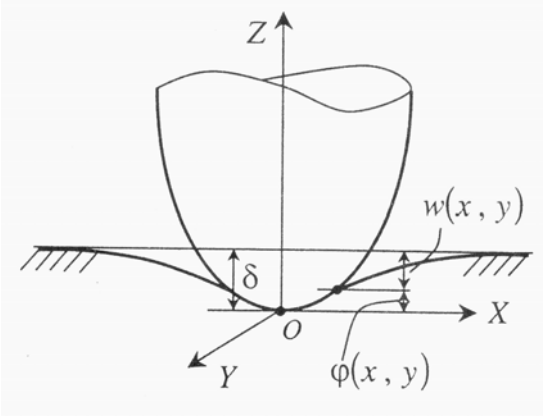


Fig. no 3

$$\frac{1-\nu^2}{\pi E}\iint_D \frac{p(\xi,\eta)}{\sqrt{(x-\xi)^2+(y-\eta)^2}}d\xi d\eta = \delta - \frac{1}{2}\left(\frac{x^2}{\rho'}+\frac{y^2}{\rho''}\right),\ (x,y)\in D \qquad (19)$$

at which is added the equilibrium condition $(15)_1$. In equations (18) and (19) ρ' and ρ'' are the main radius curves of projectile in ***O***, system axes ***Oxyz*** being oriented so that $\rho' > \rho''$.

3. CONCLUSIONS & ACKNOWLEDGMENT

The contact problem between a rigid paraboloidal body and an elastic semispace is of the most importance, because the paraboloidal projectile equation is valid at first approximation for projectile of any configuration in the near by of any elliptic point of its boundary. So the contact domain is of elliptic shape

$$D = \left\{(x,y)\left|\frac{x^2}{y^2}+\frac{y^2}{b^2}\le 1, b\le a\right.\right\} \qquad (20)$$

with ***a*** and ***b*** unknown semiaxes. The integral equation for elastic contact (19) is verified by pressure function

$$p(\xi,\eta) = \frac{3}{2}\frac{P}{\pi ab}\sqrt{1-\frac{\xi^2}{a^2}-\frac{\eta^2}{b^2}} \qquad (21)$$

and the interpenetration projectile in semispace is:

$$\delta = \frac{3}{2}P\frac{1-\nu^2}{\pi E}\frac{K(k)}{a} \qquad (22)$$

where

$$K(k) = \int_0^{\frac{\pi}{2}} \frac{dt}{\sqrt{1-k^2\sin^2 t}} = \frac{\pi}{2}\left\{1+\sum_{p=1}^{\infty}\left[\frac{(2p-1)!!}{(2p)!!}\right]^2\cdot k^{2p}\right\},\ 0\le k<1 \qquad (23)$$

K(k) is elliptical second kind integral of Legendre [1] with $k=\sqrt{1-\frac{b^2}{a^2}}$ ellipse eccentricity.

REFERENCES

1. Badescu, R., Maican, C., *Integrale utilizate in mecanica, fizica, tehnica si calculul lor*, Bucuresti: Editura Tehnica (1968).
2. Buracu, V., Alecu, A., *Aplicatii ale teoriei potentialului in mecanica solidelor*, Bucuresti: Editura Tehnica (2006).
3. Teodorescu, P., *Probleme spatiale in teoria elasticitatii*, Bucuresti: Editura Academiei (1970).

.

"HENRI COANDA" AIR FORCE ACADEMY ROMANIA

"GENERAL M.R. STEFANIK" ARMED FORCES ACADEMY SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

DURABILITY OF WOODEN BRIQUETTES

Aurel LUNGULEASA*

*Faculty of Wood Engineering, Transilvania University, Braşov, România

Abstract: *The paper presents some aspects about durability of wooden briquettes. This can be considered as a new method for briquettes characterization. This feature of briquettes characterizes the compactness and quality of briquettes, nearby of density and compression. Inside of paper there will be presented other type of durability for composites and even pellets and their methologies. In the case of wooden briquettes the paper proposes itself to present the methodology, experiments, analises of resuls and conclussions related to durability. It is analized two types of wooden briquettes and put in balance five factors of influences. Final conclusios of paper show that the negative aggregation of all influencing five factors of durability on the same type of wooden briquettes will lead to drastic decrease of properties or even completely destruction of briquettes.*

Keywords*: wooden briquette, durability, renewable fuel, vibration apparatus*

1. INTRODUCTION

Mechanical durability is the property of woody materials to be resistant to the destruction or removal of a surface layer with some strong abradable bodies. This property is especially needed when using wooden materials for boards, floors, stairs, door frames and even some pieces of machinery with high wear degree. Procedures for determining the durability of lignocellulosic materials are various, among which it can mention: sand blasting, by grinding up imitating human steps, impact with an alternative sanding, ball rotation on surfaces etc. The degree of durability of the wood materials are generally expressed by loss of mass.

To determine the durability (or wear, or abrassion) of wooden composite plates it can be used some prismatic specimens having a square base of 50mm and a height equal to that of the base plate [2, 3]. These pieces are glued on a wooden support. Equipment is composed of a trolley for horizontal movement of the specimen in both directions and an abrassive device placed above the specimen with a vertical displacement, such as to imitate human leg movement, in it's the natural wood wear. Because the value of the mass loss for plates is very small, in this case the durability is expressed per unit area of the specimen (50×50 mm) and not per its total mass (almost neglectable) .

Most of durability testers are made for pellets and less for briquettes. There are a lots of testing devices to characterise pellet stability during handling. Pellet Durability Test is done with special apparatus tests offered by UK Company Borregaard Ligno Tech [1]. This apparatus determines whether the pellets have good physical properties, high quality and consistency. Lignotester's LT-III is a portable pneumatic tester ideal for use in any location of quality control pellets and its operating principle is presented in figure 1.

LT III Lignotester tester simulates the environment in which the pellets are stored and are transferred from the factory to the customers.

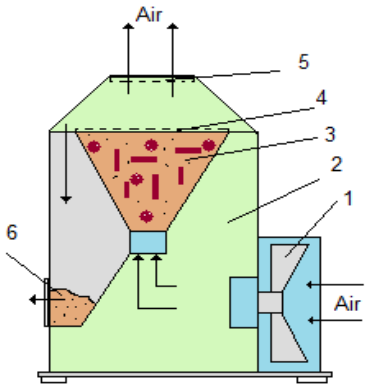


Fig. 1. Lignotester LT III for determining the pellets durability: 1-axial fan; 2-pressure chamber; 3- room for shaking pellets in ascedent air flow; 4-sieve; 5- mesh filter; 6- door to remove dust

The pellets are pneumatically tested in cascade airflow inside of a pressure chamber 2. As the pellets collide with each other and from the hard surface and perforated drain basket, they will wear. Dust is produced due to the physical process and passes continuously through the perforated sieve 4 of the test room during testing. LT III is a semi-automatic tester. Sample is 100 grams of pellets, weighed with a balance to the nearest 0.1g, placed in the test chamber 2. Tester is switched on, operates 30 seconds and then stops automatically. Test chamber 2 is swung to store the pellets in a container on a balance. Weight balance is displayed on the index value of the pellets durability. This tester is ideal for controlling the manufacturing process of pellets.

The main objective of this paper is to establish a methodology for determining the durability of wood briquettes, given by the situation that no such determination method exist in this domain (compared with pellets), but mainly because wooden briquettes can still deliver in bulk, packaged in polyethylene film for protection. During transport, unpacking, storage and use of the recipient, briquettes will rub against each other and installations walls, producing the certain loss. The determination of these losses is the objective of laboratory initiated methodology.

2. EXPERIMENTAL

Experiments on the determination of briquettes durability were made in laboratory conditions, using two types of briquettes. First of briquettes are obtained on a hydraulic machine from wooden chips and the second ones are obtained on a mechanical press from sawdust obtained from a circular saw. All characteristics of the two types of briquettes are presented in Table 1.

Table 1. Characteristics of used briquettes

Characteristics	Briquettes type	
	Type 1	Type 2
Press type	Hydraulic	Mechanic
Raw material	Chips (beech and spruce)	Sawdust (beech and spruce)
Visible aspects	No gloss, no cracks	No gloss, with many cracks
Moisture, %	10 ± 2	10 ± 2
Diameter, mm	40	66
Density, kg/m^3	780 ± 30	760± 20
Compressive strength, N/mm^2	2.0± 0.2	1.2± 0.1

Wooden briquettes and the waste material resulted after durability are colected. For experiments it has used a mechanical vibration device for sorting, whose operating principle is shown in Figure 2. As methodology, it has been used 3 wooden briquettes, which were subjected to vibration inside of box for a period of 5 minutes, above of sieve of 3 mm. Firstly three briquettes are weighed on a balance with electronic scales in grams, with an accuracy of two decimal, then they are placed over the sieve of the vibration device, then put the lid and tighten the nut. The installation starts and lasts 5 minutes. During this period briquettes are agitated over the grid, and the friction that occurs between them and the sieve and the side walls of the sieve

will obtain a certain amount of dust. After shut-down the device with the button 2, it weighs the amount of dust obtained and reported to the original mass of briquette.

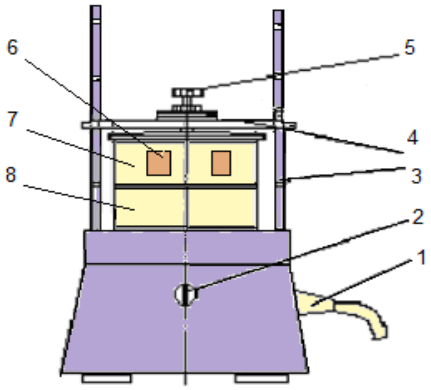


Fig. 2. Vibration apparatus for determining durability of wooden briquettes: 1- power cable, 2- start and variation button of vibration amplitude, 3- columns; 4-device for lid tight, 5-knob with nut tightening; 6-briquettes; 7-sorting box with a sieve dimensions of 3 × 3 mm, 8-pack of the dust collecting

In this way, the degree of durability for wooden briquettes are obtained, a performance indicator for quality of briquettes. To determine this indicator the following relationship is used:

$$A = \frac{m_l}{m_i} \cdot 100 \quad [\%] \qquad (1)$$

A - abrassion, expressed in %;
m_l - mass of briquettes loss, in g;
m_i - initial mass of briquettes, in g.

3. FIVE CRITERIA OF ANALYSIS

Durability of wooden briquettes, usually expressed as the degree ofdurability, has a great number of influence factors [2], but mainly correlated with their density and compression [5]. Thus, if the wooden briquettes have high density and compression the durability will be surely lower. In a general way it can say that as the briquettes has a little durability the better quality of briquettes will be, that means it will lose less of them during transport and storage [5]. To this general rule it can add the fact that if the briquettes have some cracks, then they will have a higher durability. The high variation of air humidity will create cracks and decay of briquettes, meaning a large detachment of amount of dust and even pieces of briquettes. Worst wooden briquettes are those to which a large dust and pieces amount are lost [4].

Also, if the wooden briquettes have a natural gloss, they will have a higher compaction and less durability. Luster is given to wooden briquettes by the increased compaction of cylindrical outer surface, but can be also increased by heating and charring of even outside surface. Therefore, it is very important that the briquettes compactness and its outer gloss to be very high for obtaining a good low durability.

If it is analyzed the two types of wooden briquettes we observed that the general principles set forth in above paragraphs shall meet. A first idea on the two types of briquettes assessed on the principle of operation of the plant for briquetting, namely the mechanical installations have raised the possibility of compaction of briquettes to 1200kg/m^3, which has not happened in our case, because the briquettes only had a density of 760kg/m^3, even lower than those obtained by hydraulic press (780 kg/m^3). From this point of view since the beginning we expect that such wooden briquettes to have a lower durability.

A second element of comparison is that of appearance, namely if they have or no cracks. Both types of wooden briquettes do not have bright, so it can not differentiate in this regard,

but the second ones have a lots of cracks on the outer surface, which is why it expects them to have a high wear.

A third element of wooden briquettes comparison is the raw material used to make them. Both types of wooden briquettes are made of beech combined with spruce, in 1/1 ratio, but type 2 is made of sawdust compared with the first type that is realized from wooden chips, it is expecting them to be more compact, but this does not happen. For these reasons, type 2 of briquettes will have a weaker durability than the first ones.

A fourth element of comparison and one of the most important is the density. From this viewpoint the wooden briquettes type 2 has a lower density, namely 760kg/m^3, against the other type 1 of briquette that is 780 kg/m^3. Therefore the briquettes type 1 will have higher wear than type 2.

A fifth element of comparison and distinction of the two types of wooden briquettes and the overwhelming influence is the compressive strength of briquettes. From this point of view it can see a clear difference in favor of a briquette type 1, which have a resistance of 2 MPa, compared to type 2, which has only 1.2 MPa, namely with 66% higher.

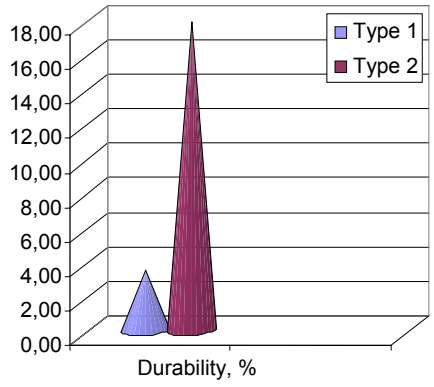


Fig. 3. Durability value size of two types of wooden briquettes

This difference translates into a better durability of type 1 of wooden briquettes.

Summarizing all five previous distinctive features of comparing (procedures of briquetting, raw material, cracks, density an compression strength) it can see that all the influence factors favors the type 1 of wooden briquettes, which is why this type of durability of 3.5% is much better than type 2 of briquettes, namely 17.9 %, that means a increasing durability of type 2 of 5.1 times (see fig. 3).

4. FINAL CONCLUSIONS

Durability is an important feature of pellets and briquettes, which characterize the stability and compactness, along with other features such as effective density, compression and shear [5]. There are many determinations of pellets durability and no for wooden briquettes. The influence factors of briquettes durability are numerous, but the paper noted that the compression is very important (near density, luster and cracks).

Durability of other woody materials such as wooden pellets and composites are two points of departure in establishing a methodology for determining the durability of wooden briquettes. The comparative study of two types of wooden briquettes presented in the paper highlights the importance of each influencing factor of the briquettes durability and their aggregation on the same type of wooden briquettes will lead to drastic destruction of briquettes with high durability. High durability of briquettes leads to higher losses during transport and storage at the beneficiary, in the form of dust and chips and if combined that with large differences in moisture contents the briquettes can be totally disintegrated.

REFERENCES

1. Borregaard Lignotech, *Pelleting Aids*, Available: http://hysteriah. no/borregaard/ testers. htm/, (December, 2011).
2. Lowe, R. -Judging pellet stability as part of pellet quality, *Feed Technology*, 9.2, pp. 15-19, Available: http://www. AgriWorld.nl/, (2005).
3. Mitisor Al, *Tehnology of laminated products* (in Roumanian), Transilvania University of Brasov, Brasov (1967).

4. Tummerman M, Rabier F, Jensen P D, Hartman H, Bohm T - Comparative study of durability test methods for pellets and briquettes, *Biomass and Bioenergy*, vol 30, Issue 11, pp. 964-972, (2006).
5. Wilson O., T. - *Factors affecting wood pellet durability*, Degree of Master of Science, The Pennsylvania State University, The Graduate School, Department of Agricultural and Biological Engineering, Available: http://www.tow _thesis_final_rev2.pdf/ (May, 2010).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

TIRE MODEL FOR SIMULATIONS OF VEHICLE MOTION ON HIGH AND LOW FRICTION ROAD SURFACES

Cristian MINCA, Ana Maria DINCU

University "Politehnica" of Timisoara, Romania, cristian.minca@yahoo.com

Abstract: *An on-road analytical tire model has been developed to predict tire forces and moments at the tire/road interface. The model is computationally efficient and it only requires a limited set of easily obtained input parameters. Force and moment calculation are based on mechanical analogs that describe longitudinal and lateral tire tread and sidewall deflections during braking, traction and cornering. Longitudinal deflections are determined using a simple linear elastic spring model, while lateral deflections are calculating using an elastic beam model. Surface sliding friction is define by experimental curves relating the friction coefficient to the wheel/road differential velocity. Source code has been developed to include the model as a force element subroutine in commercially available dynamic analysis software known as DADS (Dynamic Analysis Design System). The tire model has been successfully demonstrated in DADS using a simple simulation of a tire test device. Preliminary comparisons of model predictions with available test data have been favorable. Efforts are underway to incorporate the tire subroutine into a DADS model of a HMMWV to conduct driving simulations on dry, snow and ice covered road surfaces.*

Keywords: *tire, tire – road interaction, contact patch*

1. INTRODUCTION

On-road vehicle mobility is important to the military, as it is a major factor governing the movement of troops and material in the field. Accurate representations of wheeled vehicle maneuvering capabilities (traction, braking and cornering) are needed via high resolution dynamic simulations to predict maximum over the road vehicle speeds as road conditions worsen due to degraded weather. Personnel at the Cold Regions Research and Engineering Laboratory (CREEL) are using DADS to create dynamic simulations of vehicles operating under winter conditions.

A critical element in any wheeled vehicle dynamic model is the set of algorithms that defines the interaction between tire and road. A model is provided in the current version of DADS that predicts tire response to vertical loading. A tire model is also provided in DADS that predicts longitudinal and lateral reaction forces and moments during combined traction.

2. TIRE MODEL DEVELOPMENT

Numerous approaches to tire modeling are documented in the literature. Two simple ones are adopted here to describe tire deflection and forces in the vertical (i.e. normal to the road surface) and longitudinal (in the tire plane, tangent to the road surface) directions. A novel approach involving elastic elastic beam theory is used to define displacement and forces in the third "lateral" direction.

2.1 FORCE AND MOMENT CONVENTIONS

Figure 1 shows the force and moment vectors calculated by the tire model being discussed. These act at the central intersection point of the tire disk and road surface plane. They constitute an equivalent orthogonal representation of the road forces generated along the displaced tire patch. The x and z axes shown are parallel to the longitudinal axis of the tire and the road surface normal, respectively.

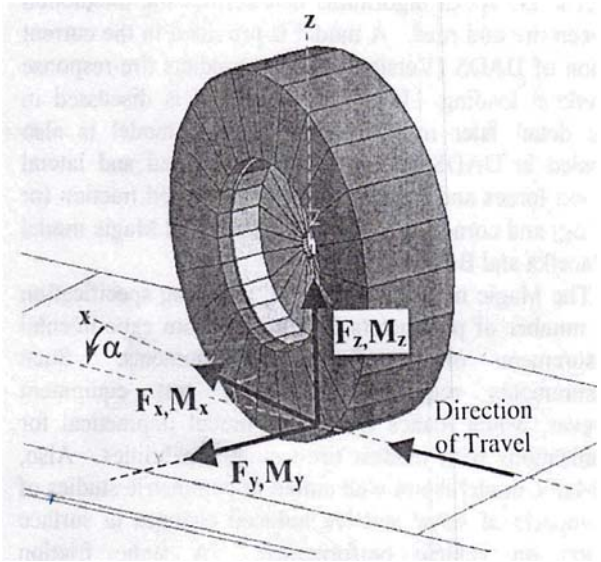


Fig. 1 Calculated Tire Forces and Moments [1].

2.2 VERTICAL TIRE RESPONSE

"Vertical" tire/road interactions (normal to the road surface along the z axis) are treated independently of lateral and longitudinal interactions, and calculated using the distributed contact model currently in DADS. This model describes tire normal deflections and velocities based on the lateral cross-sectional area generated by an equivalent undeformed disk intersecting with the road profile. The normal deflection of the actual of the flattened tire is computed from the intersected arc length of the undeformed disk. Tire normal force is calculated using a simple linear spring model with user-specified spring constant. The latter is easy to measure; Table 1 lists the spring constant K_{vert} for a light-truck tire that was determined for measurements made at CRREL. [3]

Damping can be affected as well in the normal direction in the current DADS code if the user provides a damping constant. The stiffness and damping constants can also be replaced by empirically-based curves.

2.3 LONGITUDINAL TIRE RESPONS

Longitudinal tire/road interactions are represented in the CRREL tire model by a simple I-dimensional quasi-static "Brush" (or "Cantilevered Spoke") mechanical analog described by Dixon (1996) and a nominal expression for rolling resistance. Figure 2 depicts the brush analog.

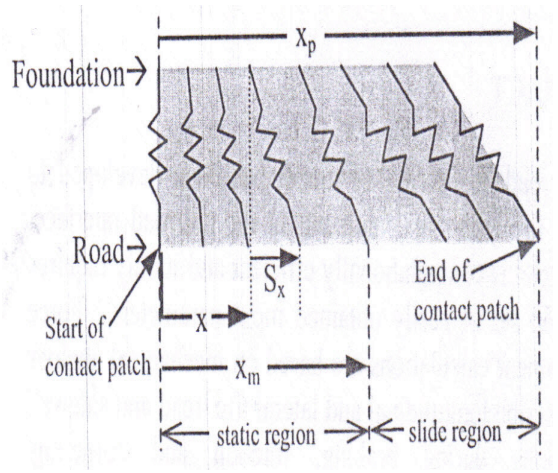


Fig. 2 "Brush" Analog used to Describe Longitudinal Tire Behavior along Tire Contact Patch

2.3.1 TIRE PATCH STATIC REGION

In the Brush model, the contact patch is divided into two sections: a forward "static" region where the tire tread adheres to the road surface, and an aft "slide" region where sliding occurs between tire and road. Contact patch displacement is limited by the tire longitudinal foundation stiffness C_1 and surface frictional forces. In the forward static region, at a distance x from the leading edge of the patch, the tire tread streatches an amount S_x equal to:

$$S_x=(1-V_x/\omega R)x \qquad (1)$$

-V_x is the velocity of the wheel center in the longitudinal direction;
-ω is the wheel rotation rate;
-R is the tire rolling radius.

The longitudinal friction force $f_{x,st}$ exerted on the tire in the static region is the product of S_x and the foundation stiffness C_1 integrated from x=0 to x_m, where x_m marks the transition point from the static to sliding regions. This equates to:

$$F_{x,st}=C_1/2\ (1-V_x/\omega R)x^2_m \qquad (2)$$

The tire foundation stiffness C_1 can be obtained from a simple static pull test. Figure 3 shows the test setup used a CRREL to determine C_1. A load cell capable of measuring horizontal and vertical forces supports a vertically loaded tire. The load cell itself is supported by a frictionless bearing, which is pulled by a pneumatic cylinder. Longitudinal load and tire displacement are recorded and plotted, and the slope of the resulting curve determined. This value is then divided by the length of the tire contact patch to arrive at the foundation stiffness.

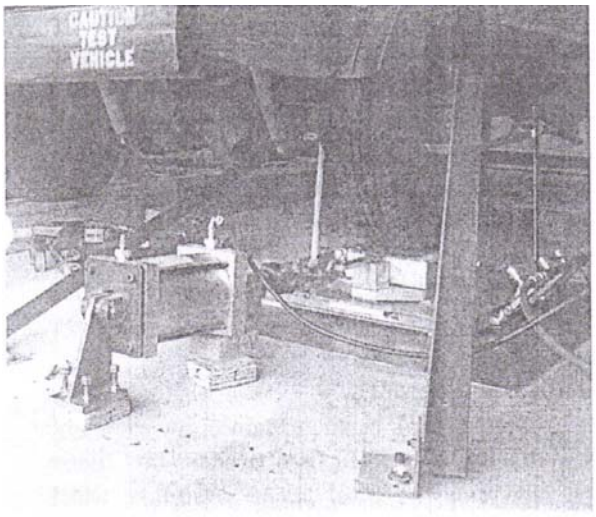


Fig. 3 CRREL Test apparatus for measuring tire foundation stiffness.

2.4 LATERAL TIRE RESPONS

Lateral tire behavior is non linear and complex, and most often described using empirical and semi-empirical approaches (Pacejka and Bakker 1993, Brach and Brach 2000, and Nicholas and Comstok 1972). In addition, several analytical models exists, such as the one describe by Shim, Margolis and Belltawn 2000. This model simulates combined braking and cornering, but is limited to linear tire behavior at small slip angles. Ellis (1969) proposes two analytical for tire lateral response: the taut string with elastic curtain and the beam on an elastic foundation. While the former, like the previously discussed model is only applicable to small slip angles, the latter applies to all longitudinal and lateral slip conditions. The mathematical derivation for Ellis' elastic beam model uses several numerical approximations however, and he treats tread and carcass/sidewall deflections separately. Application of the model, either by its author or others, is not evident in the literature as well. The beam-on-elastic-foundation is a useful analog nonetheless, and an alternate set of equations is offered here to describe it.

2.4.1 ELASTIC BEAM THEORY

The tire is treated as a beam restrained by an elastic foundation attached to a fix base (wheel rim). Beam deflection represents tire tread lateral deflection, which follows a linear path in the static region of the tire patch

determined by the slip angle **α**, and a parabolic curve in the slide region.

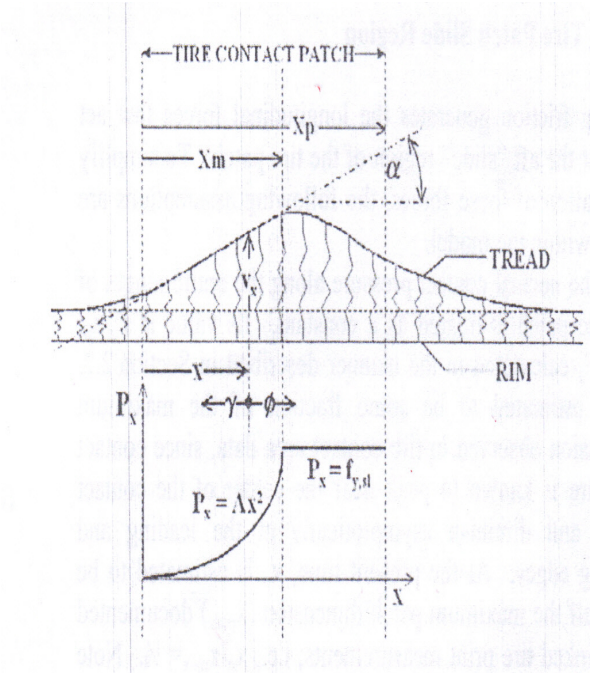


Fig. 4 Plan view of tire patch lateral deflection using a beam on elastic foundation model

3. MODEL IMPLEMENTATION IN DADS

A simple simulation of a tire tester device was created and used to debug and fully implement the new code in DADS. The tire tester is shown in figure 5. In this simulation, a tire supports a dead weight while being guided along a ramp al constant speed and constant slip angle. Longitudinal slip is gradually varied during the simulation such that the tire is free rolling at the beginning and fully braked by the end.

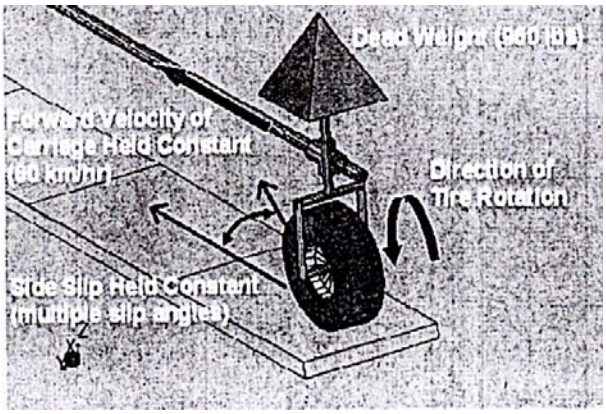


Fig. 5 DADS Tire tester simulation

Figures 6-11 display sample predictions of tire forces and moments for different slip angles from the tire tester simulation. The tire input parameters used are those listed in table 1.

Table 1: Tire model parameters for a light truck tire Goodyear Wrangler AT, P235/75R15, 35 psi

Vertical stiffness	K_{vert}=1327 lb/in
Longitudinal foundation stiffness	C_1=284 lb/in^2
Lateral foundation stiffness	k=36 lb/in^2
Rolling resistance coefficient	k_{rr}=0,01
β=(k/EI)$^{1/4}$	**β**=0,148 in^{-1}
Undeflected tire radius	R_u=14,438 in
Patch length coefficient	M_{est}=2300 lb/in

Figures 6 and 7 show longitudinal and lateral forces generated during combined cornering and braking on dry pavement for all ranges of longitudinal slip (i.e. braking) and slip angles of 2 and 5 degrees. Curves extracted from Bakker, Nyborg and Pacejka for an unspecified radial tire at the same vehicle speed and normal load are shown for relative comparison. The CRREL predictions are slightly different from the Bakker, Nyborg and

Pacejka curves, but this is to be expected, as the tires represented are likely different.

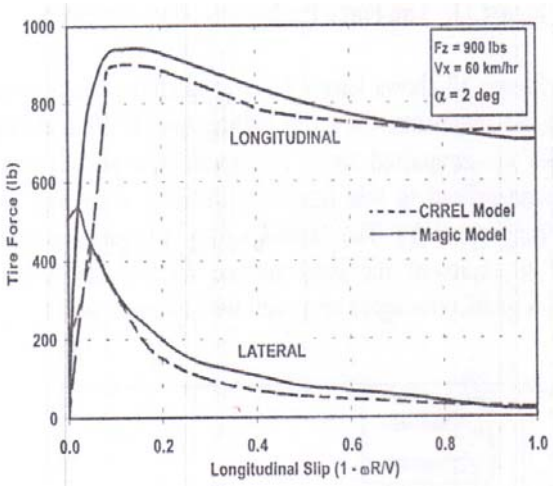


Fig. 6 Tire forces on dry pavement –**α**=2 deg

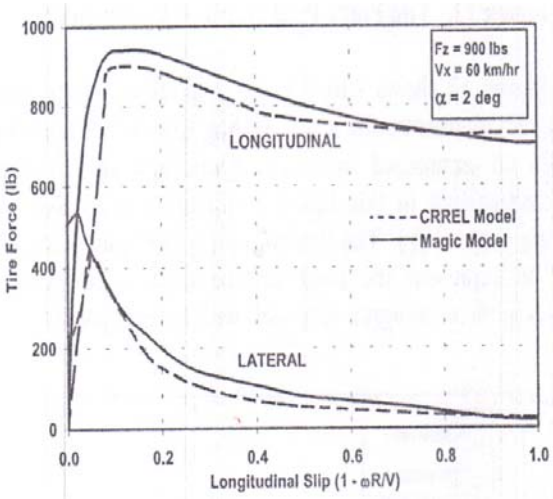


Fig. 7 Tire forces on dry pavement –**α**=5 deg

Figure 8 shows model predictions of lateral force vs. longitudinal force for different slip angles. The appearance here of dual lateral force values at a single longitudinal force is due to the drop-off in sliding friction with increasing DIV. This behavior is commonly seen in tire test data in the literature, and appears to justify the manner in which the friction coefficient is expressed in the model.

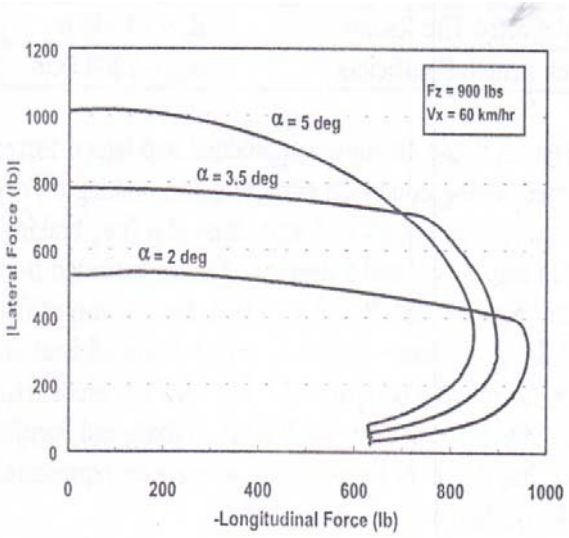


Fig. 8 Tire force prediction-dry pavement

Figure 9 shows lateral force predictions, along with field measurements for a free roling tire at different slip angles on compacted snow. (Lateral force F_y is nondimensionalized in this figure by dividing it by the tire vertical force F_z). The "snow" curve is used here to represent the road surface friction coefficient. Model predictions agree very well with measurements.

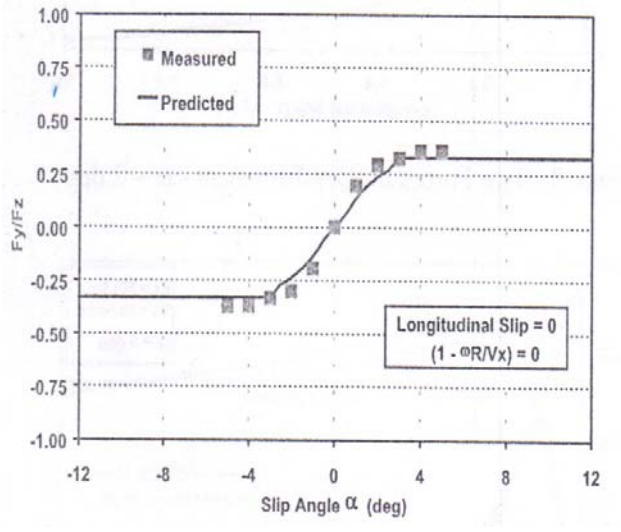


Figure 9 Lateral force predictions-packed snow

Figures 10 and 11 show sample predictions of roll moment and aligning moment on dry pavement. Both are plotted vs. longitudinal force for different slip angles. Test data are not included in these figures for comparison, as it was difficult to obtain accurate representations of these types of measurements.

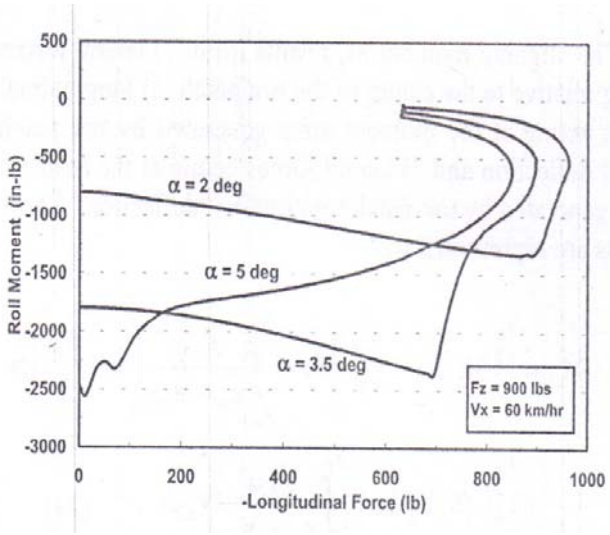


Figure 9 Roll moment predictions-dry pavement

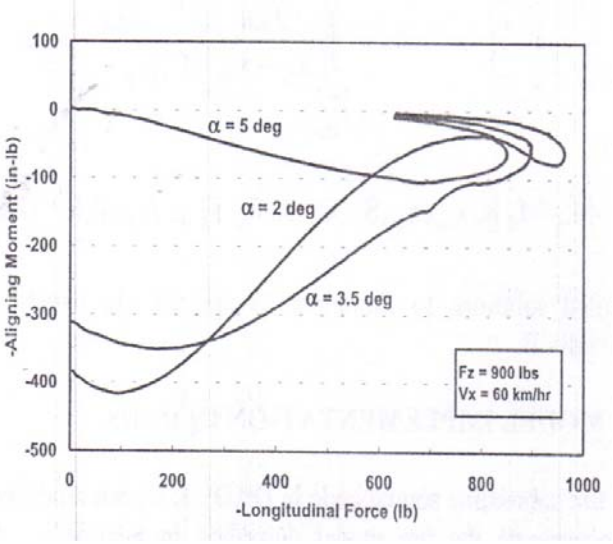


Figure 11 Aligning moment predictions-dry pavement

REFERENCES

1. Andresen A., Wambold J.C., "Friction Fundamentals, Concepts and Methodology", Transportation Development Centre Transport Canada, TP 13837E, CDRM Inc., 1999
2. Brach, R.M and R.M. Brach., "Modeling combined bracking and steering tire forces", SAE Paper, 2000
3. Dixon, J.C., "Tires, Suspension and Handling", SAE Paper 1996
4. Lacomb, J, „Three Approaches to Winter Traction Testing", U.S. Army Cold Regions Research and Engineering Laboratory, Hanover 2000
5. Lai W. M., Rubin D., Krempl E., "Introduction to Continuum Mechanics", Butterworth-Heinemann, 1999
6. Nackenhorst U., "Contact Mechanics", Lecture notes, Hannover, 2006
7. Pacejka, H.B. and E. Bakker „The Magic Formula tire model", Supplement to Vehicle Systems Dynammics, 1991

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

APLICATIONS OF FULL FACTORIAL DESIGN FOR LASER PROCESSING

Cristian MÎNZAT*, Remus BOBOESCU*

*Mechanical Faculty, University Politehnica, Timisoara, Romania,

Abstract: *We analyze the fusion lines fused applicable for laser welding of steels. A factorial experimental design type 2^2 in which were varied power and welding speed was applied to thick carbon steel plates. The laser beam focuses to the workpiece surface and at 2mm inside piece were used. The weld cross section weld depth and weld molten zone area were measured. Effects of power and welding speed were presented by Pareto charts. It was shown that the laser beam power has role in determining the material molten zone dimensions.*

Keywords: *laser welding, steel, Pareto chart, keyhole welding regime, melted area*

1. INTRODUCTION

Experimental modeling of laser welding of steels has been the subject of several studies. Olabi (2006)[1] conducted a study on CO_2 laser welding of steels with medium carbon content. As response function are considered the ratio of weld depth and width and depth of the weld and heat affected zone width. Benyounis and others (2005) [2] studied to optimize the laser welding with a CO_2 laser ,of steel with medium carbon content .As a influence factors are considered laser power, welding speed and focal point position, (defocusing distance). As the response function is take heat necessary for the process of welding, weld width, heat affected zone width and depth of weld. Anwara (2008)[3] presented a study on the laser welding of two different materials: steel AISI 316 stainless steel and low carbon steel AISI 1009 using a CO_2 laser with emission in continuous regime. The study led to the conclusion that laser power and welding speed are influence factors of significant influence on the welding bath. Benyounis (2008) [4] is studying the laser welding for stainless steel AISI304. Determined correlation function was the square type. ANOVA method was used for statistical analysis of variance and response surface method for the representation of results. The study described some conditions for the realization of the welding process.

This paper proposes a study on the weld cross section area which is melted in laser welding. On the weld cross section dimensions of molten zone are considered. Shape of melted area shows the welding regime, conduction welding or keyhole regime.

2. EXPERIMENTS

The experiment consisted in made lines of fusion (welds), 110 mm long, on Dillimax 500 steel plates with thickness of 10 mm (carbon steel, carbon content ≤ 0.16 %), figure 1. Was used a Nd: YAG Trumph Haas 3006D laser source with 3kW maximum power on a

continuous wave regime CW. Laser beam was transmitted through a optical fiber with core diameter of 0.6 mm

The focus system made a focal spot with 0.6 mm diameter. Lens focal length was 200 mm. As protective gas argon was used with a flow rate of 20 l/min. Parameters varied in the experiments are presented in Figure 2.

Figure 1 Image the welds a) plate surface b) welds cross-section

In experiments was varied the laser power, welding speed and distance between focal plane and piece surface (defocusing or defocusing depth) figure 2. Welds were cut in the stable part of the weld near the place where welding process was stopped. Weld section was processed metallographic. Weld width, near the piece surface, and weld depth were examined using a microscope with precision of 0.01 mm. Melted area was measured directly by its footprint.. Defocusing values are considered negative if the laser beam focus inside the piece.

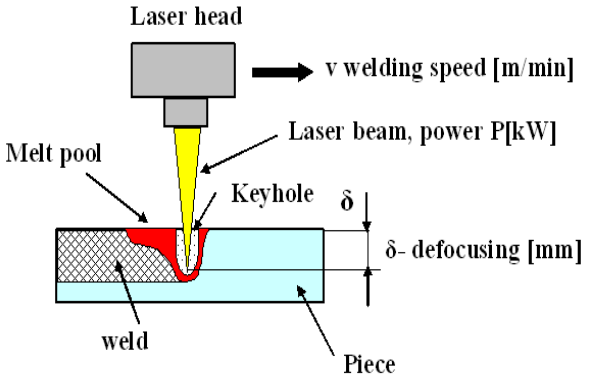


Figure 2 Scheme welding pool with varied parameters in welding process

In the experiments were varied power and welding speed. To statistically analyze the effects of parameters was necessary to introduce a dimensionless parameter values.Transformations between the two systems of parameters values are presented in table 1

The experimental plan is presented in Table 1 with actual values that coded for power and cutting speed.

Table 1: Varied parameters values in experiment

	Power		Speed	
weld	A[-]	P[kW]	B [-]	v[m/min]
1	-1	1	-1	0.6
2	+1	3	-1	0.6
3	-1	1	+1	1.5
4	+1	3	+1	1.5
5	0	2	0	1
6	0	2	0	1
$A = P - 2$ [-]		$B = -2.33 + 2.22v$ [-]		

Analysis procedure consisted of presenting the results of the mathematical model, ANOVA table showing the correlation coefficients associated with the mathematical model, Pareto chart showing the hierarchy of effects and response surface is a graphic representation of mathematical model. For the mathematical model were presented two forms for real values laser power and welding speed and for coded system values. The first allows rapid application of formulas and the second allows direct analysis of the values of regression coefficients. Based on these values were achieved Pareto charts.Figure 3 shows the analysis weld scheme and analyzed sizes that characterizing the weld.

To study objective functions characterizing welds made were considered as parameters of the laser beam power and welding speed. Power is related to the laser beam intensity. Welding speed is related with the time of interaction between laser beam and material. These parameters were independent action. Defocus of the beam at piece surface changes the effects of the laser beam intensity and time of interaction in a way that can not be said before. The two levels of defocus present in the experimental plan will be called the focus to the piece surface and focus within the piece. Defocusing effect is considered high with the

descent of laser beam focal plane within the piece.

Experimental data processing was performed using the Statgraphics program.
The analysis consisted of determining the polynomial mathematical models, making Pareto charts and statistical analysis using ANOVA method. For data analysis was considered only Pareto diagrams. Much of the information provided by other data processing is included in these figures. Pareto chart shows the contribution of each effect in determining the objective function (measured size). Associated positive sign for effect value indicates increases of objective function value. Negative sign for effect value indicates that this effect decreases the value of objective function.

Variation for objective function values will be discussed for situation where the parameter or effect increases. Pareto diagrams containing the interaction between laser beam power and welding speed are based on a quadratic model. Pareto diagrams without interaction are based on a linear mathematical model.

3. ANALYSIS WELD CROSS SECTION

Weld cross section analysis aim is to reveal the effects of parameter variations on the dimensions of the material melted area.
For the weld cross section the analyzed sizes are shown in Figure 4.

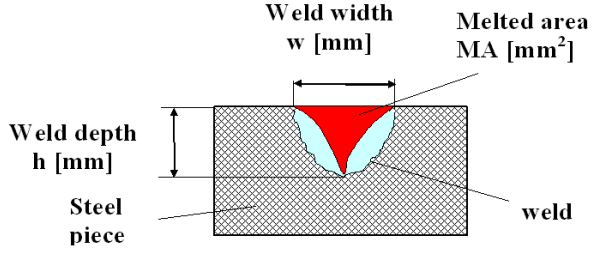


Figure 4 Weld cross-section with the considered sizes

On the weld cross section was measured near the surface of the weld the width w[mm], at the center of the weld the depth h [mm] and melted area MA [mm^2]. These measurements are shown in Figure 4.

The analysis will start with where the laser beam focusing was performed on the workpiece surface. In this case for a given power level the laser beam intensity at piece surface had maximum value. Laser beam spot size at the workpiece surface had minimal value.

Figure 5 shows the effects of power and welding speed on weld width w for the laser beam focus on the workpiece surface. Note that the weld width increases with power and decreases with welding speed. Interaction between parameters is low and decreases the weld width.

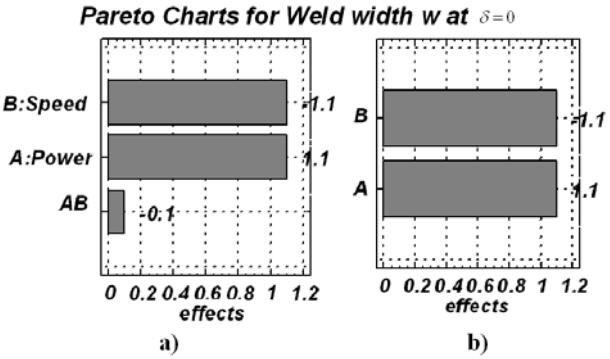


Figure 5 Pareto chart for weld width for focus at piece surface a) with interaction between the effects b) without interaction

Figure 6 presents the parameters effects on weld depth for focusing the laser beam to the workpiece surface. Note that the weld depth increases with power and decreases with welding speed. The power effect is much higher than the welding speed effect. We can say that the weld depth depends almost exclusively by power level.

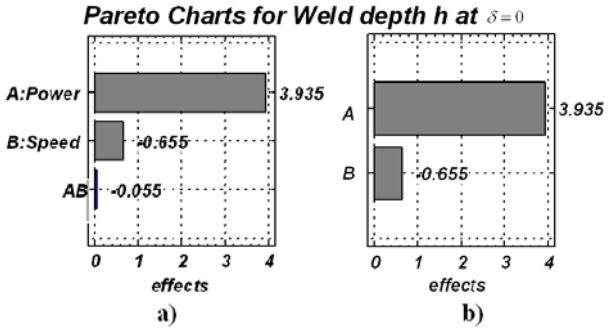


Figure 6 Pareto chart for weld depth for focus at piece surface a) with interaction between the effects b) without interaction

Figure 7 shows the effects of parameters for melted area on the cross section. It shows that melted area increases with power and decreases with welding speed. Power has the highest effect. Interaction between power and welding speed decreases melted area. The interaction effect is quite high compared with previous cases analyzed. So the overall effect of welding speed is close to the power effect.

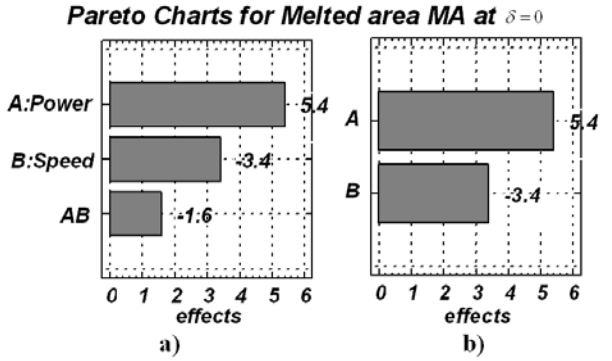


Figure 7 Pareto chart for melted area for focus at piece surface a) with interaction between the effects b) without interaction

Analysis of variance for focusing the laser beam to the workpiece surface showed that the higher effect belong to power. This is related to quantitative aspect for formation of melt. Increasing welding speed has a decreasing effect for molten zone. If we discuss strictly dimensional appearance of melt zone is observed that power and welding speed are equal but opposite sign contributions. The interaction effects between the parameters are small. This is due to the high intensity of laser beam which provides a good separation between the effects of power and welding speed.

Focus inside piece decreases the laser beam intensity on piece surface. This is achieved by increasing the laser beam spot size at the workpiece surface. In this situation laser beam propagates convergent in the keyhole. This will increase the energy absorbed in the keyhole.

Figure 8 presents the parameters effects on the weld width w for laser beam focus t inside the piece. Note that the weld width with increases with power and decreases with welding speed. Interaction between power and welding speed decreases the weld width. This effect is relatively high compared with other effects listed Decreasing effect of weld width is given by the speed of welding and its interaction with power. Overall decreasing effect does not exceed the increasing effect given by power. It looks like there is a better control of weld width by power. This was not observed for focusing the laser beam to the workpiece surface.

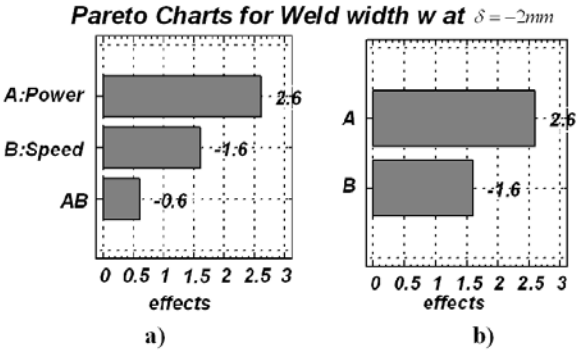


Figure 8 Pareto chart for weld width for focus within the piece a) with interaction between the effects b) without interaction

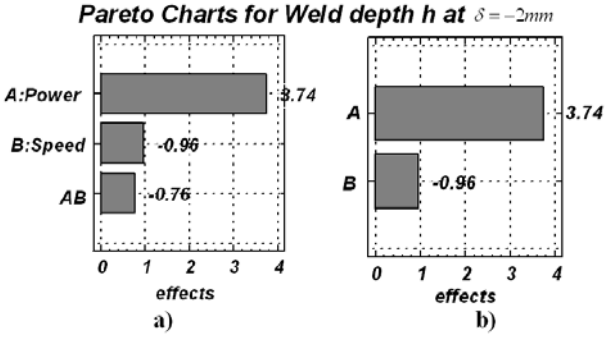


Figure 9 Pareto chart for weld depth for focus within the piece a) with interaction between the effects b) without interaction

Figure 9 presents the effects of welding parameters on weld depth for laser beam

focusing the inside the piece. Weld depth greatly increase with power and decreases with welding speed. Interaction between power and welding speed decreases the weld depth. Decreasing effect on speed (through its effect and the interaction effect) is much higher than effect when focusing the laser beam on workpiece surface.

It is shown that variations with welding speed which change the interaction time between laser and material affect greater the weld depth focusing the laser beam welding inside piece than focusing at piece surface.

Figure 10 shows the effects of parameters for melted area on the weld cross section for laser beam focus within the piece. Note that melted area increases with power and decreases with welding speed. The first effect is the power effect and the second effect is the interaction between power and welding speed. Welding speed and the interaction between speed and power decreases the melted area.

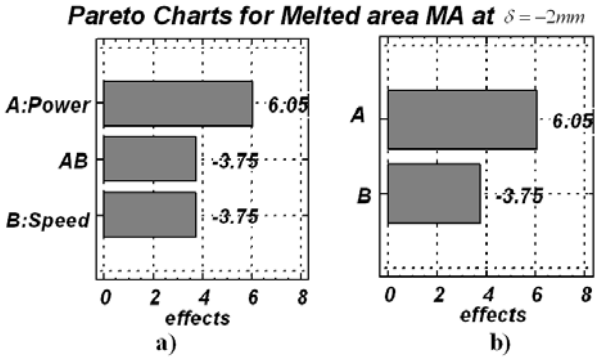


Figure 10 Pareto chart for melted area for focus within the piece a) with interaction between the effects b) without interaction

The two effects are almost equal.On the overall decreasing effect due to welding speed is greater than power effect. Thus appear that for melted area the role of interaction time between laser radiation and the material is higher.

For the laser beam focus the inside the piece was shown that there is an increased role of the interaction between power and welding speed. Weld width and weld depth depend on power as higher effect and both are expression for melt formation. Melted area has a significant dependence of welding speed. Low intensity causes heat loss in the material may have an increased role and decreases amount of melt.

4. ANALYSIS OF THE DYNAMIC ASPECT FOR WELDING PROCESS

Issues related to welding regime and melt movement can be identified in the variation of measured quantities on weld surface and weld cross section. Analyzed sizes are presented in Figure 11.

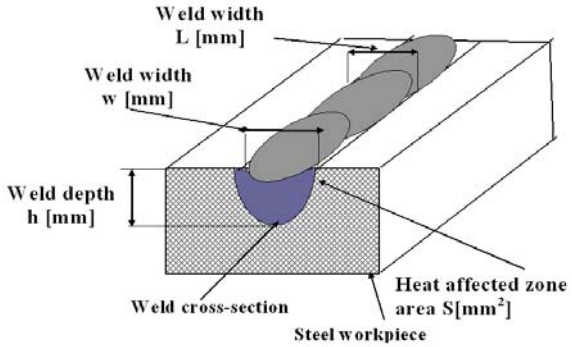


Figure 11 Scheme of weld with measured sizes

The paper analyzed variations the following sizes: weld width, shape ratio of weld cross section and the heat affected zone area on the weld cross section.

Weld width L[mm] was obtained as a result of three measurements on the weld surface at the beginning, middle and end of the welding process.The weld width characterized in general the weld and it is independent of the area in this cross section in weld was performed.

F ratio (w/h) is the ratio beetwen weld width and weld depth on the weld cross

section. This ratiois associated with the welding regime characterization.Values of F ratio below unity shows keyhole welding regime.

A heat affected zone area S[mm^2] was measured on the weld cross section. It is given by the isothermal line of transformation metal structure which is well below the melting temperature. Area heat affected zone containing molten zone area. Heat affected area can be measured with greater accuracy than the area of molten zone.

Figure 12 shows the effects of parameter variations on weld width L when laser beam was focusing the to the workpiece surface. Note that the weld width decreases with welding speed and increases with power. Welding speed has the first effect. This is almost equal to the effect of the interaction between power and welding speed. It is shown that the laser beam focus on the workpiece surface may produce instability for weld width depending on the varied parameters values.

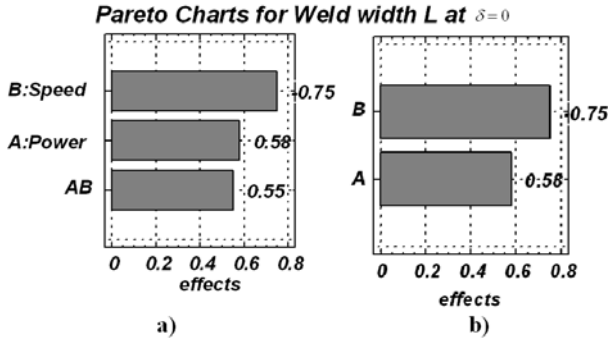


Figure 12 Pareto chart for weld width for focus at piece surface a) with interaction between the effects b) without interaction

Figure 13 shows the Pareto chart for ratio F for focusing the laser beam to the workpiece surface. Note that ratio F decreases with power and have a slight increase with welding speed. Interaction between power and speed decreases ratio F. This is the second effect. A decrease in the F ratio means transition from conduction welding regime to keyhole welding regime. This occurs for high values of laser beam intensity to the workpiece surface. Interaction sign indicates that the interaction effect acts as the effect of power favors keyhole welding regime. It will facilitate the secondary absorption of laser radiation in keyhole.

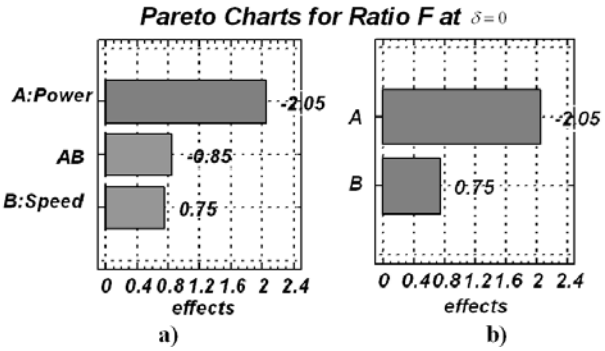


Figure 13 Pareto chart for ratio F for focus at piece surface a) with interaction between the effects b) without interaction

In Figure 14 shows Pareto diagram for the heat affected zone area on the weld cross section for laser beam focusing to the workpiece surface. It noted that heat affected zone area increases with power and decreases with welding speed. Decreasing effect of welding speed is higher than the increasing effect of power. The two effects have close values. This shows that the variation of parameters which also can produce instability in the material heat affected zone.

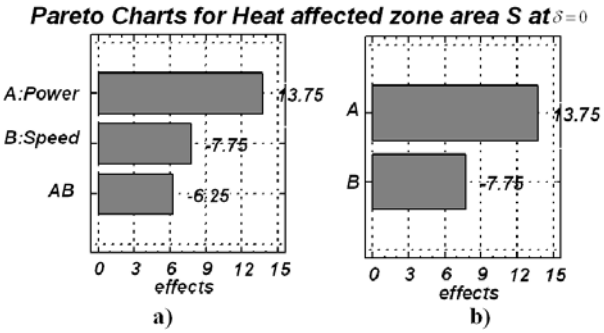


Figure 14 Pareto chart for heat affected zone area for focus at piece surface a) with interaction between the effects b) without interaction

Analyzed sizes show that with increased power is obtained keyhole welding regime. Focusing the laser beam to the workpiece surface is a source of instability for weld presented both by the weld width and heat affected zone area.

Figure 15 presents Pareto diagram for weld width L for focus within the piece. Note that the weld width increases with power and decreases with welding speed. Interaction

decreases the weld width. On the overall increasing effect of power and decreasing effect of welding speed are close.

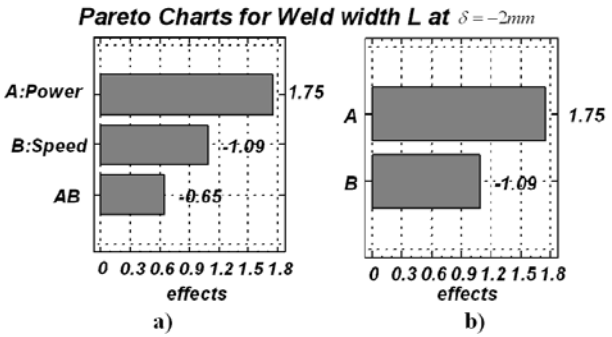


Figure 15 Pareto chart for weld width for within the piece a) with interaction between the effects b) without interaction

Figure 16 shows Pareto diagram for F ratio where the laser beam focus is achieved within the piece. Note that F ratio decreases with power and with welding speed. Interaction between power and welding speed increase ratio F. Interaction effect is close to welding speed effect. The speed effect shows that in the situation by decreasing the interaction time between laser beam and material there is propagation of melting front inside the workpiece and not in the sides of the weld bath.

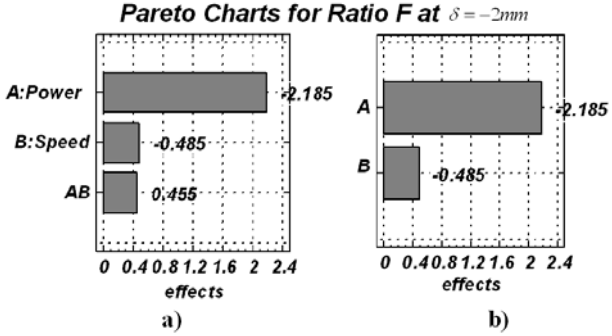


Figure 16 Pareto chart for ratio F for focus within the piece a) with interaction between the effects b) without interaction

For focus the laser beam inside the piece laser beam spot on piece surface is greater. Keyhole cavity is large and favors the emergence of multiple reflections of laser radiation.

Figure 17 presents Pareto diagram for heat affected zone area for laser beam focus the inside the piece. It shows that the area S increases with power and decreases with welding speed. Interaction between power and welding speed decreases the area S On the overall decreasing effect given by welding speed is less than the increasing effect of the power.

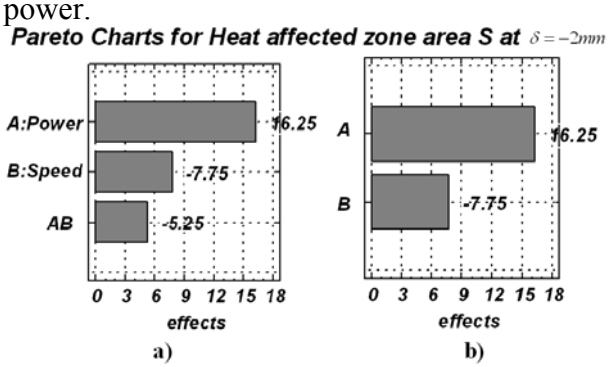


Figure 17 Pareto chart for heat affected zone area for focus within the piece a) with interaction between the effects b) without interaction

If compared with the focus on the workpiece surface shown an increase in power effect. This means increased control over the area S and reduces instability of welding process.

5. CONCLUSIONS

The paper analyzed several quantities that characterize laser welds made on steel plates. Thus the weld width w, weld depth h and molten area MA on the weld cross section show characteristics of material melting. Weld width L, the ratio F and heat affected zone area on the weld cross section can be correlated with the dynamic aspects of laser welding process. Pareto diagrams showed the effects of power and welding speed. Its considered two

particular cases to focus the laser beam, focusing on the piece surface and focus within the piece. Its showed the following:

- Power and welding speed are the main parameters that characterize the material melting and welding process.
- The highest effect on melted area belong to power
- Pentru zona topită există întotdeauna o balanță între efectul de creştere al puterii şi cel de scădere al vitezei de sudare.
- For the melting area there is always a balance between the increasing of power and decreasing effect of welding speed.

Close values for increasing and decreasing effects are considered to be a source of instability. This has influence in parameters setting for welding process.

-Laser-beam focus within the piece provides a better control on the characteristics of molten zone by setting the power.

-The dynamic aspect of the welding process was shown by the transition from conduction welding regime to keyhole welding regime with increasing power. Showed that variations in weld width L measured at different points of weld are high than for the weld width w measured near the weld cross -section.

-Variations obtained for sizes with similar definitions (weld width w, weld width L and area melted MA, heat-affected zone area) are the same type. It looks like that type of variation can be generalized and general characteristics of the welding process are presented.

-It is recommended to consider the interaction between parameters. Presentation for each analyzed size two Pareto diagrams showed that for this type of analysis considering the effects of interactions are important.

REFERENCES

1. A.G. Olabi , G. Casalino b, K.Y. Benyounis, M.S.J. Hashmi,An ANN and Taguchi algorithms integrated approach tothe optimization of CO2 laser welding, *Advances in Engineering Software* 37 (2006) p:643–648
2. K.Y. Benyounis , A.G. Olabi, M.S.J. Hashmi "Optimizing the laser-welded butt joints of medium carbon steel using RSM" *Journal of Materials Processing Technology* 164–165 (2005) pp.986–989.
3. E.M. Anawa, A.G. Olabi Using Taguchi method to optimize welding pool of dissimilarlaser-welded components *Optics & Laser Technology* 40 (2008) p:379–388.
4. K.Y. Benyounis, A.G. Olabi, M.S.J. Hashmi, Multi-response optimization of CO2 laser-welding process of austenitic stainless steel *Optics & Laser Technology* 40 (2008) pp.76–87.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

MATHEMATICAL MODELING FOR MELTED ZONE IN LASER WELDING FOR STEEL

Cristian MÎNZAT*, Remus BOBOESCU*

* Mechanical Faculty, University Politehnica, Timisoara, Romania,

Abstract: On the thick carbon steel plates were made welds with Nd:YAG laser beam. Weld width and crater obtained at stopping irradiation characterize the weld surface. It presents mathematical models that show the effect of power, welding speed and laser beam defocusing on these sizes. The hierarchy of effects by Pareto charts compares defocus effect to power and welding speed effects. Heat affected zone in on the weld cross section shows that the power has main roll in achieving melted in the material.

Keywords: *laser welding, weld crater, melt steel, laser beam defocus*

1. INTRODUCTION

Experiments consisted of fusion lines thick steel plates. Its will be called welds. Weld cross section showed the entire melted area inside material. The weld depth and melted area on weld cross-section are important for achieving welding joints.

The parameters variations were considered laser power, welding speed and defocusing in study [1]. Particular interest to defocus variations on the weld characteristics were reported in the paper [2]. As they use the laser focus within the piece. Laser focus over the piece was used in the work [3].

This paper studied several quantities that characterize the molten material obtained in irradiation with moving laser beam. Quantities that characterize the melt have been classified into two types, sizes related to weld surface and sizes related to weld cross section.

Analysis of these sizes was performed using Statgraphics program. It presents polynomial mathematical models of 3 degree to correlate objective function values (measured size) with parameter values .Statistical analysis of effects and interactions between parameters is given by ANOVA Analysis of variance.

Hierarchy of effects is presented by Pareto charts. Representations using the response functions show the variation of measured quantities with the variation of two parameters. These are customizations of mathematical models previously presented.

The aim of presented analysis is to highlight the effect of focus compared to that of power and welding speed. Laser melting effects are most easily revealed by sizes measured on the weld surface. Their variation was compared with the heat affected zone area, size measured on weld cross section.

2. EXPERIMENTS

The material used was steel Dillimax500 EN 10137. This is a fine grain steel with high elasticity limit. Chemical composition with upper limit expressed as a percentage is given as follows: $C \leq 0.16$, $Si \leq 0.5$, Mn≤0.1.6,

P≤0.02, S≤0.01, Cr≤0.7, Ni≤1, Mo≤0.6, V+Nb≤0.08

The experiment consisted of fusion lines (welds) with the line length of 110mm on steel Dillimax500 plates with 10 mm thickness. An industrial laser machine Nd: YAG Trumph Haas 3006D was used. It emits radiation with wavelength λ = 1.06 μm and have a maximum power of 3kW. Irradiation was performed in continuous regime. Laser beam was transmitted through a fiber with 0.6mm diameter. The focusing system assures the spot in focal point with 0.6mm diameter. The focal distance of lens was 200mm. As protective gas was argon with a flow rate of 20l/min. The welds were made on the sheets of material with 100×130×10 mm dimensions. There was a space 20mm between two consecutive welds.

The radiation was controlled by variation of three parameters: laser power, welding speed and defocusing, Figure 1.

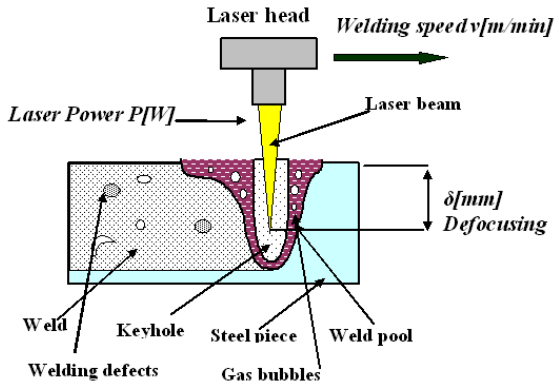


Figure 1 Schematic diagram of the laser welding process with varied parameters in experiments

After the welding the plates was cut. Cutting of plates was performed at 20 mm before the end of the process, in stabile part of weld, at same distance for all welds. The piece section has been metallographic processed (polishing and acid attack using Nital) to obtain images of melted metal, heat affected zone (HAZ), and microstructure, On the metallographic processed section were made measurements heat affected zone area A[mm^2].This was measured using a millimeter scale of precision 1 mm^2 on the weld cross-section.

The experimental plan used was one of complete factorial. To achieve mathematical models and statistical analysis of variations was used Statgraphics program.

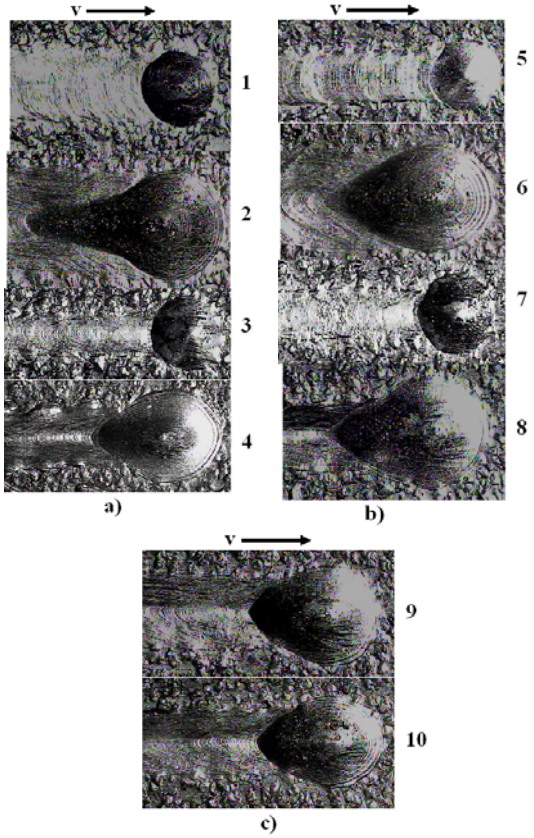


Figure 2 Photos of the crater produced at the end of the welding process a) focus at piece surface, b) focus within the piece c) replies

Table 1 Varied parameters values in experiment

Nr. crt.	Power		Welding speed		Defocusing	
	P[kW]	A[-]	v [m/min]	B [-]	δ [mm]	C [-]
1	1	-1	0,6	-1	0	-1
2	3	+1	0,6	-1	0	-1
3	1	-1	1,5	+1	0	-1
4	3	+1	1,5	+1	0	-1
5	1	-1	0,6	-1	-2	+1
6	3	+1	0,6	-1	-2	+1
7	1	-1	1,5	+1	-2	+1
8	3	+1	1,5	+1	-2	+1
9	2	0	1	0	-1	0
10	2	0	1	0	-1	0

For this analysis were introduced a dimensionless parameters values. Switching between the two systems of values of parameters is given by the following relations:

$$A = P - 2 \text{ [-]} \quad (1)$$

$$B = -2.33 + 2.22v \text{ [-]} \quad (2)$$

$$C = -1 - \delta \text{ [-]} \quad (3)$$

Both systems will be used for the presentation of mathematical models. Experimntal plan is

presented in Table 1. Images of the surface of welds associated with the experimental plan are presented in Figure 2.

3. WELD WIDTH

The mathematical model for weld width L is given by the following relations:

$$L = 2.034 + 0.5825A - 0.46B + 0.0075C - 0.025AB + 0.2925AC - 0.085BC - 0.3ABC \quad \text{[mm]} \quad (4)$$

$$L = -0.70875 + 0.93075P - 2.0535v - 0.62245\delta + 0.6105Pv + 0.4065P\delta - 1.1433v\delta + 0.666Pv\delta \quad \text{[mm]} \quad (5)$$

Statistical analysis of the effects for weld width with ANOVA method is presented in Table 2

Table 2 ANOVA for weld width L

Effect	Sum of Squares	DF	Mean. Sq.	F-Ratio	P-val
A(power)	2.7144	1	2.7144	18.09	0.05
B(speed)	1.6928	1	1.6928	11.28	0.07
C(defocusing)	0.0004	1	0.0004	0.00	0.96
AB	0.0050	1	0.0050	0.03	0.87
AC	0.6844	1	0.6844	4.56	0.16
BC	0.0578	1	0.0578	0.39	0.60
ABC	0.7200	1	0.7200	4.80	0.15
Total error	0.3000	2			
Total (corr)	6.1750	9			
$R^2 = 0.95$			$R^2(adj.\ for\ d.f.) = 0.78$		

Figure 3 shows the Pareto chart for weld width. Power has the highest effect. The power effect is statistically significant. Welding speed has the effect opposite to power, which is the second effect. The third effect is the third order interaction between parameters. This is a decreasing effect. The decreasing effect is given by welding speed by itself effect and by interactions effect that involving welding speed. The high third order interaction effect covers interactions of order 2 and that of defocus effects. It is shown that for weld width welding speed effect is stronger.

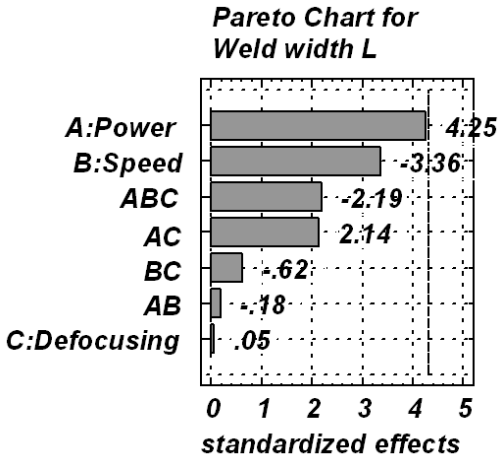


Figure 3 Pareto chart for weld width

Figure 4 shows that on the experimental field weld width increases with power and decreases with welding speed. Direct dependence of power and welding speed makes the weld width variation on the experimental to be almost linear.

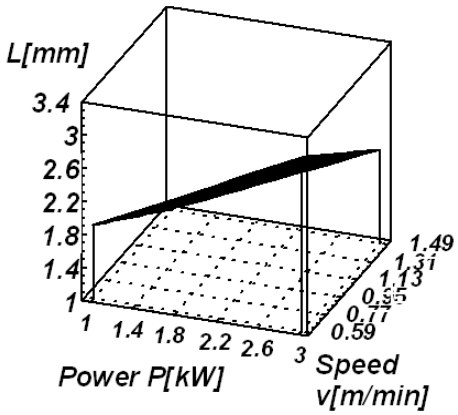


Figure 4 Variation of weld width with power and welding speed

4. CRATER AREA

The mathematical model for crater area acr is given by the following relations:

$$acr = 10.017 + 6.885.A + 2.2225.B + 0.665.C + 2.9325.AB + 1.3.AC - 0.8925.BC - 0.9075.ABC \quad [\text{mm}^2] \quad (6)$$

$$acr = -12.45445 + 14.5322P - 10.1343v - 0.214425\delta + 8.5248Pv + 0.814475P\delta - 2.04795 + 2.01465\,Pv\delta \quad [\text{mm}^2] \quad (7)$$

Figure 5 shows the Pareto chart for the crater area. Note that power has the highest effect on the crater area. All parameters have an increasing effect on the crater area. Decrease of crater area is given by the interaction between defocus and welding speed. This interaction is associated with a simultaneous decrease in the intensity of laser beam at piece surface and interaction time between laser and material, disadvantage both for melting and vaporization of the material. Presented effects have not statistically significance. The positive effect of welding speed can be explained by favoring the production of molten material against vaporization.

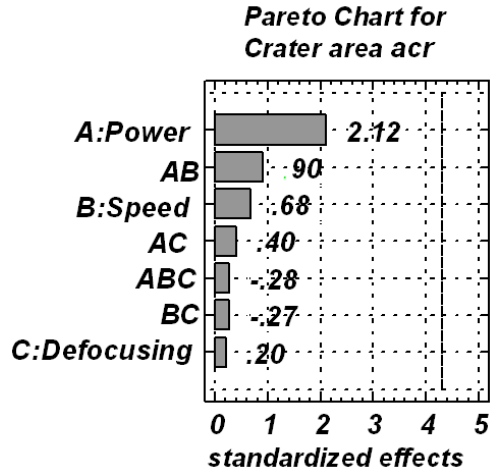


Figure 5 Pareto chart for crater area

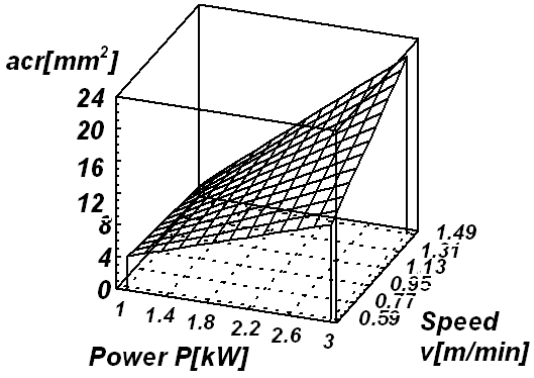


Figure 6 Variation of crater area with power and welding speed

Response surface of Figure 6 shows that on the experimental field crater area increases with power and welding speed. Increasing with the welding speed is stronger at higher power. It shows out so increasing the amount of melt in welding bath and increasing melt movement.

5. CIRCULARITY DEVIATION

The mathematical model for circularity deviation abc is given by the following relations:

$$abc = 57.16 + 45.9625.A - 16.1625.B - 16.2375.C - 11.3125.AB - 10.4375.AC + 14.0375.BC + 12.0375.ABC \quad [\%] \quad (8)$$

$$abc = -0.9575 + 1.9945P + 36.63v + 18.749875\delta - 51.837Pv - 17.609875\,P\delta + 22.28325v\delta - 26.72325\,Pv\delta \quad [\%] \quad (9)$$

Statistical analysis of the effects for circularity deviation with ANOVA method is presented in Table 3

Table 3 ANOVA for circularity deviation

Effect	Sum of Squares	DF	Mean. Sq.	F-Ratio	P-val
A(power)	16900.411	1	16900.411	63.60	0.01
B(speed)	2089.811	1	2089.811	7.86	0.10
C(defocusing)	2109.251	1	2109.251	7.94	0.10
AB	1023.781	1	1023.781	3.85	0.18
AC	871.531	1	871.531	3.28	0.21
BC	1576.411	1	1576.411	5.93	0.13
ABC	1159.211	1	1159.211	4.36	0.17
Total error	531.455	2	265.728		
Total (corr.)	26261.864	9			
$R^2 = 0.97$			$R^2(adj.for\,d.f.) = 0.90$		

Figure 7 shows the Pareto chart for the deviation from circularity of the crater. Power has the highest effect. Crater deformation has strong increase with power. Defocus and welding speed have the opposite effect of decreasing crater deformation. Decrease welding speed favor evaporation and thus decreases the amount of melt. Focus inside piece increases laser beam spot diameter and thus favors circular shape of the crater. Note that all effects presented were statistically significant. Note that the effect of parameters

is greater than the effect of interactions between parameters.

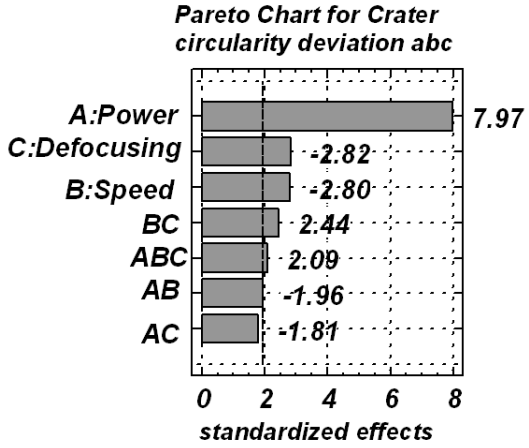


Figure 7 Pareto chart for circularity deviation

Response surface in Figure 8 shows the variation of deviations from circularity with power and welding speed. On the experimental field, crater deformation increases with power. At low power crater deformation increases with welding speed and at high power crater deformation decreases with welding speed.

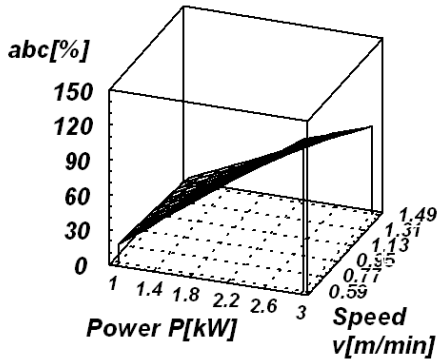


Figure 8 Variation of circularity deviation with power and welding speed

6. HEAT AFFECTED ZONE ON WELD CROSS SECTION

The mathematical model for heat affected zone area is given by the following relations:

$$A = 9.7 + 7.5A - 3.875B + 0.125C - 2.875AB + 0.625AC + 0BC + 0.25ABC \quad [\text{mm}^2] \quad (10)$$

Statistical analysis of the effects for heat affected zone area with ANOVA method is presented in Table 4.

Table 4 ANOVA for heat affected zone area

Effect	Sum of Squares	DF	Mean. Sq.	F-Ratio	P-val
A(power)	450.000	1	450.000	71.43	0.01
B(speed)	120.125	1	120.125	19.07	0.04
C(defocusing)	0.125	1	0.125	0.02	0.90
AB	66.125	1	66.125	10.50	0.08
AC	3.125	1	3.125	0.50	0.56
BC	0.00	1	0.00	0.00	1.00
ABC	0.50	1	0.50	0.08	0.80
Total error	12.60	2	6.30		
Total (corr)	652.60	9			
$R^2 = 0.98$			$R^2(adj.for\ d.f.) = 0.91$		

Figure 9 shows the Pareto chart for the heat affected zone on the weld cross section. Note that the highest effect is power effect followed by the effect of the interaction between power and welding speed. Last effects are the defocusing effects and interactions involving it.

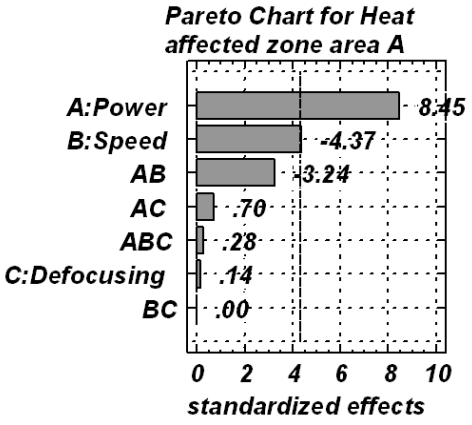


Figure 9 Pareto chart for heat affected zone area on weld cross section

Effects of power and welding speed were statistically significant. It is shown that

defocusing role is reduced in determining the weld cross section melted area.

Response surface in Figure 10 shows the variation of heat affected zone area on the weld cross section with power and welding speed. It is noted that the area increases with power. Welding speed causes a significant decrease in case to use high power values.

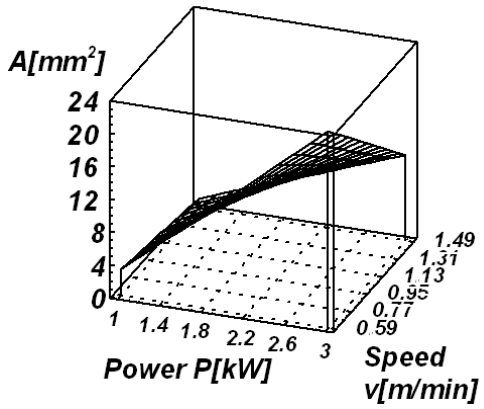


Figure 10 Variation of heat affected zone area with power and welding speed

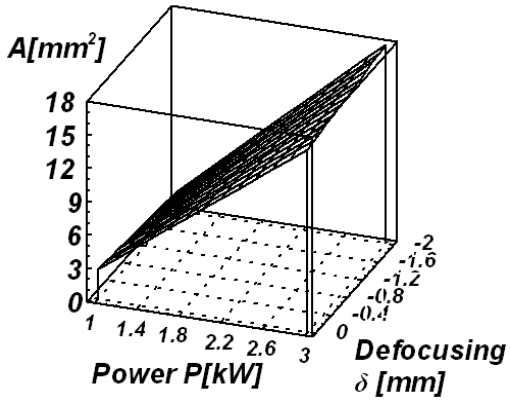


Figure 11 Variation of heat affected zone area with power and defocus

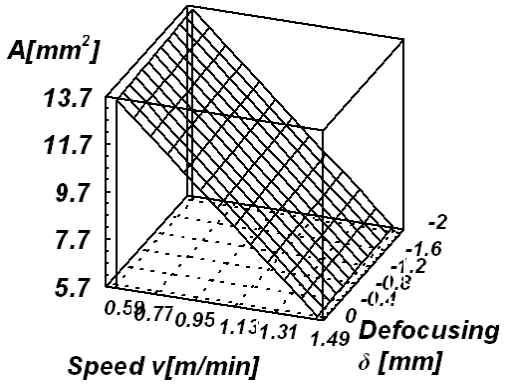


Figure 12 Variation of heat affected zone area with welding speed and defocus

Figure 11 presents the variation heat affected zone area with power and defocus. Note that on the experimental field heat affected zone area increases with power. Defocus does not produce significant variations. A linear type variation is obtained.

Figure 12 shows the variation for heat affected zone area according to the speed and defocus. Note that on the experimental heat affected zone area decreases with welding speed. Figures 11 and 12 shows that the variation of heat affected zone area with power and welding speed practically does not depend on defocus.

7. CONCLUSIONS

In the paper were presented mathematical models for sizes which characterize laser beam welds made on steel plates. There have been mathematical models that consider the parameters effects and interactions of the. We analyzed the molten zone on weld surface.

Has been shown that defocus produces variations on quantities which characterize the weld surface, but does not produce significant variations in material melted zone on weld cross section. This paper presents a mathematical model characterizing the variations of weld surface sizes based on a type 2^3 experimental plan.

From analyzed sizes mathematical models for deformation crater are appropriate and statistical significance.

REFERENCES

1. Abdel-Monem, El-Batahgy ,Effect of laser welding parameters on fusion zone shape and solidification structure of austenitic stainless steels, *Materials Letters 32* (1997) p:155-163
2. E. Akman, A. Demir, T. Canel, T. Sınmazcelik, Laser welding of Ti6Al4V titanium alloys *Journal of materials processing technology 209* (2009) p:3705–371
3. Rattana Borrisutthekul, Yukio Miyashita, Yoshiharu Mutoh Dissimilar material laser welding between magnesium alloy AZ31B and aluminum alloy A5052-O *Science and Technology of Advanced Materials xx* (2005) p:1–6.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

CONTROLLED FLOW SIMULATION USING SPH METHOD

Vasile NĂSTĂSESCU*, Lavinia GAVRILĂ**

*Military Technical Academy, Bucharest, Romania** Air Force Academy, Braşov, Romania

Abstract: *Smoothed Particle Hydrodynamics (SPH) method is a meshless numerical method, developed after 1977 and nowadays this method is practically validated as fluid flow is concerned. The most important aspects and the most difficult problems, like fluid free surface, interaction fluid-structure any many others can be better solved and in a shorter time too. This paper presents some theoretical fundamentals of the SPH method, including specific approximation of Navier-Stokes equations in this numerical method and next to it, an interesting application is also presented. The application is referring to the numerical simulation of a controlled flow, for instance, through a gate. This fluid flow numerical simulation, in such conditions, has many practically applications and is an implicit describing of the free fluid surface. The authors hope that this numerical method (SPH) to be a fitted one, in applications such aerodynamics and a direct analysis of structure behavior under aerodynamic loads. These aspects are over the subject of this paper, but in future, we will present more details and examples regarding using of the SPH method in aerodynamics. We also hope that this paper to be useful for teachers, researchers and students interested in SPH method.*

Keywords: *SPH, fluid flow, numerical analysis, kernel function, smoothing length*

1. INTRODUCTION

SPH (Smoothed Particle Hydrodynamics) method is a griddles Lagrangian technique which comes from astrophysics (Lucy, 1977). The method was extended to fluid simulation, especially with free-surface (Monaghan, 1992), nowadays SPH method being also used in many scientific fields. Applied mechanics domain is perhaps the last one, but it is intensively researched and significant advances have also been made.

2. THEORETICAL FUNDAMENTALS OF THE SPH METHOD

The SPH method belongs to the meshless methods, so the investigated domain is represented by a number of nodes, representing the particles of this domain, having their material and mechanical (mass, position, velocity etc.) characteristics. Each particle represents an interpolation point on which the material properties are known.

Practically, depanding on the used software, the boundary conditions have to be imposed to some of particles, according to the problem analyzed, like in the case of finite element method. Theoretical fundamentals of this aspect are a bit different and require more space to be presented here.

The problem solution is given by the computed results, on all the particles, using an interpolation function. We can say that the fundamentals of SPH theory consist in interpolation theory; all the behavior laws are transformed into integral equations.

The kernel function, or smoothing function, often called smoothing kernel

function, or simply kernel, gives a weighted approximation of the field variable (function) in a point (particle). Integral representation of a function $f(x)$, used in the SPH method starts from the following identity:

$$f(x)=\int_{\Omega} f(x')\delta(x-x')dx' \tag{1}$$

where f is a function of a position vector x, which can be an one-, two- or three-dimensional one; $\delta(x-x')$ is a Dirac function, having the properties:

$$\delta(x-x')=\begin{cases}1 \rightarrow x=x' \\ 0 \rightarrow x\neq x'\end{cases} \tag{2}$$

In equation (1), Ω is the function domain, which can be a volume, that contains the x, and where $f(x)$ is defined and continuous. By replacing the Dirac function with a smoothing function $W(x-x',h)$ the integral representation of $f(x)$ becomes:

$$f(x)=\int_{\Omega} f(x')W(x-x',h)dx' \tag{3}$$

where W is the smoothing kernel function, or smoothing function, or kernel function. The parameter h, of the smoothing function W, is the smoothing length, by which the influence area (support domain) of the smoothing function W is defined.

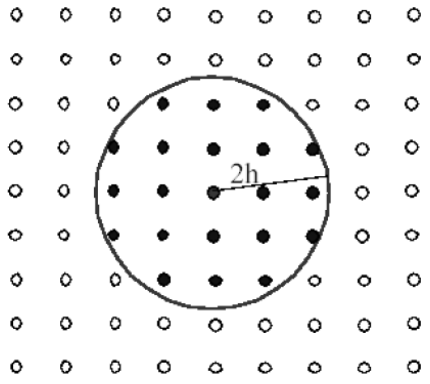


Fig. 1 The support domain of the kernel function

As long as Dirac delta function is used, the integral representation, described by equation (1), is an exact (rigorous) one, but using the smoothing function W instead of Dirac function, the integral representation can only be an approximation. This is the reason for the name of kernel approximation. Using the angle bracket, this aspect is underlined and the equation (3) can be rewritten as:

$$\langle f(x)\rangle=\int_{\Omega} f(x')W(x-x',h)dx' \tag{4}$$

The smoothing function W is usually chosen to be an even one, which has to satisfy some conditions. The most important requirements of a kernel function are presented below:

a) the smoothing function has to be *normalized* over its support:

$$\int_{\Omega} W(x-x',h)dx'=1 \tag{5}$$

b) the smoothing function has to be *compactly supported:*

$$W(x-x',h)=0 \text{ for } |x-x'|>kh \tag{6}$$

c) the smoothing function has to be *positive* for any point at x' within the support domain:

$$W(x-x',h)\geq 0 \tag{7}$$

d) the smoothing function value has to be *monotonically decreasing* with the increase of the distance away from the particle.

e) the smoothing function value has to satisfy the *Dirac delta function condition* as the smoothing length approaches to zero:

$$\lim_{h\rightarrow 0} W(x-x',h)=\delta(x-x') \tag{8}$$

f) the smoothing function value has to be an *even function* (symetric).

The literature presents different smoothing function. Theoretically, any function having the properties presented above, can be employed as SPH smoothing function.

One of the most used smoothing function is a cubic B-spline kernel function, in the form given by relation (9), where $s = r/h$, n is the number representing the spatial dimension and α is a constant which has the value: 2/3, $10/7\pi$ or respectivelly $1/\pi$, depending on the space dimension (1D, 2D or 3D).

$$W(s,h)=\frac{\alpha}{h^n}\begin{cases}\left(1-\frac{3}{2}s^2+\frac{3}{4}s^3\right);0\le s<1\\ \frac{1}{4}(2-s)^3;1\le s<2\\ 0;s\ge 2\end{cases} \tag{9}$$

The graphical representation of this smoothing function and its derivatives (first and second) can be seen in the Figure 2.

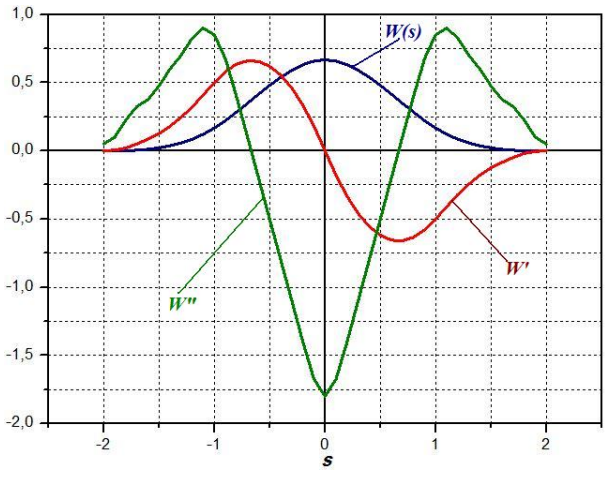


Fig. 2 The cubic B-spline kernel function

3. SPH FORMULATION OF THE NAVIER-STOKES EQUATIONS

The Navier-Stokes equations consist of the following equation set, representing three fundamental physical laws of conservation, which in SPH formulation represents a summation of the Lagrangian form:

a) the continuity ecuation:

$$\frac{\partial \rho_i}{\partial t}=\rho_i\sum_{j=1}^{N}\frac{m_j}{\rho_i}v_{ij}^{\alpha}\frac{\partial W_{ij}}{\partial x_i^{\alpha}} \tag{10}$$

where x_i is a generalized coordinate and α denotes the coordinate directions.

As the density is concerned, this is expressed in the following two forms, the last being proposed for improving the accuracy near the free boundaries or near the material interfaces having a density discontinuity.

$$\rho_i=\sum_{j=1}^{N}m_jW_{ij} \tag{11}$$

$$\rho_i=\frac{\sum_{j=1}^{N}m_jW_{ij}}{\sum_{j=1}^{N}\left(\frac{m_j}{\rho_j}\right)W_{ij}} \tag{12}$$

b) the momentum equation:

$$\frac{\partial v_i^{\alpha}}{\partial t}=\sum_{j=1}^{N}m_j\frac{\sigma_i^{\alpha\beta}+\sigma_j^{\alpha\beta}}{\rho_i\rho_j}\frac{\partial W_{ij}}{\partial x_i^{\beta}} \tag{13}$$

$$\frac{\partial v_i^{\alpha}}{\partial t}=\sum_{j=1}^{N}m_j\left(\frac{\sigma_i^{\alpha\beta}}{\rho_i^2}+\frac{\sigma_j^{\alpha\beta}}{\rho_j^2}\right)\frac{\partial W_{ij}}{\partial x_i^{\beta}} \tag{14}$$

Both forms are used, the last being more popular. The symmetrized form of both equations leads to reducing of the errors.

c) the energy equation:

$$\frac{de_i}{dt} = \frac{1}{2}\sum_{j=1}^{N} m_j \frac{p_i + p_j}{\rho_i \rho_j} v_{ij}^{\beta} \frac{\partial W_{ij}}{\partial x_i^{\beta}} + \frac{\mu_i}{2\rho_i} \varepsilon_i^{\alpha\beta} \varepsilon_i^{\alpha\beta} \tag{15}$$

$$\frac{de_i}{dt} = \frac{1}{2}\sum_{j=1}^{N} m_j \left(\frac{p_i}{\rho_i^2} + \frac{p_j}{\rho_j^2} \right) v_{ij}^{\beta} \frac{\partial W_{ij}}{\partial x_i^{\beta}} + \frac{\mu_i}{2\rho_i} \varepsilon_i^{\alpha\beta} \varepsilon_i^{\alpha\beta} \tag{16}$$

The above forms are most used in many SPH software. The superscripts α and β, used in the relations (13)…(16) are used for denoting the coordinate directions. The others notations are those frequently used in fluid mechanics (ε is shear strain rate, μ is the dynamic viscosity and p is the pressure).

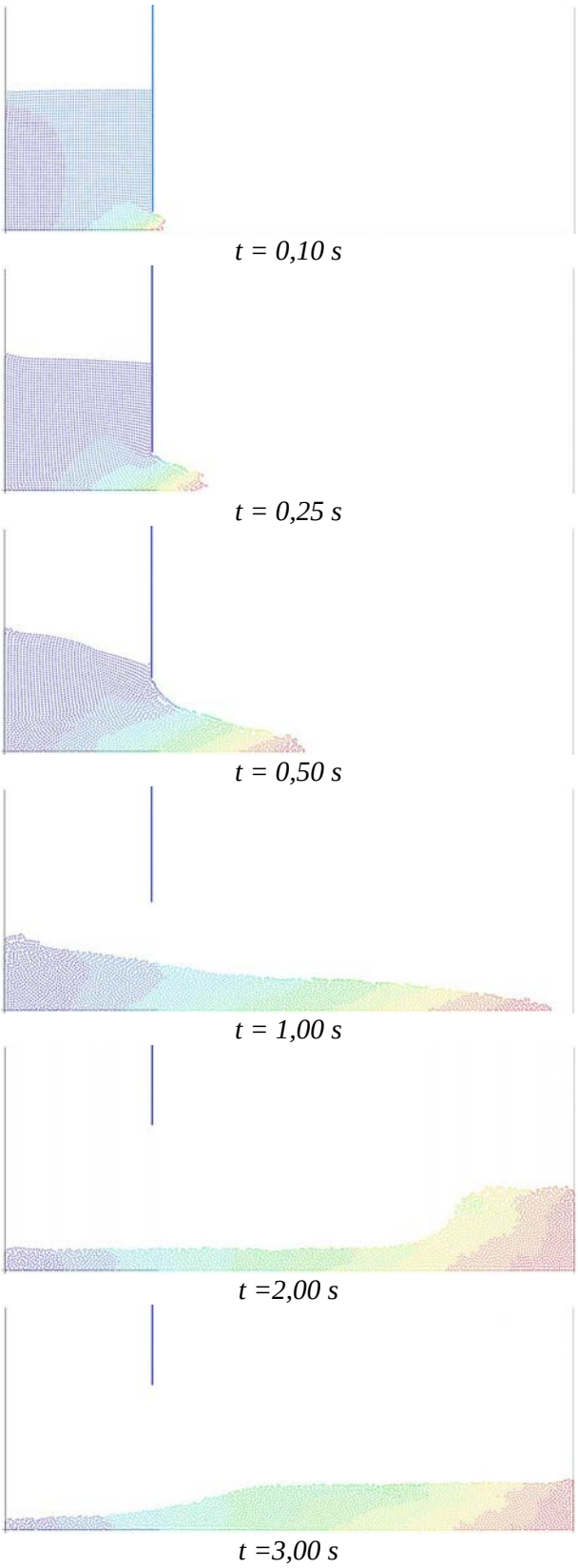
4. CONTROLLED FLOW SIMULATION USING SPH METHOD

The controlled flow is referring to the collapse of a water quantity ($1\,m^3$) through a gate with a variable space by a law. The model is a 2D one and its original state is presented in the Figure 3.

Fig. 3 The 2D SPH model

The water is modelled by 2601 particles with a nodal distance of 2 cm. Only the weight as body force is considered.

The gate moving on vertical direction and its coming back in a time shorter than analysis period, the water will be in two domains, at different levels. Figure 4 presents the water evolution at different moments. An elastic-plastic-hydro material model was used with the water charateristic parameters.



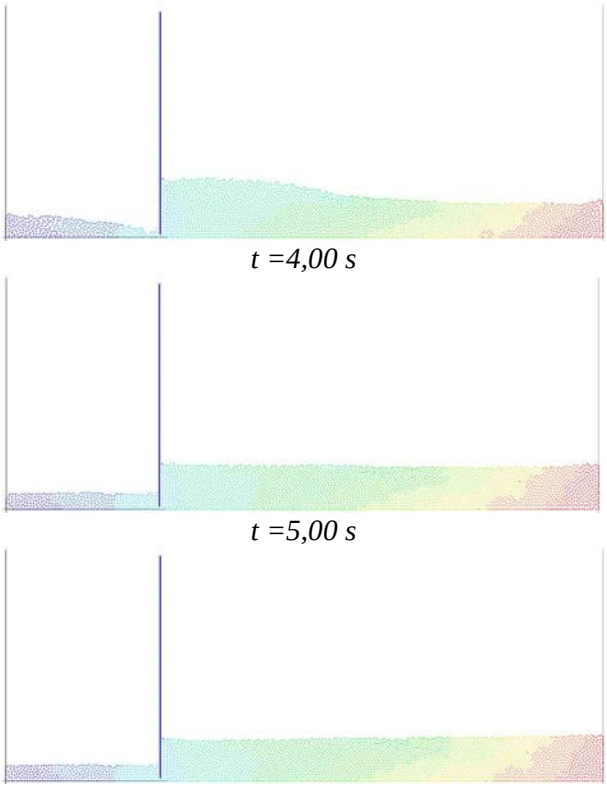


Fig. 4 Fluid evolution in time

Figure 4 presents, in the same time, the fluid state and the velocity field of particles.

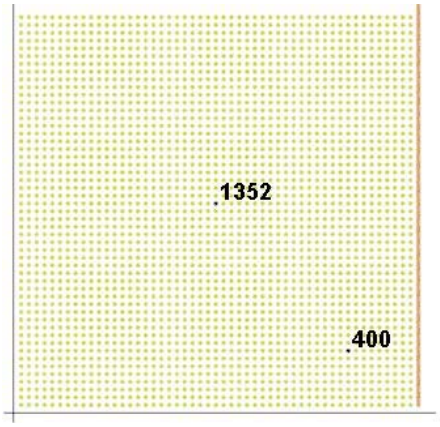


Fig. 5 Initial position of two particles

In the figures 6…9 the time evolution of two particles is presented. The initial position of these particles is shown in the Figure 5.

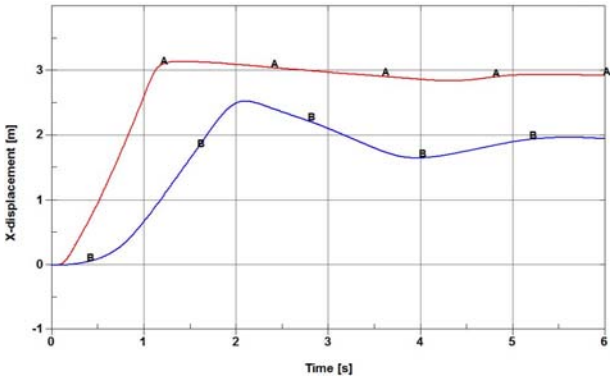


Fig. 6 UX displacement of those two particles

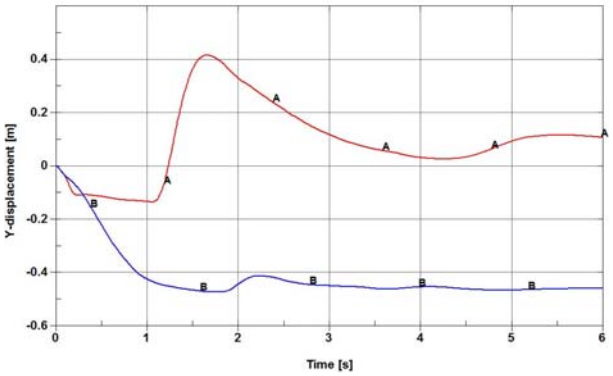


Fig. 7 UY displacement of those two particles

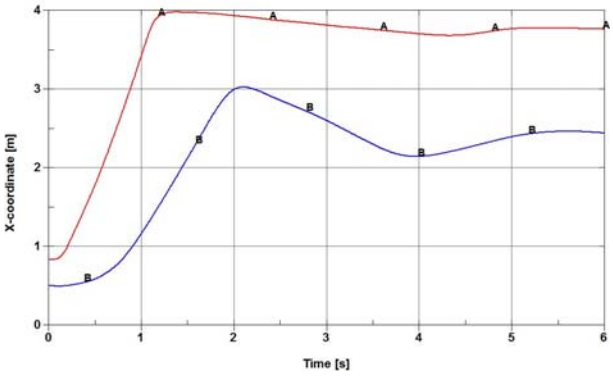


Fig. 8 X-coordinate of those two particles

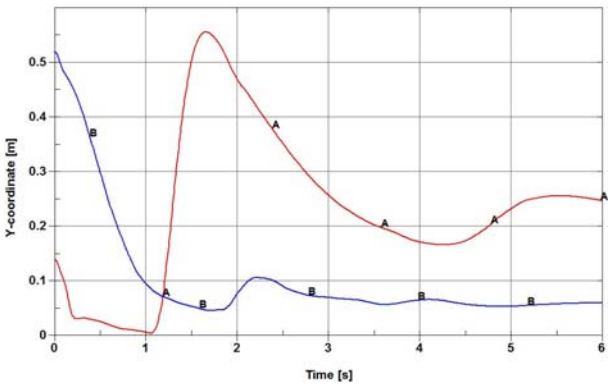


Fig. 9 Y-coordinate of those two particles

In the figures 6…9, particle A is the particle 400 and particle B is the particle 1352, presented in the Figure 5.

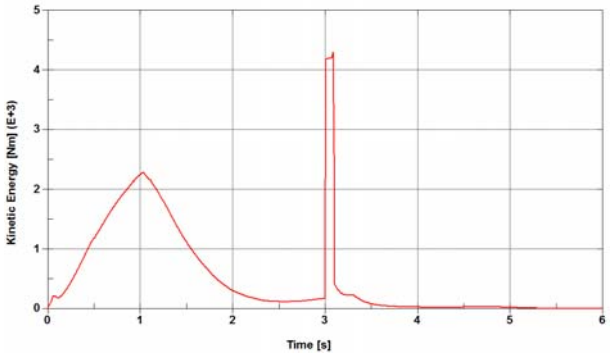


Fig. 10 The evolution in time of the water kinetic energy

The water kinetic energy, presented in the Figure 10 is in connection with the moving law of the gate, presented in the Figure 11, as everyone could notice and understand the curve allure describing the kinetic energy of the water. At the end of the analysis period (six seconds), the kinetic energy is zero, this meaning a properly analysis time.

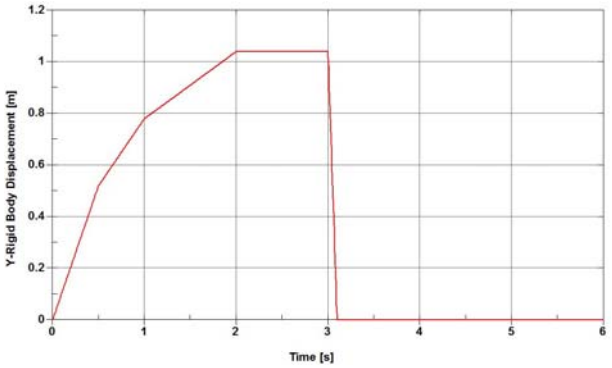


Fig. 11 The moving law of the gate

Analysing the evolution of the X anY coordinates and UX and UY displacements, we can know where those two particles will be finally. So, for this case, the both particles will be in the left side of the gate (figure 4), where the water level is greater than the right side of the gate. We also can obtain, by graphical post-processing of the results, the water level around the gate.

5. CONCLUSIONS

The SPH hydrodynamics model used in this paper can be an example for many other similar problem, SPH method being a very powerful method. The same problem could be solved using a 3D model, but more computer time would have been necesary.

Practically, SPH method is validated as an eficient numerical method in fluid mechaqnics.

Our work is intended as a recommendation for using the SPH method in researching and even in education. Many facilities are going to be discovered and only the method power and the user talent can lead to unexpected results.

REFERENCES

1. Liu, G. R., Liu, M. B., *Smoothed Particle Hydrodynamics – a meshfree particle method,* World Scientific Publishing Co. Pte. Ltd., 2009, ISBN 981-238-456-1
2. Liu, G. R., *Meshfree Methods, Mooving Beyond the Finite Element Method,* Second Edition, CRC Press Taylor & Francis Group, 2010, ISBN 978-1-4200-8209-8
3. Năstăsescu, V., Iliescu, N., *Numerical Simulation of the Impact Problems by SPH Method,* Proceedings of IV-th National Conference THE ACADEMIC DAYS of the Technical Science Academy of Romania, Iaşi, 19-20 November 2009, vol. 1, pag. 193-198, ISSN: 2066-6586
4. Qingwei M., *Advances in Numerical Simulation of Nonlinear Water Waves,* World Scientific Publishing Co. Pte. Ltd., 2010, ISBN-13 978-981-283-649-6, ISBN-10 981-283-649-7

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

THERMAL DIFFUSIVITY AND CONDUCTIVITY AT LAYER $ZrO_2/20\%Y_2O_3$ SPRAYED WITH ATMOSPHERIC PLASMA SPRAY

Geanina Laura PINTILEI*, **Corneliu MUNTEANU** *, **Gica Narcis BASESCU***, **Bogdan ISTRATE** *, **Andreea Carmen BARBANTA***

*Technical University "Gheorghe Asachi" of Iasi, Faculty of Mechanical Engineering

Abstract: *The method of deposition atmospheric plasma spray (APS) is famous among the methods usually used for coating layer thicknesses on surfaces with different degrees of complexity. One of the most delicate issues in the case of thermal barrier applied to the turbine blades is to determine the causes of exfoliation of the ceramic layer due to the large number of thermal cycles.*

The present paper presents a new concept of thermal barrier layer. The novelty is delaminating prevention and consists of a sprayed layer adherent Ni Mo Al (05-05-90) filed by electric arc and a layer of $ZrO_2/20\%Y_2O_3$, deposited by plasma spraying specimens of Ni base super alloys, which aircraft turbine blades are manufactured of. Samples were subjected to heat treatment at 1150°C in order to study the behavior of these metal layers during heating.

These layers we have chosen to spray induce a low thermal diffusivity and conductivity. The reason for this test is just that, to prove the thermal insulation of the ceramic layer.

Scanning electron microscope was used to observe the morphology and microstructure of phases. X-ray diffraction analysis was performed in order to notice the change of diffraction curves, and to observe the new phases obtained after the heat treatment.

Keywords: *SEM, XRD, thermal diffusivity, thermal conductivity.*

1. INTRODUCTION

The desire to improve the performance of aircraft motors led to the rising temperatures of the hot sources.

By rising the operating temperature can significantly improve performance and other important functional parameters of a heat engine. Turbine blades are the most stressed components of a jet engine both thermo-mechanically and chemically.

Because of rotational speed, the blades are exposed to tensile forces which can cause the lengthening of the blades. Creep blades should be avoided because of the elongation of the blade, this can reach the motor casing and destroy it. Because the super alloy the turbine blades is made of has maximum operating temperatures near to 1000°C value the idea of using ceramic materials was foreseen.

Ceramic materials have excellent refractory properties and are used to cover with a protector coating for all the metal components of the jet engines. Ceramic materials, unlike metals, are more complex crystalline cell, this explains the low mobility of crystal defects (dislocation in especial).

Due to the structure and ion type interatomic bonds can explain many of the

properties of these materials such as low thermal conductivity and diffusivity.

Thermal conductivity is an important physical property of ceramic, which define their ability to transmit thermal energy by their mass, as determined by the crystallographic structure of the phase components and structural arrangement.

Thermic diffusivity, is the ratio between thermic conductivity and specific heat at constant volume of material.

Zirconium oxide, appears as monoclinic, tetragonal and cubic crystals. The product as total stabilized (FSZ) or partially stabilized (PSZ). This oxide has the following excellent properties mechanical and technological:

- good resistant to bending and traction;
- low thermal conductivity;
- oxygen ion conductivity;
- Young modulus of steel.

Because of these properties of zirconia ceramics are preferred for high demand components of mechanically.

However these properties of ceramic products depends on: processing parameters such as nature and continuity link between crystalline ceramic granules, presence and amount of impurities, sintering parameters and conditions, presence and volume of pores, etc..

This paper presents the study of structural properties by multilayer coatings $ZrO_2/20\%Y_2O_3$. SEM analysis is used to measure porosity coatings, deposited layer thickness determination and structural analysis of the layers. X-Ray diffraction is used to determine the phase and constituents of the deposition structure. Was performed thermic diffusivity to determine the influence of ceramic layer as the base material have a low thermal diffusivity and conductivity.

2. EXPERIMENTAL PROCEDURE SPRAYING EQUIPMENT AND MATERIAL POWDER

Thermal barrier coatings were obtained by atmospheric plasma spraying deposition (APS). Samples were sprayed with ceramic powder $ZrO_2/20\%Y_2O_3$ using SPRAYWIZARD 9MCE by Sulzer Metco.

The bond coating was sprayed with Ni Mo Al powder on rectangular specimens with electric arc using Sulzer Metco Smart Arc 350, on super alloy specimens of Ni base, cleaned in an ultrasonic bath with acetone and sand blasted with electro corundum. The size of the specimens is 8x30x2 mm.

The characterization of samples submitted to surface treatments by plasma spray deposition was performed morphologicaly (determination of the layer thickness, determination porosity, adherence and absorption of the layer) and compositionaly (determining the chemical composition of the layer).

To highlight the results, analysis were performed using electron microscopy with electron microscope QUANTA 200 3D DUAL BEAM. X-Ray diffraction was performed using an X' Pert PRO MRD equipment. Thermo physical properties of materials were analyzed with the device 457 LFA Micro Flash. Samples were subjected to a heat treatment in furnace Chamber Furnaces with Gas Heating at the temperature of 1150°C.

Deposition parameters for atmospheric plasma spray (APS) are presented in Table 1, and intermediate layer parameters with NiMoAl deposited by arc are shown in Table 2.

TABLE 1. TECHNICAL PARAMETERS FOR THE DEPOSITION

Cooling water debit	8,7 bar
Velocity of rotation	55 rot/min
Electrode voltage (U)	60 V
Plasma gas intensity A)	600 A
Composition of plasma	46,1%Ar/13,51%H_2
Spraying distance	120 mm
The cooling pressure of the water	14-17 I/min (3,7-4,5 gal/min)

TABLE.2. SULZER METCO SMART ARC 350

U	31V
I	200A
Air pressure	60 PSI

3. EXPERIMENTAL RESULTS

3.1. Atmospheric plasma spray (APS)

Thermal spraying is a group of processes designed to achieve thin layers, in which fine

powders, metallic or nonmetallic, shall be deposited, melted or semi-melted, to form a coating.

The particularity of this process is it's capacity for deposition of metallic, ceramic – metallic (named "cermets"), ceramic and polymeric layers with a thickness from 100 µm to 1 mm, for a various industrial applications.

The layer is totally created when a big number of powder particles are covering each other. These particles are related to substrate mainly with mechanical links. A common characteristic for all types of layers obtained with this process is given by the lenticulare or lamelare structure of the grains, obtained after a quickly solidification of the powder particles after the impact with the substrate, which has a smaller temperature. If powders are not produced

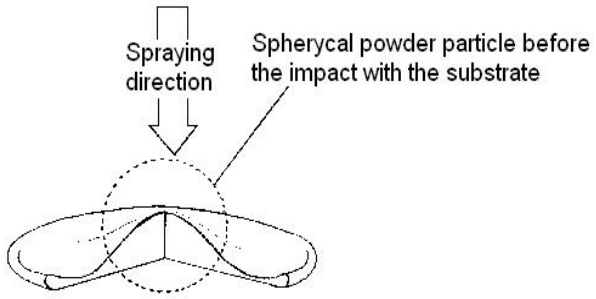


Fig. 1. Schematic representation of a spherical particle sprayed onto a plate substrate

3.2. Particle size distribution

Particle size is an important variable that influences coverage characteristics. To ensure the powder's melting in the plasma spraying, for a given set of parameters, the spraying powder's size should be checked.

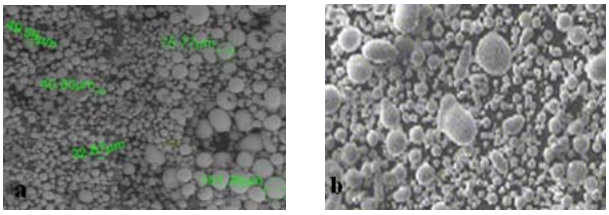


Fig. 1. Powder morphology used in thermal spraying: a) ZrO_2/20% Y_2O_3 and b) Ni5Mo5Al

3.3. Micro structural characteristics

In SEM images of the surface layer small cracks, with diameter of 200 µm, can be observed (Figure 2.a.).

Heat treatment at a temperature of 1150°C for 100 hours, has led to a compaction of layer deposited (Figure 2.b.), only a few separate particles can be seen, resulting in a good compact layer.

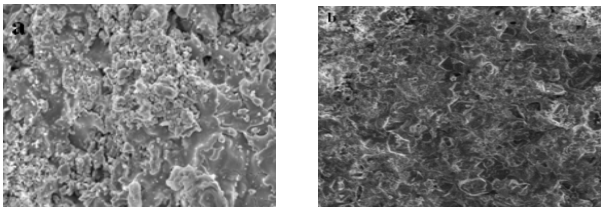
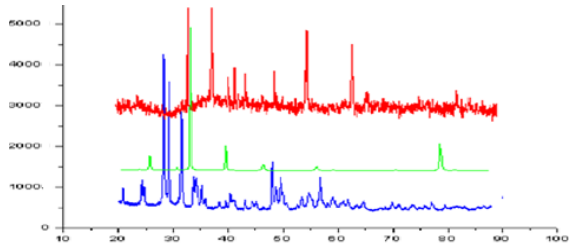


Fig. 2. SEM images of the layer obtained by plasma spray deposition of powder ZrO_2/20% Y_2O_3: a) before heat treatment at 1000X, b) after heat treatment at 1000X

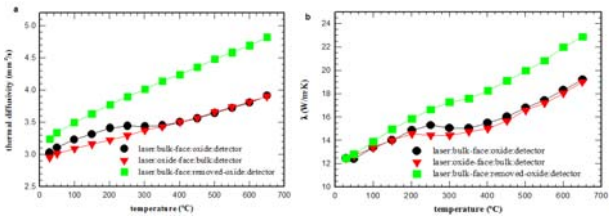
4. X-RAY DIFFRACTION

With XRD analysis observations will be made on constituents and phases of the layer deposited by thermal spraying. With the help of x-ray diffraction we could see the modification of the diffraction curves before and after thermal treatment, thus highlighting the phases obtained after sintering.



5. THERMO PHYSICAL PROPERTIES OF MATERIALS ANALYSIS

This study describes the experimental results of thermal diffusivity, specific heat at constant pressure, and thermal conductivity of porous 20 mol% yttria-stabilized zirconia (YSZ).



6. CONCLUSIONS & ACKNOWLEDGMENT

With this APS technique, almost any material can be deposited, provided it can be melted or become plastic during the spraying process.

Particle size is an important stage in the metallization process that influences coating characteristics. For this reason, in certain sets of parameters the size of the spray powder should be taken into account.

After heat treatment at a temperature of 1150°C for 100 hours deposited layer compaction can be seen. You can see very few separate particles, resulting in a great compact layer.

After X diffraction analysis and heat treatment at 1150 ° C we found areas devoid of peaks characteristic of the solid solution obtained after heat treatment, which shows a very specific complete and ordered structure close to amorphous layers.

Improving the thermal conductivity and diffusivity is possible to increase the entrance temperature of gas turbines and improve performance.

BIBLIOGRAPHY

1. Christopher Petorak, Rodney W. Trice (2011), *Surface & Coatings Technology 205 (2011) 3218–3225*, Effect of heat-treatment on stress relaxation behavior of plasma-sprayed 7 wt.% Y_2O_3–ZrO_2 stand-alone coatings , Purdue University, School of Materials Engineering, West Lafayette, IN 47907, USA.

2. Bangdao Chen, Hongzhong Liua, Hongtao Wang, Fan Fan, Li Wang, Yucheng Ding, Bingheng Lu, (2011), *Applied Surface Science 257 (2011) 9125– 9128*, Thermal shock induced nanocrack as high efficiency surface conduction electronemitter,

3. Liangfa Hu • Chang-An Wang • Zijun Hu • Sheng Lu • Chencheng Sun • Yong Huang (2011), *Springer Science+Business Media, LLC 2010*, Porous yttria-stabilized zirconia ceramics with ultra-low thermal conductivity. Part II: temperature dependence of thermophysical properties.

4. http://en.wikipedia.org/wiki/Thermal_diffusivity.

5. http://en.wikipedia.org/wiki/Thermal_conductivity.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

INTEGRATING ISSUES OD FRICTION STIR WELDING OF STEELS IN CURRENT ENGINEERING PRACTICE OF SPECIAL TECHNIQUES

Lukáš REPKA*, Harold MÄSIAR**

*Faculty of special technology, University of Alexander Dubcek in Trencin

Abstract: *In engineering practice there in the last decade a significant increase in labor productivity in proportion to the rising requirements for quality, economic efficiency and safety at work of the machining operations. The relatively new and modern methods to achieve a high level of these parameters, aspects, conditions and requirements, the integration of friction stir welding of steels in current engineering practice.*

Keywords: *friction stir welding, ferritic steels, research, welding, modern method, materials, temperature*

1. INTRODUCTION

Integration of friction stir welding of steel as an innovative method of joining materials in a real engineering environment was preceded by long and extensive research and development of the method. Research was conducted worldwide for materials with low melting point such as. copper, aluminum, zinc and lead. The final output of research in terms of concrete results of the welding of these materials in commercial-scale use. The research confirmed the proven benefits of friction stir welding of low-melting materials as compared with conventional hot melt welding methods, which led to considerable interest in the application of technology and examined for bonding materials with high melting temperature, such as. ferritic steel whose melting point is in the range above 1000 ° C. For further research, resulting in increased demands on the welding tool, the tool must be resistant to mechanical wear and thermal deformation at high temperatures accompanying the process of friction stir welding of ferritic steels. Based on studies demonstrated satisfactory welding tool joints forming the desired quality, made from PCBN material - polycrystalline boron nitride or WC - tungsten carbide. The Friction stir welding of steels provides for a significant number of benefits and innovation and the three basic problems encountered in the welding of ferritic steels with various uses.

2. THE PRINCIPLE TECHNOLOGY OF FRICTION STIR WELDING METHOD

The technology is based on the principle of rotating injection tool in the longitudinal direction of the contact plane of two joined materials (Fig. 1). Materials are to each other without join butt weld gaps, which are firmly clamped without movement of the supporting substrate. The bottom of the wear resistant welding tool is completed by a thorn, and the rotation of the rotating mandrel and contact with the material there is friction welded to generate heat, which will result in the creation of material welded joint plastification [1].

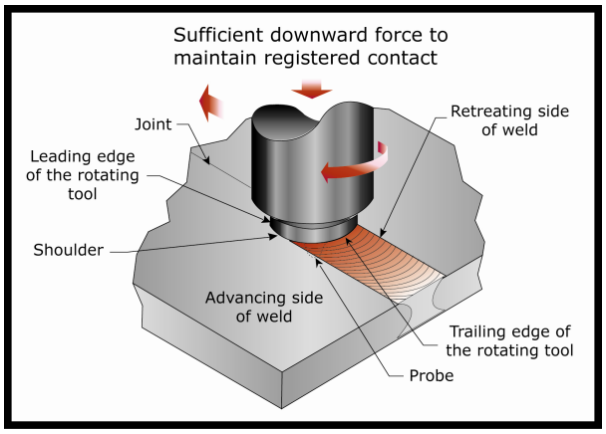


Fig. 1 Schematic representation of friction stir butt welding process [1]

Basic weld material can not be warmed by heat generated by friction of the melting point, but the value is reached temperatures high enough to plastificated basic material allows longitudinal movement of the welding tool to the line of contact of welded materials and created a permanent hole mandrel tool has been steadily filling. Fills the hole created back arm welding forging force generation tool joined plastificated material to the lower layers of the weld joint. The movement of material in the thickness direction of welded materials in combination with-flow around the rotating tool is incurred welded known viruses, which leads to mutual mixing of the two materials bonded together, and the creation of the weld. The area of the weld and the welding tool steels (welding tool is welded together with the material is heated at high temperature) is necessary to protect the supply of protective inert gas. This gas is fed through a welding nozzle to create the weld site. With the gradual moving the rotating tool along the contact surfaces of plasticized material flowing around the ends around the welding tool (punch), transferred from the capture (start of movement of material) to the end of the metal movement, which arises from the welding tool. Physical contact with the moving layers of metal heated base material and the plastic deformation of the joint significantly facilitates the process of capturing the course material and it is dynamic recrystallization, resulting in the formation of the weld joint [1].

3. THE WELDING TOOLS FOR FRICTION STIRRING WELDING

The rotating tool (Fig. 2) advancing the line of weld surface leaving behind touch whose dimensions are the dimensions of the mandrel (pin) tool. Wing area is roughly the shape of the annular diameter and the diameter of the mixed touch at the touch of welded plates. For this reason, that to achieve the highest strength and quality of service is necessary to optimize the welding process parameters so that at the smallest diameter mandrel (pin) to achieve the greatest diameter of the mixed. The main process parameters affecting the diameter of the mixed geometry of the working tool and especially the geometry of the mandrel. Tools are usually made from tool steel, whose mechanical properties are sufficient for most soft metals such as aluminum and its alloys, or. PCBN of unconventional materials - polycrystalline boron nitride or WC - tungsten carbide for welding of ferritic steels [2].

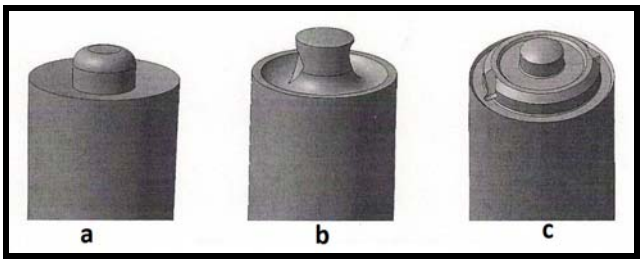


Fig. 2 Geometry of the working parts of the welding tools - a) Tool A, b) Tool B, c) Tool C [4]

In the case of instruments A and B (Fig. 2ab) is similar to the character of power injection. After initial contact with the tool material with

heavy load strength gradually increases until it reaches a level at which the amount of heat generated is sufficient to cause reduction in strength and a significant increase in its plasticity. After overcoming the first local maximum begins to penetrate into the tool joint force constant, which is maintained through self-regulation process. If there is any increase in the resistance of material against the penetration of the tool, there is also the intense heat and the resultant increase in the plasticity and vice versa. In case of contact with the tool printed material on the front, there is a further increase in power injection up to a maximum value which is a thorn embedded in welded materials and tool face abuts the plate surface. In this position, the rotating tool remain after the set period of residence and ejected from the site [2].

4. EXAMPLES OF USING FRICTION STIR WELDING

Friction stir welding is mainly used for welding aluminum and magnesium (Fig. 3), but is also suitable for copper, titanium and steel. Allows you to connect a dissimilar materials, eg. aluminum alloy with magnesium. Commercially it is used mainly for welding aluminum alloys 2xxx series (Al-Cu), 6xxx (Al-Mg-Si), 7xxx (Al-Zn) and magnesium alloys AZ series. Quality links also arise when combining aluminum alloys that are difficult to weld by conventional fusion welding methods. Sheets and plates of aluminum and copper to a thickness of 30 mm can be welded to a transition to full penetration [3]. **This technology is welded:**

- Ship building: aluminum deck panels, boat hulls, masts and beams,

- In aerospace: the wings and fuselages, fuel tanks of aircraft and space shuttle and military rockets,

- In the railway industry: container and tank wagons, trams, subway cars and high-speed trains,

- Road transport: aluminum automotive frame structures, RV, motorcycle and bicycle frames, platform trucks, welding clips made of hydroformed aluminum tubes, extruded profiles welding automobile frames for casting,

- In construction: aluminum bridges, window frames, cladding panels and the like [3].

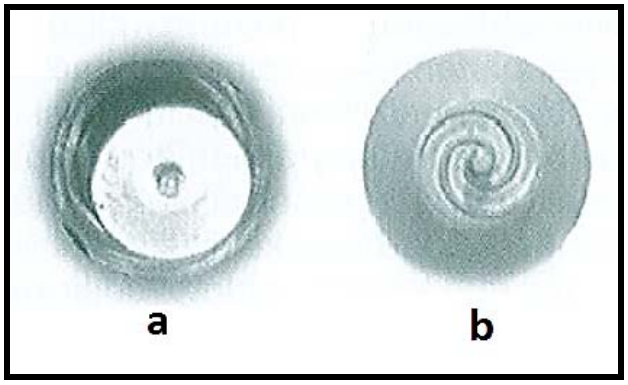
Friction stir welding is also applicable when making overlapped joints called. Pro-StirTM technique. Pro-StirTM the technology of production of welded joints in nearly final form of the structure using friction mixing overlapped joints. Technology is creating the final design iterations overlapped welded joints of thin or thick plates, followed by mechanical surface treatment on the final shape and size desired. This method allows - creating structures that would be using other conventional methods of production (fusion welding, machining, or. Fitting) imply a high loss of material required to produce the desired final design dimensions. The method also finds application in the production of complex structures, which can only be difficult, or they can not even construct appropriate method [3].

The advantages of friction stir welding [3]:

• do not result from changes in volume due to freezing (because there is no melting)
• residual stress and strain are minimal,
• at any time without weld porosity,
• The process is environmentally clean and highly energy efficient,
• can weld in all positions
• no need for any additional material or protective atmosphere,
• Requires no sanding and cleaning of welded areas.

Obr. 3 Transversal cross section of a weld [1]

Welding parameters for the instruments are usually chosen based on the results of previous optimization studies carried out in order to ensure flawless welds, creating high quality and good looks. The maximum temperature is concentrated in the weld areas directly related to the size of embedded energy in the resulting weld, parameters on the size and rotation speed of advancement of welding tool. It follows that the welds made with tools that are characterized by lower application rate of progression and increased rotational speed of the tool (Fig. 4a) can be considered hot welds. Welds made with instruments for which application is characterized by a greater progression rate and lower tool rotational speed (Fig. 4b) can be considered as cold welds [3].



Obr. 4 THE WELDING TOOLS FOR FRICTION STIRRING WELDING – a) with cavity conical shoulder, b) with scrolled shoulder [1]

For welding tools with tapered countersink tool shoulder is most commonly applied average welding mandrel (pin) 10 mm with a cone angle of 8 °, culminating in a cylindrical mandrel diameter of 3 mm in left-hand thread and a length of 0.9 mm. The axis of the tool is adjusted as needed with regard to the basic material. Tools with a spiral arm diameter 14 mm is usually set at zero angle, the pin is the same parameters as for instruments with a conical recess shoulders [3].

5. THERMAL REGIMES AND TECHNOLOGICAL PARAMETERS OF WELDING

Setting the optimal thermal welding is chosen based on results of examination of the impact of the main parameters affecting the amount of heat input for welding materials. Commonly used experimental methodology, based on the principle of the contact methods of temperature measurement, which ensures accuracy with variation not exceeding ± 15 ° C. The variable parameters of the friction stir welding is a welding tool rotation speed in the range 500 - 1400 rpm. / min, the average surface of the support shoulder tool - 8 to 12 mm and the welding speed from 80 to 210 mm / min. created by welding thermal cycles are directly subordinated to the theory of heat transfer laws. A necessary condition for the emergence of quality of welded joints in soft metals and their alloys to ensure the maximum temperature in the formation of weld greater than 390 ° C [2].

6. CONCLUSIONS & ACKNOWLEDGMENT

Friction stir welding appears in recent years as a highly efficient and reliable process for joining materials which are produced by high quality and precision welded joints of the required quality. Currently Extensive research into the wider application of this method in routine engineering practice, with very good results especially when combining metals and alloys of light materials (eg aluminum). However, application of friction stir welding is possible even during welding of ferritic steels.

When properly selected welding parameters and their continuous compliance during welding can ensure accuracy and continuity of the process.

REFERENCES

1. Vilaca, P., Quintino, L., Emílio, B., Loureiro, A., Rodrigues, D.M. . Performance of friction stir welding in similar and dissimilar thin plate joining. *Welding*. Issue (2009).

2. Alifrenko, E.A., Pavlová, V.I., Osokin, E.P. . Friction stir welding applied for thin – walled joints of aluminium – magnesium alloy type 1516. *Welding.* Issue (2011).

3. Van Haver, W., Geurten A., De Meester, B., Defrancq, J. . Friction stir overlap . welding of thick 2124 aluminium plate. *Welding.* Issue (2010).

4. Addison, A.C., Robelou, A.J. . Friction stir spot welding. Principal, parameters and their effects. Proceedings 5th Internatiolnal Symposium on Friction Stir Welding, Metz. France (2004).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

THE STUDY OF THE MECHANICAL INFLUENCES ON THE PISTON WRIST ADJACENT PARTS CAUSED BY THE RESIZING OF ITS DIMENSIONS

Ionut SERBAN*, Cornel ARAMA, Andreea ARAMA*****

*"Transylvania" University, Brasov, Romania,
"Henri Coandă" Air Force Academy, Brasov, Romania, * freelancer, Brasov, Romania

Abstract: *Nowadays the main tendency is the manufacturing of new low pollution engines. So, the "downsizing" trend is very popular today together with other auxiliary propulsion systems such as hybrid, electrical, natural gas, hydrogen etc. Another method to make an engine with high dynamic performances and low pollution is to optimise all the internal phenomena, process and components. Shortly, we are talking about an "efficient" engine. MAZDA has developed the "skyactiv" concept: as a result of their experience, the engineers tried to apply for Diesel and Otto engines the same compression ratio 14:1 and they optimised the burning process. MAZDA specialists say that the slap piston phenomenon, which appeared after applying this revolutionary technical solution, is cancelled by innovative solutions developed during ten years of experience. In conclusion, taking into account the new tendencies in engines manufacturing (three of them were shortly presented above: downsizing, efficient and skyactiv) we can talk about the increase of importance of one of the projection stages: the research and the analysis of the manufacturing influence and assembling modalities on the adjacent parts and on the functional ensemble they belong to. In this paper the influences of resizing of piston wrist on the adjacent parts will be theoretically analysed (3D modelling and FEM analysing) only from the mechanical point of view and some optimization possibilities will be highlighted.*

Keywords*: optimization, structures, engine, design, automotive*

1. INTRODUCTION

The piston has two points of contact with the adjacent parts: the piston wrist and, using the piston rings, a lateral contact with the cylinder. Taking into account the type of assembling method of piston wrist into the eye of the connecting rod, with tightening (fixed piston wrist into the connecting rod foot) and free into the connecting rod foot, there are two types of contacts between the adjacent parts. These two types of contacts have different influences on the functional ensemble they belong to:

- piston-piston wrist bosses: the contact with sending the gas pressure force between two cylindrical surfaces which are one inside the other one, with friction in piston bosses and piston wrist fixed into the eye of the connecting rod (at the variant named "with fixed piston wrist into the foot (eye) of the connecting rod" (Fig. 1);

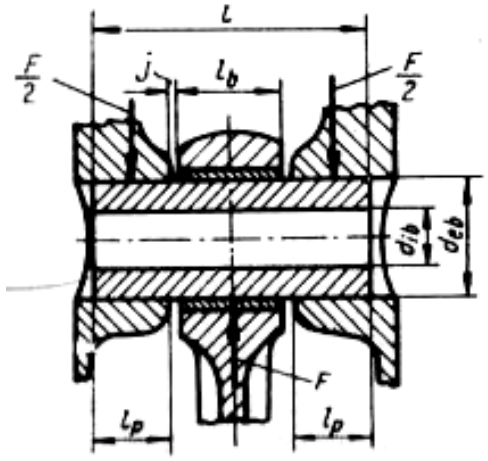


Fig. 1 – Draft of the contact between the piston boss and piston wrist (the diagram of the forces)

- (piston + piston rings) – the cylinder: the contact between two cylindrical surfaces moving alternating one to the other, with the main task to guide the piston and with lateral (horizontal) forces which, in module, have lower values than the vertical forces: F_n in Fig. 2.

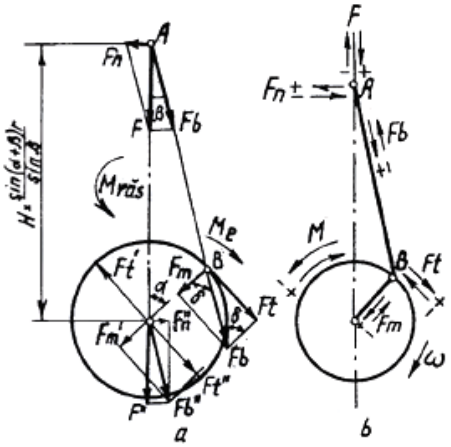


Fig. 2 – Forces and torques which act in crank gear (piston wrist centered assembling)

2. THE MODEL

The variant which is studied here is the fixed piston wrist into the eye of the connecting rod. As we can see in Fig. 6, there are two types of cylindrical areas of a mechanical contact between the adjacent parts which have the lengths: l_p and l_b. The first one, l_p, is found twice because there is the contact between the piston and the piston wrist. The second one, l_b, is the length of contact between the piston wrist and the connecting rod. In our situation, the piston wrist is considered fixed into the eye of the connecting rod (with tightening).

It is obvious that the operating mode, sending the pressure, which is the result of burning the fuel, through the two l_p areas from the piston to the piston wrist and the friction between the piston and the piston bosses, are the most important components of this functional ensemble. The idealization of the realistic physical model and its equalization with a study model is showed in Fig. 3:

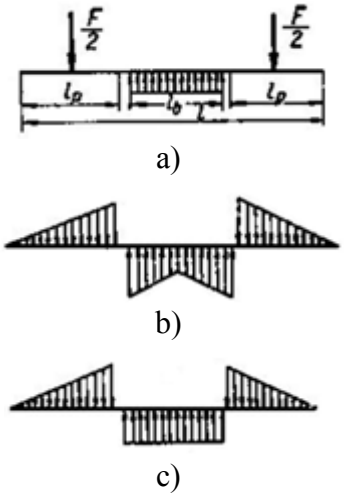


Fig. 3 – The loading diagram (the equivalent model)

Therefore, in fig. 3 we have the loading diagram (the equivalent model) between the piston bosses – the piston wrist and the piston wrist – the eye of the connecting rod where:

a) just leaning the beam and an uniform distribution of the connecting rod loading – are not enough; insufficient;

b) a more reasonable loading distribution – is sufficient;

c) a simplified loading distribution, based on *b)* variant – is sufficient.

Fig. 4 is a simplified example of a fixed piston wrist ensemble, without loading.

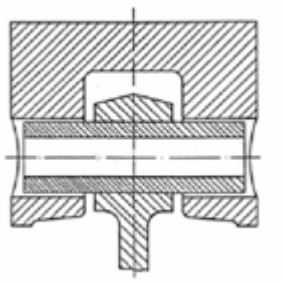


Fig. 4 – A fixed piston wrist ensemble

The influence of resizing the piston wrist length on the adjacent parts and on the functional ensemble is going to be studied in this paper using a 3D model (Fig. 5).

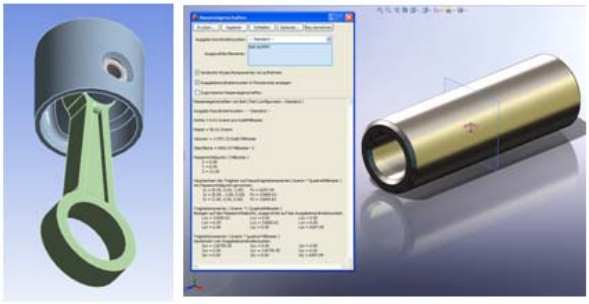


Fig. 5 – The 3D study model and the details of the piston wrist (the 62 [mm] standard variant)

The dimensions, masses and weights of the components were approximated with 1289 cm^3 Otto engine (type 810-99) parts. The maximum pressure of the exhaust gases were valued to 50 daN/cm^2 (500 N/mm^2 = 50 bar). The dimensions of the piston wrist are:

- 20 mm – the external nominal diameter;
- 13 mm – the internal diameter;
- 62 mm – the length.

The mass of the piston wrist in the virtual model is 90,61 [g]. The used material is alloy steel. Its density is 0,0077 [g/mm^3]. The load centre is in the middle of the part. Some properties of aluminium alloy (density = 0,0027 [g/mm^3]) were attached to the piston. In this case, the weight of the virtual model is 307,33 [g]. The mass of the connecting rod is 493,06 [g] and the density of alloy steel, which was attached, is 0,0077 [g/mm^3].

The existing tightening between the eye of the connecting rod and the piston wrist is -0,02 mm / -0,04 mm.

We have to say that this analyzing is made taking into account only the mechanical loads. The thermal loads are not taken into consideration.

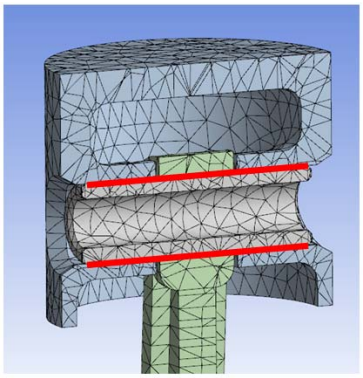


Fig. 6 – The area of the increase of stresses and deformations at the studied 3D model

3. THEORETICAL ISSUES

The phenomenon from the piston wrist modelling is made using mathematical formulas. In this situation, the analysing of the phenomenon is not going to be made in detail with the projecting data of the piston wrist. We are going to refer only to the mathematical formulas which describe the deformations of the piston: the bending, the elliptic section deformation and the unit pressure decreasing between the piston wrist and the piston bosses.

The formula of the piston wrist bending is:

$$f_1 = \frac{(p_z - p_j)D^2(l-2c)^2 l}{60E\left(d^4 - d_0^4\right)} \qquad (1)$$

where:

l – the piston wrist length;

c – half of the effective length of the piston wrist;

D – the piston wrist diameter;

E – the coefficient of elasticity;

p_z – the pressure of the exhaust gas;

p_j – the inertial forces.

The piston deformation contains an elliptic component. Its formula is:

$$f_2 = \frac{\pi(p_z - p_j)D^2\left(d + d_0\right)^3}{320El\left(d - d_0\right)^3} \quad (2)$$

The aim of the optimization process is to decrease the unit pressure which is developed between the piston wrist and the piston bosses and it is expressed in the formula:

$$q = \frac{p_z - p_j}{2dl_p} \quad (3)$$

where l_p is the length of the piston wrist.

The aim of the study is:

- to analyze an ensemble where the length of the piston wrist is resized;
- the increasing of the values of the tensions and of the maximum deformations which appear in the contact area between the adjacent parts;
- drawing some conclusions.

The variation of the piston wrist length causes the variation of pressures and the deformations from the piston's bosses. In this situation, the piston-piston wrist-connecting rod ensemble will have a different bending behaviour.

4. SIMULATION AND OPTIMIZATION

The maximum developed pressure (which was caused by burning fuel and it is approximated with 50 bar) is presented in Fig. 7. The pressure distribution on the surface of the piston is also made normally (red colour).

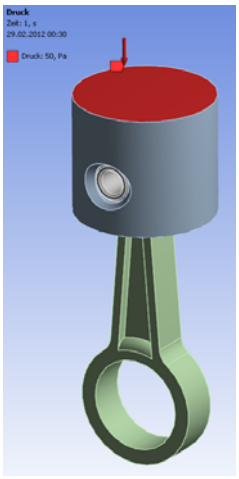


Fig. 7 – The loading of piston-the piston wrist-connecting rod ensemble (the gas pressure force)

The state of induced stress (von Mieses), in [Pa], for the genuine manufacturing variant is presented in Fig. 8:

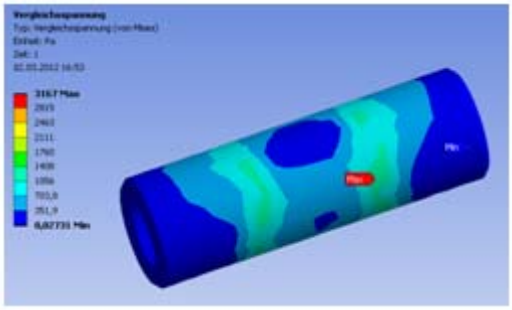


Fig. 8 – The tensions which appeared into the piston wrist

The deformation state is presented in Fig. 9:

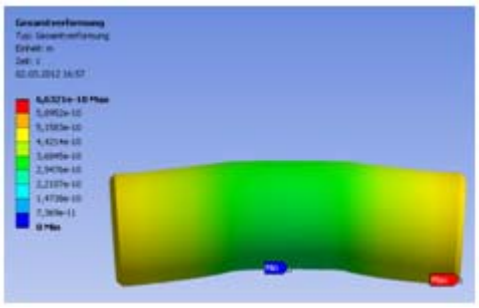


Fig. 9 – The deformation state that appeared into the piston wrist

The von Mieses variation diagram of tensions from piston's bosses is presented in Fig. 10:

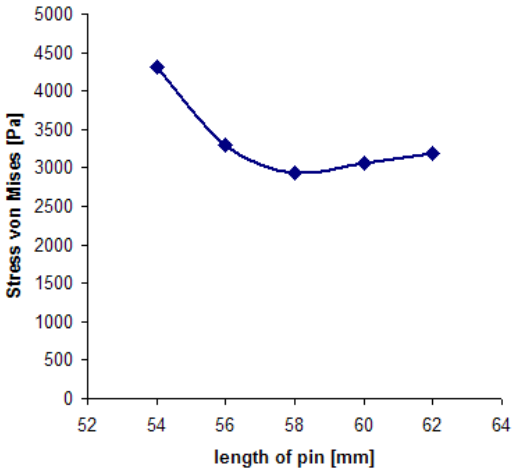


Fig. 10 – The tensions which appeared into the piston's bosses

The variation diagram of the piston wrist tensions is presented in Fig. 11:

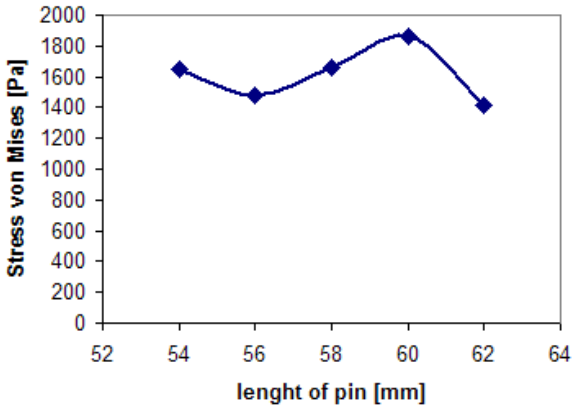


Fig. 11 – The tensions which appeared into the piston wrist, in the area between the piston's bosses and the eye of the connecting rod

The diagram of the deformation which appeared into the piston wrist, in the area between the piston's bosses and the eye of the connecting rod, is presented in Fig. 12:

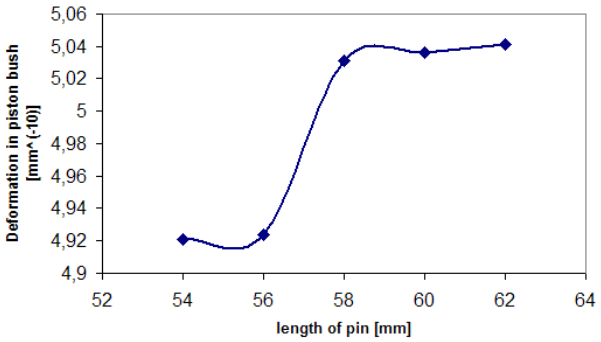


Fig. 12 - The deformation which appeared in the piston wrist, in the area between the piston's bosses and the eye of the connecting rod

The state of tensions and of deformations of the piston for the variant with piston wrist (62 mm initial length) and the highlighting of the critical areas:

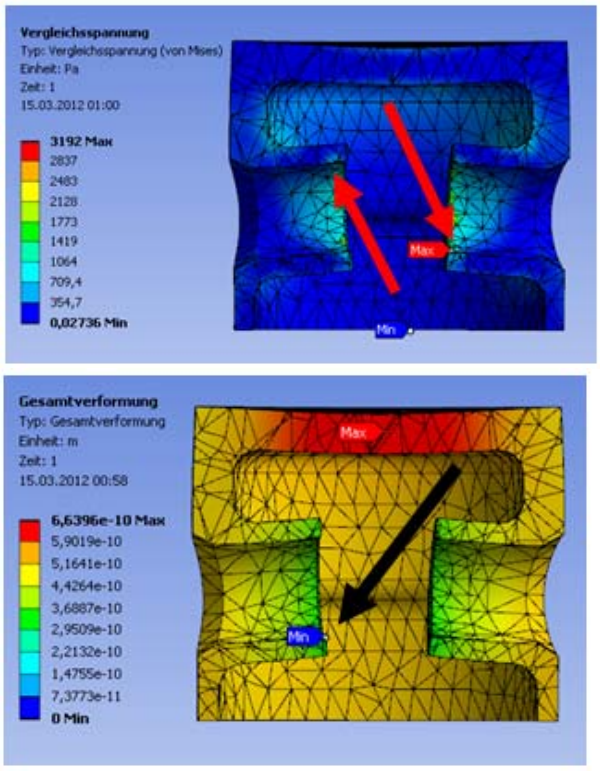


Fig. 13 - The state of tensions and deformation of the piston

The state of tensions and deformation of the piston wrist for the length 62 mm is presented in Fig. 14:

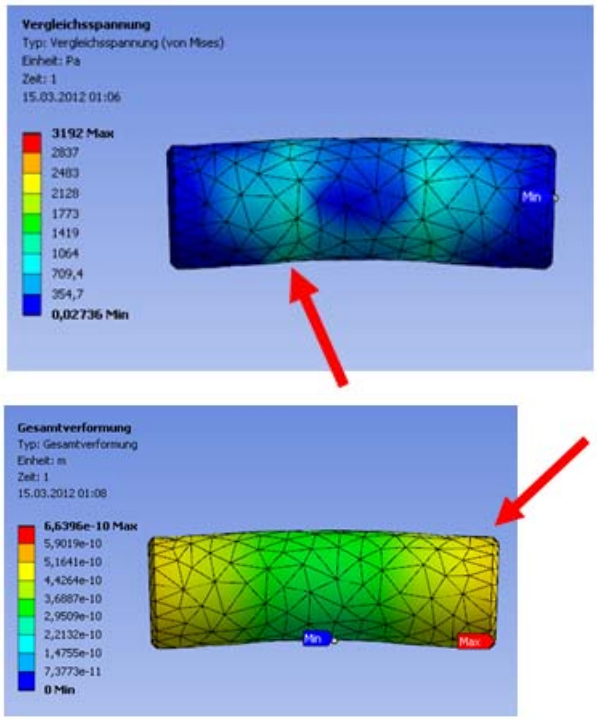


Fig. 14 - The state of tensions and deformations of the piston wrist

The state of tensions was presented in the upper images of figures 13 and 14 and the state of deformations was presented in the bottom images of the same figures.

5. CONCLUSIONS

The study gives us some conclusions about the behaviour of the parts and the possibilities to optimize them. Therefore, the decreasing of the piston wrist length causes the increasing of the piston wrist's tensions into the piston's bosses (Fig. 10).

The tensions from the area between the piston's bosses and the eye of the connecting rod vary following an approximately sinusoidal curve. Their tendency is to increase to the same extent with the decreasing of length (Fig. 11).

The deformation of the piston wrist (Fig. 12) decreases with the decrease of its length. The decreasing of the piston wrist's length also causes the moving down (to the crankshaft) of the load center of the ensemble. This change influences the distribution formula of the connecting rod weights for the vibration calculus. We could continue and we could analyze the deformation stage in the cross section of the piston wrist (an elliptic deformation). Thus, other conclusions could be formulated.

BIBLIOGRAPHY

1. Bobescu, G. s.a. *Motoare pentru automobile si tractoare*, Vol. II, Editura "Tehnică", Chi□inău, 2000;

2. Brebenel. A s.a. *Autoturismul Dacia 1300*, Edi□ia a II-a, Editura "Tehnică", Bucure□ti, 1978;

3. Schumacher, A. *Optimierung mechanischer Strukturen - Grundlagen und industrielle Anwendungen*, Springer Verlag, Berlin, 2005;

4. Serban, I. s.a. *Considerations about optimized cad design application for the automotive and engine's mechanical structures*, CONAT Paper, Transilvania University of Brasov, 2011.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

POLYMER BASED HYBRID MATERIALS FOR AEROSPACE APPLICATIONS

Fulga TANASA, Madalina ZANOAGA

"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania

Abstract: *Hybrid materials represent one of the most fascinating class of materials developed in recent years. The tremendous possibilities of combination of different properties in one material initiated extensive research on potential novel materials and high performance applications.*
The aviation and aerospace industry is an area of major interest in terms of new solutions and innovation. The spin-off effect for technology from the aerospace industry to other industrial sectors is particularly pronounced for materials technology which, in the wider sense including computer modelling, interfaces and surface science, is a key instrument to meet challenges. This paper is intended as an overview of the main issues concerning the design and structure-properties relationship of hybrid materials for aerospace applications.

Keywords: *hybrid materials, aerospace applications, design, structure-properties relationship*

1. INTRODUCTION

The aerospace industry created the image of an ideal airplane: it would be extremely light weight, have wings with variable geometry, run on renewable energy, and would make no noise. After its lifetime, all its parts would be reusable or recyclable. Although far from the present-day situation, this vision is a valuable set of guidelines for the research and industry. The vision is aligned with the customers' expectations: low operating costs, high productivity and availability, low environmental impact, and simple operation and maintenance.

Improvements of the structural part of the aircraft will contribute to meet these demands. Large expectation are therefore attributed to new hybrid and multifunctional materials and coatings, e.g. for multifunctional airframes with smart technologies capable of structural health monitoring, structural adaptation and self healing [1].

During the recent decades, the penetration of advanced composite and hybrid materials in the aircraft industry was significant. The use of composites in aircraft have increased from 5-6% in the 1980s (A310, Boeing 767), 10-15% in the 1990s (A340, Boeing 777), to 23% in the new A380 and up to 52% in the planned A350 and Boeing 787. This development is the result of the steadily increasing performance, reliability and diversity of these materials.

Five main classes of challenges for composite and hybrid materials in aircrafts have been identified: performance, functionality, manufacturing, environment and knowledge. Performance challenges are, for example, resistance to high and low temperature cycling, compression resistance, damage tolerance and reduction of life cycle costs. Functionality challenges are structural

health monitoring, management of noise and electrical hazards, validation of bonds, integration of smart systems. As for manufacturing, challenges are recycling and re-use, fabrication of large complex parts and reduction of manufacturing costs. The environmental challenges are related to finding alternatives to petroleum feedstock, lowering the energy use in manufacturing and designing for repair, recycling and re-use of parts. Finally, there are considerable challenges related to in-depth knowledge of long-term ageing effects, prediction of materials properties and characterization, envisage specific applications.

One basic demand for the hybrid materials used in present-day aircrafts is the optimization of the design of complex composite structures and for this purpose new knowledge and new modelling tools are required (interface interactions models can lead to lighter structures with longer lifetime and higher reliability; damage models should increase the damage tolerance of structures; etc.).

Another problem is that most composite materials that are in use today are electric insulators, which creates risks for uncontrolled electrical charges and sparks. Design of electrically conductive hybrid materials for aerospace industry is an important development topic.

Other tasks: composite structures with better and more reliable performance under humid conditions at high temperature (hot-wet performance), demand for fibre composites with higher compressive strength [2], smart materials able to react to external or internal changes or even switchable systems [3].

2. POLYMER BASED HYBRID MATERIALS STRUCTURE DESIGN

2.1 Structural considerations. Basically, a hybrid material includes two moieties blended on the molecular scale; commonly, one of these compounds is inorganic and the other one organic. A more detailed definition takes into consideration the possible interactions between the inorganic and organic species. Class I hybrid materials show weak interactions (such as van der Waals, hydrogen bonding or weak electrostatic interactions), while class II hybrid materials present strong (covalent, coordinative, ionic) interactions between the components. Due to the gradual change in the strength of interactions, there is a steady transition between classes of hybrid materials (Fig. 1).

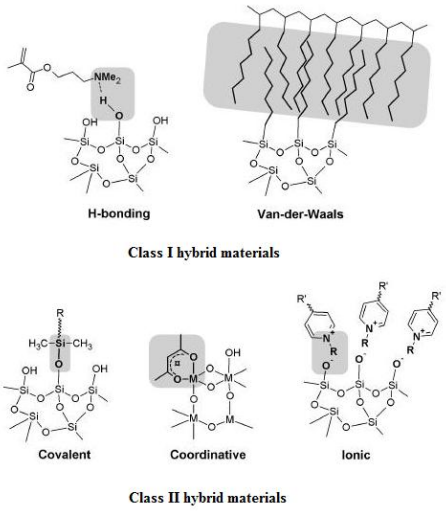


Fig. 1. Typical interactions in hybrid materials

Structural properties can also be used to distinguish between various hybrid materials. An organic moiety containing a functional group that allows the attachment to an inorganic network can act as a network modifier, builder or functionalizer [4].

Blends are formed if no strong chemical interactions exist between the inorganic and organic building blocks, e.g. an organic polymer with entrapped discrete inorganic moieties through physical interactions or the inorganic components are entrapped in a crosslinked polymer matrix. When an inorganic and an organic network interpenetrate each other, without strong chemical interactions, the so called interpenetrating networks (IPNs) are formed. Class II hybrids are yielding in the case of discrete inorganic building blocks, e.g. clusters, covalently bonded to the organic polymers or inorganic and organic polymers covalently connected with each other. A schematic presentation of these structures is shown in Fig. 2.

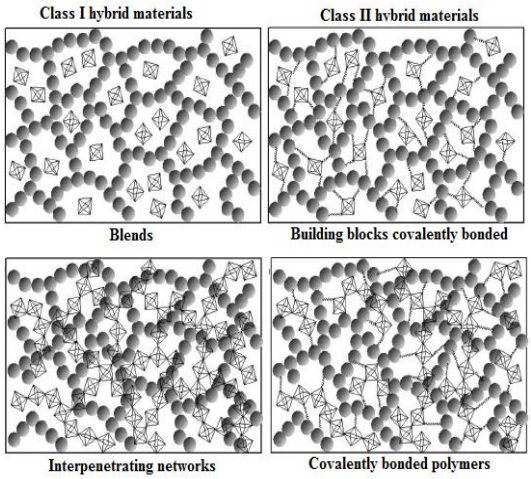


Fig. 2. Structural features of hybrid materials

2.2 Synthetic Strategies towards Hybrid Materials. Two different approaches can be used for obtaining hybrid materials:
(A) well-defined preformed building blocks react with each other to form the final hybrid material in which the precursors maintain (at least, partially) their original integrity;
(B) one or both structural units are formed from the precursors that are transformed into a novel (network) structure.

Both methodologies have their advantages and disadvantages.

Building block approach. Building blocks maintain (at least, partially) their molecular integrity throughout the material formation. At the same time, typical properties of these building blocks are transferred to the novel materials. Representative examples of such well-defined building blocks are modified inorganic clusters or nanoparticles with attached reactive organic groups (Fig. 3.). Cluster compounds often consist of at least one functional group that allows an interaction with an organic matrix. Two reactive groups can lead to the formation of chain structures, whilst building blocks having three reactive groups can be used for the formation of crosslinked materials (without any additional molecules).

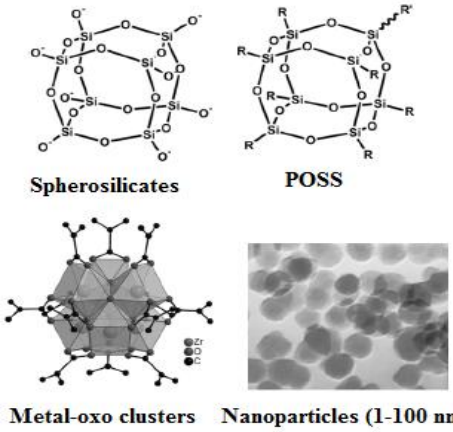


Fig. 3. Typical building blocks for hybrid materials

Beside the above mentioned molecular building blocks, nanosized building blocks, such as particles or nanorods, can also be used to form nanocomposites.

The building block approach has one large advantage compared with the *in situ* formation: because at least one structural unit is well-defined and usually does not undergo significant structural changes during the material formation, a better structure–property prediction is possible. Furthermore, the building blocks can be designed as to transfer their best performance in the new materials (i.e., good solubility of inorganic compounds in organic monomers by surface groups showing a similar polarity as the monomers).

***In situ* formation.** Contrary to the building block approach, the *in situ* formation of the hybrid materials is based on the chemical transformation of the precursors used for materials design and preparation. A typical example is the case when organic polymers are formed, but also the inorganic component is obtained by the sol–gel process. In these cases, well-defined discrete molecules are transformed into multidimensional structures,

which often show totally different properties from the original precursors. Simple, commercially available molecules are used and the internal structure of these hybrid materials is determined by the composition and reaction conditions. Therefore, control over the latter is a key step in this process. For example, if the inorganic species is a silica derivative formed by the sol–gel process, the change from base to acid catalysis yields in different structures: base catalysis leads to a particulate microstructure, while acid catalysis generates a polymer-like microstructure.

The sol–gel process. This process is chemically related to a polycondensation reaction. Usually, the reaction results in a three-dimensional crosslinked network. The fact that small molecules are used as precursors for the formation of the crosslinked materials implies several advantages: for example, a high control of the purity and composition of the final materials, the use of a solvent based chemistry which offers many advantages for the processing of the materials formed [5-7].

The silicon-based sol–gel process is probably the one that has been most investigated. The main feature of the silicon-based sol–gel processes is the incorporation of organic groups using organically modified silanes. Si—C bonds have enhanced stability against hydrolysis in the aqueous media, which is not the case for many metal–carbon bonds, so it is possible to incorporate a wide variety of organic groups in the formed network.

Principally, $R_{4-n}SiX_n$ compounds (n = 1÷4, X = OR', halogen) are used as molecular precursors, in which the Si—X bond is labile towards hydrolysis reactions, forming unstable silanols (Si—OH) that condensate yielding in Si—O—Si bonds. In the first steps of this reaction, oligo- and polymers, as well as cyclics, are formed subsequently resulting in colloids that define the sol. Solid particles in the sol undergo crosslinking reactions and form the gel. The process is catalyzed by acids or bases, resulting in different reaction mechanisms with distinct reaction rates and kinetics expressed by the gel point. In non-hydrolytic sol–gel processes, the reaction between metal halides and alkoxides is used.

Formation of organic polymers in the presence of preformed inorganic components. In this specific case, there are several possibilities to overcome the incompatibility of the two species. The inorganic material surface can be modified with non-reactive organic groups (e.g., alkyl chains), or moieties that contain reactive surface groups (such as polymerizable functionalities). Depending on these, the material can be pretreated: for example, a pure inorganic surface can be treated with surfactants or silane coupling agents to make it compatible with the organic monomers, or functional monomers that react with the surface of the inorganic material can be added. If the inorganic component has nonreactive organic groups attached to its surface and it can be dissolved in a monomer which is subsequently polymerized, the resulting material is a blend. In this case, the inorganic component interact only weakly or not at all with the organic polymer; hence, a class I hybrid material is formed. Homogeneous materials are only obtained in this case if agglomeration of the inorganic components in the organic environment is prevented. This can be achieved if the interactions between the inorganic components and the monomers are better or at least the same as between the inorganic components. However, if no strong chemical interactions are formed, the long-term stability is questionable because of diffusion effects in the resulting hybrid material [8-10]. Examples of such materials are alkyl chain functionalized silica nanoparticles that can be introduced into many hydrophobic polymers, the use of block copolymers containing a poly(vinylpyridine) segment that can attach to many metal nanoparticles, or the use of hydroxyethyl methacrylates in the polymerization mixture together with metal oxide nanoparticles. The stronger the interaction between the components, the more stable is the final material, as in class II materials. Examples for such strong interactions are the surface-attached polymerizable groups that are copolymerized with organic monomers.

If a porous 3D inorganic network is used as inorganic component, a different approach has to be employed depending on the pore size, the surface functionalization of the pores and the stiffness of the inorganic framework. In many cases, intercalation of organic components into the cavities is difficult because of diffusion limits. The 2D layered inorganic materials can intercalate organic molecules and, if polymerization between the layers occurs, even exfoliate, producing nanocomposites. The exfoliated hybrids only contain a small weight percentage of host layers with no structural order. Layered materials are able to completely delaminate if the forces produced by the intercalated polymers overcome the attracting energy of the single layers. This is not possible in the case of the stable 3D framework structures, such as zeolites, molecular sieves, etc.

Hybrid materials by simultaneous formation of both components. Simultaneous formation of the inorganic and organic polymers can result in the most homogeneous type of interpenetrating networks [3,11]. Usually, the precursors for the sol–gel process are mixed with monomers and both processes are carried out at the same time, with or without solvent. Applying this method, three processes are competing: (a) the kinetics of the hydrolysis and condensation forming the inorganic phase, (b) the kinetics of the polymerization of the organic phase, and (c) the thermodynamics of the phase separation. Tailoring the kinetics of the two polymerizations so they occur simultaneously and rapidly enough, phase separation can be avoided or minimized. Additional parameters, such as attractive interactions between moieties, can also be used to avoid phase separation.

One problem that also arises from the simultaneous formation of both networks is the sensitivity of many polymerization processes or final materials towards sol–gel conditions. Ionic polymerization, for example, often interacts with the precursors or intermediates of the sol–gel process, so free radical polymerization is used instead.

An interesting route towards hybrid materials is the use of precursors that contain alkoxides which can also act as monomers in the organic polymerization. This leads to nanocomposites with reduced shrinkage and high homogeneity [3].

3. PROPERTIES AND APPLICATIONS

The new concept of "care-free structures" in aerospace industry [12] suggests that optimized structures should be designed for minimum cost-maximum performance and this approach is connected to the wide variety of possibilities offered by polymeric hybrid materials.

Environmental and safety concerns will drive the design of new aircrafts that will benefit from the hybrid materials. CNTs reinforces polymers are lightweight materials that will reduce the weight of aerospace crafts by 40%, hence the energy consumption, providing higher electrical and thermal conductivity. More than 4000 lb. (2 tons) of copper wire is used for commercial aircrafts (Boeing 747), replacing it with lighter CNTs hybrids will reduce the weight and enhance the performance. Same in the case of cryogenic propellant tanks of space crafts. Recent works has shown that the addition of organically modified clays to toughened epoxy resins leads to a 60% reduction in hydrogen permeability, enhanced compatibility with liquid oxygen and improved resistance to microcracking [13].

Polymer based composites and hybrid materials have high costs, but are excellent in damage tolerance and corrosion resistance which translates to low maintenance and high performance. For instance, the B787 with 50% composite is promising twice as long operation time between scheduled maintenance intervals of the B767 it replaces [14].

Laminates of aluminum and polymer composites provide exceptional fatigue-crack-growth resistance and damage tolerance at high specific strength. Hybrid laminates of titanium alloys, aluminum alloys and reinforced polymers are considered to provide combinations of properties beyond the capabilities of the current materials.

4. CONCLUSIONS

Towards new hybrid materials: modelling tools to optimise design, including damage and interface modelling; new polymers dedicated to hybrids (from renewable sources, recycled, "one-fits-all" polymers, reversible thermosets, self-healing polymers); new reinforcement materials (carbon and other fibres and other nano-carbon structures); multifunctional coatings (conductive, antifriction, self cleaning, de-icing/anti-icing, air cleaning, self-healing), smart materials.

REFERENCES

1. SusChem Hybrid Materials Workshop Report, "Setting the Future Materials Research Agenda for Sustainable Chemistry", 3-4 March 2010, Luxembourg.
2. Koziol, K., Vilatela, J., Moisala, A., Motta, M., Cunniff, P., Sennett, M., Windle, A. High-Performance Carbon Nanotube Fiber, *Science* 318 (2007).
3. Kickelbick, G. Introduction to Hybrid Materials. In Kickelbick, G. (ed.), *Hybrid Materials: Synthesis, Characterization, and Applications*, Weinheim: Wiley-VCH (2006).
4. Loy, D. A. Sol–Gel Processing of Hybrid Organic–Inorganic Materials Based on Polysilsesquioxanes. In Kickelbick, G. (ed.), *Hybrid Materials: Synthesis, Characterization, and Applications*, Weinheim: Wiley-VCH (2006).
5. Wright, J. D., Sommerdijk, N. *Sol-Gel Materials: Their Chemistry and Biological Properties*, London: Taylor & Francis Group (2000).
6. Schubert, U., Hüsing, N., Lorenz, A. Hybrid Inorganic-Organic Materials by Sol-Gel Processing of Organofunctional Metal Alkoxides. *Chem. Mater.* 7 (1995).
7. Brinker, C. J., Scherer, G. W. *Sol-Gel Science: The Physics and Chemistry of Sol-Gel Processing*, London: Academic Press (1990).
8. Gómez-Romero, P., Sanchez, C. (Eds.). *Functional Hybrid Materials*, Weinheim: Wiley-VCH (2004).
9. Haas, K.-H. Hybrid Inorganic-Organic Polymers Based on Organically Modified Si-Alkoxides. *Adv. Eng. Mater.* 2 (2000).
10. Sharp, K. G. Inorganic/Organic Hybrid Materials. *Adv. Mater*., 10 (1998).
11. Kickelbick, G. Concepts for Incorporation of Inorganic Building Blocks into Organic Polymers on a Nanoscale. *Progr. Polym. Sci.* 28 (2003).
12. Hinrichsen, J. Requirements for Care-free Aircraft Structures and Expected Benefits from Hybrid Structures/Materials, SAWE Paper 3387, 65th Annual Conference of Society of Allied Weight Engineers, May 2006, Valencia, CA, USA.
13. Miller, S. G., Meador, S. A. Polymer-Layered Silicate Nanocomposites for Cryotanks Applications. In Proceedings of the 48th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 2007, Honolulu, Hawaii.
14. Fredell, R., Gunnink, J., Bucci, R.J. and Hinrichsen, J. Carefree Hybrid Wing Structures for Aging USAF Transports. In Proceedings of First International Conference on Damage Tolerance of Aircraft Structures, 2007, TU Delft, Netherlands.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

SELF-HEALING MATERIALS – FROM DESIGN TO SPECIFIC APPLICATIONS

Fulga TANASA, Madalina ZANOAGA

"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania

Abstract: *Self-healing materials possess tremendous potential in increasing the longevity of structural materials. Consequently, a large number of academic and industrial research organizations have come forward to explore new concepts in design and synthesis of such materials. Though this field of innovative product research shows high promises, it has some practical limitations in understanding crack healing kinetics and stability of healing functionality. In this paper, different types of healing processes, design strategies and specific applications are reviewed.*

Keywords: *self-healing materials, autonomic process, non-autonomic process, design, applications*

1. INTRODUCTION

All materials, natural or synthetic, are susceptible to natural or artificial degradation. In the case of structural materials, the long-time degradation processes lead to microcracks that cause failure. Thus, repairing is indispensable to enhance reliability and lifetime of materials, especially when hi-tech industrial branches (aerospace and automotive industry, IT and robotics, healthcare, etc.) are involved. Though scientists are inspired by the natural process of blood clotting or repairing of fractured bones, incorporating the same concept into engineering materials is not fully possible due to the complexity of the healing processes in nature [1–4]. Self-healing phenomenon can be defined as the ability of a material to heal (recover/repair) damages, automatically and autonomously, without any external intervention. Many common terms such as self-repairing, autonomic-healing and autonomic-repairing are used to define such a property in materials. Incorporation of self-healing properties in man-made materials very often cannot perform the self-healing action without an external trigger. Based on these considerations, self-healing process can be of the following two types:

- autonomic (without any intervention);
- nonautonomic (needs human intervention or external triggering).

In the following section, the main design strategies for obtaining self-healing materials will be presented, as the most important tool is the concept of material microstructure and the relationship between microstructure and properties, processing, as well as applications.

2. DESIGN STRATEGIES

Materials science, one of the most fascinating and challenging branches of knowledge, is a multidisciplinary science. In understanding and designing materials with properties able to resolve specific tasks, physics, chemistry, engineering are employed.

The different types of materials (plastics, paints, coatings, metals and alloys, etc.) have their own self-healing mechanisms which depend on material microstructure.

The different strategies of designing self-healing materials are as follows: release of healing agent, reversible cross-links, miscellaneous technologies (electrohydrodynamics, conductivity, shape memory effect, nanoparticle migration, co-deposition).

2.1 Release of Healing Agents. Liquid active agents, such as monomers, dyes, catalysts and hardeners contained into microcapsules, hollow fibers or channels, are embedded into polymeric systems during manufacturing stage. In the case of a crack, these reservoirs are ruptured and the reactive agents are poured into the cracks by capillary force where it solidifies in the presence of predispersed catalysts and heals the crack. The propagation of cracks is the major driving force of this process. On the other hand, it requires the stress from the crack to be relieved, which is a major drawback of this process.

Microcapsule Embedment. Microencapsulation is a process of enclosing micron-sized particles of solids, droplets of liquids or gases in an inert shell, which, in turn, isolates and protects them from the external environments [5-7]. Healing agents or catalysts containing microcapsules are used to design self-healing polymer composites. Literature suggests the use of microencapsulated healing agents in a polyester matrix to achieve a self-healing effect. Recently, self-healing capabilities were achieved by embedding encapsulated healing agents into polymer matrix containing dispersed catalysts; i. e., dicyclopentadiene (DCPD) was used as liquid healing agent and Grubbs' catalyst [bis(tricyclohexylphosphine) benzylidine ruthenium (IV) dichloride] as internal chemical trigger, both of them dispersed in an epoxy matrix. The monomer is relatively less expensive and has high longevity and low viscosity [1, 8,9]. Figure 1 shows the self-healing mechanism of encapsulated DCPD and Grubb's catalyst.

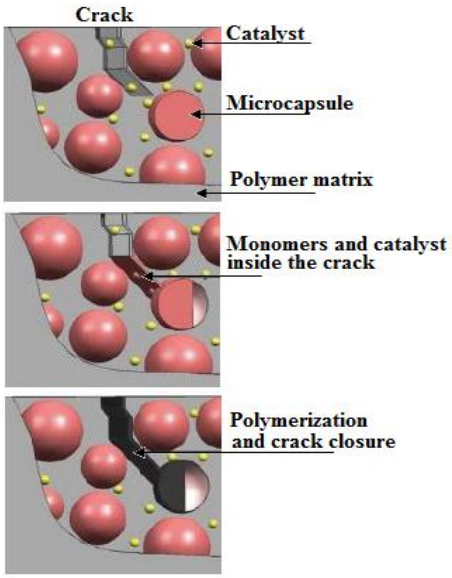


Fig. 1. Self-healing mechanism of the encapsulated DCPD and Grubb's catalyst

It was demonstrated that 75% of the fracture toughness recovery of compared to the original specimen can be achieved. Later, encapsulated catalyst was used instead of encapsulated monomer healing agent [10]. Monomers, such as hydroxyl-functionalized polydimethylsiloxane (HOPDMS) and polydiethyoxysilane (PDES), were added to vinyl ester matrix where they stay as microphase-separated droplets. The polyurethane microcapsules containing the catalyst di-*n*-dibutyltin dilaurate (DBTL) is then dispersed in the matrix. Polydimethylsiloxane (PDMS)-based self-healing elastomers using two different types of microcapsules have been designed [11], and the size of microcapsules on the self-healing efficiency was also investigated [12]. The critical factors that influence the microencapsulation-based self-healing approach to produce an effective self-healing material are summarized in Table 1.

Hollow Fiber Embedment. In order to achieve multiple healing, another type of reservoir that might be able to deliver larger amount of liquid healing agent was developed: capillaries; with only limited success, initially [13]. Later, large diameter capillaries were embedded into resins, but the trials were unsuccessful as well [14]. Smaller hollow glass fibers (Hollex fibers) filled with resin have been also used [15], but they were unable

to deliver the resin into the crack due to the high viscous epoxy resins.

Table. 1. Factors influencing the microencapsulation-based self-healing materials

Parameters	Factors of influence
Micro-capsules	Inertness towards the polymers shell Capsules lifetime Compatibility with the medium Weakness of the shell wall Proximity to the catalyst molecules Interfacial attraction strength between capsules and matrix
Monomers	Low viscosity Low volatility
Polymerization process	Rate of polymerization Stress relaxation Shrinkage Temperature
Catalysts	Solubility in monomer Dispersion
Coatings	Stability of properties upon incorporation of microcapsules Thickness Dispersion Processing
Healing effect	Rate of healing Repetitional

Later, a process to optimize the production of borosilicate hollow glass fibers (with diameters from 30 to 100 μm and hollowness of 55% - Fig. 2) was developed [16] and these fibers were used as containers for liquid healing agents and/or dyes [17].

The release and infiltration healing agent from fractured hollow fibers into the crack plane was also demonstrated.

This approach of offers certain advantages, as follows: higher volume of healing agent is available; different activation methods; visual inspection of the damaged site is feasible; hollow fibers can easily be mixed and tailored with the conventional reinforcing fibers.

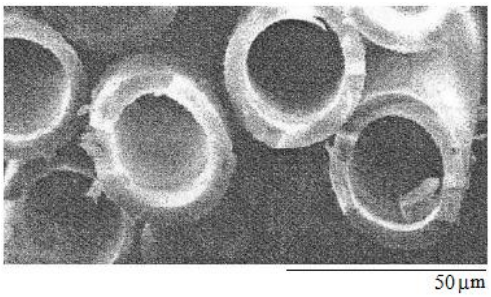


Fig. 2. Hollow fibers

Besides the above advantages, this approach has disadvantages as well: fibers must be broken to release the healing agent; low-viscosity resin must be used to facilitate fiber infiltration; use of hollow glass fibers in carbon fiber-reinforced composites will lead to problems concerning the coefficient of thermal expansion; multistep fabrication.

Microvascular System. This approach relies on a centralized network for distribution of healing agents into polymeric systems in a continuous pathway, in order to overcome the difficulty of short supply of the healing agent [18]. The fabrication process is complex and it is very difficult to achieve synthetic materials with such networks for practical applications.

2.2 Reversible cross-links. Polymeric materials having superior mechanical properties, but showing brittleness and tendency to crack, are usually obtained by cross-linking which is an irreversible process. One approach to bring processability to cross-linked polymers is the introduction of reversible cross-links in polymeric systems [19]. In addition, reversible cross-links also exhibit self-healing properties, but an external trigger, such as thermal, photo- or chemical activation) is needed. Thus, these systems show non-autonomic healing behaviour.

Diels–Alder (DA) and Retro-DA Reactions. Major classes of thermally reversible polymers are made using Diels–Alder (DA) reactions. Examples of this category include low temperature cross-linking of furanic polymers with maleimide or polymers containing maleimide pendants. Retro-DA reactions occur at elevated temperatures, evolve by debonding the chemical linkages of formed networks and yield in reversing the cross-linking process [20].

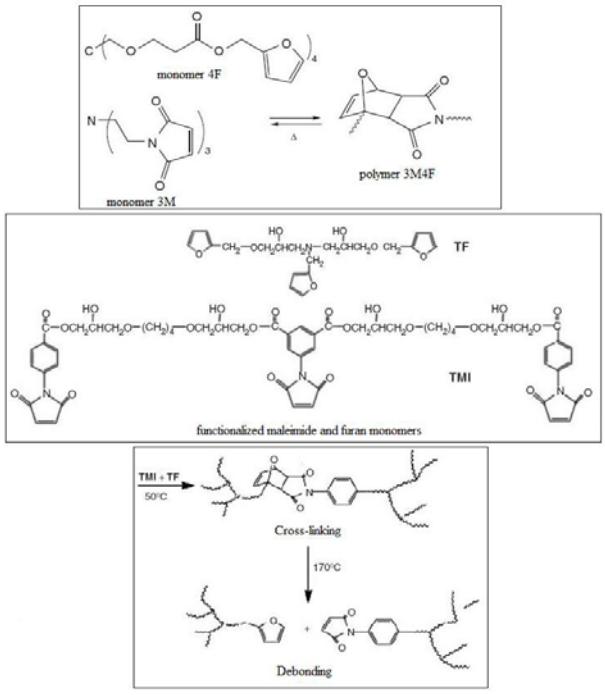


Fig. 3. Typical DA reactions

The [4+2] cycloadditions are the most studied thermally controlled covalent bond formation reactions. The first polymer where this strategy to design thermally remendable polymers was used is the polymer 3M4F, made of a multi-diene (4 furan moieties, 4F) and a multi-dienophile (3 maleimide moieties, 3M) [20], showing a strength recovery of 53-83%.

Modified polyamides having various amounts of maleimide and furan pendant groups have been used to obtain self-healing materials using DA and retro-DA reactions [21], but the prepared adduct does not show complete repairing of the cracks due to the low mobility of high molecular polyamide chains.

For the first time, the light-induced crack healing by the [2+2] photochemical cycloaddition of cinnamoyl groups has been reported [22]. The photochemical healing is very fast and does not require catalysts, additives or heat treatments.

Ionomers. Ionomers are a special class of polymeric materials that contain a hydrocarbon backbone and pendent acid groups, which are partially or fully neutralized to form salts. The polar ionic groups tend to aggregate as a result of electrostatic interactions, despite the opposing tendency of the chain elastic forces. The presence of ionic groups and their interactions produce physical reversible cross-links. As ionomers are not thermosetting materials, they can be processed like thermoplastics. The unique combination of physical properties and processability made this class of polymers fit to be used in food packaging, membrane separation, roofing materials, automobile parts, golf ball covers, coatings and, due to the reversible nature of ionic bonds, in designing of self-healing polymeric systems [23,24].

Supramolecular Polymers. Recently, low molar mass monomers are assembled together by reversible noncovalent interactions to obtain polymer-like rheological or mechanical properties [25-28]. Since noncovalent interactions can be reversibly broken and subjected to the thermodynamic equilibrium, these special materials, supramolecular polymers, show additional features (environment depending switch properties, improved processability, self-healing behaviour, etc.) compared to usual polymers. Some examples of supramolecular polymers (main- and side-chain types) are shown in Figure 4.

Different types of assembly forces, such as metal–ligand, hydrophobic, electrostatic and π–π interactions, as well as hydrogen bonding, are used to design supramolecular polymers. Hydrogen bonding is the most popular route of achieving supramolecular polymers. The main challenge in this approach is to find the right balance between the association constant and a reversible system. The higher the association constant, the lesser is the reversible interaction. In contrast, the lower the

association constant, the better the reversibility, but smaller assemblies and poor mechanical properties.

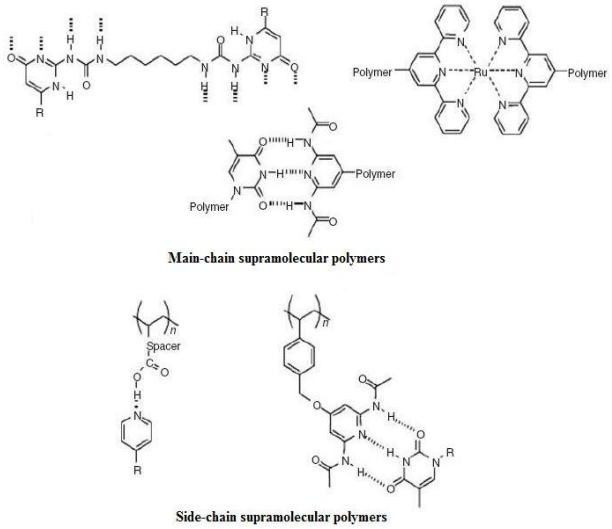


Fig. 4. Different types of supramolecular polymers

2.3 Miscellaneous Technologies. These emerging technologies, other than the most important design approaches already described, are presented herein.

Electrohydrodynamics. In this approach, the blood clotting process was mimicked *via* colloidal particle aggregation at the defected site, using the principle of electrohydrodynamics (EHD) flow, in order to design self-healing materials. The aggregation of particles is not sufficient to heal the defects as the voids between colloidal particles prevent formation of a dense surface.

A series of self-healing structural composites with electromagnetic functionality was also reported [29]. The self-healing effect is achieved through the contribution of all components, such as thermoreversible polymers, reinforcing fibers, and electromagnetic wires. In example, when fibers having negative CTE (coefficient of thermal expansion) is used to fill the core of the braid or fill in the weave of laminate, it will contract upon heating.

Conductivity. The tunable conductivities in polymeric materials can offer information on the structural integrity through electronic feedback that might give an insight to the most challenging task of detecting and quantifying microcracks. Thus, materials having conductivity, as well as self-healing capability, might be advantageous especially in deep sea or space applications. The conductivity, on the other hand, can also be used for inducing self-healing properties in polymeric systems.

Organometallic polymers based on *N*-heterocyclic carbenes and transition metals have been used to design electrically conductive self-healing materials [30]. These polymers exhibit structurally dynamic characteristics in the solid state and have good processability. When a microcrack is formed in a system, it decreases the number of electron percolation pathways and, thereby, an increase in electrical resistance.

Shape Memory Effect. Certain strongly ordered systems (alloys, ceramics, polymeric materials) show the shape memory effect, associated with self-healing properties, through different mechanisms [31].

Nanoparticle Migrations. It was demonstrated that nanoparticles suspended into a polymer fluid can segregate into cracks due to the polymer-induced depletion attraction between the particles and the surface [32]. The morphology obtained from the molecular dynamics simulations was used in a lattice spring model to determine the self-healing efficiency. The model predicts restoration of mechanical properties up to 75–100%. Self-healing materials based on this approach are yet to be demonstrated. Incorporation of nanoparticles into polymeric systems has advantages: it increases the

mechanical strength of the system and also segregates to the crack surface. Carbon nanotube is a potential candidate for developing self-healing materials based on this approach due to its superior mechanical properties compared to other particles.

Co-deposition. Electrolytic co-deposition can also be employed to design self-healing anticorrosive coatings. Microcapsules containing corrosion inhibitors can be added to composite plating coatings by this method [33].

3. APPLICATIONS AND CONCLUDING REMARKS

Currently, the self-healing materials development is enabled by the numerous research directions, so these materials will continue to find use in various applications, most of them in industry. Nowadays, the developed applications are mainly in the automotive, aerospace and building industries.

For example, Nissan Motor Co. Ltd has commercialized world's first self-healing clear coat for car surfaces, the "Scratch Guard Coat". This hydrophobic paint repairs scratches; depending on the depth of the scratch and the temperature in the surrounding environment, the entire recovery occurs between 1 and 7 days.

Another example in this category is the two component polyurethane clear coats from Bayer Material Science, Desmodur and Desmophen. This coating heals small scratches under the influence of heat (sunlight) and the principle employed to design such coatings is the use of dense polymer networks with flexible linkages.

The other industrial segment where applications of self-healing materials are foreseen is the aviation and space industry. Use of composites in aircrafts has grown significantly in the past years. Hollow fibers reinforced composites are a valid solution to recover cracking or damages. Self-healing polymers have also found uses in space applications.

Self-healing materials possess tremendous potential in increasing the longevity of structural materials. Consequently, a large number of academic and industrial research organizations have come forward to explore new concepts in this field. Though promising, the field of self-healing materials has some practical limitations in understanding crack healing kinetics and stability of healing functionality. Thus, the main challenge of self-healing material development is the autonomic detection of cracks and its subsequent healing.

The available technologies to design self-healing materials are not cost effective. This limits the wide use of these materials for different commercial applications. In future, new design strategies and technologies that will enable the possibility of using self-healing materials in our day-to-day life can be expected.

REFERENCES

1. Ghosh, S.K. (editor). *Self-healing Materials: Fundamentals, Design strategies and Applications.* Weinheim: Wiley-VCH (2009).
2. Fratzl, P., Weinkamer, R.. Hierarchical structure and repair of bone: deformation, remodeling, healing. In van der Zwaag S. (ed), *Self Healing Materials. An Alternative Approach to 20 Centuries of Materials Science*, Dordrecht: Springer (2007).
3. Vermolen, F.J., van Rossum, W.G., Javierre, E., Adam, J.A.. Modelling of Self Healing of Skin Tissue. In van der Zwaag S. (ed), *Self Healing Materials. An Alternative Approach to 20 Centuries of Materials Science*, Dordrecht: Springer (2007).
4. Kessler, M.R.. Self-healing: a new paradigm in materials design. *Proceedings of the Institution of Mechanical Engineers Part G-Journal of Aerospace Engineering*, 221 (2007).
5. Thies, C.. Microencapsulation. In Kroschwitz, J.I. (editor-in-chief) *Encyclopedia of Polymer Science and Engineering*, vol. 9, New York: John Wiley & Sons, Inc. (1987).
6. Benita, S.. *Microencapsulation: Methods and Industrial Applications*, New York: Marcel Dekker (1996).

7. Arshady, R.. *Microspheres, Microcapsules and Liposomes*, London: Citrus Books, (1999).
8. Shansky, E.. *Synthesis and Characterization of Microcapsules for Self-healing Materials*, Dept. of Chemistry, Indiana University, Bllomington (2006).
9. Tillner, S., Mock, U.. Korrosionsschutz - Mikrokapseln kitten Risse. *Farbe Und Lack*, 10 (2007).
10. Cho, S.H., Andersson, H.M., White, S.R., Sottos, N.R., Braun, P.V.. Poly-dimethylsiloxane-Based Self-Healing Materials. *Advanced Materials* 18 (2006).
11. Keller, M.W., White, S.R., Sottos, N.R.. An elastomeric self-healing material. In *Proceedings of the 2006 SEM Annual Conference and Exposition on Experimental and Applied Mechanics*, Society for Experimental Mechanics 1 (2006).
12. Rule, J.D., Sottos, N.R., White, S.R.. Effect of microcapsule size on the performance of self-healing polymers. *Polymer* 48 (2007).
13. Dry, C.M., McMillan, W.. Crack and damage assessment in concrete and polymer matrices using liquids released internally from hollow optical fibers. In *Procs of SPIE – Intl Society for Optical Engineering*. 2718 (1996).
14. Motuku, M., Vaidya, U.K., Janowski, G.M.. Parametric studies on self-repairing approaches for resin infused composites subjected to low velocity impact. *Smart Materials and Structures*. 8 (1999).
15. Bleay, S.M., Loader, C.B., Hawyes, V.J., Humberstone, L., Curtis, V.A.. Smart Repair System for Polymer Matrix Composites. *Composites A, Applied Science Manufacturing*. 32 (2001).
16. Hucker, M., Bond, I., Foreman, A., Hudd, J.. Optimisation of hollow glass fibres and their composites. *Advanced Composites Letters*. 8 (4) (1999).
17. Williams, H.R., Trask, R.S., Bond, I.P.. Vascular Self-Healing Composite Sandwich Structures. In The 15th US National Congress of Theoretical and Applied Mechanics. Boulder, Colorado, USA (2006).
18. Toohey, K.S., Sottos, N.R., Lewis, J.A., Moore, J.S., White, S.R.. Self-healing materials with microvascular networks. *Nature Materials*. 6 (2007).
19. Bergman, S.D., Wudl, F.. Remendable polymers. In van der Zwaag S. (ed), *Self Healing Materials. An Alternative Approach to 20 Centuries of Materials Science*, Dordrecht: Springer (2007).
20. Chen, X., Dam, A., Ono, K., Mal, A., Shen, H., Nutt, S.R., Sheran, K., Wudl, F.A.. Thermally Re-mendable Cross-Linked Polymeric Material. *Science*. 295 (2002).
21. Liu, Y.-L., Chen, Yi.-W.. Thermally Reversible Cross-Linked Polyamides with High Toughness and Self-Repairing Ability from Maleimide- and Furan-Functionalized Aromatic Polyamides. *Macromolecular Chemistry and Physics*. 208 (2007).
22. Chung, C.-M., Roh, Y.-S., Cho, S.-Y., Kim, J.-G.. Crack healing in polymeric materials via photochemical [2+2] cycloaddition. *Chemistry of Materials*. 16 (2004).
23. Kalista, S.J. Jr.. Self-healing of thermoplastic poly(ethylene-co-methacrylic acid) copolymers following projectile puncture. Master Thesis. Virginia Polytechnic Institute and State University, Blacksburg, Virginia (2003).
24. Sun, C.X., van der Mee, M.A.J., Goossens, J.G.P., van Duin, M.. Thermoreversible cross-linking of maleated ethylene/

propylene copolymers using hydrogen bonding and ionic interactions. *Macromolecules*. 39(2006).
25. Bouteiller, L.. Assembly via hydrogen bonds of low molar mass compounds into supramolecular polymers. *Advances in Polymer Science.* 207 (2007).
26. Lehn, J.M.. Supramolecular polymer chemistry—scope and perspectives. *Polymer International*. 51 (2002).
27. Weck, M.. Side-chain functionalized supramolecular polymers. *Polymer International*. 56 (2007).
28. Shimizu, L.S.. Perspectives on main-chain hydrogen bonded supramolecular polymers. *Polymer International*. 56 (2007).
29. Plaisted, T.A., Amirkhizi, A.V., Arbelaez, D., Nemat-Nasser, S.C., Nemat-Nasser, S.. Self-healing structural composites with electromagnetic functionality. In Proceedings of Symposium on Industrial and Commercial Applications of Smart Structures Technologies, SPIE's 10th Annual International Conference on Smart Structures and Materials. Vol. 5054 (2003).
30. Williams, K.A., Boydston, A.J., Bielawski, C.W.. Towards electrically conductive self-healing materials. *Journal of the Royal Society of Interface*. 4 (2007).
31. Otsuka, K., Wayman, C.M. (editors). *Shape Memory Materials*, Cambridge: Cambridge University Press (1998).
32. Balazs, A.C., Emrick, T., Russell, T.P.. Nanoparticle polymer composites: where two small worlds meets. *Science*. 314 (2006).
33. Liqun, Z. Electrolytic co-deposition of polymer-encapsulated (microencapsulated) particles. In Ghosh, S.K. (editor) *Functional Coatings by Polymer Microencapsulation*. Weinheim: Wiley-VCH Verlag GmbH (2006).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

AIRCRAFT JET ENGINE EXHAUST NOZZLE HYDROMECHANICAL AUTOMATIC CONTROL SYSTEM

Alexandru Nicolae TUDOSIE

Electrical, Power Systems and Aerospace Engineering Department, University of Craiova, Romania

Abstract: *The paper deals with a hydro-mechanical automatic control system for an aircraft engine exhaust nozzle. The author identifies the system's operational behavior and establishes the motion equations, which determines the non-linear mathematical model. After its linearization and an appropriate system modification, as well as after Laplace transformation applying, one has obtained the linear non-dimensional equation system; based on it, system's block diagram and transfer functions were determined. Equation system's co-efficient were estimated based on some previous experimental determinations made by the author for a VK-1-type jet engine, as well as based on some literature existing data. One has also performed some studies concerning system's stability and some simulations (system's step input time response) in order to establish system's quality. The established simplified mathematical model, as well as the conclusions, may be useful for further similar studies.*

Keywords: *jet engine, exhaust, nozzle, control, hydraulic, actuator, model*

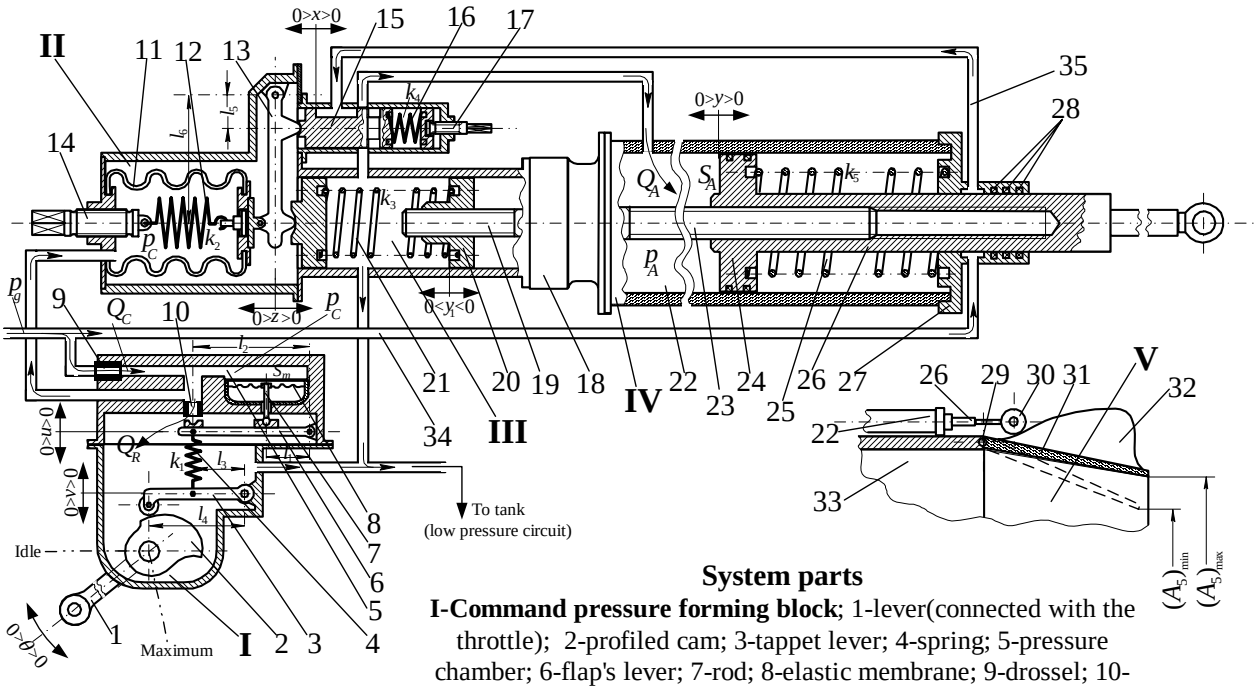
1. INTRODUCTION

Aircraft engine's exhaust nozzle is one of its most important parts, being the one responsible of the hot gases jet forming (even for some engine's thrust vectoring). Nowadays modern engines have variable-area nozzles, their area A_5 being an important control parameter during the engine operation.

Exhaust nozzle's gas-dynamic behavior and characteristics are described in [5,6,9]; meanwhile, nozzles description as controlled object is presented in [3,10]. Some possibilities for the nozzle's exhaust area automatic control (based on mechanical and/or electro-mechanical follower systems) were presented in [3,9] and, by the author, in [2,4]. Nozzle's exhaust area must be commanded with respect to some other control parameters, such as injection fuel flow rate, turbine's (or compressor's) pressure ratio, engine's speed, throttle's position etc.

The purpose of this paper is to identify the nozzle's opening system in fig. 1 as a controlled object, by describing it through its mathematical model, as well as through its transfer function and by performing some stability and quality studies, which can be further extended for a whole class of similar systems, or can be used for other specific engine control embedded systems studies.

The system in figure 1 consists of the following main parts: I-command pressure signal forming block; II-slide-valve command block; III-position transducer (feed-back); IV-hydraulic actuator; V- exhaust nozzle with mobile flaps.



System parts

I-Command pressure forming block; 1-lever(connected with the throttle); 2-profiled cam; 3-tappet lever; 4-spring; 5-pressure chamber; 6-flap's lever; 7-rod; 8-elastic membrane; 9-drossel; 10-nozzle drossel; II-Slide-valve's command block; 11-silphon; 12-silphon's spring; 13-slide-valve's lever; 14-adjusting bolt;15-slide-valve; 16-slide-valve's spring; 17-adjusting bolt; **III-Position transducer**; 18-planetary reducing gear; 19-screw with thread on the left; 20-nut; 21-transducer's spring; **IV-actuator**; 22-hydraulic cylinder; 23-screw with thread on the right; 24-piston with nut; 25-actuator's spring; 26-actuator's rod; 27-lid; 28-sealing rings; **V-exhaust nozzle**; 29-knuckle; 30-pressing roll; 31-volet (flap); 32-profiled contour; 33-exhaust tube; 34,35-supplying pipes;

Figure 1. System constructive and operating scheme

As fig. 1 shows, the system works with respect to the throttle's position (through the 1-lever rotation angle θ); nozzle's flaps outer contours (32) are profiled, so the actuator's rod (26) displacement presses the 30-roll on this contour, determining nozzle flaps' positioning. Consequently, nozzle's exhaust area A_5 is determined by the throttles position, so this system is a follower one. Nozzle's opening command law $A_5 = A_5(\theta)$ is given by the 2-cam profile, cam connected to the 1-lever. System's hydraulic actuator has one active chamber A, its rod position being established by the balance between the pressure force in chamber A and the 25-spring's elastic force. The active pressure p_A is determined by the 15-slide-valve's position *x*, which itself is the result of a force balance (the pressure force of the silphon 12, given by the command hydraulic pressure p_C and the actuator's position transducer 21-spring's elastic force).

System's supply is assured by a hydraulic pump (which belongs to the aircraft or to the engine). Consequently, hydraulic fluid's flow rate and pressure are given by the pump's speed, therefore system supplying hydraulic pressure p_g is usually assured by a constant pressure valve mounted after the pump

According to these observations, one can affirm that exhaust area A_5 depends on the actuator's rod displacement y, which itself depends on the throttle's angle θ and on the supplying pressure p_g

$$A_5 = A_5(y); y = y(\theta, p_g). \quad (1)$$

2. SYSTEM MATHEMATICAL MODEL

The studied system's mathematical model consists of the motion equation for each of its parts. The non-linear equation will be transformed, in order to bring them to an acceptable form for further studies, as well as for simulations.

2.1 Non-linear mathematical model

The system non-linear motion equations are the following:

a) command pressure forming block

$$v = v(\theta), \tag{2}$$

$$k_1\left(u + \frac{l_3}{l_4}v\right)l_2 = p_C S_m l_1, \tag{3}$$

$$Q_C = \mu_g \frac{\pi d_g^2}{4}\sqrt{\frac{2}{\rho}}\sqrt{p_g - p_C}\,, \tag{4}$$

$$Q_R = \mu\ \pi d_s u\sqrt{\frac{2}{\rho}}\sqrt{p_C}\,, \tag{5}$$

$$Q_C - Q_R = \beta V_{C0}\frac{\mathrm{d}p_C}{\mathrm{d}t} + S_m\frac{\mathrm{d}}{\mathrm{d}t}\left(\frac{l_1}{l_2}u\right), \tag{6}$$

b) slide-valve command block

$$[S_C p_C - k_2(z + z_r)].l_6 - k_2(z + y_1).l_6 = \\ = l_5 k_4(x + x_r), \tag{7}$$

$$x = \frac{l_5}{l_6}z\,, \tag{8}$$

c) actuator's rod displacement transducer

$$y_1 = i_{tr}y;, \tag{8}$$

d) actuator

$$Q_A = \mu_b b x\sqrt{\frac{2}{\rho}}\sqrt{p_g - p_A}\,, \tag{9}$$

$$Q_A = \beta V_{A0}\frac{\mathrm{d}p_A}{\mathrm{d}t} + S_A\frac{\mathrm{d}y}{\mathrm{d}t}, \tag{10}$$

$$S_A p_A = m_p\frac{\mathrm{d}^2(y + y_s)}{\mathrm{d}t^2} + \xi\frac{\mathrm{d}(y + y_s)}{\mathrm{d}t} + \\ + k_5(y + y_s), \tag{11}$$

where v is the 3-lever displacement, depending on 2-cam's profile; u – nozzle-flap system's 6-lever displacement; $l_1, l_2, l_3, l_4, l_5, l_5$ – levers' arms' length; S_m – membrane 8 surface area; Q_C, Q_R – hydraulic fluid flow rates from/into the command pressure forming block; μ_g, μ, μ_b – flow rate co-efficient; ρ – fluid's density; β – compressibility co-efficient; d_g, d_s – drossels (9 and 10) diameters; k_1, k_2, k_3, k_4, k_5 – springs' elastic constants; V_{C0} – 11-silphon's volume; S_C – 11-silphon's lid surface area; z – 13-lever displacement; z_r – pre-tensioning displacement of the 12-spring; x_r – pre-tensioning displacement of the 16-spring; i_{tr} – 18-gear reduction ratio; y_1 – transducer's piston's displacement; S_A – actuator piston surface area; m_p – piston mass; ξ – friction co-efficient; V_{A0} – actuator active chambers volume; b – slide-valve slot width; y_s – instant piston's position.

The above determined non-linear equation system (equations (2) to (11)) is difficult to be used for further studies, so it can be brought to a linear form, using the small perturbation method, considering formally any variable or parameter X as

$$X = X_0 + \Delta X, \tag{12}$$

where X_0 – steady state regime's value, ΔX – parameter's deviation and $\overline{X} = \frac{\Delta X}{X_0}$ the non-dimensional deviation.

2.2 Non-dimensional linearised model

In order to determine a linearised form for the above equation system, one has to identify the main parameters, which are $\theta, v, u, z, x, y, y_1, Q_C, Q_R, Q_A, p_C, p_A, p_g$. The displacements x_r, z_r (representing the adjustments made during the ground testing period), has no relevance for the system dynamic behavior, so they are excluded.

Expressing each one of them as in eq. (12) and introducing them into the equation system, after eliminating the terms containing the

steady state regime, one obtains the system's linear form.

Using some appropriate chosen amplifying terms, the linearised mathematical model can be transformed in a non-dimensional one; after applying the Laplace transformation, one obtains the system's linear non-dimensional mathematical model, as follows

$$\bar{v} = k_\theta \bar{\theta}, \tag{13}$$

$$\bar{u} = k_{uc}\bar{p}_C - k_{uv}\bar{v}, \tag{14}$$

$$(\tau_C \mathrm{s}+1)\bar{p}_C = k_u(\tau_u \mathrm{s}+1) - k_{gp}\bar{p}_g, \tag{15}$$

$$\bar{x} = k_{xc}\bar{p}_C - k_{xy}\bar{y}, \tag{16}$$

$$(\tau_A \mathrm{s}+1)\bar{p}_A = k_{gA}\bar{p}_g + k_x\bar{x} - \tau_y \mathrm{s}\bar{y}, \tag{17}$$

$$\bar{y} = \frac{k_{yA}}{T_y^2 \mathrm{s}^2 + 2\omega_0 T_y \mathrm{s} + 1}\bar{p}_A, \tag{18}$$

together with $\bar{A}_5 = k_{5y}\bar{y}$, where the involved co-efficient are

$$k_\theta = \frac{\theta_0}{v_0}\left(\frac{\partial v}{\partial \theta}\right)_0,\ k_{cg} = \frac{\mu_g \pi d_g p_{g0}}{4Q_{C0}\sqrt{2\rho(p_{g0}-p_{C0})}},$$

$$k_{uc} = \frac{S_m l_1 p_{C0}}{k_1 l_2 u_0},\ k_{CC} = \frac{\mu_g \pi d_g^2 p_{g0}}{4Q_{C0}\sqrt{2\rho(p_{g0}-p_{C0})}},$$

$$k_{uv} = \frac{l_3 v_0}{l_4 u_0},\ k_{Rc} = \frac{\mu\pi d_s\sqrt{p_{C0}}}{Q_{C0}\sqrt{2\rho}},\ \tau_A = \frac{\beta V_{A0} p_{A0}}{Q_{A0} k_{AA}}$$

$$k_{Ru} = \frac{\mu\pi d_s u_0\sqrt{2p_{C0}}}{Q_{C0}\sqrt{\rho}},\ \tau_{cc} = \frac{\beta V_{C0} p_{C0}}{Q_{C0}},$$

$$k_{CRC} = k_{CC} + k_{Rc},\ \tau_{uc} = \frac{S_m u_0 l_1}{Q_{C0} l_2},\ \tau_y = \frac{S_A y_0}{k_{AA} Q_{A0}},$$

$$k_{xz} = \frac{z_0 l_6 (k_2+k_3)}{k_4 x_0 l_5},\ k_{xy} = \frac{y_0 l_6 k_3 i_{tr}}{k_4 x_0 l_5}, \tag{19}$$

$$k_{Ag} = \frac{\mu_b b x_0 p_{g0}}{Q_{A0}\sqrt{2\rho(p_{g0}-p_{A0})}},\ k_{xC} = \frac{S_C p_{C0} l_6}{k_4 x_0 l_5},$$

$$k_{AA} = \frac{\mu_b b x_0 p_{A0}}{Q_{A0}\sqrt{2\rho(p_{g0}-p_{A0})}},\ k_{Ay} = \frac{S_A p_{A0}}{k_5 y_0},$$

$$k_{gA} = \frac{k_{Ag}}{k_{AA}}, k_{xA} = \frac{k_{Ax}}{k_{AA}}, k_x = \frac{1}{1+k_{xz}}.$$

Based on some practical observation, one can make some supplementary hypothesis, as follows: a) the fuel is a non-compressible fluid ($\beta = 0$), so the terms containing it become null ($\tau_A = \ = \tau_C = 0$); b) the inertial effects are very small, so the term containing m_p could be considered also null. Consequently, eqs. (15) and (17) become

$$\bar{p}_C = k_u(\tau_u \mathrm{s}+1) - k_{gp}\bar{p}_g, \tag{20}$$

$$\bar{p}_A = k_{gA}\bar{p}_g + k_x\bar{x} - \tau_y \mathrm{s}\bar{y}. \tag{21}$$

Based on the simplified model, one can build the system's block diagram with transfer functions, which is depicted in figure 2.

2.3 System transfer function

As fig. 2 shows, the system has two inputs ($\bar{\theta}$ and $\bar{p}_g$) and a single output ($\bar{y}$). Using the above-determined mathematical model's equations, one can obtain an equivalent form:

$$\bar{y} = \frac{(\tau_{u\theta}\mathrm{s}+\rho_\theta)\bar{\theta} + (\tau_{ug}\mathrm{s}+\rho_g)\bar{p}_g}{(\tau_{yA}\mathrm{s}+1)(\tau_{uA}\mathrm{s}+1)}, \tag{22}$$

where

$$\tau_{yA} = \frac{k_{yA}\tau_y + \frac{\xi}{k_5}}{1+k_{yA}k_x k_{xy}},\ \tau_{uA} = \frac{k_u k_{uc}\tau_u}{k_u k_{uc}-1},$$

$$\tau_{u\theta} = \frac{k_{yA}k_x k_{xc} k_u k_{uv} k_\theta \tau_u}{(k_u k_{uc}-1)(1+k_{yA}k_x k_{xy})},$$

$$\rho_\theta = \frac{k_\theta - k_{yA}k_{gA}k_x k_{xc} k_{uc} k_{uv}}{(k_u k_{uc}-1)(1+k_{yA}k_x k_{xy})}, \tag{23}$$

$$\tau_{ug} = \frac{k_{yA}k_{gA}k_u k_{uc}\tau_u}{(k_u k_{uc}-1)(1+k_{yA}k_x k_{xy})},$$

$$\rho_g = \frac{k_{yA}k_{gA}(k_u k_{uc} - 1) + k_{yA}k_x k_{xc}k_{gp}}{(k_u k_{uc} - 1)(1 + k_{yA}k_x k_{xy})}.$$

It results two transfer functions:

a) with respect to the throttle's position

$$H_\theta(s) = \frac{\tau_{u\theta}s + \rho_\theta}{(\tau_{yA}s + 1)(\tau_{uA}s + 1)}, \qquad (24)$$

b) with respect to the supplying pressure

$$H_g(s) = \frac{\tau_{ug}s + \rho_g}{(\tau_{yA}s + 1)(\tau_{uA}s + 1)}. \qquad (25)$$

Usually, the supply pressure p_g can be assumed as constant, because it is assured by a hydraulic pump (spinned up by the engine's rotor) and a constant pressure valve. Consequently, one can assume that $\bar{p}_g = 0$, which means that only the first transfer function, $H_\theta(s)$, becomes relevant.

3. SYSTEM STABILITY AND QUALITY

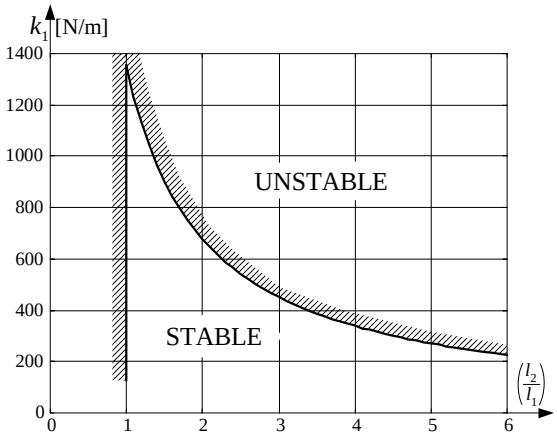


Figure 3. System's stability domain

Transfer functions (24) and (25) have their characteristic polynomial $(\tau_{yA}s+1)(\tau_{uA}s+1)$ of second order; furthermore, one can observe that, as long as τ_{yA} and τ_{uA} are strictly positives, the characteristic polynomial has real negative roots, that means that the system is a stabile one.

While τ_{yA} is always positive, because all the factors involved in its formula (see eq.(23)) are strictly positives, the other time constant τ_{uA} should be studied, because of its denominator. Consequently, the condition that τ_{uA} were positive is

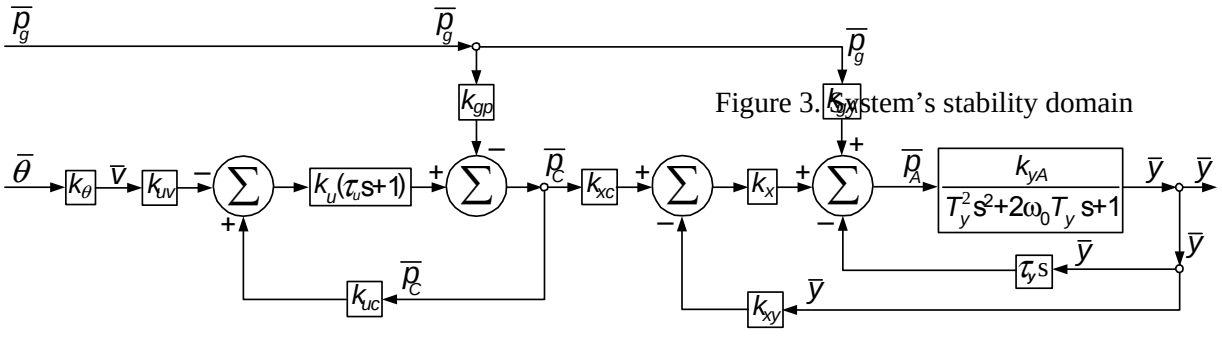


Figure 2. System block diagram with transfer functions

$$k_u k_{uc} - 1 > 0. \quad (26)$$

Based on the expressions (19) for k_u and k_{uc}, one obtains (27)

$$\frac{8\mu d_s p_{C0}\sqrt{p_{g0}-p_{C0}}}{\mu d_g^2\sqrt{p_{C0}}+4\mu_s d_s u_0\sqrt{p_{g0}-p_{C0}}}\cdot\left(\frac{l_1}{l_2}\right)\frac{1}{k_1}>1,$$

which leads to a relation between the command pressure forming block's 4-spring elastic constant k_1 and the 6-lever arms' ratio. So, one can choose the elastic constant with respect to the lever arms ratio in order to obtain system's stability. Figure 3 shows the co-relation between those two parameters, as well as the stability/instability domains limits.

Regarding system's quality, one has performed some simulations (based on the block diagram in fig. 2), studying system's step response (more precisely: system response for step input of a single input parameter, $\bar{\theta}$, respectively for both input parameters $\bar{\theta}$ and $\bar{p}_g$). For the co-efficient presented in (19)-formulas calculation one has considered data from a VK-1F jet engine. One has obtained a particular form for eq. (22) and, considering also the co-relation to $\bar{A}_5$ [2], it has resulted as follows

$$\bar{A}_5(t)=\frac{0{,}0712\times(0{,}0422s+0{,}1025)}{(0{,}1474s+1)(0{,}6376s+1)}\bar{\theta}(t)+ \\ +\frac{0{,}0453\times(0{,}0198s+0{,}2556)}{(0{,}1474s+1)(0{,}6376s+1)}\bar{p}_g(t). \quad (28)$$

System step response for a single input parameter is depicted in figure 4 and for two input parameters – in figure 5. As output parameters one has considered, obviously, the actuator's rod displacement $\bar{y}$, but also the command pressure $\bar{p}_C$.

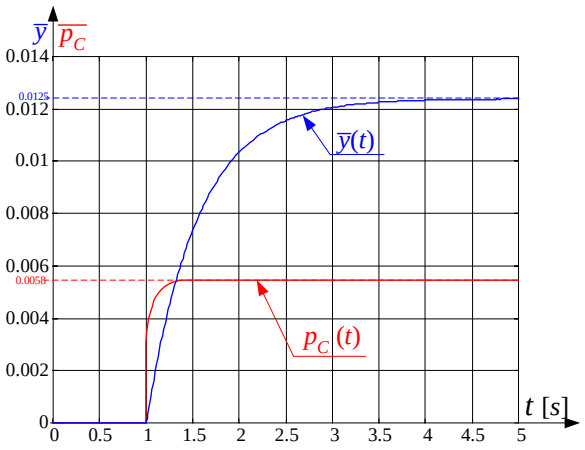


Figure 4. System's step response for $\bar{\theta}$ input

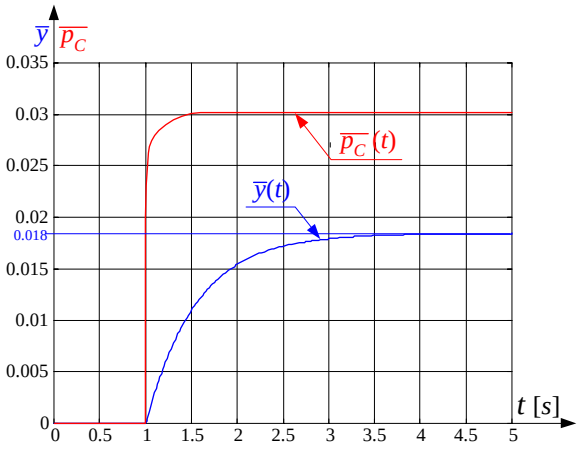


Figure 5. Step response for $\bar{\theta}$ and $\bar{p}_g$ inputs

4. CONCLUSIONS

The studied hydro-mechanical exhaust nozzle's opening system is a second order control system, as its transfer function shows.

Transfer functions characteristic polynomial has two real roots, one strictly negative, the other one negative under an explicit condition (see eq. (26)), which determines both a relation between the k_1 spring elastic constant and the lever arms ratio (27), and the stability domains too.

System's quality studies reveal an aperiodic stability for both analyzed situation and for both output parameters. The system is a static one, its stabilization being fulfilled with static error.

One can observe that rod's displacement parameter $\bar{y}$ stabilizes itself in 2.5…3 seconds, with a static error of 1.25% (for a single input) until 1.8% (for two inputs). Command pressure's parameter $\bar{p}_C$ is more rapid, stabilizing in 0.5 seconds, with a static error between 0.58% (for a single input) and 3.0% (for two inputs).

The influence of the throttle displacement parameter $\bar{\theta}$ above the rod's displacement parameter is bigger than supply pressure's

parameter $\bar{p}_g$ influence. Obviously, pressure's parameter $\bar{p}_g$ influence above the command pressure $\bar{p}_C$ parameter is bigger, as the step responses diagrams reveals.

Formulas (22) for $\bar{y}$ and (28) for $\bar{A}_5$ may be considered the simplified mathematical model for the above described system and can be used for further studies involving embedded engine control systems where such an exhaust nozzle control system (or similar) is used.

REFERENCES

1. Abraham, R. H., *Complex dynamical systems*. Santa Cruz, California, USA: Aerial Press (1986).
2. Aron, I., Tudosie, A., Jet Engine Exhaust Nozzle's Automatic Control System. *Proceedings of the 17th International Symposium on Naval and Marine Education.* Issue (2001).
3. Lungu, R., *Flight Apparatus Automation*. Universitaria, Craiova, (2000).
4. Lungu, R., Tudosie, A., Corcau, J. Automatic control system for the exhaust nozzle flaps positioning. *Constructia de masini*, Bucharest: Issue (2001).
5. Mattingly, J. D., *Elements of Gas Turbine Propulsion*. New York, USA: McGraw Hill (1996).
6. Pimsner, V., *Air-breathing Jet Engines. Processes and Characteristics*. Bucharest, Romania: Didactic and Pedagogic Publishing (1983).
7. Stoenciu D., *Aircraft Engine Automation. Aircraft Engines as Controlled Objects*. Bucharest: Military Technical Academy Inprint (1977).
8. Stoenciu D., *Aircraft Engine Automation. Catalog of Automation Schemes*. Bucharest: Military Technical Academy Inprint (1986).
9. Stoicescu M., Rotaru, C., *Turbo-Jet Engines. Characteristics and Control Methods*. Bucharest: Military Technical Academy Inprint (1999).
10. Tudosie, A. N., *Aerospace Propulsion Systems Automation*. Craiova: University of Craiova Inprint (2005).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

CONTROL SYSTEM FOR A SINGLE SPOOL JET ENGINE WITH VARIABLE-AREA EXHAUST NOZZLE

Alexandru Nicolae TUDOSIE*, Constantin Lucian SEPCU*

*Electrical, Power Systems and Aerospace Engineering Department, University of Craiova, Romania

Abstract: *This paper presents an aircraft single-spool jet engine with variable-area exhaust nozzle as controlled object. The authors have identified a possible control structure based on two input parameters (fuel flow rate Q_c and nozzle's exhaust area A_5), respectively two output parameters (speed n and combustor gas temperature T_3^*). One has defined an engine control system structure and one has also established its mathematical model, based on some previous contributions and experimental works (having as subject a VK-1-type jet engine). Some simulations, concerning engine's step input response, were performed, in order to establish engine's quality. The employed method and some of the obtained results could be extended for further studies (such as twin spool jet engines, or jet engines with afterburning).*

Keywords: *jet engine, spool, nozzle, control, model, speed, temperature.*

1. INTRODUCTION

The engines for modern aircraft, especially the ones for combat aircraft, must assure high level of thrust, low time response and maneuverability. For an engine high thrust level, there are necessary high compressors pressure ratios π_c^*, high combustor burned gas temperatures T_3^*, as well as alternative thrust augmentation methods (such as afterburning, compressor or combustor water injection).

Aircraft jet engines as controlled objects are studied in [7,9,10], where the authors have identified, amongst a multitude of parameters, possible control parameters (inputs), possible controlled parameters (outputs), as well as theoretical command laws.

As input parameters, one has identified only three: a) the combustor fuel flow rate Q_c (for all engine types); b) the exhaust nozzle's opening A_5 (only for engines with variable-area nozzles); c) the afterburner fuel flow rate Q_p (only for the engines with afterburning).

Jet engines for aircraft are built in a large range of performances and types (such as single- or double-spool, single jet or twin jets, with or without afterburning). Different types of fuel pumps assure their fuel supply: with plungers, with pinions (toothed wheels), or with impeller. For all of them, the output fuel flow rate depends on their rotation speed and on their actuator's position; for the pump with plungers the actuator gives the plate's cline angle, but for the other pump type the actuator determines the by-pass slide-valve position (which gives the size of the discharge orifice,

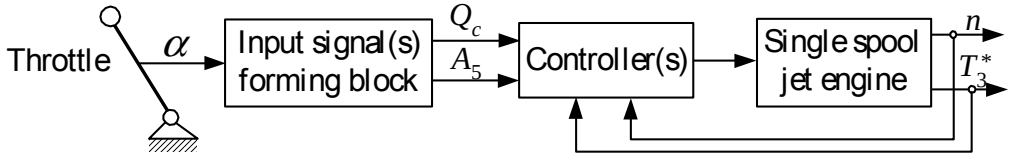


Figure 1. Engine control scheme

that means the amount of the discharge fuel flow rate).

Usually, fuel pumps are included in the jet engine's control system; more precisely: the fuel pump is turned round by the engine's shaft (obviously, through a gear box), so the pump speed is proportional (sometimes equal) to the engine's speed *n*, which is the engine's most frequently controlled parameter. So, the other pump control parameter (the plate angle or the discharge orifice width) shall be issued by the engine's speed controller [2,11].

Engine's speed controllers are built based on various operating principles, in a large range of types. Mostly all of them are controlling the engine speed using as main parameter the injected fuel flow rate [2,9,10,11,12].

Engine's exhaust nozzle's opening control systems are presented in [4,10,13], being designed as follower systems (in order to reproduce the desired A_5 with respect to the throttle's position.

This paper's aim is to build a model for a single spool jet engine with two input parameters, based on previous theoretical and/or experimental control schemes.

2. ENGINE'S CONTROL SCHEME

Single spool jet engine's most important outputs (controlled parameters) are [6,7,9,10]: spool (shaft) speed (also called engine speed) *n* and combustor hot gases temperature T_3^*. As inputs (control parameters), one can use the fuel flow rate Q_c and the nozzle's gas exhaust area A_5. Possible mixed control schemes, using the above-mentioned parameters, are presented in [9,10]. Although, the aircraft's pilot has at his disposal only the throttle (as possibility to control the engine). Consequently, the throttle has to generate somehow, by its displacement, the input signals forming, which means that engine input parameters Q_c and A_5 should be determined as some other control systems' outputs (as figure 1 shows).

Combustor gases temperature T_3^* is very difficult to be measured and to be used as control/controlled parameter; instead of T_3^* nowadays jet engines' measured temperature is the more accessible T_4^* temperature, behind the turbine. Even so, the gas temperature is rarely used as controlled parameter, at most as limited parameter, its control being accomplished by a distinct system, involving the injection fuel flow rate;

This paper deals with an embedded control system for a single-spool jet engine with variable-area nozzle. Engine's control system is depicted in figure 2 and consists of two sub-systems: the first one is meant to establish the injection fuel flow rate, the second one (a follower system) is meant to co-relate the exhaust nozzle's area to the throttle's position.

The first sub-system is the engine speed

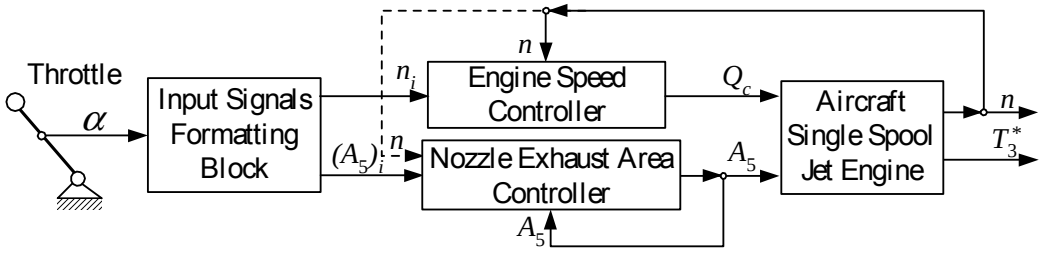


Figure 2. Single spool jet engine control system scheme

control system; such controllers were described in [2,11,12]. The second sub-system, for the nozzle's area control, is a follower-one, described in [13] (or similarly in [4] and [10]).

The system in figure 2 can be improved, for its operational security, if one uses a temperature controller (a system which discharges a fraction of the injected fuel flow rate when the highest admissible T_3^* or T_4^* temperature value is overflowed)

An operational block-diagram of the described system is the one in figure 3.

3. SYSTEM'S MATHEMATICAL MODEL

The above described system is built-up of three main parts: the engine, the speed controller and the exhaust nozzle's controller; their reunited motion equations are building the system's mathematical model.

3.1 **Jet engine's model**, determined and described in [7], consists of two equations, one for the engine's speed, the other for the combustor's temperature, both of them with respect to the fuel flow rate and to the exhaust nozzle's area, as follows

$$(\tau_m s+1)\overline{n} = k_c\overline{Q}_c + k_{nA5}\overline{A}_5 - k_{HV}\,\overline{p_1^*}, \quad (1)$$

$$(\tau_m s+1)\overline{T_3^*} = k_{T3c}(\tau_{Tc}s+1)\overline{Q}_c + \\ + k_{TA5}(\tau_{TA}s+1)\overline{A}_5 - k_{TH}(\tau_{Tp}s+1)\overline{p_1^*}, \quad (2)$$

where τ_m is the engine's time constant, τ_{Tc}, τ_{TA}, τ_{Tp} – model time constants, k_c, k_{nA5}, k_{HV}, k_{T3c}, k_{TA5}, k_{TH} – gain co-efficient.

The terms containing $\overline{p_1^*}$ are describing the flight regime disturbances effects.

3.2 **Engine speed controller's model**, determined and described in [11], consists of

a) fuel pump's equation (with respect to its speed *n* and to its actuator position *y*)

$$\overline{Q}_c = k_{pn}\overline{n} + k_{py}\overline{y}, \quad (3)$$

b) actuator's equations

$$\overline{x} = k_u\overline{u} - k_{es}\overline{n}, \quad (4)$$

$$\tau_s s\overline{y} = \overline{x} - \overline{z}, \quad (5)$$

c) rigid feed-back equation (for *z*)

$$\overline{z} = \rho_s\overline{y} \quad (6)$$

where τ_s is the actuator's time constant, k_{pn}, k_u, k_{es} – gain co-efficient, ρ_s – feed-back gain.

3.3 Exhaust nozzle controller's equations, as determined in [13], with respect to throttle lever's position (θ) and to the supplying pressure (p_g) are, as follows

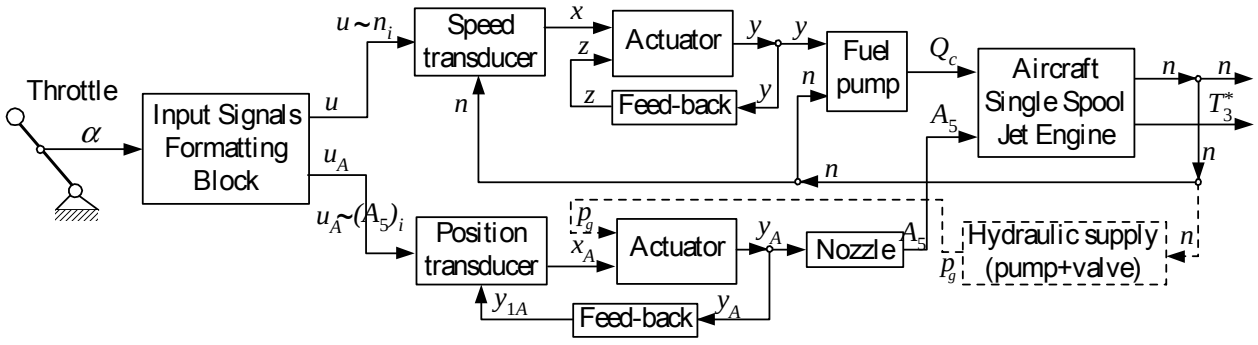


Figure 3. Single spool jet engine control system's operational diagram

$$\bar{A}_5 = k_{5y}\bar{y}_A, \quad (7)$$

$$\bar{y}_A = \frac{(\tau_{u\theta}\mathrm{s}+\rho_\theta)\bar{\theta}+(\tau_{ug}\mathrm{s}+\rho_g)\bar{p}_g}{(\tau_{yA}\mathrm{s}+1)(\tau_{uA}\mathrm{s}+1)}, \quad (8)$$

where the above annotations have the forms presented in [13].

Together with the above-mentioned eight equations, one has to consider both input signals formatting block's equations

$$\bar{\theta} = k_{\alpha\theta}\bar{\alpha}, \quad (9)$$

$$\bar{u} = k_{\alpha u}\bar{\alpha}, \quad (10)$$

(where α is the engine throttle's position angle, $k_{\alpha\theta}, k_{\alpha u}$ – gain co-efficient) and hydraulic supply equations. As shown in [9,10], the hydraulic pump is connected to the engine's shaft, so its speed is proportional to *n*, so the hydraulic fluid's pressure is

$$\overline{p_f} = k_f \bar{n}. \quad (11)$$

Even if one uses for supplying a constant pressure valve, one shall consider the valve's equation, as determined in [10]

$$\bar{p}_g = \frac{k_{gf}}{\tau_g \mathrm{s}+1}\overline{p_f}. \quad (12)$$

Based on these 12 equations, one has built the block-diagram with transfer functions, depicted in figure 4.

4. ABOUT SYSTEM'S QUALITY

One can observe that the embedded control system, when the flight regime is kept constant, has a unique input, which is the throttle's position (displacement) α. The authors have performed some simulations, in order to determine the system's response for a step input of the throttle's displacement, using the system's block diagram with transfer functions, depicted in figure 4. System's response, that means its time behavior, concerning the speed *n* and the combustor gas temperature T_3^*, was studied for the embedded system, comparative to a system without variable area nozzle.

Engine transfer function was calculated as presented in [7, 10].

In the first case, the authors have simulated the time behavior for an engine (VK-1F) with variable area exhaust nozzle, at sea level, operating at maximum regime. One has considered a constant flight regime, so the terms containing $\bar{p}_1^*$ became null. System step response is presented in figure 5; one can observe a stable behavior, more precisely a non-periodic stability, for both output parameters. The engine can be considered a static controlled system, its stabilization being realized with static error(s), during a time period of 3.0…3.5 seconds. Both parameters have about the same static error, somewhere around 4.5%.

The second studied case has considered the same engine, without variable-area nozzle, so the terms containing $\bar{A}_5$ became also null. System step response is presented in figure 6;

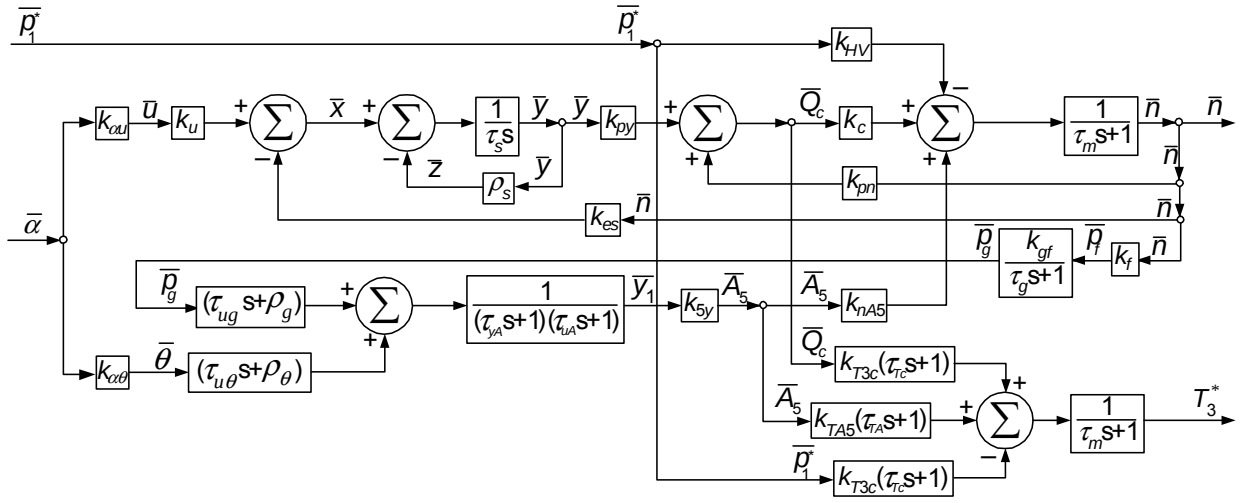


Figure 4. Single spool jet engine control system's block diagram with transfer functions

one can observe the same non-periodic stability for the engine's speed parameter $\overline{n}$, but temperature's parameter $\overline{T_3^*}$ has a different behavior, having an initial jump, a small overflow and, eventually, a non-periodic stabilization. System's static errors have, obviously, the same values, being around 4.5%; the stabilization time is a little smaller, being between 1.5 and 2 seconds.

Third case of the simulation has considered both system inputs (throttle's displacement and flight regime). More specific, one has considered the first case study configuration and, supplementary, a step growth of the inlet air pressure $\overline{p}_1^*$ (a more intense flight regime). One can observe, as figure 7 shows, a different system behavior, concerning both parameters and their monitored aspects (stability type, static error and time of stabilization). Therefore, when the flight regime becomes more intense (flight speed increases and/or flight altitude decreases), because of the engine's speed controller design, speed parameter $\overline{n}$ should remain constant [10,11]; although, its stabilization to a new regime realizes, periodic-type, with a small initial overflow and with a small negative static error (-1.8%).

One can also observe that, in order to keep the same speed level, as well as the same thrust, the fuel flow rate has to grow (as the dashed curve in figure 7 shows); meanwhile, as consequence, the combustor's temperature parameter $\overline{T_3^*}$ level grows too, with an initial step growing, followed by an aperiodic stabilization; the static error is nearly the same (positive, around 4.5%). The stabilization times remain practically the same as in the first case.

5. CONCLUSIONS

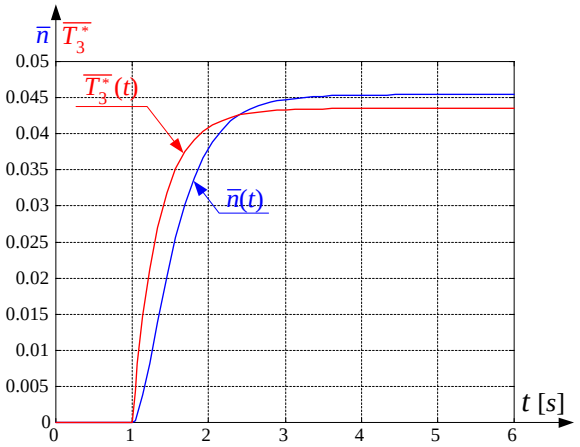


Figure 5. Time response of a single spool jet engine with variable-area nozzle for α step input

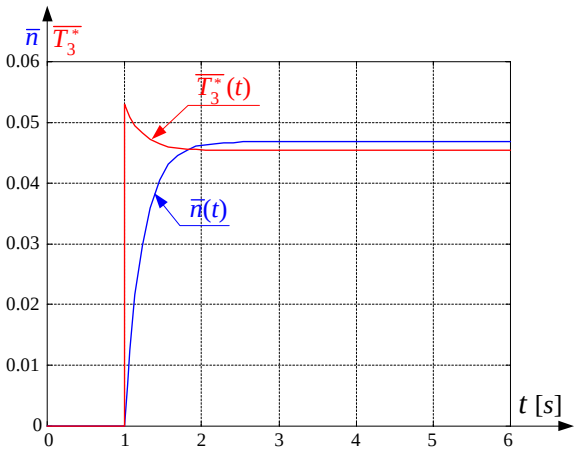


Figure 6. Time response of a single spool jet engine with constant area nozzle for α step input

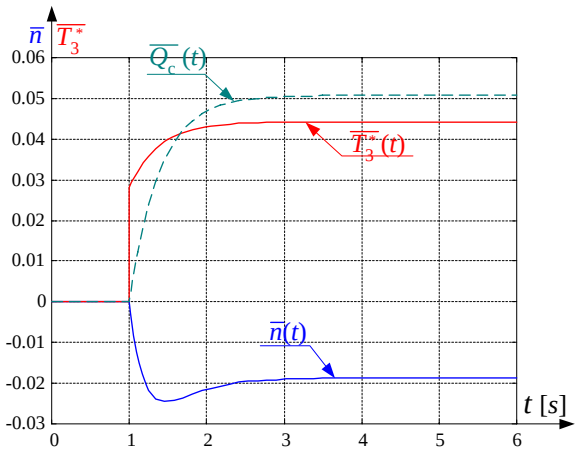


Figure 7. Step response for both inputs (throttle $\overline{\alpha}$ and flight regime $\overline{p}_1^*$)

The authors have studied a single-spool jet-engine (VK-1 type), with variable-area exhaust nozzle and mixed control system.

The studied embedded control system was described both as mathematical model and as block diagram with transfer functions; based on it, one has performed some simulations, in order to determine system's quality (time behavior for step input(s)).

The simulations results have shown a stable system, no matter were the studied situation. Although, comparing figure 5 and 6, one can affirm that the engine with variable-area exhaust nozzle has nearly the same behavior as the same engine with constant area nozzle, from the speed's parameter point of view; the difference is made by the combustor temperature, which has a jump and an overflow in the second case. One can affirm that the exhaust variable area nozzle's presence improves the system's behavior from the temperature's point of view.

The above-presented mathematical model and the block diagram with transfer functions can be formally used for other similar single-spool single-jet engines, being necessary the co-efficient calculus (co-efficient involved in eq. (1) to (12), having the forms determined in the referenced papers).

The same mathematical model can be completed with the appropriate equations, in order to make it useful for a study of a single spool single jet engine with afterburning, or it can be extended, with appropriate chosen modifications, to the twin spools jet engines.

REFERENCES

1. Abraham, R. H., *Complex dynamical systems*. Santa Cruz, California, USA: Aerial Press (1986).
2. Lungu, R., Tudosie, A.. Single Spool Jet Engine Rotation Speed Control System, Based on Fuel Flow Rate Control. *Proceedings of the XXVII-th Scientific International Session of the Military Technical Academy*, Bucharest: Issue (1997).
3. Lungu, R., *Flight Apparatus Automation*. Universitaria, Craiova, (2000).
4. Lungu, R., Tudosie, A., Corcau, J. Automatic control system for the exhaust nozzle flaps positioning. *Constructia de masini*, Bucharest: Issue (2001).
5. Mattingly, J. D., *Elements of Gas Turbine Propulsion*. New York, USA: McGraw Hill (1996).
6. Pimsner, V., *Air-breathing Jet Engines. Processes and Characteristics*. Bucharest, Romania: Didactic and Pedagogic Publishing (1983).
7. Stoenciu D., *Aircraft Engine Automation. Aircraft Engines as Controlled Objects*. Bucharest: Military Technical Academy Inprint (1977).
8. Stoenciu D., *Aircraft Engine Automation. Catalog of Automation Schemes*. Bucharest: Military Technical Academy Inprint (1986).
9. Stoicescu M., Rotaru, C., *Turbo-Jet Engines. Characteristics and Control Methods*. Bucharest: Military Technical Academy Inprint (1999).
10. Tudosie, A. N., *Aerospace Propulsion Systems Automation*. Craiova: University of Craiova Inprint (2005).
11. Tudosie, A.. Automatic hydro-mechanical control system for a jet engine's rotation speed. *Proceedings of the Scientific Session "25 Years of High Education in Arad"*. Issue (1997).
12. Tudosie, A.. Hydro-mechanical Jet Engine's Speed Controller Based on the Fuel's Injection Pressure's Control.

WSEAS Transactions on Systems. Issue (2008).

13. Tudosie, A.. Aircraft Jet Engine Exhaust Nozzle Hydromechanical Automatic Control System. *International Conference of Scientific Paper AFASES 2012.* Issue (2012).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

A TACTICAL APROACH TO TAKING CURVES IN TRAFFIC

Bogdănel-Nicolae VĂCARU*, Cornel ARAMĂ, Andreea ARAMĂ*****

*"Transylvania" University, Brasov, Romania,
"Henri Coandă" Air Force Academy, Brasov, Romania, * freelancer

Abstract: *From the point of view of traffic safety, the braking-system operation and the handling of the steering wheel are the most important operations which are made by a driver. In this paper we deal with the tactical approach to car turns; by tactics I mean the organization, the preparation and the conducting of the maneuver. Speaking again from the point of view of traffic safety the necessary and sometimes sufficient condition for a driver to turn the car is to keep his road lane regardless of driving conditions and vehicle characteristics. This is sometimes impossible to do, first of all because of the vehicle's dimension. In this situation the driver has to be sure that he is not going to disturb the other traffic participants.*

Keywords: *the handling of the steering wheel, trajectory, the loop of pathway, landmarks, the factors of correct turning*

1. INTRODUCTION

From the point of view of traffic safety, the braking-system operation and the handling of the steering wheel are the most important operations which are made by a driver. In this paper we deal with the tactical approach to car turns; by tactics I mean the organization, the preparation and the conducting of the maneuver.

Speaking again from the point of view of traffic safety the necessary and sometimes sufficient condition for a driver to turn the car is to keep his road lane regardless of driving conditions and vehicle characteristics. This is sometimes impossible to do, first of all because of the vehicle's dimension. In this situation the driver has to be sure that he is not going to disturb the other traffic participants.

2. PATHWAYS IN TRAFFIC

When large vehicles approach the curves with small radius ("tightly turns"), they use the method called "with loop". This "loop" can be done before changing the direction of the road, after this point or combined.

The pathways which are going to be (or could be) followed by A vehicle are presented in figure 1:

- the red pathway – turning with loop after the corner of the crossroads;
- the blue and the black pathway (depending of the vehicle's length) – turning with loop before the corner of the crossroads;
- the green pathway – turning with double loop (combined style).

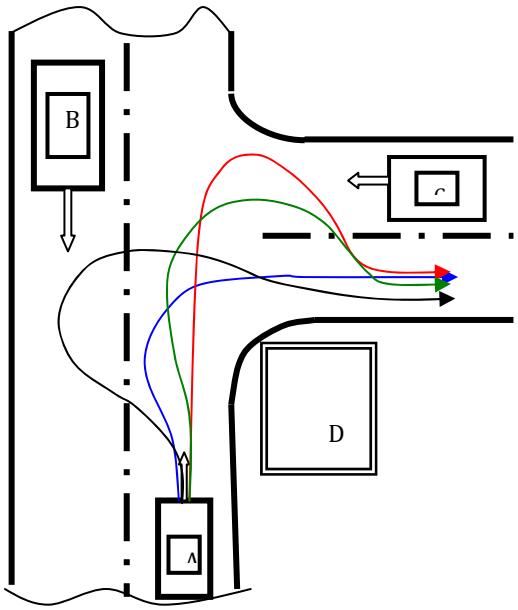


Fig. 1 (conducting to taking curve "with loop")

If B vehicle is in traffic in the position presented in figure 1, the black pathway can not be followed, than, possibly, with the approval of B driver. It is suggested that the dimensions of A vehicle do not allow following the blue pathway. If this is not possible, the green or red pathway will be followed.

If C vehicle is there, A driver will choose the black or blue pathway. The situation does not allow asking C driver's permission by the A driver. The A driver, in order to avoid some traffic unpleasant situations (caused by the presence of the D obstacle which does not allow the A driver to see the situation from the C vehicle direction), will choose the black and blue pathway. When we talked about "unpleasant situations", we referred, for example, to a traffic jam because of meeting face to face of the A vehicle with the C vehicle (if they have trailers, it could be impossible to move back).

Conclusion: in the situation from figure 1, taking into account the traffic presence of the B and the C vehicles and the D obstacle which obstructs the A driver to see if somebody comes from the C direction, the A vehicle could follow the next pathways:

- the blue pathway if the dimensions of the car allow it;
- the black pathway in two possible ways: 1. exploring the route without disturbing the B driver, and 2. first getting the permission from the B driver.

Be careful! The larger the vehicle, the bigger the loop made during the maneuver must be.

We have to emphasize the right way to taking a curve especially for the untrained drivers because of the possibility to hit the border with the rear wheels. This can happen because the pathway followed by the front axle, which is seen all the time by the driver, is completely different from the pathway followed by the rear axle as we can notice in figure 2.

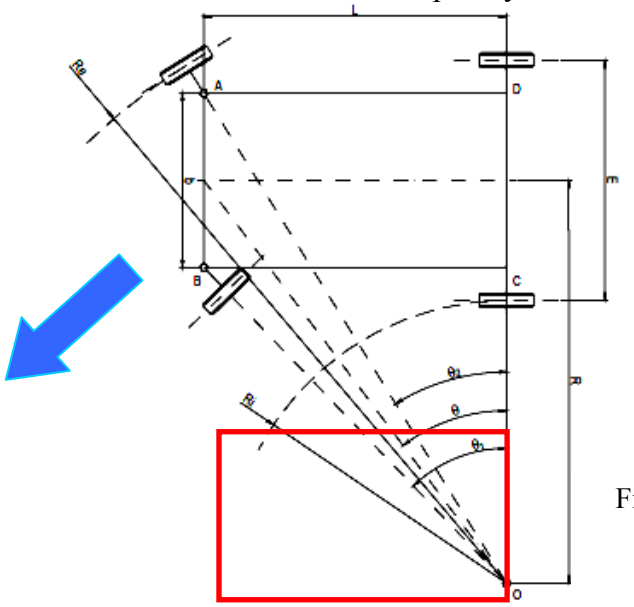


Fig. 2 Turning tightly (curve with small radius)

As we can easily notice , if the wheels of the front axle, called A and B, and the right wheel of the rear axle, called D, avoid without

problems the red obstacle, the left wheel of the rear axle, called C, hits the border and this situation could cause serious damages to parts of the wheel . In order to avoid this situation, the driver must make a little loop. In this case, the wheel which is on the internal part of the curve will avoid the red obstacle. On other words, the driver will turn the steering wheel to the left after the moment when the C wheel passes by the obstacle (the maneuver is similar to the red pathway from figure 1). If the vehicle is longer, the maneuver will take more time.

3. THE RELATION BETWEEN EYES AND HANDS

There is a direct relation between the eyesight and the reactions of the body, depending on the direction we are looking, because all the moves of the body will be done so that the vehicle to be driven to that direction.

At the first sight, this principle seems to be an advantage. But, at the same time, it could be a great disadvantage because our hands and feet will take us, instinctively, to the direction we are looking, but, we should be careful (!) as they will do this even if we are looking the wrong direction! Moreover, they will "wish" to do this using the shortest route no matter what there is on this route (obstacles, for example). So, if we, during turning the car to a direction, look at a tree near the road, we will realize that we will drive, instinctively, the car directly to it! A situation more dangerous could be when we set our eyes on the vehicle that comes to us from the other direction and we will go, without noticing, to its direction. If we do this, we can easily pass the road separation line and we can cause a frontal crush.

The solution to avoid these situations is to set our sight on the accurate landmarks during driving, especially during difficult traffic situations.

The correct succession of landmarks during turning the vehicle is:

- during training maneuvers to approach the curve (braking, speeding down, taking correct position of vehicle on the lane) our sight must look for and fix the turning point (the point where we have to start the handling of the steering wheel);
- during the application phase (the turning itself) our sight will fix the apex (the point where the way of the vehicle is going to be tangential to the internal radius of the vehicle's lane) and immediately after ensuring the way of reaching the apex, our sight the must move to the exit point of the turning maneuver or even further in order to know what it is going to be after the curve and to act accordingly.

The longer the driving experience, the faster the mental process of identifying these landmarks is going to be and the "deeper" the sight will be.

4. TURNING EFFICIENCY

Speed, fluency, elegance and safety of the journey depend to some extent on the modality of taking curves with the vehicle. That is why the factors of correct turning must be analyzed very carefully.

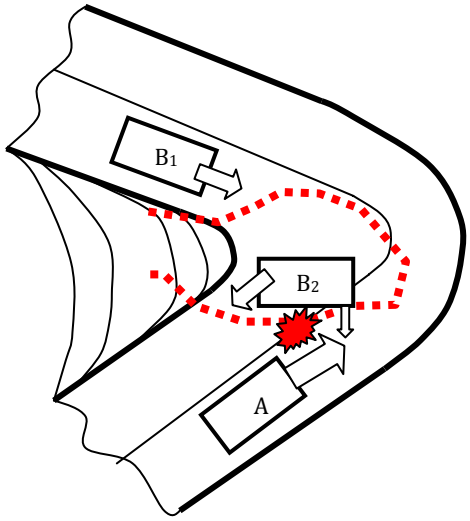


Fig. 3 (the unexpected appearance of risk factors during turning which could cause a temporarily loss of grip)

These factors are:

- **The adherence (grip)** – a decisive factor in order to choose a correct path. In order not to have "unpleasant surprises" and for maximum efficiency, the driver must develop a real grip "feeling". This skill develops in time together with the driving experience. Drivers should pay attention to the temporary variation of adherence that could surprise them in curves: mud, sand, drained gravel from slopes, wet leaves (in curves they can grow until the border of road), water ponds which could lead to the aquaplaning (in curves they appear because of the overloading of the asphalt), frozen snow drained from the slopes etc. one of these situations is presented in figure 3 where the B vehicle is surprised by the temporary presence of some disturbing factors of road adherence in curves - the red area (could be snow, mud, gravel etc.). It skids and, despite the fact that it succeeds to keep the steering wheels to the correct direction, the rear axle looses the adherence, the B vehicle reaches B_2 position and hits the A vehicle.
- **The available live wheel power (torque)** – before entering a curve, the gear down is recommended. Turning attack with a lower gear position and higher engine revolution gives the vehicle a higher engine power and torque which increase the stability of the turning vehicle. It is recommended that the vehicle should enter the curve with an "in force" engine on deceleration (engine braking) and acting the brake pedal. The exit must be with an "in force" engine, too, but on the acceleration and the driver must be ready to gear up (stable in the driver's seat, using "the fourth/false pedal").
- **The turning speed** – it is recommended, for maximum efficiency, taking the curves at a maximum possible speed of the vehicle but in maximum safety road conditions. Taking into account that, for an amateur driver, safety of traffic must be the most important thing, it is mandatory to give a subunit safety coefficient for this speed of the vehicle. The higher this safety coefficient, the higher the safety of passing the curve. But, we must not forget that each meter from the straight road which follows after the curve will be passed with higher speed if the supplementary speeding of vehicle when the one exiting from curve is bigger!
- **The turning radius –** the modality to approach the curve, the chosen trajectory, the speed of passing the curve and the safety of passengers depend on the turning radius.
- **The characteristics and settings of the vehicle** - the modality to approach the curve, the chosen trajectory, the speed of passing curve and the safety of passengers also depend on the stability and maneuverability of the vehicle.

5. CONCLUSIONS

Recommendation: in order to turn as efficient as possible, try to chose a right trajectory (be careful to the landmarks which have to be followed with the eyes), approach turning with an enough low speed that could allow the driver to correct some mistakes, to gear down before beginning to move the steering wheel in order to have enough engine speed to exit from the curve with a sufficient speed to have a maximum efficiency. Sometimes it is better to act the brake pedal, to tight securely the steering wheel without shaping. Be careful to the turning speed! Approaching "on the limit" to taking curves will generate an accident when doing the least error. This can happen mainly on Romanian

roads where unpleasant surprises could appear every step of the way!

Attention! Do not change the gear speeds during taking curves. You could do this only if there is some danger of accidents because the maneuver requires moving the right hand to the gear shift lever and, in this situation, only the left hand will be on the steering wheel and, when taking curves it is recommended to have both hands on the wheel. Moreover, the driver's body would not be steady in the seat because he can not place the left foot on the "false pedal". He needs the left foot to act the clutch pedal.

Therefore, for the driver, there will be only a fix support point (his back on the seat). There is also another one, not very fix because the driver can not force too much on it (the heel of the right foot which is busy acting the accelerator) .The third support point is unstable -the left hand, which stays in its place, on the steering wheel. Normally, passing the curve must be done with the same gear speed from the beginning to the end of the turning. If the curve radius varies, surprising the driver or this one did not appreciate correctly the trajectory, maintaining the correct direction of the vehicle depends on the driver's experience and his skills.

REFERENCES

1. Cristea, P., Arta de a conduce automobilul, City: *Bucharest*, Publishing House: *Stadion* (1970).

2. Cunescu, S., Ignat, D., Pavelescu, T., Săvulescu, A., *Îndreptar automobilistic*, City: *Bucharest*, Publishing House: *Tehnică* (1968).

3. Drăgan, A., Cosma, V., *Linia vieții*, *Auto motor şi sport*, no: 9/2011.

4. Păuşan, N., Aur, T. *Auto CONTROL tehnici şi tactici de conducere defensivă şi sportivă*. City: *Cluj-Napoca,* Publishing House: *Napoca Star* (2011).

4.3 *RENEWABLE ENERGY AND ENVIRONMENT, FOOD PRODUCTION*

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

AN EXPERT SYSTEM FOR WASTEWATER pH CONTROL

Mădălina CĂRBUREANU *

*Mechanical and Electrical Engineering, Petroleum-Gas University, Ploiesti, Romania

Abstract: *A very important parameter for all water categories, inclusively for wastewaters is pH that is a measure of a solution acidity or alkalinity. The problem of wastewater pH control is one of present interest, due to the complexity and non-linearity of the pH neutralization process. For pH control can be applied conventional or advanced control techniques. Some of the advanced techniques belong to artificial intelligence domain (AI), such as: expert systems, fuzzy logic, neuro-fuzzy, neural networks, genetic algorithms, etc. In the present paper it is developed a prototype expert system for pH control, system named SEpHControl that can be implemented as a controller into an automatic system for pH control.*

Keywords: *expert system, pH control, controller, neutralization*

1. INTRODUCTION

The most advanced application of expert systems (ES) is in the control of certain parameters (for instance: pH, flow, level, etc.), that describe various processes. In literature, there is presented a set of expert systems (ES), in some cases combined with other instruments (like fuzzy logic, etc.), ES used for controlling certain parameters from a wastewater treatment plant (WWTP), such as the BIOEXPERT system or for the optimal adjustment of control loops, such as EXPERT_AT system [3, 4, 1].

In control problems, an ES can be implemented to work like a controller. According [5], the expert systems implemented as controllers are, from conceptual point of view, similar to fuzzy controllers, but their knowledge base (KB) and the inference engine (IE), can use more evolved strategies to determine which rules will be applied at a certain moment. Plus, ES and fuzzy controllers have in common the fact that for generating the adequate command it is used the plant operator's knowledge and expertise, fact that is a major advantage especially in the case of complex processes.

2. THE EXPERT SYSTEM SEpHControl

2.1 System architecture. In figure 1 it is proposed the architecture of an automatic system for pH control named SRA-pH that uses as controller the developed expert system SEpHControl.

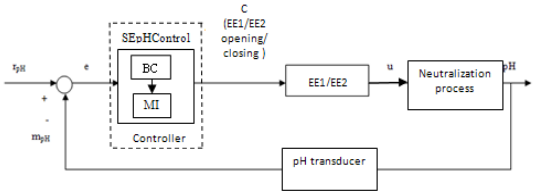


Fig. 1. SRA-pH architecture

As we can observe in figure 1, the SRA-pH system has the following components:

1. the expert system SEpHController which is in fact the system controller;
2. two execution elements EE1and EE2 used for acid or alkaline neutralization agents dosage;
3. the command (C) generated by the controller (SEpHController), respectively the EE1 or EE2 opening percentage;
4. the model of the neutralization process from literature [2]
5. a pH transducer that measures the pH value at the process output;
6. the error (e) defined as the difference between pH reference value (r_{pH}) and the pH measured value (m_{pH}) at the process output.

For developing the expert system SEpHControl (the SRA-pH controller) it was used the ES generator VP-Expert 2.1, developed by Paperback Software International.

After studying the wastewater pH neutralization process, we developed the SEpHControl analysis tree with the structure presented in figure 2.

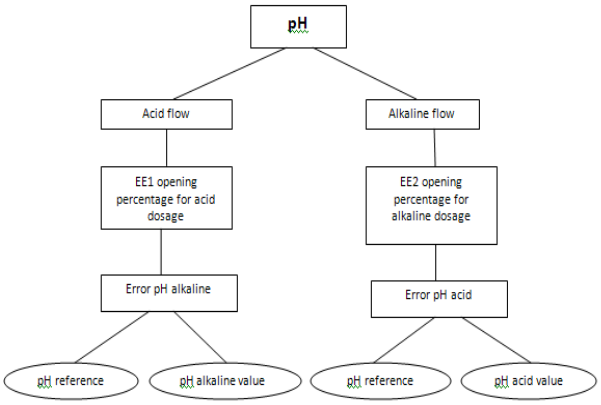


Fig. 2. SEpHControl analysis tree

As we can observe in figure 2, the goal variable is pH, namely the pH value at the neutralization process output (neutral, weak acid, strong acid, weak alkaline or strong alkaline pH).

In table 1 are presented the analyzed variable and their values, numerical and symbolical (the possible domain of values).

Tabel 1. The values domain

Variable	Domain
pH (units)	neutral ∈ (6.5 7.5) strong acid ∈ [2 5] weak acid ∈ (5 6.5] strong alkaline ∈ [9 12] weak alkaline ∈ [7.5 9)
Acid flow (acid_flow)	high (≈98 l/h) big (≈ 90 l/h) medium (≈ 85 l/h) low(≈ 80 l/h) zero (≈ 75 l/h)
Alkaline flow (alkaline_flow)	high (≈ 200 l/h) big (≈ 190 l/h) medium (≈ 180 l/h) low (≈ 175 l/h) zero (≈ 150 l/h)
EE1 percentage opening for acid F1 dosage (percent_opening_ee_acid)	high ∈ [45% 100%] big∈ [30% 50%] medium ∈ [15% 35%] low ∈ [0% 20%] zero ∈ [0% 0.05%]
EE2 percentage opening for alkalineF2 dosage (percent_opening_ee_alkaline)	high ∈ [45% 100%] big ∈ [30% 50%] medium ∈ [15% 35%] low ∈ [0% 20%] zero ∈[0% 0.05%]
Error pH alkaline (error_ph_alkaline)	high ∈ [-5 -2] big ∈ [-3 -1] medium ∈ [-2 -0.5] low ∈ [-1 0] zero ∈ [-0.5 0]
Error pH acid (error_ph_acid)	high ∈ [2 5] big ∈ [1 3] medium ∈ [0.5 2] small ∈ [0 1] zero ∈ [0 0.5]
Reference value pH (reference_ph)	REF (=7)
Influent alkaline pH value (ph_infl_alkaline)	B1 ∈ [9 12] B2∈ [8 10] B3 ∈ [7.5 9] B4 ∈ [7 8] B5 ∈ [7 7.5]
Influent acid pH value (ph_infl_acid)	A1 ∈ [2 5] A2 ∈ [4 6] A3∈[5 6.5] A4 ∈ [6 7] A5 ∈ [6.5 7]

The knowledge base (KB) of the SEpHControl expert system (of the controller), it is composed from a number of fifty two heuristic rules, from which are presented the following ones:

1. if reference_ph=REF and ph_infl_alkaline =B1 then error_ph_alkaline=high;

2. if error_ph_alkaline=high then percent_ opening_ee_acid=high;
3. if opening_ee_acid=high then acid_ flow =high;
4. if reference_ph=REF and ph_infl_acid =A1 then error_ph_acid=high;
5. if error_ph_acid=high then percent_ opening_ee_alkaline=high;
6. if percent_opening_ee_alkaline=high then alkaline_flow=high;
7. if acid_flow=high and alkaline_flow=zero then pH=strong_acid;
8. if acid_flow=big and alkaline_flow=low then pH=strong_acid;
9. if acid_flow=medium and alkaline_ flow=low then pH=weak_acid;
10. if acid_flow=low and alkaline_ flow=big then pH=weak_alkaline;
11. if acid_flow=zero and alkaline_flow =high then pH=strong_alkaline;
12. if acid_flow=zero and alkaline_flow = zero then pH=neutral.

2.2 SEpHControl user interface. In figure 3 it is presented the expert system SEpHControl interface developed in VP-Expert 2.1.

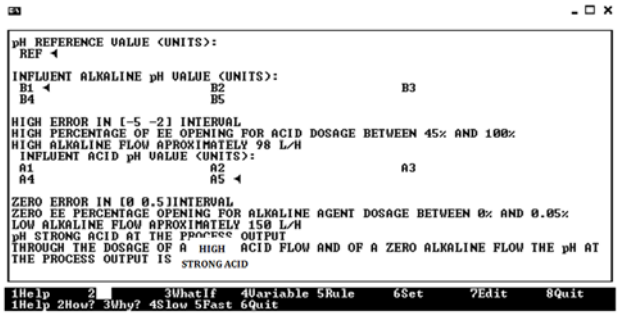


Fig. 3. SEpHControl interface

As we can observe in figure 3 for obtaining the pH value (neutral, strong acid, etc.) at the process output, respectively the flow of alkaline or acid neutralization agent necessary for bringing the pH value at the reference value, the user must give to the system the reference value for pH and the influent pH value (influent with alkaline or acid pH). Depending on these values, the system determines the error which that becomes input for the system controller. Dependent on this error it is determined the EE1 or EE2 percentage opening for acid or alkaline neutralization agent dosage necessary for pH adjustment.

2.3 Experimental results. In tables 2 and 3 are presented the experimental results for different influent pH values, either acid or alkaline. After consulting the system knowledge base, using the corresponding rules, the developed system determines the necessary neutralization agent flow (NaOH or H_2SO_4) for bringing the pH value at the reference value (pH=7, neutral pH), and also the pH character (acid or alkaline/basic) after dosing a certain reactive flow.

Tabel 2. Experimental results

pH reference	Influent alkaline pH value (units)	Influent acid pH value (units)	Error pH alkaline	EE1 percentage opening (%)
REF (=7)	B1 ∈ [9 12]	A5 ∈ [6.5 7]	high ∈ [-5 -2]	high ∈ [45 100]
	B2∈ [8 10]	A4 ∈ [6 7]	big ∈ [-3 -1]	big∈ [30 50]
	B3∈ [7.5 9]	A3∈ [5 6.5]	medium ∈[-2 0.5]	medium∈ [15 35]
	B4 ∈ [7 8]	A2∈ [4 6]	low ∈ [-1 0]	low ∈ [0 20]
	B5∈ [7 7.5]	A1 ∈ [2 5]	zero ∈ [-0.5 0]	zero ∈ [0 0.05]
	B5∈ [7 7.5]	A5 ∈ [6.5 7]	zero∈ [-0.5 0]	zero ∈ [0 0.05]
	B4∈ [7 8]	A5 ∈ [6.5 7]	low ∈ [-1 0]	low ∈ [0 20]
	B5 ∈ [7 7.5]	A4 ∈ [6 7]	zero ∈ [-0.5 0]	zero ∈ [0 0.05]

Table 3. Experimental results

Acid flow(l/h)	Error pH acid	EE2 percentage opening (%)	Alkaline flow (l/h)	pH
high (≈98)	zero ∈ [0 0.5]	zero ∈ [0 0.05]	zero (≈ 150)	strong acid
big (≈ 90)	low ∈ [0 1]	low ∈ [0 20]	low (≈ 175)	strong acid
medium (≈ 85)	medium ∈ [0.5 2]	medium ∈ [15 35]	medium (≈ 180)	weak acid
low (≈ 80)	big ∈ [1 3]	big ∈ [30 50]	big (≈ 190)	weak alkaline
zero (≈ 75)	high ∈ [2 5]	high ∈ [45 100]	high (≈ 200)	strong alkaline
zero (≈ 75)	zero ∈ [0 0.5]	zero ∈ [0 0.05]	zero (≈150)	neutral
low (≈ 80)	zero ∈ [0 0.5]	zero ∈ [0 0.05]	zero (≈150)	neutral
zero (≈ 75)	low ∈ [0 1]	low ∈ [0 20]	low (≈ 175)	neutral

As it can be observe in tables 2 and 3 when the acid flow it diminish, the basic flow raises and inverse, this because at a certain moment it works just one actuator (or EE1 for acid flow dosage or EE2 for basic flow dosage). It was obtained a neutral pH at the process output when both actuators are on zero action (are closed) fact that means that the pH value it reached the reference value and that isn't necessary the dosage of reactive (when one of the actuators is thinly opened or the other one it is closed).

3. CONCLUSIONS & ACKNOWLEDGMENT

The knowledge based systems, category from which make part the expert systems, it is one of the most known and used technique of artificial intelligence, with applicability in a large number of domains.

The developed expert system SEpHControl, implemented as a controller of a control system, function of its rules and heuristics, supplies solutions for improving the automatic process of pH control through the establishment of the necessary reactive flow for basic or acid pH neutralization.

The expert system SEpHControl is from conceptually point of view similar to a fuzzy controller, according [5]. This problem it will be discussed in a future paper, where it will be developed a fuzzy controller for an automatic system dedicated to pH control.

Using knowledge and certain inference rules, an expert system is capable to suggest to a plant operator the most adequate action for solving different problems that can appear in a plant, such as: pH control, level control, flow control, etc.

Due to the fact that expert systems can be used as controllers in automated control systems and due to the similarity with fuzzy controllers and neuro-fuzzy ones, the expert systems proves to be a useful tool in control problems and more.

REFERENCES

1. Cărbureanu, M., Expert System for Assessing the Effluent's Quality of a Wastewater Treatment Plant. *Petroleum - Gas University of Ploiesti*. 2 (2010).
2. Ibrahim, R., Practical Modeling and Control Implementation Studies on a pH Neutralization Process Pilot Plant, PhD Thesis, Available:http:// theses. gla. Ac .uk /311/01/FINAL_THESIS_200508.pdf (January,2012).
3 Lapointe, J., BIOEXPERT - An expert System for Wastewater Treatment Processes Diagnosis. *Computers & Chemical Engineering*. 13 (1989).
4 Oprea, M., *Sisteme bazate pe cunoştinte.* Bucharest: MatrixRom (2002).
5 Tzafestas, S., Expert control systems, Available: http://www.eolss.net/Sample-Chapters/C18/E6-43-25-00.pdf (March, 2012.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

THE MONITORING OF WASTEWATER pH USING A DATA MINING TECHNIQUE

Mădălina CĂRBUREANU *

*Mechanical and Electrical Engineering, Petroleum-Gas University, Ploiesti, Romania

Abstract: *The monitoring of wastewater pH value at the output of a plant neutralization process it is a very important task because it directly influence the quality of the plant effluent and therefore the quality of the emissary. A strong basic (alkaline) or acid pH determines the alteration of the emissary characteristics and also of the streams wherewith it is in contact. At plant neutralization process output the pH must have a neutral composition this way being respected the technical normative in domain. In the present paper, it is used a data mining technique, namely classification (C5.0 algorithm implemented in See5 system) for monitoring the pH value (acid or basic) at the neutralization process output. For implementing the results obtained through this technique, it is also developed a system for pH monitoring using CBuilder programming environment.*

Keywords: *data mining, classification, rules, pH neutralization*

1. INTRODUCTION

The pH neutralization process from a wastewater treatment plant it is a very complex one and more it is a non-linear process that takes place in the plant chemical step. The pH at the process output can be: basic (alkaline), acid or neutral. At the process output the pH must be a neutral one to follow the pH admissible limits imposed through technical normative in domain, such as NTPA-001/2002 [4].

In literature, there are presented many applications of data mining techniques in wastewater treatment domain. Some examples in this sense are:

1. TELEMAC (Telemonitoring and Advanced Telecontrol of Yield Wastewater Treatment Plants) [1];
2. GESCONDA - an intelligent data analysis system for knowledge discovery and management in environmental databases, [2], etc.

The structure of the paper it is organized as follows:

1. The classification implementation where through the application of C5.0 algorithm are obtained the decision rules necessary to develop the proposed system;
2. The proposed monitoring system development where it is presented the monitoring system developed using the classification results;
3. Conclusions where are emphasized the most important aspects of classification and the utility of the developed system.

2. THE CLASSIFICATION IMPLEMENTATION

C5.0 algorithm it is an improved version of ID3 and C4.5 data mining algorithms, introduced by Quinlan to solve the classification problems and to outrun all the limitation of the previous algorithms [3]. The classifiers obtained through the usage of this algorithm are under decision tree form or under rule set form. In this case we choose to use the decision tree form.

In the current paper we used the Windows version of C5.0 data mining tool, namely See5 demonstration version as we can observe in figure 1.

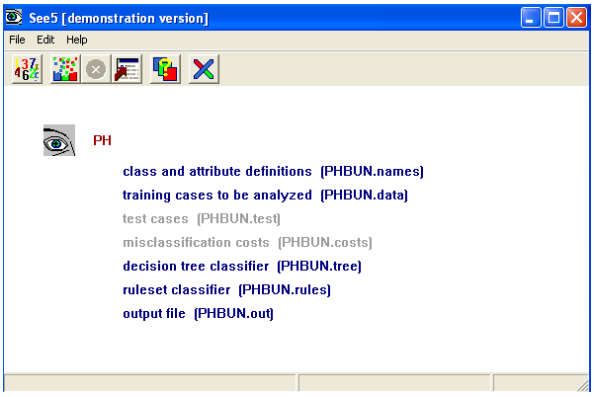


Fig. 1. See5 interface

As we can observe in figure 1, See5 uses certain type of files such as [5]:

1. .names – file in which are described the application attributes;
2. .data – file that contains the cases used for building the classifier;
3. .tree – file that contains the classifier under decision tree form;
4. .rules – file that contains the classifier under decision rules form;
5. .out – the report obtained through the classifier generation.

For See5 system we build two files, such as: pH.data and pH.names. The pH.data supplies information on the training cases from which See5 will extract patterns. It contains a number of twenty four entries for a number of parameters such as:

1. REF – the pH reference value imposed through legislation;
2. INFLALK – the value of the alkaline pH in the plant influent;
3. INFLACID – the value of the acid pH in the plant influent;
4. ERRALK – the error value defined as the difference between pH reference and the alkaline pH value in the plant influent;
5. EEACID – the opening degree for the acid (H_2SO_4) pump (%);
6. ACIDFLOW – the acid flow necessary to bring a basic pH to a neutral one;
7. ERRACID – the error value defined as the difference between pH reference and the acid pH value in the plant influent;
8. EEALK – the opening degree for the alkaline/basic (NaOH) pump (%);
9. ALKFLOW – the alkaline flow necessary to bring an acid pH to a neutral one;
10. pH– the pH value (strong acid, weak acid, strong alkaline, weak alkaline, neutral) at the process output.

The pH.names file describes the application attributes and classes as we can observe in figure 2.

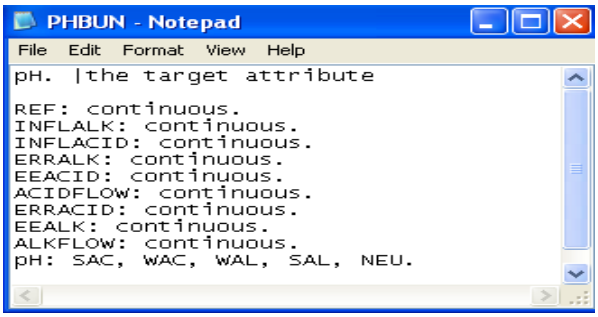


Fig. 2. pH.names structure

As we have mentioned, the classifier it is generated under a decision tree or under a rule set form. We generated the classifier under decision tree form, as we can observe in figure 3.

```
Decision tree:

EEACID >= 30 (22.5):
:...ERRALK <= -1 (-0.875): SAC (6)
:   ERRALK >= -0.75 (-0.875): WAC (2)
EEACID <= 20 (22.5):
:...EEALK <= 10 (25): NEU (10/1)
    EEALK >= 40 (25):
    :...INFLACID <= 3.5 (3.75): SAL (2)
        INFLACID >= 4 (3.75): WAL (4/1)
```

Fig. 2. Decision tree

In table 1 are presented the statistical results obtained through the generation of the decision tree.

Table 1. Statistical results

Classifier form	Decision tree
Error	8.3%
Misclassified instances	2
Correct classified instances	22
Rules number	5

In figure 3 it is presented the confusion matrix where it is emphasized the performance on the training cases that shows the kinds of error made.

```
 (a)   (b)   (c)   (d)   (e)    <-classified as
----  ----  ----  ----  ----
   6                             (a): class SAC
         2                   1   (b): class WAC
               3                 (c): class WAL
               1     2           (d): class SAL
                           9     (e): class NEU
```

Fig. 3. Confusion matrix

In figure 3, the decision tree misclassifies:
1. one of the weak acid (WAC) cases as neutral (NEU);
2. one of the strong alkaline (SAL) cases as weak alkaline (WAL).

It is useful to know also each attribute contribution to the classifier (attribute usage), as we can observe in table 2.

Table 2. Attribute usage

Attribute	Attribute usage (%)
EEACID	100%
EEALK	71%
INFLACID	38%
ERRALK	33%

From table 2, we observe that the most important contribution to classification is that of EEACID attribute (100%).

The rules of the decision tree presented in figure 2, written under *if-then* form are:
1. IF EEACID>=30 AND ERRALK<=-1 THEN pH=SAC;
2. IF EEACID>=30 AND ERRALK>=-0.75 THEN pH=WAC;
3. IF EEACID<=20 AND EEALK<=10 THEN pH=NEU;
4. IF EEACID<=20 AND EEALK>=40 and INFLACID<=3.5 THEN pH=SAL;
5. IF EEACID<=20 AND EEALK>=40 AND INFACID>=4 THEN pH=WAL.

3. THE PROPOSED MONITORING SYSTEM

Using the rules obtained through classification, we developed using C++Builder 6 a system for monitoring the pH of wastewater at the output of a plant neutralization process. The proposed system interface it is presented in figure 4.

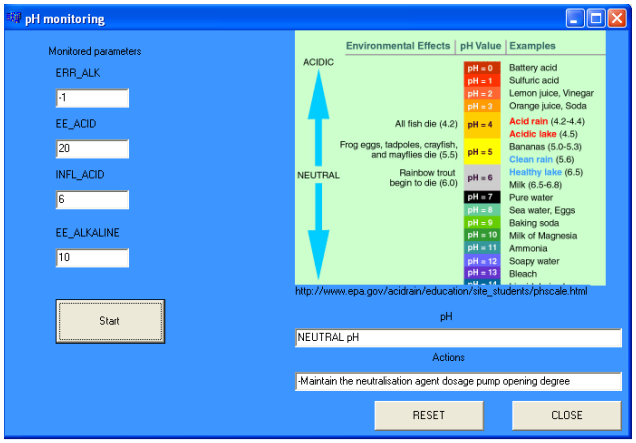


Fig. 4. The system interface

The pH character (neutral, weak acid, strong acid, weak alkaline or strong alkaline) at a plant neutralization process is influenced by a number of parameters such as:
1. the composition of the plant influent (acid or basic (alkaline));
2. the error defined as the difference between the reference value of pH (pH=7, neutral pH) and the influent composition (acid or basic) at the plant input;
3. the opening degree of agent neutralization dosage pumps (pump for acid or basic

neutralization agent dosage) that depends on the error value, etc.

The proposed pH monitoring system offers to the user the following facilities:

1. for the monitored parameters, the proposed system provide to the user (that can be , for instance, a plant operator), information regarding the value of the wastewater pH at the process output (if the value of pH is in the admissible values established through technical normative in domain - NTPA 001/2002);
2. the system also provides a set of actions that can be taken depending on the pH value at the process output, such as:
   a. if the value of pH at the neutralization process output in neutral then the suggested action is for instance to maintain the functioning parameters (the opening degree) for the acid or basic neutralization agent dosage pumps;
   b. if the value of pH at the process output is acid then the suggested action is to increase the opening degree of pump for dosing the basic/alkaline solution;
   c. if the value of pH at the process output is basic then the suggested action is to increase the opening degree for acid dosage pump.

The utility of such type of system developed using a data mining technique (such as classification) consist in the fact that it can helps the plant operators in monitoring the values of pH at the plant output and it also suggest the immediate solution at the problems that can occur.

4. CONCLUSIONS & ACKNOWLEDGMENT

The pH neutralization process it is of present interest due to its complexity and to the various factors that influence it. By constructing classifiers (under decision tree or rule sets form) the number of monitored parameters it is reduced using the attribute usage criterion, fact that facilitates the achieving of an improved and more focused monitoring.

The development of a system for pH monitoring can supply to plant operator valuable information regarding the functioning parameters of the plant pH neutralization process fact that offers the possibility to take immediate measures to prevent dangerous situations, such as: the pH of the plant effluent is acid/strong acid or basic/strong basic with dangerous effects on the environment.

The pH neutralization process it will be discussed in a future paper, where it will be developed a fuzzy controller for an automatic system dedicated to pH control.

REFERENCES

1. Dixon, M., Gallop, J.R., Lambert, S.C., Healy, J.V., Experience with data mining for the anaerobic wastewater treatment process, *Environmental Modeling & Software*, Vol. 22, pp. 315-322 (2007).
2. Gibert, K., Sanchez-Marre, M., Rodriques-Roda, I., GESCONDA: An intelligent data analysis system for knowledge discovery and management in environmental databases, *Environmental Modeling & Software*, Vol. 21, pp. 115-120, (2006).
3. Khosrow-Pour, M., *Emerging Trend and Challenges in Information Technology Management*, Idea Group Inc, Hershey , USA, Available : http://www.dl-provider .com/download-k: Download %20 Emerging%20Trends%20and%20Challenges%20in%20Information%20Technology %20Management%20%20.html?aff.id=1266&aff.subid=1 (February , 2012).
4. NTPA -001/2002, Available: http: // www .aqua-biotec.ro/NTPA001.pdf (March, 2012).
5. RULEQUEST RESEARCH, See5: An Informal Tutorial, Available: http:// www. rulequest.com/see5-win.html (February, 2012).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

MODELING OF THE TEMPERATURE CONTROL SYSTEM OF THE PLASTIFICATION CYLINDER OF INJECTION MOLDING MACHINE

Vadim CAZAC *, Ilie NUCA **

* TehElectro-SV Co, , ** Technical University of Moldova

Abstract: *At present the development of industry of plastic products tends to grow up the quality of products obtained by this method and increase productivity. The common denominator on quality, productivity and cost efficiency in producing plastic objects, it is thermal process that must ensure the material plastification in cylinder of plastification of machine for injection of the plastical materials.*
In this paper is elaborated a mathematical model describing the thermal process heating plasticizing cylinder for injection molding machine with consideration of thermal influence between of heating zones and cyclic variation of material speed in the cylinder. On the basis of elaborated mathematical model were simulated transient processes at start and in working regime of the machine with different types of regulators in the temperature control system in each thermal zone. Was made a comparison between the quality of transient process with regulators P, PI, PID granted Ziegler-Nichols method and the results obtained with the fuzzy controller.Profound study of transient processes in Simulink Matlab allowed optimize the regulators for temperature control system for each heating zone. Implementation in practice of a system of adjusting and control of plastic injection machine was in the company The electro-SV Implementing of this system is based on a universal controller of at the company .

Keywords: *plastification, plastics, Injection Moulding Machine, plastification cylinder*

1. INTRODUCTION

Processing by injection is the technological process by which plastics , brought in a state of flowing is introduced under pressure into a mold for formation. After filling the mold, the material is kept under pressure and hardened by cooling for thermoplastic and heating for thermosetting polymers. The advantages of formation by injection consist in possibility of obtaining objects with complicated shapes different sizes and form a very wide range of polymers. The operations are automated and machines have a high performance.[3]

Processing conditions depend on the properties of the material, technological parameters of processing and also of the technical and technological parameters of plastic injection machines.

At present the development of plastics products tends to rise the quality of products obtained by this method and and also to grow the productivity proces. The common denominator of the quality, productivity and cost in production proces is the heating process. This is possible only by designing of the machines with parameters take into account the specific properties of processed materials and ensure the specific of the technological process.

The study object is an injection molding machine type ДЕ3330 Ф1 (Fig. 1) [7] with a control system based on electromagnetic relays which ensures the working cycle of the machine for the different regimes and a temperature control system for

injection unit which consists of four discrete PID controllers with static power relays and resistive electrical heaters.

Figure 1. General view of the ДЕ 3330 Ф1 type machine [7]

The main purpose of this paper is to design and simulate the optimal thermal control system of the plastification cylinder of injection machine based on the analysis of transient and stationary process with different types of digital controllers: P, PI, PID and fuzzy.

To come to ours main purpose we have to solve some basically problems as:

- ✓ The analysis of the processes, and its particularities of the operating regimes of the machine.
- ✓ Adapting of the mathematical model that describes the physical nature of the process without losing the physical sense and the simulation in Matlab.
- ✓ Determination of the criteria for granting the temperature control system, and the calculation of the coefficients for selected regulators.

2. THE MATHEMATICAL MODEL OF THE INJECTION MOLDING MACHINES

2.1 Calculation of the thermal regime of the plastic injection machines

Calculation of the thermal regime processing of plastics is very important to designing and exploitation this type of machines, given the fact that thermoplastic materials processed are sensitive to changes in temperature.

In general in any screw casting machine we have more temperature zones on the length of plastification cylinder. From technological point of view for each type of material it is recommended that each area to have a certain temperature. For the calculation of thermal areas of plastification of castings machines is necessary to determine the amount of heat released during to the plastic deformation of the polymer on each area of the machine, which is determined by: the geometry of the screw, the number of rpm, polymer viscosity, length of area. This energy can be determined by using the following empirical relationship[5]:

$$Q_{pl} = 110330.5 \cdot d_1^2 \cdot m^2 \cdot \eta \cdot l / h \quad (1)$$

where: d_1- effective diameter of the screw, m;
m - number of revs, rpm;
η- effective viscosity of the material (kg/h)/m^2;
h - screw channel depth, m;
l - the length of thermal area, m.

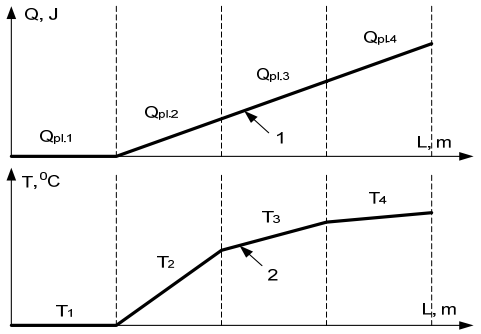


Figure 2. Eliminated energy curve to plasticizing material (1) and temperature curve in each zone of injection unit (2) [5]

2.2 The mathematical model of starting regime of the injection unit

For the elaboration of the mathematical model of the start thermal regime for machine and to modeling the process we use the method of blocks. It is supposed that in the starting regime all elementary blocks in each zone are with concentrated parameters. In such conditions the scheme will have the following structure shown in Figure 3

where:$T_{înc.}$;$T_{cil.}$;T_{melc};$T_{iz.}$- average temperature of the heater, cylinder, screw and insulation,
Q_{el} – the power delivered for heaters, W;

According to the structural scheme are elaborated equations of thermal balance in differential form for each block:

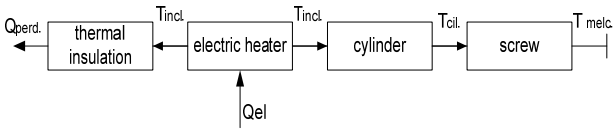


Figure 3 Block diagram of the mathematical model of a region of injection unit [5]

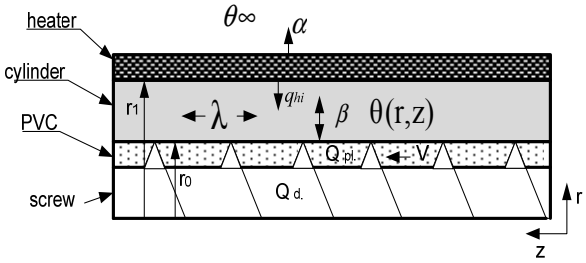


Figure 4. Heat flow in the heating cylinder [2]

- for heater

$$\frac{d}{d\tau}(m_{inc.}c_{inc.}T_{inc.}) = Q_{el.} - \frac{\lambda_{inc.}\cdot S_{inc.}}{2h_{inc.}}(T_{inc.} - T_{cil.}) \quad (2)$$

- for insulation

$$\frac{d}{d\tau}(m_{iz.}c_{iz.}T_{iz.}) = \frac{\lambda_{inc.}\cdot S_{inc.}}{2h_{inc.}}(T_{inc.} - T_{iz.}) - \\ -\alpha_1 \cdot S_{extern}(T_{iz.} - T_{mediu}) \quad (3)$$

- for zone cylinder

$$\frac{d}{d\tau}(m_{cil.}c_{cil.}T_{cil.}) = \frac{\lambda_{inc.}\cdot S_{inc.}}{2h_{inc.}}(T_{inc.} - T_{cil.}) - \\ -k_T \cdot S_{cil.}(T_{cil.} - T_{melc}) \quad (4)$$

- for screw zone

$$\frac{d}{d\tau}(m_{melc.}c_{melc.}T_{melc.}) = k_T \cdot S_{cil.}(T_{cil.} - T_{melc}) \quad (5)$$

In the relationships (2-5) we have: $M_{inc.}$, $M_{iz.}$, $M_{cil.}$, M_{melc},- the weight of heaters, insulation, cylinder, screw, kg;

c_{inc}, $c_{iz.}$, $c_{cil.}$,c_{melc} – the specific heat of material, kcal/kg°C;

$\lambda_{inc.}$, $h_{inc.}$, $S_{inc.}$- thermal conductivity of material [W/m·^{0}C], the heater thickness, m; and total area of the heater m^2;

α_1 - heat transfer coefficient from the external surface of the insulation in the external environment [W/(m^2·^{0}C)];

k_T – heat transfer coefficient from the internal surface of the cylinder through the air between cylinder and screw, [W/(m^2·^{0}C)];

T_{med} – the ambient temperature, ^{0}C

2.3 The mathematical model of the injection unit in continuous working regime

The thermal calculation of injection unit in starting regime aims to determine necessary power for heaters of the plastification zones and which ensure the temperature required for processing the polymers in injection unit.

To elaboration the mathematical model of the injection unit in the normal work regime we have take into consideration the movement of material through the cylinder. Was specified above if the material is in the areas of plastification and dosage, the structure of the flow of material is subject to a diffuse model with a single parameter, the load area (first technology area) movement structure of material in corresponding to the model of the ideal moving .

The mathematical model of the heating model for a zone of plastification in normal exploitation, is developed with consideration to the fact that in this area begin removing heat from plastic deformation of the material and cylinder temperature to moving the material is a constant size determined by type of processed material.

Block diagram of mathematical model is present in figure 5:

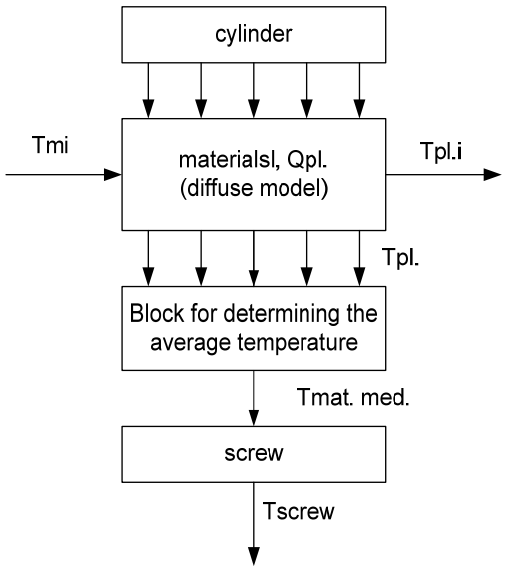


Figure 5. Block diagram of the mathematical model which describe the thermal working regime for plastification area [5]

For each block are elaborated equations heat balance in differential form:

1) for the cylinder:
$T_{cil.i}(l,\tau)$ = const, i- thermal zone number (i= 1,2,3);
2) for material taking into account that the flow structure of the material is described by a diffuse model with a parameter:

$$\begin{aligned}&\frac{d}{d\tau}\left(\overline{\Delta S}_i \Delta l \overline{\rho_{Mi} c_{Mi}} T_{Mij}\right) = \\ &= u_M \Delta S_i \overline{\rho_{Mi} c_{Mi}} \cdot (T_{Mij-1} - T_{Mij}) + \\ &+ u_M \Delta S_i \overline{\rho_{Mi} c_{Mi}} \cdot (T_{Mij+1} - T_{Mij}) + \\ &+ Q_{pl} + k_{cil.-mat.} \Delta S_{cil.i.j} (T_{cil.i} - T_{Mij}) \\ &+ k_{mat.-melc.} S_{melc} (\overline{T_{med.i.}} - T_{melc.i})\end{aligned} \quad (6)$$

where: $\overline{\Delta S}_i$ - the average of the surface of the cross section of thermal zone;
Δl - elementary length of the area;
Q_{pl} - heat from of plastic deformation on the length Δl;
$k_{cil.-mat.}$ - heat transfer coefficient of the cylinder to material;
$\Delta S_{cil.i.j}$ - heat transfer surface of the cylinder to the material on the length Δl;
$T_{cil.i}$ - cylinder temperature; T_{Mij} - temperature of the material in zone j; j- index of thermal zone section [3]

3) for block which determining average temperature [3]

$$\overline{T_{mat.i}} = \frac{1}{n}\sum_{j=1}^{n} T_{Mij} \quad (7)$$

Based on equations (6-7) with prescribed initial conditions is calculated heating of the material which moving through the cylinder in length of the thermal zone. [3]

3. THE TEMPERATURE CONTROL SYSTEM SIMULATION

The equations (2-7) describe only thermal processes in the system without automatic temperature control loops.

In this subparagraph is elaborated a model which allows to simulate transient processes in the system with the temperature controllers for each zone separately and which allows to determine the optimal parameters of regulators for functioning the system as a whole and to consider the influence of heat between neighboring zones.

The influence of the areas was modeled in the basis of law to transfer the heat between objects at different temperatures and temperature gradients of zones the active part of the injection unit of machine, this allows us to determine the influence of each zones and to regulate the system temperature in zones when there is this influence.

Also in this model is simulated the elimination of heat by the material processed in depending on the coefficient of viscosity and pressure exerted on it during the injection.

As an example in Figure 6 is shown the scheme of the model with fuzzy regulator.

The simulation of model with regulators P, PI, PID was performed also with this scheme then where they were replaced with the fuzzy controllers so that we simulated the model with different regulators and performed a qualitative analysis of transient processes with different types of regulators.

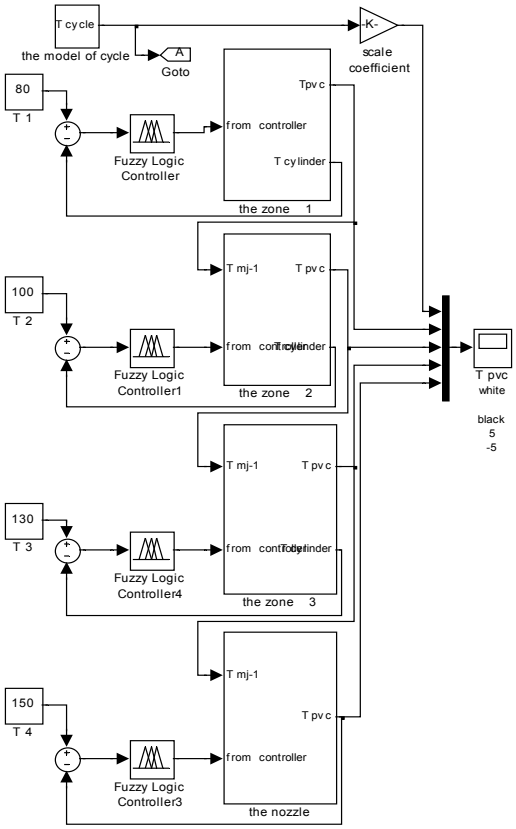


Figure 6 Simulink model of the temperature control system

The results obtained in simulation the model without temperature control system:

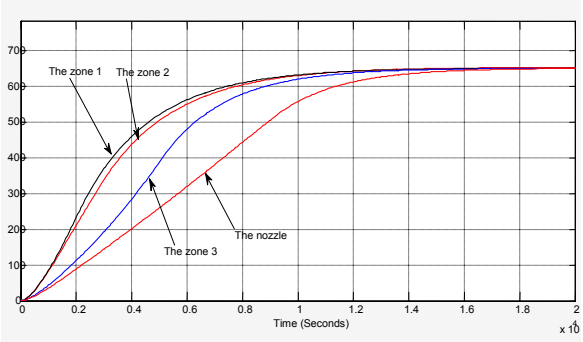


Figure 7 The temperature variation in each zone of the cylinder in starting regime without a regulating system

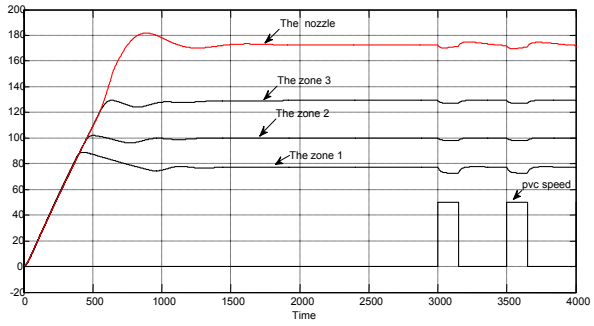


Figure 8 The temperature variation of material with PID regulator

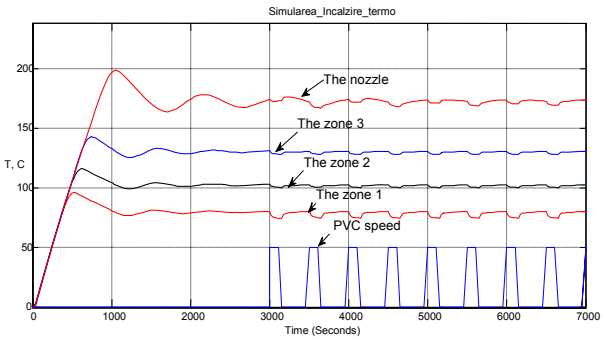


Figure 9 The temperature variation of material with PI regulator

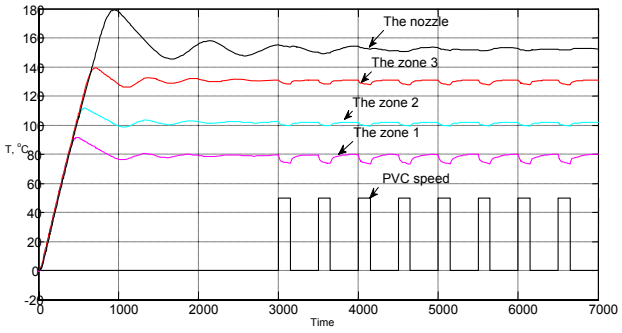


Figure 10 The temperature variation of material with Fussy regulator

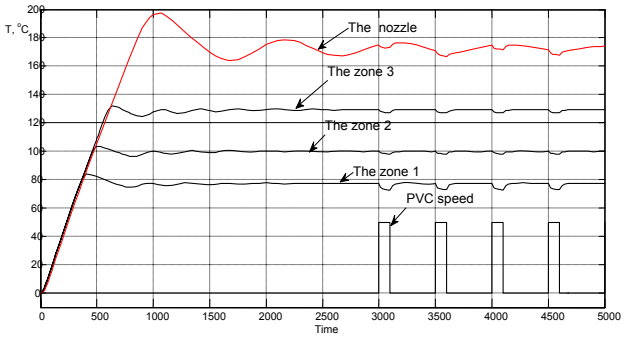


Figure 11 The temperature variation of material with P regulator

Simulation of the heating system of injection unit allows us to observe the temperature changes in every heating zone of cylinder in starting regime of the machine and working regime under a cyclic speed variation of material processed through the plastification cylinder.

The comparative analysis of the results of figure 7-10 are resulting that the best performance for this system is ensures with a PID controller, with a minimum override of temperature in the nozzle of only 7%, stationary error of 1.4 %, the transitory time is 1000 s.

The influence of the zones is more pronounced when the temperature difference between zones is higher which causing an error occurs the temperature control to the zone to which is prescribed lower temperature.

CONCLUSIONS

The resultants of this work are:

1. Was elaborated a mathematical model of the plastification cylinder of injection molding machine by analyzing the physical process of plastification with elimination an amount of heat of processed material under the influence of pressure exerted by the screw. The model is liable to be user for the different types of machines with different constructive parameters of the injection unit.
2. Computer simulation permitted to optimization of static and dynamic process of the automatic control system of temperature of the real machine in report to rapidity and exclusion of oscillations and override of temperature to the thermal areas of the plastification cylinder and nozzle.
3. The results of this study was used to modernization the control system with PLC of plastic injection machine type ДЕ 3330 Ф1 [7]. To practical tests of the upgraded machine, has been demonstrated that digital temperature control for each thermal area ensure to the slow output to stationary regime, avoiding thermal shocks that lead to increase of the reboot, maintaining constant parameters and compensating disturbing factors .

REFERENCES

1. Tomoyuki AKASHI: *Temperature Control of Heating Cylinder of Injection Moulding Machine by Decoupling Method*, Trans. of the Society of Instrument and Control Engineers Vol.E-1, No.1, 51/59 (2001)
3. Dominick V. Rosato, Donald V Rosato,Marlene G. Rosato: *Injection molding handbook*, ed. 3 ISBN 0-7923-8619-1, 1997
4. *Tehnologii de injecție în matriță*: Îndrumar de proiectare, Universitatea Politehnica București, Facultatea Ingineria și Managementul Sistemelor Tehnologice, CatedraTehnologia Construcților de Mașini, 2009
5. Douglas M. Bryce: *Plastic Injection molding; Manufacturing Process Fundamentals* . SME, 1996. ISBN 0-87263-472-8
6. Cazac Vadim: *Automatizarea mașinii de injecție a materialelor plastice*; Teză de master, Chisinau, 2012.
7. http://www.impuls95.ru/catalog/item/thermoplastic_3330_f1.html

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

PROPERTIES EVALUATION OF BIODIESEL FUEL MIXTURES

Timur Chis

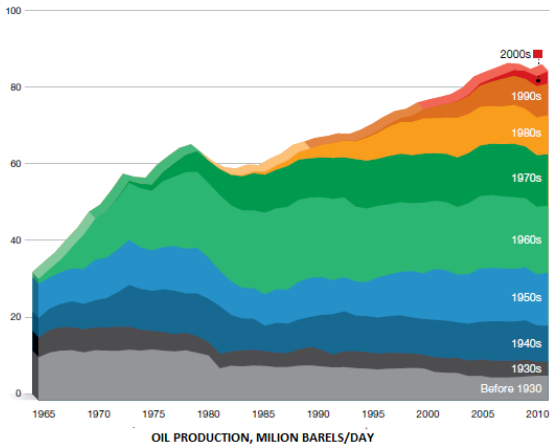
Ovidius University Constanta

ABSTRACT: *To reduce organic volatile pollution and waste gases (VOC) has established itself as oil to be mixed with biodegradable products. The presence of 5% biodiesel in diesel and 5% ethanol in gasoline blending brings along problems of these products and the need to assess the quality of these mixtures.*
This paper aims to present the results of our research needs that must meet the two products (biofuels and oil products) to be mixed and how best to blending and mixing properties obtained from evaluating mathematical and laboratory results.
It also presents a numerical optimization method to mixtures of the components so as to achieve the desired results by the end consumer of petroleum products and bring changes to their quality and quantity.

KEYWORDS: oil, biofuel, mixture.

1. Introduction

In the 2007-2011 oil production increased from 84 million bpd to 88 million barrels per day with less variation of it in 2009 (the year beginning the global crisis). But although increased production and consumption is maintained at a constant level is observed that the price has not dropped very much.



Maintaining high price is due to:
a controlled level of extraction (and so few oil suppliers)
b Conditions increasing extraction (increasing costs).

For the period immediately following the global oil production will continue on a trend growth of 0.2%, the production capacity of 90 million barrels per day (14,310,000 cubic meters per day) [Oil-Supply Trends 2011].

This regression is due to extraction:

a. Reduce a growth of oil-consuming countries,

b Geostructures political change in Arab countries (unfolding revolution reduced oil and gas production),

C. Development of alternative energy (wind, bio-type products, etc.)

D. Increasing environmental requirements in oil consuming countries.

It also forecasts the development of oil production for the period 2012-2040 [Oil Supply Trends-2011] indicate a change in supply sources (sources conventional production will drop to 60 million barrels per day), increasing production LPG and oil and marine shale.

Decreasing the amount of oil from conventional sources is due to:

a decreasing rate of discovery of new conventional oil deposits,

b Growth natural decline of existing deposits (reduced production of oil during operation),

c Reduction of reservoir gas pressure during the extraction and thus reducing the amount of oil extracted due to this pressure,

d Oil deposit water front advancement due to lower gas pressure and thus increasing the water-oil ration during the extraction,

In the current system of exploitation of oil deposits, the level of extraction (recovery factor) is more than 45%. Also a deposit of oil exploitation takes place over a period of 30 years, production capacity is variable depending on the cutting active layers and the investment made.

In conditions of increasing oil prices on international markets and maintaining selling prices of petroleum products at a constant level, any refinery processing provide efficiency by:

a. bead of profit reduction of processing ensuring of cheaper crude processing

b. Ensuring similar blend crude type and quality at the design behind the refinery.

In these circumstances processed in the refineries in Romania during these types of oil:

Trees in a refinery to provide a crude mixture of type C and type selected selected,

c. in refinery Teleagen ensure a mixture of the crude oil type Petromar type Rebco (Russia),

d in Midia refinery ensure a mixture of oil type Kazastan (CPC) and Rebco (Russia),

d in Onesti refinery plant modifications are made to process a crude type CPC (Kazastan).

As shown refineries:

a. and a changed supplier of oil after 1990,

b have changed the type of crude processed.

Therefore the need for delivery of crude blend type is dictated by:

Ensuring a constant volume of oil with strict conditions on physicochemical properties (for the ultimate quality of finished products in the refinery), considering that during the production deposit (which was the basis for designing refinery) it decreases decline due to the deposit,

b.

Ensuring a better quality oil with higher prices and therefore the sale of finished products

Obtain products quality (given that oil is a declining sales trend).

Given the multitude of Deposits that provide a wide range of crude oils and evolution of external suppliers (Currently very expensive REBCO crude oil type oil-type near Brend) WAS Chosen as a way of working in the building blend crude Mixtures According to the provider at and less time depending on economic and Financial Analysis. This is due primarily to transportation company (Can not provide a separate transportation system for each batch of oil) and low storage capacity (Often lots of oil pumps with different properties in the Same tank). Just so a new strategy in Romania raw evaluation and Implementation of Principles of Their mixing

2. Experiments

In Romania the first research on mixing crude and petroleum products were performed in the Laboratory of Chemical Analysis of Petroleum Products Enterprise conditioning CHIMPEX Jenicu Nicolau found by engineer since 1970 [J.Nicolau-1970]. Studies have tried to establish: best recipes of a mixture of diesel and fuel oil for marketing as bunkering fuel, Recipes optimal mixtures of oil in order to ensure conditions pipeline. The end result of assimilation research conditions consisted of mixing oils (use indices Maurine Henry) to achieve blend crude type (with notes that before mixing to ensure rates are performed and laboratory tests).

Also in the paper "Mathematical programming in the oil industry" [M.Manea-1970], Mr. Gheorghe I. husband presented a linear mathematical model to ensure appropriate processing crude mixtures. In this model linearization tried oil mixtures based only on price and working conditions and less than physico-chemical components. Research has been resumed by Timur Chis [T.Chis-2011] by trying to find a mathematical model to ensure behavior mixing oil physico-chemical properties according to (density, viscosity and pour point).

In laboratory studies undertaken and published articles [T.Chis-2012] were presented:

Romanian oil with a viscosity behavior after their mixing, Effect of additives on oil mixtures, What is the best in solving the mathematical model of crude mixtures. In the literature world oil mixtures are studied to optimize them in creating the blends as economically viable. In his article "A Novel Scheduling Strategy for Crude Oil Blending" [L.Bai other-2010] presents a numerical model that aims to optimize the flow control mixtures from various components of the blend result. After applying this model can be a computer program useful in achieving blend crude, which considers only the flow of oil and its price (to create a more profitable blend).

Such properties can be additive (ie its final value is directly proportional to weight) or neaditive.

For additive properties determine the final value as follows:

$$M = \sum_{i=1}^{n} m_i$$

$$P = \frac{\sum_{i=1}^{n} m_i p_i}{M}$$

Where:

-M is the mass-mixing,

- I is the mass components,

- P is the property.

As additive properties have been defined:

a density,

b. content of sulfur

c specific gravity.

For properties ne additive relationships were established:

$$y_i = f(p_i)$$

$$M = \sum_{i=1}^{n} m_i$$

$$Y = \frac{\sum_{i=1}^{n} m_i y_i}{M}$$

$$P = invf(Y)$$

$$1 \le i \le n$$

where:
- i is the mass of component I,
- p_i is the property of component i,
- y_i is defined as pseudo property of component I,
- M is the mass of mixture,
- Y pseudo-mixing property,
- Real property P of the mixture,
- F function of obtaining property by pseudo property y p,
- Invf function to obtain real property P of the mixture with pseudo properties Y.

As neaditive properties were determined:
a pour point,
b freezing point
c boiling point,
d point of aniline,
e flash-point,
F. ASTM color,
g color of Union,
h distillation temperature at which 10%, 20%, 30%, 40%, 80% and 90% by volume.

3. Viscosity oil mixtures

a. Method H.Maurin

In this paper Programation Lineair Apliquee [H.Maurin-1967] was able to define a system of analysis of mixtures of oil viscosity behavior, which can be useful and oil mixtures.
It stretches from the use of indices to calculate viscosity.
Equation to calculate the mixture viscosity is

$$IHM = \sum_{i=1}^{m} m_i \cdot IHM_i$$

where:
- IHMi is pseudo properties (in this case index Henri Maurine),
- I is the amount required mixture.

b.Method of viscosity index (Equation Refutas)
VBI is denoted by the mixture components viscosity index.
VBI = 14.534 × ln [ln (v + 0.8)] + 10.975
In eqution above v is viscosity (cSt) and ln is the natural logarithm.
In the second stage [Robert E. Maples -2000], is calculated:

VBIBlend = [wA × VBIA] + [wB × VBIB] + ... + [WX × VBIX]
Where w is the weight fraction (% ÷ 100) of each component. Once we obtain the mixture viscosity index is to determine the viscosity reversing equation :
v = ee (VBN - 10.975) ÷ 14.534 - 0.8
where VBN is the mixture viscosity index and e is the transcendental number (Euler number = 2.71828).

Techniques for mixing oils

Blend crude type (resulting from mixtures of compounds) must meet the following conditions:
a. uniformity,
b final product properties meet the requirements of the beneficiary,
c To ensure continuity in providing final produslui.

To obtain a mixture of type blend can apply these techniques:
a mixing of components in lines a pumping
b mixing components in tanks,
c Mixing components in airflow.

Blending mode to obtain a necessary component of type oil blend is achieved by:
a product of mechanical agitation,
b Injection of gas flow,
c circulation fluid jet mixing.

Also mixing of components can be performed in a continuous or discontinuous.

3. Results obtained

To see the behavior of physical parameters of compounds during oil and biofules to achieve mixtures in the laboratory, Chemistry, Electronics and Petroleum Faculty Technology we performed a set of tests on a mixture of oil.

By studying the density and viscosity to try:
a.Determination of variation of these properties with a mixing ratio,
b. Checking the results with numerical models described above,
c. Making a model of numerical simulation.
Viscosity was determined according to standardized ASTM [ASTM D1665 - 98 (2009)] Engler Viscometers.
Density was determined according to standardized ASTM D1298 99 (2005).
He conducted an experiment to see the influence of ration on the viscosity and density mixing.
They mixed one crude oil PETROMAR and Biodiesel has the following properties:

PETROMAR OIL
Density from 0.8255 to 15^0C,
Viscosity 4.66^{0}E

BIODIESEL
Density from 0.8702 to 15^0C,
Viscosity 1.88^{0}E

RATIO BIODIESEL	RATIO OIL	DENSITY OF MIXURES
200	0	0.8702
190	10	0.867965
180	20	0.86573
150	50	0.859025
50	150	0.836675
20	180	0.82997
0	200	0.8255

VISCOZITY MIXTURES (S)	VISCOZITY GRADE (E)
96	1.882352941
99	1.941176471
103	2.019607843
112	2.196078431
172	3.37254902
208	4.078431373
238	4.666666667

OIL PETROMAR	VISCOZITY,E	VISCOZITY (HM)
0	1.882352941	23.59
10	1.941176471	23.877
20	2.019607843	24.164
50	2.196078431	25.025
150	3.37254902	27.895
180	4.078431373	28.756
200	4.666666667	29.33

VISCOZITY BY CALCUL	DIFERENCES	%
1.85	0.032352941	3.235294
1.912	0.029176471	2.917647
1.972	0.047607843	4.760784
2.155	0.041078431	4.107843
3.332	0.04054902	4.054902
4.032	0.046431373	4.643137
4.63	0.036666667	3.666667

CONCLUSIONS

Making a crude mixture of surgery is increasingly used to make recipes for refining both the economic and especially to ensure crude oil that provides the best results for the existing plant,
It is easier to create an appropriate oil installation requirements designed only to modify the facility,
To ensure the successful sale of heavy crude

oils can be made as close to the crude mixtures better quality and more expensive
For the mixtures of oil can successfully use linear programming with application software WinQsb with boundary conditions supplied oil flow optimization function content processing finished products or cost (acquisition cost),
To determine the point of viscosity of the mixture can be successfully applied indices Maurine Henry (with error less than 5%), methodology best mixing technique is to inject the mixture of the easiest line (in turbulent flow regime) to control flow injection
Researches suggest that future to diversify in these directions:
Analysis of mixtures of oil a viscosity treated polymer
Analysis of the pour point oil mixtures,
Develop computer programs to determine optimum mixing ration in order to obtain oil with better quality and so economical.

REFERENCES

1. ASTM D86 - 11b Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure
2. ASTM D97 - 11 Standard Test Method for Pour Point of Petroleum Products
3. ASTM D1298 - 99(2005) Standard Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method
4. ASTM D1665 - 98(2009) Standard Test Method for Engler Specific Viscosity of Tar Products,
5. D. D. S. da Cruz, M. D. C. Faria, K. M. Boaventura, H.C. Pinheiro, M. da S. Costa- *Optimization tool for predicting crude oil blending properties*-2nd Mercosur Congress on Chemical Engineering, 2012,
6. T.Chis-*Optimizarea proceselor chimice, Aplicatii si probleme*, Editura Pim, Iasi, 2011,
7. T.Chis-Optimizarea proceselor chimice cu ajutorul programului WinQsb, Editura PIM, Iasi, 2012,
8. T.Chis-*Roumanian Oil Clasification*, SGEM Conference, Varna, 2011,
9. T.Chis-*Optimisation of Roumanian Oil Blend*, SGEM Conference, Varna, 2012,
10. T.Chis-*Optimisation of oil blending*. Chemia 2012 Conference, Constanta, 2012,
11. Energy Crisis- *Can we drill our way out*, Green Econometrics Journal, 2008

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

A STUDY OF BIOLOGICAL DECONTAMINATION OF FUEL AVIATION FIGHTING

Timur CHIS
Ovidius University Constanta

ABSTRACT: *Storage of petroleum products and bring changes to their quality and quantity. Especially in jet fuel, its storage resulted in loss of fuel quality due to microorganisms. Although chemists and biologists confirmed by theoretical studies that the presence of heavy metals (particularly lead) and low wax content and high arenas may destroy microorganisms. But microorganisms can develop their abilities to degrade hydrocarbons, or structural advantages are the extremely simple cell, which can adapt to critical situations.Also available organic substances in oil and food provide the energy source for some microorganisms.*
They degrade oil and jet fuel especially these inconveniences may occur:
a. Blocking filters,
b. Pipes blocking,
c. Errors of measurement devices for fuel
d. Corrosion acceleration due to sedimentation of water,
e. Damage to fuel quality (density, turbidity, octane modify).
To eliminate these possibilities should be sterile conditions for storage of fuel, this is impossible,
To ensure the elimination of this drawback, this material is to present the results obtained by the author on aviation fuel samples treated with micro molds) and were decontaminated with organic acids.

KEYWORDS*: OIL, KEROSEN, WATER EFECTS, COROSION.*

1. INTRODUCTION

During the storing of petroleum products to solve a problem is a loss of quality due to their cuataminations. In specialized studies [D. Popescu, 2004] this idea has appeared in small amounts and arenas in large amounts inhibits the development of micro-organisms. Also it was considered as heavy metals existing in the structure of hydrocarbons (lead, etc) and the solvents growth of resistant organisms slows down in oil. Through the study of water from petroleum products storage [T. Chis, 2012] it was established that some micro-oganismes they develop the ability to degrade hydrocarbons forming stages that metabolize bioconoses substrates organic.

Organic substances present in hydrocarbons in a variety of chemical structures provide a supportive environment for the development of microbial cultures in appropriate conditions of temperature, pressure and humidity the outer.

Starting from the idea that biodegradation is an attribute of organic substances by ensuring the circulation of chemical substances in nature, this property has on petroleum products and in particular on the negative effect of aviation kerosene by stopping pipes transport, combustion, decrease properties accelerating the corrosion rate, stopping flow

filters and especially the emergence of errors in reading apparatus quality control of oil.
Precisely why the airline industry have introduced quality standards to ensure a smooth
operations of aviation fuels. To maintain the quality of these products is necessary to store oil kerosene of sterile conditions in Aviation (what is doable) or maintenance activity of micro-organisms to a level at which their development, not to bring damage to air operators.
This material are intentions to studying the behaviour of oil and petroleum products (by especially kerosene) contact with bio acids.
These microorganisms are geared to the conditions of the water found in petroleum research on microbial metabolizing farm of hydrocarbons acknowledging the results obtained through the issue of the effects of a biological, chemical or organic.
Metabolic pathways of degradere hydrocarbons consisting in the production of enzymes and depraved surfactantilor after which specific forms of oil emulsions. Biosurfactants are byproducts of yeast and bacteria Gram negative and positive. The final products are carbon dioxide and water, but it forms the final aldelhide as byproducts, ketones, alcohols and organic acids (which are more than hidrocarburiile intiale oxidizable).
Alkanes with linear short catena (C2-C8) of Mycobacterium paraffinicum are byodegradations or Pseudomonas species [D. Daylarde, E. Saccol, 1996]. Alkanes with long isomery storable representation (C9-C20) are metabolizations of Pseudomonas, Micrococcus, Actinomyces, Torulopsis Candida, Penicillium, Aspergillus, Hormonicus. Alkanes Branched are with metabolizations of isomery Corynebacterium. Cycloparafines are treated as species of Pseudomonas and Nocardia. Degradation of olefines by breaking doubles is the connecting links. The arenas are the source of carbon for microbial species of Pseudomonas, M., Hormonicus.
The petrochemical industry is due to replacement of microbial contamination of stored products contaminated water, this water vapor in the storage area, lack of proper evacuation of oil (when the outlet is in the aqueous sediment storage). Water storage area is an essential factor for development of microbial cultures. At the interface between water and oil are developing microbial cultures in water due to dissolved oxygen, carbon found in oil and mineral elements from water and oil as the growth and development of microorganisms. This ensures the development of aerobic organisms oxygen, but when the culture decreased oxygen using anaerobic microbial metabolites obtained in aerobic processes. Following the development of these crops to eliminate hydrogen sulfide gas corrosive. To note that when biocenosis formation, microbial degradation occurs rapidly and cultures death is submitted to a slurry tank bottom stick. Also as metabolites of microorganisms with an occurrence of surfactant action on blood interaciale water-oil. Reducing this tension leads to increased water solubility in oil and petroleum product so turbititatii increase.
One problem is the use of contaminated oil formation of biopolymers on injectors or filters due to increased cell mass. Also microbial growth additives that destroy the structure of nitrogen or phosphorus (D. Popescu, 2004)

2. Experiments

To observe the behavior of oil contaminated with microbial cultures were collected 5 samples of such storage tanks:

a. sample of oil with a density of 0.870, 0.05% water and 1.3 sulfur,
b. A sample of kerosene
c. A sample of water from storage tank kerosene,
d. A sample of water from crude oil storage tank,
e. A sample of sediment from the oil storage tank.

All samples were examined with an electronic microscope X 1000 aiming at the opalescent oil, viscosity and content of suspensions in water sample odor and the amount of suspension and the interface water / oil emulsification and transparent tape.

The degree and type of contamination was performed according to ASTM D 5465-93 method. The method consists in determining the growth of colonies at the same temperature on a contaminated sample. Sample set for analysis is emulsified in a sterile Ringer solution and homogenized in a sterile Petri agar melted and flooded the flat surface of solid agar. Grown colonies are counted to estimate the degree of microbial contamination of samples tested, results are reported in units colony per milliliter (cfu / ml). Also we studied the effect of bioacid crops by liquid chromatography analysis. To reduce microbial cultures was used consisting of chlorine and methyl bioacid combined with izotiazolin (5-chloro-2-methyl-4-izotiazolin-3-one).

3. Results obtained

Samples of the oil tank were analyzed and were found on these microbial populations:

Sample of oil-Flavobacterium leiagnothi, resinovorum Flavobacterium, Flavobacterium and Pseudomonas flavescens Alcaligenes.

Water samples: Pseudomonas fluorescens.

Sampling of kerosene tank was analyzed and these were identified microbial cultures: Tetracoccus sp. Micrococcus sp. And Acinetobacter lwoffii.

Also contains water: Flavobacterium Flavobacterium denitrificans gelatinum Acinetobacter parvulum Flavobacterium indologenes Pseudomonas fluorescens

All bacteria are identified in the literature.

To inhibit growth of microorganisms was used bioacid made of a mixture of chlorine, methyl izotiazolin (5-chloro-2-methyl-4-izotiazolin-3-one).

This bioacid was used in composition of 150 ppm, 100 ppm and 50 ppm to 1 liter samples aiming at:
A. Evolution of microbial populations,
B. Quality of kerosene,
C Quality oil.

To study the evolution of microbial populations were formed 24 samples collected every 4 of each sample.
Were treated with 3 samples of each product bioacid microbial populations and behavior followed for 3 weeks.
The results are:

First sample:

Crude :
- the first day -1.8 x 102 CFU / ml,
- the first week, -3.6 x 102 CFU / ml,
- second week -7.2 x 102 CFU / ml,
- third week -10.4 x 102 CFU / ml,

Water in oil:
- first day -2.3 x 104 CFU / ml,
- the first week, -4.6 x 104 CFU / ml,
- second week -6.9 x 106 CFU / ml,
- third week -10.3 x 106 CFU / ml,

Kerosene:
- first day -3 x 103 CFU / ml,
- the first week, -6 x 103 CFU / ml,
- second week -9 x 103 CFU / ml,
- third week -12 x 103 CFU / ml,

Water in Kerosene:

- first day of -5 x 105 CFU / ml,
- the first week, -6 x 105 CFU / ml,
- second week -7 x 105 CFU / ml,
- third week -8 x 105 CFU / ml,

Treatment with 150 ppm bioacid

Crude

-First week, -5 x 10 CFU / ml,
-Second week -3 x 10 CFU / ml,
-Third week -2 x 10 CFU / ml,

Water in oil:

-First week, -1.5 x 102 CFU / ml,
-Second week -1 x 102 CFU / ml,
-Third week -0.3 x 102 CFU / ml,

Kerosene:

-First week, -2 x 10 CFU / ml,
-Second week -1 x 10 CFU / ml,
-Third week -0.8 x 10 CFU / ml,

Water in Kerosene:

-First week, -2 x 103 CFU / ml,
-Second week -1 x 103 CFU / ml,
-Third week -0.5 x 103 CFU / ml,

Treatment with 100 ppm bioacid

Crude
-First week, -1 x 102 CFU / ml,
-Second week -0.8 x 102 CFU / ml,
-Third week -0.5 x 102 CFU / ml,

Water in oil:
-First week, -3 x 103 CFU / ml,
-Second week -2 x 103 CFU / ml,
-Third week -1 x 103 CFU / ml,

Kerosene:
-First week, -0.5 x 102 CFU / ml,
-Second week -0.3 x 102 CFU / ml,
-Third week -0.1 x 102 CFU / ml,

Water in Kerosene:

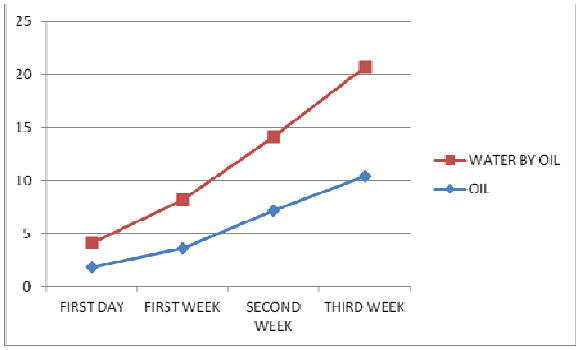
-First week, -2 x 102 CFU / ml,
-Second week -1 x 102 CFU / ml,
-Third week -0.5 x 102 CFU / ml,

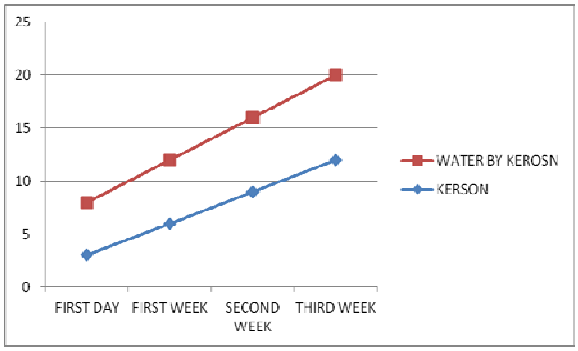
CONCLUSIONS

Samples were collected from two reservoirs, namely oil and kerosene.
Microbial populations were analyzed in four stages, namely the oil, water from oil, kerosene and the water in kerosene.
Note that water samples contain more pollutants than product samples.
Treatment with a form of chlorine and methyl bioacid reduce populations of microbial cultures.
Also bring a higher content bioacid microorganism cultures maintain a low level.
Need a larger amount of bioacid but product quality decreases

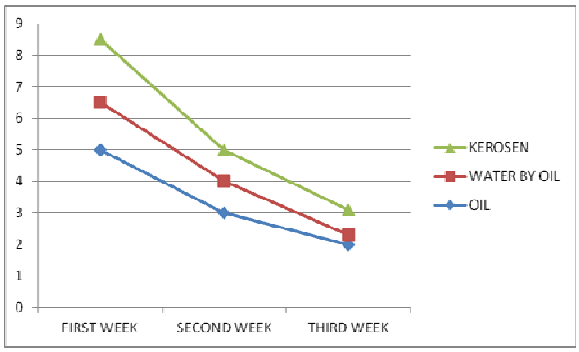
REFERENCES

1. - Fuel analysis. RL 900 Test Methods 26,
2. T.Chis-Efects of oil and kerosene to microroganisme, SGEM Conference, Varna, 2012,
3. CDNenitescu - Organic Chemistry, Vol 1, Didactic and Pedagogic Publishing, Bucharest, 1980,
4. Christine Gaylarde, Enilson Saccol L. To, Peter M Gaylarde - LABS 2 - Biodegradation and Biodeterioration in Latin America, Brazil, March 1996
5. D. Popescu-control study of microbial contamination of jet aviation fuel, oil and Environment Conference, Ploiesti, 2004





EVOLUTION BY MICROBIAL TO SAMPLE



EVOLUTION BY MICROBIAL TO SAMPLE TRATED BY 100 PPM BIOACID

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

APPLICATIONS OF ENVIRONMENTAL INFORMATION SYSTEMS IN HYDROMETEOROLOGICAL FORECAST

Mirela COMAN*, Bogdan CIORUȚA*

*Mineral Resources and Environment Faculty, North Center University of Baia Mare
Tehnical University of Cluj-Napoca, Romania
Address: 62/A Victor Babeş str., 430083, Baia Mare
comanmirela2000@yahoo.com or bciorutza@yahoo.com

Abstract: *Environmental Informatics, defined as the research and system development focusing on the environmental sciences relating to the creation, collection, storage, processing, modeling, interpretation, display and dissemination of data and information, could be considered one of the best options which provide the expected solutions for the increasing complex expectations of the mankind in the field of ambient protection.*

In a broad sense, hydrometeorology is a border line science linking meteorology - the science of atmosphere - with hydrology - the science of water of the earth and earth's atmosphere.

The purpose of the present paper is to extend the perspectives in studying of Environment Information Systems integrated in the problematic issues reclaimed by the hydrometeorology field. Therefore, during this work paper, we try to give additional explanations for the methodologies and strategies implicated in the evaluation and forecasting processes with a vision in developing future.

According to the real impact of the Environmental Information Systems focuses on the development of new and innovative approaches to the creation, dissemination and applied use of environmental information resources we reemphasize the significant role of EISs in the attractive background of hydrometeorology. Obviously, the importance of the subject of hydrometeorology has become increasingly recognized and it is studied with the help given by the tools develop in this sense, tools that make the importance of Environmental Information Systems to be vital in the context of applied hydrometeorology.

Keywords: *Environmental Informatics, environmental sciences, hydrometeorology*

1. INTRODUCTION

The present era that we are living can be described, without restraint, as the "Information Age" [11, 12]. No matter what area of science and technology we look at, it is more obvious than ever that we are dealing with an 'information overflow' without precedent in the history of humanity [3].

In this context is being clear to everyone that we are dealing also with an 'environmental information overflow'.

Environmental Sciences are no exception to the rule [2], so the recent advances in this field would have been unthinkable, unmanageable and unattainable without the support offered by the computational mathematics and the modern information technology tools, in the sense of Environmental Information Systems or in the large perspective given by the Environmental Informatics [2, 3].

Environmental Informatics (EI) [11], defined as the research and system

development focusing on the environmental sciences relating to the creation, collection, storage, processing, modeling, interpretation, display and dissemination of data and environmental information, could be considered one of the best options which provide the expected solutions for the increasing complex expectations of the mankind in the field of ambient protection.

Also EI with the exceptional help of Environmental Information Systems (EISs) [3], provides the information processing and communication infrastructure to the interdisciplinary and very complicated field of environmental sciences aiming at data, information and knowledge integration, the application of computational intelligence to environmental data as well as the identification of environmental impacts of environmental information technology.

As a part of the Environmental Informatics [11] and also as a branch of meteorology that deals with problems involving the hydrologic cycle, the water budget and the rainfall statistics of storms, the hydrometeorology could be consider, in a broad sense, as a border line science linking meteorology - the science of atmosphere - with hydrology - the science of water of the earth and earth's atmosphere.

However, the perception of this science is often premature and non-unanimous [3,12], factor which makes the boundaries of the hydrometeorology to be not clear-cut and the problems of the hydrometeorology to overlap with those of the climatologist, the hydrologist, the cloud physicist, the weather forecaster and the managers. Much more, this perspective for different specialist to interact makes considerable emphasis which are placed on determining, theoretically or empirically, the relationships between meteorological variables and the maximum precipitation reaching the ground. These analyses often serve as the bases for the design of flood-control and water-usage structures, primarily dams and reservoirs.

Other concerns of both informaticians and hydro-meteorologists include the determination of rainfall probabilities, the space and time distribution of rainfall and evaporation, the recurrence interval of major storms, snow melt and runoff, and probable wind tides and waves in reservoirs.

The whole field of water quality and supply is of growing importance in hydrometeorology and also in the sector of environmental information systems, where the environmental informaticians give the necessary information for shaping, creating and implementation of the sustainable development strategies for local and regional communities.

2. CONSIDERATIONS OF EISs IMPLICATIONS IN HYDROMETEOROLOGICAL FORECAST

2.1 The hydrometeorology – conceptual boundaries and perspectives

The hydro-meteorological science with its relative applications [1] has made strong progress over the last decade at the European and worldwide level. In these conditions appear new modeling tools, post processing methodologies and observational data. The recent European efforts in developing a platform for e-science provide an ideal basis for the sharing of complex hydro-meteorological data sets and tools.

Despite these early initiatives, however, the awareness of the potential of the Grid technology as a catalyst for future hydro-meteorological research (HMR) is still low and both the adoption and the exploitation have astonishingly been slow, not only within individual EC member states, but also on an European scale.

Lately, special attention was given to research, management and control issues whether we refer to environmental pollution, as a whole, whether we talk about risks (hazards) technological or natural and all disturbing elements to the dynamic equilibrium of the environment or with a degree or another of acceptability for the population.

For the development of hydrological forecasts, the necessary basic data are collected the field devices via a network of meteorological and hydrological characteristic points located in the river basins [4, 6]. These

data are transmitted to the dispatcher center where are processed resulting the real characteristics of floods.

At the dispatcher center arrive also recorded data on hydraulic structures in the area and after processing, resulting their influence on the hydrological regime. Having available all the data collected, the dispatcher center sets to reach the optimal commands hydro-technical constructions and protection measures required in various sections of the river network. Therefore, construction of a hydro-technical basin shall be the source of information for the hydrologic flow regime changed and beneficiaries of hydrological forecasts for optimal and safe operation.

2.2 The methodology of obtaining and disseminating the hydro-meteorological information. The Water Information Systems (WIS) and its importance

Measurement at the points of, the data are obtained using non-automated and automated processes media [4]. Non-automated resources are common and include the bridegroom, limnigraphes, hydrometers, thermometers, pluviometers, pluviographes.

Resources shall be automated stations equipped with sensors to measure rainfall and temperature main and stations equipped with sensors to measure water levels, rainfall and temperature.

Besides the main sensors at these stations can add sensors to measure other hydro-meteorological factors such as humidity, atmospheric pressure, wind direction and speed, the sunshines, the water equivalent of snow, etc.

Stations are measured at times scheduled by the collection, query cycle is adjustable between 15 minutes and 6 hours to the needs dictated by general hydro-meteorological conditions.

Basic means of systematic dissemination of hydro-meteorological information and forecasts are daily hydro-meteorological bulletin, but besides this, there are special situations or restricted areas, and in this case, we need a special hydro-meteorological bulletin.

The Environmental Information Systems (EISs) consists therefore of all means of collection, transfer, processing and verification of information in the decision-water resources of hardware known as well as all procedures, programs and information processing software, programs related-known means of software.

The Water Information System (WIS), as part of the EIS, include the classic, established based on human operators and automated water information system based on the - component calculation and applied ecuations or functions related to computational mathematics [7, 8].

The concept of information flow in the water includes all ways of gathering, transmission, processing and utilization of information as well as content and frequency.

Such information is divided into two categories [4]:

- slow flow or statistical information;
- fast or operators information flow in real time.

In the water activities decision-making shall be used both types of information [7]. Much of the information flow becomes faster recovery after slow flow information and is stored in so-called statistical databases and others that are not needed in decision-making disappear after a preset time.

Collection, compilation, processing and use of information decision scope selected from water are through specialized units called, "dispatching of the waters" with skills

in line with the country's territorial administrative organization [4, 9].

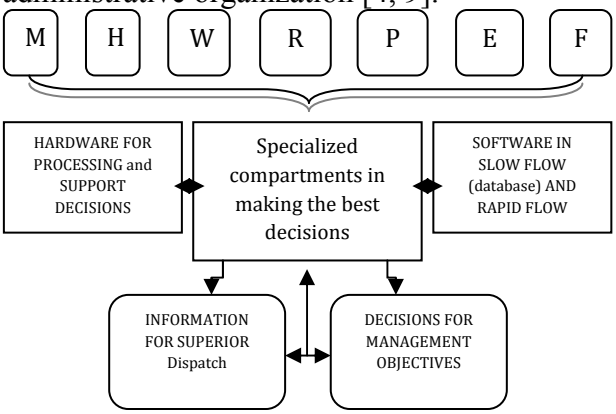


Fig. no. 1. The scheme of WIS-dispatcher

The input information [4] for the Wather Information System (WIS) - dispatcher are characterized by the following categories of data: meteorological (M), hydrological (H), data exploitation of hydrotechnical works (W), issues relating to regulation of water uses (R), the protection of water quality data (P), environmental protection (E), protection against floods and ice (F). The main products of the dispatch information refer to the selection of the higher dispatcher information and decide for dispatcher from managed targets, which shall be added and establish decision-making skills at different levels - which appears to be one of the most complex operations managerial.

In Europe, according to the implication of EIS in hydrometeorology as WIS, a large number of hydrometeorology research projects have been financed by the European Commission in the last years, projects such as:

- HyMeX (Hydrological cycle in the Mediterranean eXperiment, [13]);
- FLOODsite (Integrated Flood Risk Analysis and Management Methodologies, [14]);
- IMPRINTS (Improving Preparedness and Risk maNagemenT for flash floods and debriS flow events, [15]);
- FP6 PREVIEW (Prevention Information and Early Warning, [16]);
- CLIVAR (CLImate VARiability and predictability: a programme of the World Climate Research Programme, [17]);
- FloodProBE (Flood Protection of the Built Environment [18]).

2.3 Prediction of hydrometeorology events with help of EISs. Warnings and hydro-meteorological forecasts

Prediction of hydro-meteorological events relies on hydrological and meteorological forecast models [4, 9] that solve the basic equations that describe the hydrological cycle in the atmosphere. These predictions are based on observational measurements, for example of rainfall and river flow.

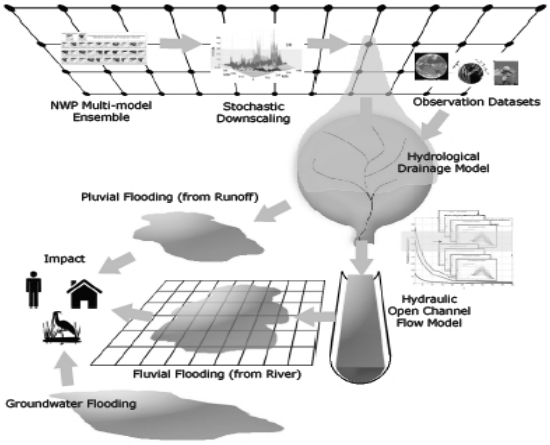


Fig. no. 2. Implication of EISs in hydrometeorological science area

In recent years [1], the quantity and complexity of the tools and data sets, as well as drawings, diagrams and charts making software, has increased dramatically for the next three reasons.

- ✓ remote sensing observations from satellites and from ground-based radars provide complete three-dimensional coverage of the atmospheric and land surface state, vastly increasing the quantity of data;
- ✓ forecasting methods combine multiple numerical weather prediction and hydrological models through stochastic downscaling techniques to quantify the uncertainty in the forecast;
- ✓ is increased recognition of the need to understand the entire forecasting chain, from observations through to civil defense response, resulting in complex workflows able to combine different

data sets, models and expertise in a flexible manner.

All the hydro-meteorological observations, forecasting methods and other prediction and models combine and develop, in a sense or another, tools given by Environmental Information Systems giving birth to a new science, of perspective, named Hydro-Meteo-Informatics.

Hydro-Meteorological Research is closely linked to operational forecasting. Researchers rely on data archives maintained by operational agencies and increasingly make use of operational modeling and simulating environmental informatics tools.

In establishing the basic hydrological forecasts, we have the following objectives:

- determine the data to be measured and collected, including the information from hydro-technical works amending the flow regime;
- establishment of computational methods, including the mathematical modeling operational;
- the endowment with the adequate computer equipment;
- ensuring a reliable informational system and the defense plans and operating regulations associated for taking of appropriate measures.

The hydrological prognosis is, in principle, through modeling, which is a research path of complex phenomena.

Application of hydrological models could have physical or mathematical dominant composition, as follows:

- ✓ representing the laws of the basin hydrologic (rainfall-runoff models) used for forecasting and generalizations;
- ✓ chronological simulation data strings to complete the measurements and observations of short duration, to which is added the transfer information, and extrapolation and interpolation of hydrological temporal and spatial parameters.

Another type of forecasting, which requires a detailed research and enjoys particular attention to, is the long-term hydro-meteorological forecast [6]. This may be based on water reserves of the basin, the water supply network of riverbeds or established statistical methods.

2.4 Environmental Information Systems applications in hydrometeorology forecast

Although international agencies like the United Nations or the European Commission (EC), national government organizations, and local authorities increasingly ask for globally certified management tools to deal with extreme events of precipitation and floods, the scientific community is still reduced to the ability to communicate *scenes* to urban, regional and national decision makers [5].

Unfortunately, the hydro-meteorological *scenes* are typically both information-light and emotion-heavy with a *degraded* view at scientific data and environmental information.

Important prerequisites of such abilities are observed data, formally sound models to supplement them, the reliable access to distributed data archives and interoperable computational technologies with respect to the Environmental Information Systems.

Without the support of an adequate information and communication infrastructure such, an undertaking will be difficult if not impossible [9].

As for scientific hydro-meteorological workflows the visualization instruments have to deal with an increasing amount of data generated by modeling tools and more sophisticated acquisition instruments.

3. CONCLUSIONS

In the context of the present era, perceived as the "Information Age", where is more obvious than ever that we are dealing with an 'information overflow' without precedent in the history of humanity, the importance of Environment Information Systems [12] is more than vital [11].

The perspective of Environmental Information Systems (EISs) [10] especially in solving many environments problems [2, 3], such as the problematic issues reclaimed by the hydrometeorology area – in accordance with this work paper - (prediction, prognoses, modeling and simulation models of floods [6], information dissemination to the public etc) [8] brings the idea that all this aspects must be integrated with the environmental information elements related to sustainable development.

Meteorologists, hydrologists and engineers have long recognized the value of hydro-meteorological data and more importantly the rainfall data for hydrologic analyses [5]. Thus, application and analysis of meteorological data for the solution of hydrologic problems has precisely come to be known as the science of hydrometeorology.

In engineering hydrology dealing with design and operation of water resource projects, the subject of hydrometeorology occupies a central position. Obviously, the same importance of the subject of hydrometeorology has become increasingly recognized [7, 8] even in the field of environmental protection engineering or in the environmental informatics area, and it is now studied not only by hydrologists and engineers but also by students from many different disciplines, with the help given by the tools develop in this sense, tools dedicated to EI [3] that make the importance of Environmental Information Systems to be essential in the context of applied hydrometeorology.

REFERENCES

1. Castronova A. M., Goodall J. L., (2010) *A Generic Approach for Developing Process-Level Hydrologic Modeling Components*. *Environmental Modelling & Software*, 25(7), pp. 821–835
2. Cioruța B., Coman M., (2011) *Evoluția, definiția şi rolul SIM în dezvoltarea strategiilor pentru protecția mediului*, revista Ecoterra, no. 27/20011
3. Cioruța B., Coman M., (2011) *Incursiune în cercetarea ştiințifică modernă a mediului înconjurător. De la SIM la Informatica Mediului*, revista Ecoterra, no. 29/20011 [www.ecoterra-online.ro]
4. Giurma, I., (2003) *Viituri şi măsuri de apărare*, Ed. „Gh. Asachi", Iaşi
5. Horsburgh J. S., Tarboton D. G., Maidment D. R., Zaslavsky I., (2008) *A Relational Model for Environmental and Water Resources Data*. *Water Resources Research*, 44(5)
6. Podani, M., Ispas, Şt., Nedelcu, A., (2001) *Hidrologie inginerească*, Ed. Sfinx 2000, Târgovişte
7. Quarati A., Rebora N., Schiffers M., (2011) *Filling the Gap Between ICT and HydroMeteo Research Communities: The DRIHMS Project*. *ERCIM News*
8. Rao I., Huh E., Lim S., (2006) *An Adaptive and Efficient Design and Implementation for Meteorology Data Grid Using Grid Technology*. [in:] Proceedings of the 15th IEEE International Workshops on Enabling Technologies, Manchester, UK
9. Şelărescu, M., Podani, M., (1993) *Apărarea împotriva inundațiilor*, Ed. Tehnică, Bucureşti
10. www.environheal.pub.ro
11. http://en.wikipedia.org/wiki/Environmental_informatics
12. www.iseis.org/jei
13. www.hymex.org
14. www.floodsite.net
15. www.imprints-fp7.eu
16. www.preview-risk.com
17. www.clivar.org
18. www.floodprobe.eu

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

CONSIDERATIONS REGARDING BAIA MARE URBAN AREA WEATHER EVOLUTION

Mirela COMAN*, Bogdan CIORUȚA*, Gilbert TARO*

*Mineral Resources and Environment Faculty, North Center University of Baia Mare
Tehnical University of Cluj-Napoca, Romania
Address: 62/A Victor Babeş str., 430083, Baia Mare
comanmirela2000@yahoo.com or bciorutza@yahoo.com

Abstract: *Human interest in meteorological domain has been manifested since ancient times, when scientists began to observe and describe the weather and have tried to explain most of the weather phenomena.*

Science in 2007 at North University of Baia Mare is continuously registered meteorological data with Oregon Scientific WMR 100 weather station type. It can follow the climatic parameters continuously from the urban area and microclimates. Recorded weather data are displayed on the main console; it has the possibility to connect to a computer and through a program allows unlimited recording of the data. Recorded weather variables are temperature indoor/outdoor, humidity indoor/outdoor, wind speed and direction, average monthly rainfall, daily, annual, atmospheric pressure, dew point temperature, the cooling produced by wind, temperature index and more.

The main aim of this paper is to survey the environment for application meteoinformatics importance of projects and for ecological research. As we know, it is necessary to extend the perspectives in studying of Environment Information Systems (EISs) integrated in the urban ambient problematic. Meteoinformatic systems became usable in terms of research recently, but their efficiency and ease of use has led to an increasing rate of their use.

As prospects for the future would be to create a computerized network through which to connect personal weather stations, obtaining valuable information from several regions of the country and can, thus clearly distinguish details of the mezoclimate of each region.

Keywords: *meteorology, weather station, climatic parameters, meteoinformatics, EISs*

1. INTRODUCTION

The beginnings of meteorology can be traced back to ancient times [1] and contain serious discussion about the processes of cloud formation and rain and the seasonal cycles caused by the movement of earth around the sun [2]. The Greeks were the first meteorologists (7th century B.C.).

Thales of Miletus associated weather with movement of the stars and planets and considered water to be the basic element of all matter. Anaximander thought that wind was moving air, idea which was later rejected by Aristotle. His ideas included the four elements (earth, wind, fire and water) in a world in which people must be seen a vital part.

He said that they were arranged in separate layers, but they could mingle.

Aristotle also believed that heat could cause water to evaporate. He deduced many things about weather, both wrong and right, but was the first to explain it. Thus, Aristotle is considered the founder of meteorology.

One of the first weather instruments was designed by a German-Nicholas deCusa. In the 15th century, he hung out some wool and noticed that it was heavier when moisture condensed on it.

Around 1593, Galileo was the first to realize that gases and liquids expand when heated, and he invented the first thermometer. Also, in 1643, Evangelista Torricelli invented the barometer. Very close to this time, wind and calibrated rain gauges were invented.

In 1686, Edmund Halley proposed that air is heated by the sunrises and winds are caused by air flowing in to replace air that has risen.

In the 1740's, Ben Franklin proposed that storms move from place to place. In 1768, John Heinrich Lambert developed the hygrometer.

In 1830, William Redfield discovered the circular path of a hurricane. He noticed that after a hurricane, trees in eastern Connecticut fell in one direction, while those in the western part of the state fell in the other direction.

In 1918, Vilhelm Bjerknes and his son Jacob discovered that many weather phenomena result from the meeting and interaction of warm and cold air masses. Also, Carl Gustaf Rossby discovered the jet stream and that it governs the easterly movement of most weather.

One of the most impressive achievements described in the *Meteorology* is the description of what is now known as the hydrologic cycle.

Meteorology, as we perceive it now, may be said to have had its firm scientific foundation in the 17th century after the invention of the thermometer and the barometer and the formulation of laws governing the behavior of atmospheric gases.

It was in 1636 that Halley, a British scientist, published his treatise on the Indian summer monsoon, which he attributed to a seasonal reversal of winds due to the differential heating of the Asian land mass and the Indian Ocean [3].

2. THE SPECIFIC IMPLICATIONS OF WEATHER EVOLUTION

2.1 The modern meteorology concept

The current weather and forecast is constantly repeated by the media as the weather channel provides meteorological information 24 hours a day.

Regular programming on television is interrupted for severe weather updates, because the meteorologists are constantly considered and called upon as key witnesses in trials where weather may have effected the events in question [4,5].

Forecasting is the real challenge of meteorology and as can be seen in the section on history, it has come a long way.

2.2 The dynamism of meteorology

Dynamic meteorology generally focuses on the fluid dynamics of the atmosphere. The idea of air parcel or area is used to define the smallest element of the atmosphere, while ignoring the discrete molecular and chemical nature of the considered atmosphere [3].

An air parcel is defined as a point in the fluid continuum of the atmosphere, in which the fundamental laws of fluid dynamics, thermodynamics and atmospherically motion are used to study the atmosphere. The physical quantities that characterize the state of the atmosphere are temperature, density, pressure, and much more, all these variables having unique values in the continuum [5].

Weather forecasting is perceived as the application of science and technology to predict the state of the atmosphere for a future time and a given location. Human beings have attempted to predict the weather informally for millennia, and formally since at least the 19th century. In this sense weather forecasts are made by collecting quantitative data about the current state of the atmosphere and using scientific understanding of atmospheric processes to project how the atmosphere will evolve in a considered time and space.

Once an all-human endeavor based mainly upon changes in barometric pressure, current weather conditions and sky condition, forecast

models are now used to determine future conditions [3,4].

Human input is still required to pick the best possible informatics forecast model to base the forecast upon, which involves pattern recognition skills, teleconnections, knowledge of model performance and knowledge of model biases.

The chaotic and complex nature of the atmosphere, the massive computational power required to solve the equations that describe the dynamism of atmosphere, error involved in measuring the initial conditions and an incomplete understanding of atmospheric processes mean that forecasts become less accurate as the difference in current time and the time for which the forecast is being made increases. The use of ensembles and model consensus help narrow the error and pick the most likely outcome.

There are a variety of end uses to weather forecasts. Weather warnings are important forecasts because they are used to protect life and property, in the sense of environmental protection and people health security.

Forecasts based on temperature and precipitation are important to agriculture, and therefore to commodity traders within stock markets. Temperature forecasts are used by utility companies, for example, to estimate demand over coming days. On an everyday basis, people use weather forecasts to determine what to wear on a given day. Since outdoor activities are severely curtailed by heavy rain, snow and the wind chill, forecasts can be used to plan activities around these events, and to plan ahead and survive them.

There are different kind of meteorology as it follows:

- *aviation meteorology* - deals with the impact of weather on air traffic management and it is important for air crews to understand the implications of weather on their flight plan as well as their aircraft;
- *agricultural meteorology* – is the science concerned with studying the effects of weather and climate on plant distribution, crop yield, water-use efficiency, phenology of plant and animal development, and the energy balance of managed and natural ecosystems;
- *hydrometeorology* - is the branch of meteorology that deals with the hydrologic cycle, the water budget, and the rainfall statistics of storms;
- *nuclear meteorology* - investigates the distribution of radioactive, aerosols and gases in the atmosphere;
- *maritime meteorology* - deals with air and wave forecasts for ships operating;
- *military meteorology* - is the research and application of meteorology for military purposes.

Creating forecasts is a complex process which is constantly being updated and always associated with the Environmental Information Systems (EISs). It involves the application of information technology and detailed meteorological knowledge of how the atmosphere, the Earth's surface and the oceans work. Like many others fields related to environmental protection modern weather forecasting applies scientific knowledge to predict future atmospheric conditions across the globe or the considerate area of a community, for example, from observations of the current state, made from land; at sea; in the air and from space.

2.3 A brief history of meteorology

Meteorology, branch of science that deals with the atmosphere of a planet, particularly that of the earth, the most important

application of which is the analysis and prediction of weather [3].

Individual studies within meteorology include aeronomy, the study of the physics of the upper atmosphere; aerology, the study of free air not adjacent to the earth's surface; applied meteorology, the application of weather data for specific practical problems; dynamic meteorology, the study of atmospheric motions (which also includes the meteorology of other planets and satellites in the solar system); and physical meteorology, which focuses on the physical properties of the atmosphere.

Aristotle's *Meteorologica* (340 B.C.) is the oldest comprehensive treatise on meteorological subjects. Although most of the discussion is inaccurate in the light of modern understanding, Aristotle's work was respected as the authority in meteorology for some 2,000 years. In addition to further commentary on the *Meteorologica,* this period also saw attempts to forecast the weather according to astrological events [4], using techniques introduced by Ptolemy.

As speculation gave way to experimentation following the scientific revolution, advances in the physical sciences made contributions to meteorology, most notably through the invention of instruments for measuring atmospheric conditions, Leonardo da Vinci's wind vane (1500), Galileo's thermometer (1593), and Torricelli's mercury barometer (1643) [4].

Further developments included Halley's account of the trade winds and monsoons (1686) and Ferrel's theory of the general circulation of the atmosphere (1856).

The invention of the telegraph made possible the rapid collection of nearly simultaneous weather observations for large continental and marine regions, thus providing a view of the large-scale pressure and circulation patterns that determine the weather.

3. THE WEATHER EVOLUTION IN BAIA MARE URBAN AREA

Knowledge of weather prediction and atmospheric parameters has been concerns since the beginning of human history. If at first the weather was seen as a divine element, then we started tracking atmospheric factors, description of weather phenomena and tried to understand weather as a complete phenomenon.

Weather forecasting is a complex process that binds many parameters which can provide current information on weather for the following days. Weather influences human activity and its prediction allow greater freedom in scheduling of human activities [1].

As we presented in a previous article ,the weather station of University of Baia Mare is used for continuous monitoring of weather condition and weather data in order to create a database [1]. The purpose of this monitoring is to continue to issue monthly and annual reports on weather and monthly and annual reports, which are useful in environmental projects, or to describe and understand the urban microclimate.

Fig. no. 1. Oregon Scientific WMR weather station

The weather station measures a broad spectrum of meteorological variables and allows wireless connection of 10 different types of sensors along the sensors included in the console. Weather station equipment includes a full outdoor sensor consisting of a thermo-hygrometer, an anemometer with vane, a rain gauge and a barometer [1].

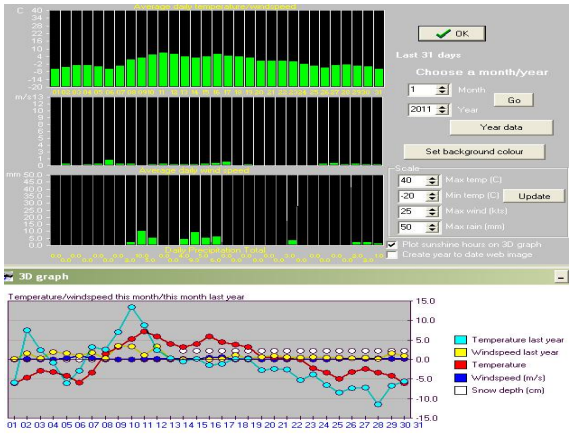


Fig. no. 2. Example of recorded weather variables

Recorded weather variables are: temperature indoor / outdoor, humidity indoor / outdoor, wind speed and direction, average monthly rainfall, daily, annual, atmospheric pressure, dew point temperature, the cooling produced by wind, temperature index and more [1].

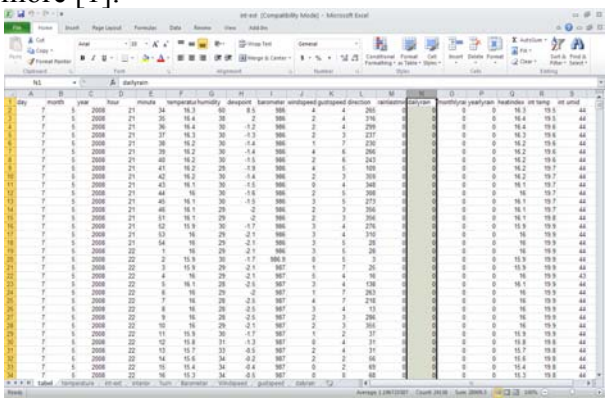


Fig. no. 3. Data registered by Oregon Scientific WMR 100 Weather Station

The main aim of this paper is to survey the environment for application meteoinformatics Importance of Projects and for ecological research. As we know, it is necessary to extend the perspectives in studying of Environment Information Systems integrated in the urban ambient problematic to give a new approach in meteorological information representation by diagrams, graphics or other figures.

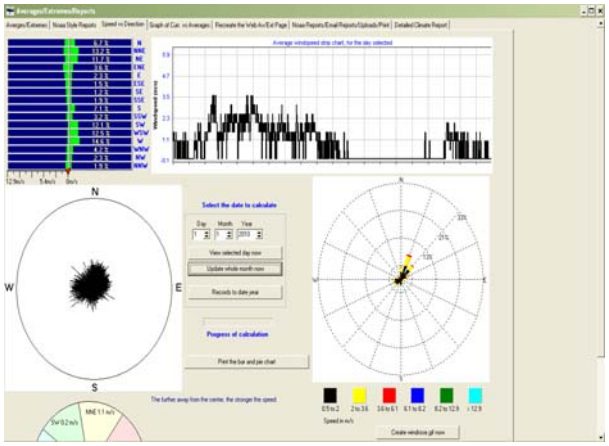


Fig. no. 4. Graphs registered by Oregon Scientific WMR 100 Weather Station

Meteoinformatic systems became usable in terms of research recently, but their efficiency and ease of use has led to an increasing rate of their use.

Weather stations such as Oregon Scientific WMR 100 Weather Station are used in most projects, thus making it easier to retrieve data about the weather. At University of Baia Mare has been successfully applied on information obtained from weather station in a number of areas, such as:

- ✓ Microclimate research – projects;
- ✓ Research in urban climate – database;
- ✓ Research on soil-tailings from Bozanta tailing damp.

As prospects for the future would be to create a computerized network through which to connect personal weather stations, obtaining valuable information from several regions of the country and can, thus clearly distinguish details of the mezoclimate of each region.

Future weather stations are tools that help everyday life of man, as a modern tool, easily accessible and useful.

4. CONCLUSIONS

The word “meteorology” and the terms associated such as “meteoinformatics” or “hydrometeorology” were coined from a research book called “Meteorologica” which was written by Aristotle [2,6]. This early work described the science of earth like its geology, elements, hydrology, seas, wind and weather.

In the modern term, the term meteorology explains a complete and multidisciplinary science. It is essential for understanding the dynamics of atmosphere and for forecasting weather phenomena like hurricanes and thunderstorms and much more [7].

Weather forecasting was practiced since the beginning of time with more or less accuracy. Historical records show several examples of weather predicting methods based on observing surrounding elements.

Sky is undoubtedly the first indicator, and the main one, used in meteorology, its cover and nature of clouds provides clues of the upcoming temperature and weather. The wind factor is also important and is associated with temperature and often rains. Animals and birds are also known to give indications about the future weather. Scientists across the world since ancient times have tried to understand the meteorological phenomena like wind and rain. Many instruments for measuring wind power, humidity and rain were invented in the early 15th century.

During the 17th century, several discoveries tipped in favor of scientific meteorology. A device to measure temperature was invented by Galileo Galilei and the factor that atmospheric pressure was linked to altitude was discovered by Blaise Pascal. The invention of barometer by Evangelista Torricelli is significantly the most important discovery. It is still in use today which indicates atmospheric pressure changes that are linked with the future weather changes.

There are also other methods which have been evolved. Meteorology is a lot related with cycles and their analysis which was what Fernando II de Medici wanted to prove. He carried out a very determined program in 1654 for recording weather patterns in different European cities with a view to compile data and make their analysis.

Other breakthroughs were followed in the 18th century and science was taken to a new level. A modern mercury based thermometer was invented by Gabriel Fahrenheit. Theories about hydrodynamics were devised by Daniel Bernoulli and those theories had helped greatly in understanding the atmospheric changes.

When the theory of thermodynamics and atmospheric pressures were adapted, no real changes were important for understanding meteorology. In recent times, focus has been given on meteorological tools for its improvement and attaining better accuracy results. A tremendous boost was given to meteorology because of the technology in two ways. The first is the ability to communicate results and analysis with timing, it was made possible due to the invention of telegraph.

The second is the ability of probing skies with using balloons, satellites and radars.

Meteorology is a part of our everyday lives, reported to the weather evolution in the context of local society expansion.

People are kept updated about the changing weather with dedicated channels and mobile devices. The science is still progressing and is an important element of the economy with many industries like agriculture and civil aviation depending on it.

REFERENCES

1. Coman, M., Taro, G., Cioruța B., (2011) *Application of meteoinformatics for the analysis of wether forecast data*, International Conference of Scientific Paper AFASES 2011, www.afahc.ro
2. Taro, G., Coman, M., (2009) *Interurban Research Regarding the Evolution of Temperature in Baia Mare*, Scientific Bulletin of North University of Baia Mare, vol XXIII
3. http://en.wikipedia.org/wiki/Meteorology
4. www.imd.gov.in/doc/history/history.htm
5. www.imd.gov.in/doc/history/modern-meteorology.htm
6. www.shorstmeyer.com
7. www.meteoromania.ro

.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

SALIX - RENEWABLE ENERGY SOURCES

Tatiana GRÎU, **Aurel LUNGULEASA**

Faculty of Wood Engineering, Transilvania University of Brasov, Brasov, Romania

Abstract: *Renewable energy sources are the new directions in the field of scientific research. Exploring the potential of Romanian energetic results that biomass is a new direction for energy development. This paper describes the energy composition of Salix species – which can become a business in the developing countries as Romania. In the extended text of paper there are mentioned the methods how to determine the micro and macro structure of wood and the energy power of the sample from Salix viminalis.*

Keywords: *biomass, salix viminalis, renewable energy, calorific value, ecology*

1. INTRODUCTION

Renewable energy represents the future of ecological energy and heat in industry and especially in residential houses. A large study was done on existing renewable energy potential in Romania; according to which biomass represent 49% of the total renewable energy source [9, 14].

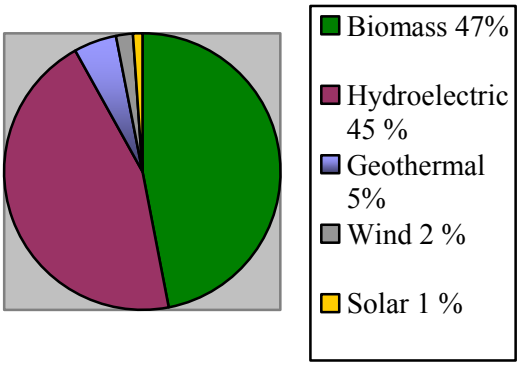


Fig.1 Potential sources of renewable energy in Romania [9]

An alternative factor for Romania is to gain energy and heat from biomass, Romania posses large areas of forests, of which 4.283 million hectares of broadleaf forests and coniferous forests about 1882 thousand hectares. Willow and poplar occupies an area of about 4 % of broadleaf forests within about 186 thousand hectares [3, 15].

In the years of energy crisis of The Golf War, and a few years ago when Romania and UE observed the weakness and dependence on gas imported from Asian countries, the authorities thought to a new alternative for producing energy for heat [12, 16]. UE expects that among the fuel materials to introduce renewable source which will occupy about 12% from the production of energy [2].

Biomass includes wood biomass, biogas, agricultural residues, which demonstrated at this time an ability power to several species: sugar cane, sun flower, rape, willow, etc. According to a study, the production of biogas began in the 1950s, in Germany, where farmers use ferment to produce biogas from biological waste of animals; they have been shown that 112 of cattle produces 86.400

m^3/year of biogas, a cow make approximately 200 liter/day of methane [5].

Energetic willow (*Salix Viminalis L*) is an agriculture plant with energetic potential and it is also ecological. In Romania there are known over 20 species of Salix, which in the past the craftmen used to produce basckets, furniture, etc., from the stems and it was very well developed in the south [6].

2. THE MACROSCOPIC AND MICROSCOPIC OF THE STEM

2.1 The macroscopic structure of Salix species. The main wood species identification keys are character dichotomy. Willow is a broadleaf species, with pores evenly scattered, small and invisible, with heartwood, narrow and invisible rays. These categories also include the: Black poplar, Wild pear, Rowan, etc. [8].

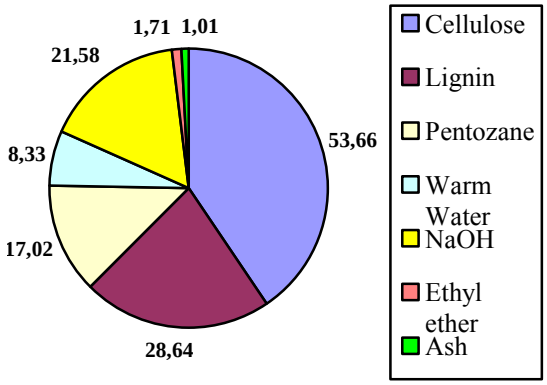


Fig.2 The chemical composition of Willow species[10]

From the chemical composition notes that the most part contains cellulose ($C_6H_{10}O_5$) in which by its chemical composition exist carbon, hydrogen and oxygen, as the essential elements for combustion [1, 10].

The macroscopic structure of wood species is determined by visible characteristics with the naked eyes (in Fig.3): sapwood (2), heartwood (3), rings (1), medullar spots (4), early wood, late wood, color, luster, texture and wood design. The macroscopic index for willow species: it is a species with a density between 600-700 kg/m^3, the faded color, yellowish-white, glossy texture, less pronounced and the sapwood is usually variable, up to 4 m tall (rarely up to 8 m), branches long, erect; shoots are long, flexible, with internal green bark, buds – unequal at least twice as long than broad, compressed stems, velvety; leaves – lance-shaped or linear lance-shaped, 8-15 cm long, 0.5 to 1.5 wide, long and gradually narrowing towards the top, margins entire or irregularly – sinuous, slightly rolled back, in front dark green, inside gray-white and covered with silky hairs, with prominent median rib, yellow patent arched lateral veins on the main ridge; petiole short, not exceeding 10 mm; flowers – male with two stamens, the females with an ovary sessile, style thin, elongated, divergent stigmas; have nectarous gland [4].

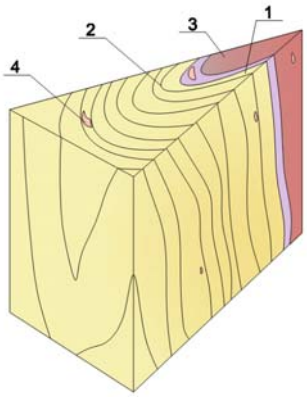


Fig.3 The Macroscopic structure of willow species [8]

2.2 The microscopic structure of willow species. The microscopic structure is characterized as a heterogeneous overall structure, the essential character of the wood are vessels, which in Fig. 4 can analyze the late and early wood composition.

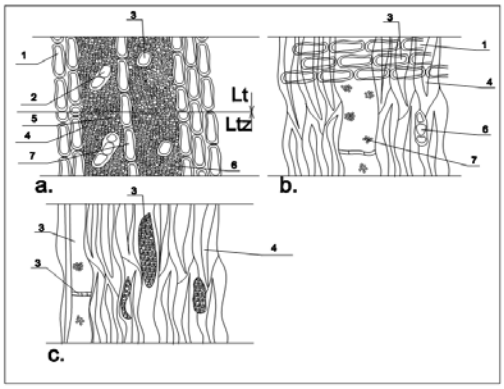


Fig.4 The microscopic structure of willow species [8]

a. cross section; b. radial section; c. tangential section; 1 – cells yoke radial, 2 – vertical resin canal, 3 – axial tracheids of late wood, 4 – axial tracheids of early wood, 5 – areole pit, 6 – fenestrated form pit, 7 – radial tracheids, 8 – horizontal resin canal [8].

3. THE CHARACTERISTICS OF THE WILLOW SPECIES

3.1 Preparation of land. Willow is a plant that grows on land, meadows and riverbeds. Researchers have determined over 200 varieties of willow, of which 18 varieties have energetic characteristics: fast growth, high calorific value, disease resistance; long life of the varieties (25-30 years), height 7-8 m. The necessary conditions for growing and harvest are:

- processed agricultural land with fertilizers;
- mechanical intervention with pesticides.

The agricultural land must be processed with fertilizers, and the pH recommended for land is 5.5 – 7.5 [17].

These are lands that contains clay and sand that keeps the moisture needed for growth and development of willow. Practing the plowing, hoeing, disking during the summer is essential for obtaining the desired harvest. The nesessary of fertilizer applicaton for every year:

- Ist year - 450 kg/ha;
- IInd year - 100-150 kg/ha;
- IIIrd year - 100-150 kg/ha.

Managing with fertilizers has a major impact on plant growth in the first two years of cultivation.

The fertilizer is taken up in spring season till the lugers begin to grow.

3.2 Planting the willow species. Planting can be done both manually and mechanize. The shoots that are plant need to be cut to the lengths of 18±1cm and kept in water at least 24 hours before planting. Between March and April, after the period of frost has passed it is recommended to plant the seedlings [15].

Fig.5 The technology of Willow planting [13]

The plants are buried in the ground in two rows with 75 cm distance between them, followed by a space for passing the combine. The distance recommended between the seedlings is 60-75 cm and the demand for a hectare is 14000 seedlings. Planting rows should be long and at the end to finish with an access road that will divides each row of seedlings.

3.3 Intervention and harvesting. Each year and season it is made work for weed and any other pests (diseases, insects).

In the first year it is necessary to ground control where we want to plant the energetically willow [12].

Fig.6 The technology of harvest the willow species [13]

In the second year is required intervention with herbicides and mechanical intervention and in coming years only need practically no intervention because there are no weeds growing.

The intervention with herbicides are necessary to maintain a rich fertilization for soil, where the energetically plants are grown.

The harvesting takes place in winter when leaves have fallen bushes. The machine is used for harvesting combine that cuts and chop them and collected in a trailer towed by a tractor.

3.4 Dissolution the willow plantations. The dissolution is easy to execute without major damage to the soil. First procedure is to harvest, then must leave the seedlings to grow approximately 0,5 m and sprinkle with pesticides that destroy crops, in the last phase occurred soil disking.

4. POWER ENERGY

4.1 The energy power of willow species. The calorific value is the amount of heat released by a unit of fuel burned completely. There are two kinds of calorific power: one expressing the high water vapor that has been condensed, so give us heat of vaporization, and the lower is the water in the flue gas is in the form of vapor, in this case developed some heat for vaporization of water is consumed [7,11].

The high calorific value is the amount of heat released from the fuel burned completely, while the lower amount is the difference between higher heating value and amount of heat consumed in vaporization of water in the flue gas.

The Willow species (*Salix Viminalis L*) [17] is an energetically plant with a capacity of approximately 18000-19000 kJ/kg, which is higher than the species of poplar – 14600 kJ/kg or compressed sawdust – 17500 kJ/kg. The willow species are some common species in Romania; it can see them in the beds of the rivers and meadows.

3.2 XRY-1C Oxygen Bomb Calorimeter. Calorific value of solid fuels for eg. the wood species is determined by bomb calorimeter and the difference in temperature is indicates by the amount of water that cools bomb calorimeter**.**

In this way determine the quantity of heat released by a unit mass of solid fuel analysis; value is ultimately the calorific value of fuel.
The installation is composed of: bomb calorimeter body (1) which is made of stainless steel cover (2) – is provided with two valves (4) and (5), and an electrode (6). The valve (4) connects the tube (7) on where enter the oxygen pressure in the system. The valve (5) is discharged at the end of the experiment. The tube (7) is fixed - shield (13), which protects the body when it is exposed to the flame of combustion process. Crucible (15) has the role of protection and is made of quartz [7].

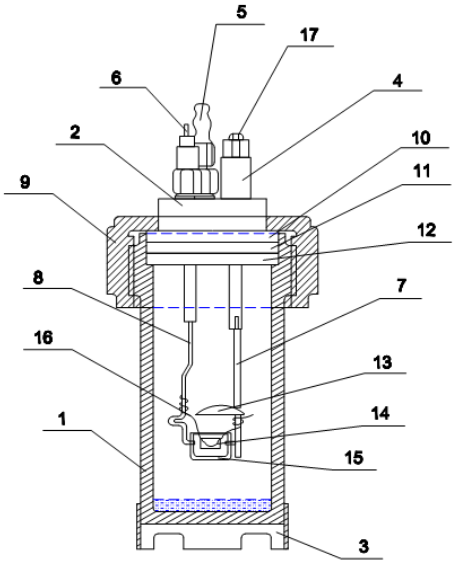


Fig. 7 Bomba Calorimeter XRY-1C Oxygen

Combustion process consists of three periods: fore, main, after. As graphical analyzed (Fig.8) note that it is starting with the initial period (Fore), where there is water in the tank to determine temperature variation of heat, because heat exchange with the enveroment. The following period from chart that lasts about 6 minutes, it is observed the fact that the temperature does not increase

essentially, it remains between 0,1 - 0,2 K. After this period the willow sample begins to burn.

Main period (Main) aims to determine the increase of water heat in the tank, because of the burning wood particle. Where looking at the chart in Fig. 8 shows that the main period lasts from the time 6 minute to 22 minutes and the temperature is increasing.

In the final period (After) is determined the averange water temperature variaton due to exchange with external environment. Final period lasts from 22 minutes to 31 minutes, the temperature remaining constantly.

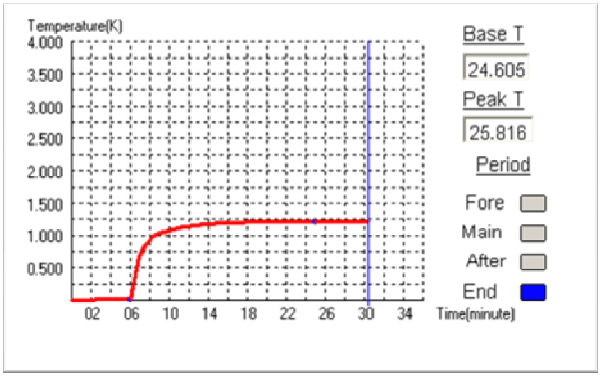


Fig.8 Performance of combustion in the XRY-1C Oxygen Bomb Calorimeter

4. CONCLUSIONS

According to a firm from Miercurea-Ciuc [17], it may find that the *Salix Viminalis L* cultivation can become a profitable business, with an estimated net profit of 800-900 euro/ha/year and a simple calculation can be determined as a plantation of about 20000 ha necessary to provide energy for 145000 apartments, and for all this we can have a net profit about 16-18 millions/year.

Annual production of willow is 30 t/ha. Willow can be used for other purposes like: paper production, raw material for pulp, pharmacy industry, raw material for methanol, furniture and wood industry, construction etc.

Another reason for investment in energetic willow (*Salix Viminalis L*) production is to maintain and value the lands that are in decay. The plantation with energetic willow can protect people that live in open fields to blizzards from snowing, or in spring from flood, because willow like water and moisture.

REFERENCES

1. Beldeanu, C. E.. *Forest products and wood study.* (in Romanian). Brasov: Transilvania University (1999).
2. Călin, L., Jădăneanț, M., Romanek, A.. Wooden biomass gasification. (in Romanian). [online]. *The AGIR* Bulletin nr. 1-2. (2008). Availble: http://www.agir.ro/buletine/337.pdf (January, 2012).
3. Costel, E., Vorovenci, I., Vlad., C.. Place and role of forests in the Romanian and world economy. (in Romanian). *Proceedings of the 7th National Conference for biotechnology and environmental protection and the 4th National Conference for ecosanogenesis, with international participation* . Brasov (2005).
4. Curtu, L., Sofletea, N.. *Dendrology – Determination and description of species.* (in Romanian). Volume I. Brasov: Publishing House "For Life" (2000).
5. Eder, B., Schulz, H.. *Biogas technology*. Practical guide. Published in 1996, translated into Russian in 2008 by ZORG BIOGAS Company. [online]. Available : http://www.zorgbiogas.ru/upload/pdf/Biogas_plants_Practics.pdf (December, 2011).
6. Ivanescu, S.T., Nicovescu, H., Nedea, P.. *Osiery. Culture and recovery osiery.* (in

Romanian). Bucharest: Publishing House Ceres (1979).
7. Lunguleasa, A., Costiuc, L., Patachia, S., Ciobanu, V.. *Wooden biomass to biofuels.* (in Romanian). Brasov: Publishing House Transivania University of Brasov (2007).
8. Lunguleasa, A.. *Identification of wood.* (in Romanian). Brasov: Publishing House Transivania University of Brasov (2003).
9. Robert, D., Perlack, L., Wright, L., Anthony, F., Turhollow, P., Robin, L., Graham, G., Bryce, J., Stokes, S., Donald, C. E.. *Biomass as feedstock for a bioenergy and bioproducts industry: the technical feasibility of a billion-ton annual supply.* U.S. Department of Energy under contract. [online]. Available: http://www1.eere.energy.gov/biomass/pdfs/final_billionton_vision_report2.pdf (February, 2012).
10. Simionescu, Cr., et al.. *Limits of variation concerning the presence of chemical components in some wood species in Eastern Carpathian Forest*. (in Romanian). Bucharest: Technical Publishing House (1964).
11. Şova, V., Şova, M., Mureşan, M., Şerbănoiu, N., Hoffmann, V., Bacanu, Gh., Ungureanu, V., Fetcu, D., Boian, I.. *Practical work thermotechnics.* (in Romanian). Brasov: University of Brasov (1987).
12. *** Energetical Willow. *Agriculture – news, grants, European funding, job announcements.* [online]. Available: http://www.agricultura.ro112.com/2011/05/salcia-energetica.html (January, 2011).
13. *** 2010. *REBINA AGRAR*. [online]. Available: http://www.rebina.ro/poze/ (January, 2012).
14. *** 2010. Variety of energetically willow in 2010. *REBINA AGRAR*. [online]. Available: http://www.salix-viminalis.ro/ (January, 2012).
15. *** Energetically willow - Rebina Agrar. *REBINA AGRAR*. [online]. Available: http://www.rebina.ro/rebinaagrar/index.php (January, 2012).
16. *** REBINA AGRAR. Catalog - Salix for energy. *SC REBINA AGRAR SRL*. Timiş, [online]. Available: http:// www.rebina.ro/downloads/catalog.pdf (January, 2012).
17. *** Energetical Willow. *SC KONTRASTWEGW SRL*. [online]. Available:http://kontrastwege.ro/ ro/salcia-energetica/ (December, 2011).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

CONSIDERATION CONCERNING WATER POLLUTION IN LARGE ELECTRO-POWER PLANTS

Mihaela Cosmina TITA*, Daniela ROSCA*, Ph. DONDON, I. BALA*****

*Electrical Engineering Faculty, University of Craiova, Craiova, Romania,
** Université de Bordeaux, IPB UMR
*** Regional Agency of Environmental Protection Craiova, Romania

Abstract: *This paper highlights the importance of energy sector, but it also reveals environmental issues that appear in the process of obtaining electricity and thermal energy. This is reason for the main indicators of environmental quality are monitored both locally and regionally.*
Keywords: *LEP, limits, water pollution*

1. INTRODUCTION

Energy is at the same time a positive and negative factor: it contributes to the development of society, in order to facilitate progress, but in the same time is an important source of pollution that harms the environment. Energy demand has grown with the evolution and modernization of society. [1]

The amount of energy required at global level, whether we are using renewable or non renewable energy, increases with the population explosion in the last centuries. [4] Electricity is increasingly replacing other forms of energy due to the facility with which it is transported and the option of turning it into other useful forms of energy such as mechanical energy, chemical energy, light or heat. For this reason, nowadays from all the energy consumption, more than 30% it is electricity. [2]

According to Romania's Energy Strategy overall energy demand in 2030 will be about 50% higher than in 2003, and the oil necessary will be about 46% higher. Known oil reserves can sustain the current level of consumption only until 2040, and the gas until the year 2070, while world reserves of coal provides a period of over 200 years of utilization. [5]

2. ENERGY AND ENVIROMENT

According to Romania`s National Institute of Statistics most electricity production comes from power plants.

Near Craiova is located an energetical complex with two large electro-power plants (LEP) Isalnita and Craiova 2. LEP consists in complex installations that transform chemical energy of natural fuels in electricity and heat. All the plants facilities are crossed by the following mass flow: the coal necessary for combustion goes to boilers burning and the gas supply is achieved by using an adjusting gas station. The air necessary for combustion is taken from the outside of the building in which the steam boilers are installed using air fans.

The appropriate water supply is obtained from Jiu River which is used after demineralized water treatment process.

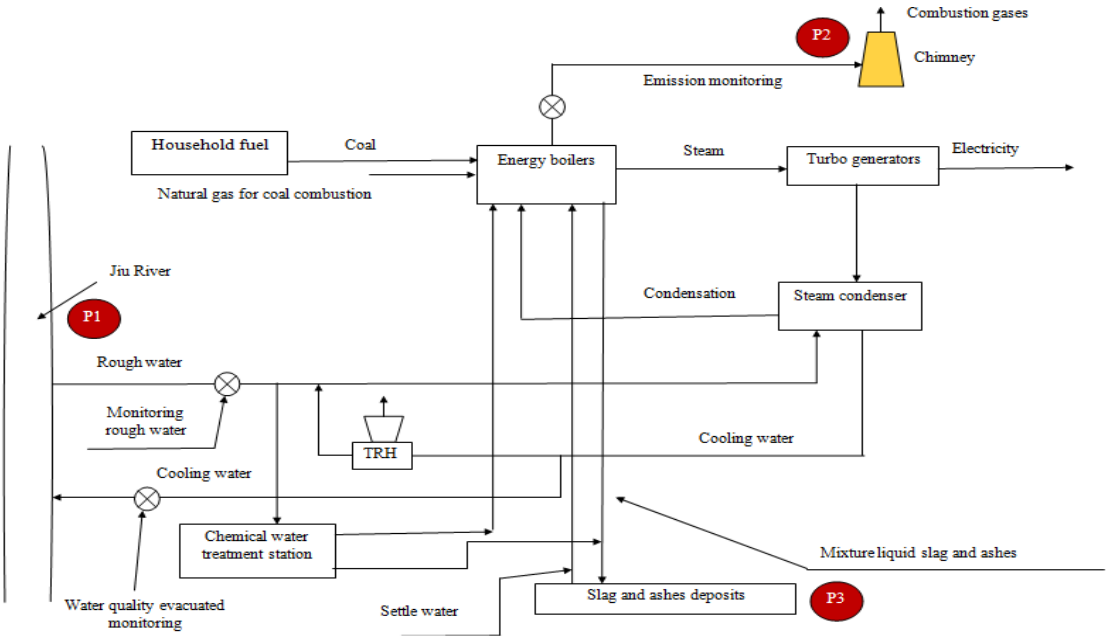


Figure 1. Material flow in LEP

According to material flow diagram (figure 1), the fuel is converted into energy as a result of combustion processes in steam boilers and then it passes trough turbo generators to become electricity. All the remaining steam that was not turned into electricity is condensed and reintroduced in the energy circuit or can be used as cooling water for other installations.

After the process of obtaining electricity and heat all the environmental factors are polluted in some measure.[6]

In figure 1 with P1 is noted all the problem of water pollution created by the LEP for Jiu River. Some of the water quality indicators are influenced by the released of technological water directly in the running water; combustion gases, noted with P2, represents the second environment factors influenced by LEP. These harmful gases depending on the atmospheric dispersion phenomena can have a direct influence over the area nearby the source of pollution or they can cause problems in remote areas. Slag and ashes, noted with P3, represent a great problem because the soils were is located all the waste combustion cannot be used for agriculture or other purposes.

Water is the only natural and renewable source on the planet that is vulnerable and limited as well. It can be used both as raw material in productive activities as well as an energy source, means of transportation, in the same time it plays an important role in maintaining ecological balance.[3]

All the necessary water comes into the LEP trough a adduction channel situated in 44` 395039 N, and 23` 716232E.

During the process of obtaining electricity water from the river Jiu is used in steam condensers and as cooling water in the chemical treatment station of the plant or can be used in the heating circuit of the city.

The disposal of the used water are realized through an evacuation channel situated near the power plant in the location 44` 392414 N, and 23` 714237E.

The water that is reinserted into the natural flow of the river Jiu must comply with the main quality indicators indicated in the legislation.

According to NTPA 001/2002 the charge level of pollutants from urban and industrial waste water in natural receivers must be within allowable limits.

The main water quality indicators monitories by a specialist worker of the energy complex are pH, chloride, ammonium, suspensions, residue, sulfates and temperature.

All the indicators are monitored every day upstream and downstream the energy complex by plants employs and occasionally by the Environmental Protection Agency.[7]

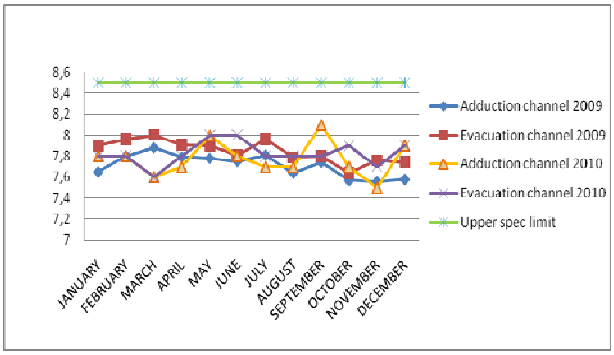


Figure 2. *pH* evolution in Jiu River

According to figure 2 the value for pH before and after the energy complex do not exceed upper specification limit.

These values are possible because all the residual waters are neutralized before it reach evacuation channel.

In the production steps a major quantity of water is used to cooling down energy generators and turbo generators.

Because of that temperature values are closely monitored to lower the thermal pollution possibility.

This type of pollution can influence in a fast and directly manner fish and all the aquatic vegetation. In the last years the measurement shown a decrease of water temperature from the power plant discarded in emissary.

As can be seen in figure 3 the limit of 35^0C are exceed only in summer time, because the temperature in the adduction channel is very close of the maxim specification limit. [7]

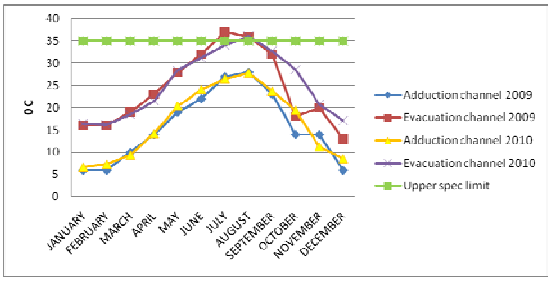


Figure 3. Temperature evolution in Jiu River

Another problem in terms of water pollution can be the quantity of metal in residual water.

3. EXPERIMENTAL RESULTS

In the experimental results it has been used water sample from the adduction and evacuation channel. All the samples were analyzed with a VARIAN Atomic Absorption Spectrometer 280 FS and dedicated software SpectrAA. The software can display the concentration or absorbance for each sample.

According to the experimental result (figure 4) the level of lead in the evacuation channel is exceeded only when the concentration in the adduction channel exceed the legal limits.

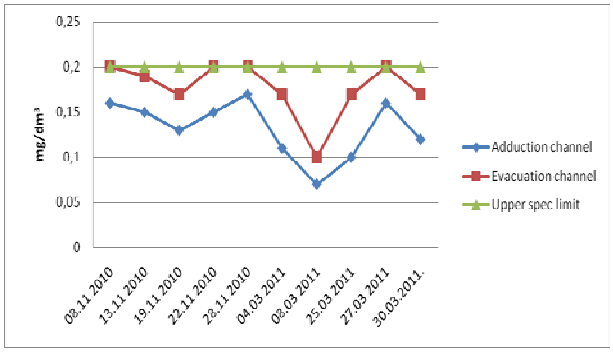


Figure 4. *Pb* level in Jiu River

From sample taken from the adduction and evacuation channel analysis have been performed in order to determine the level of copper and iron as shown in the figure below.

The concentrations of copper in the residual water from the power plant are very low, as seen in figure 5. The difference between the measured value and standard limit is very high therefore copper pollution is not relevant to this energy sector.

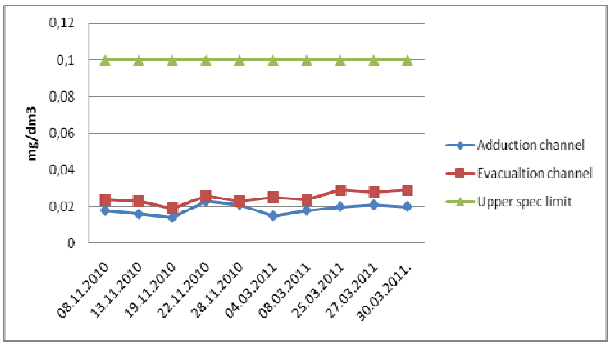


Figure 5. *Cu* level in Jiu River

The measurements conducted in distinct months, when energy requirements are different, show that Fe pollution is not a common situation near a LEP (figure 6). [7]

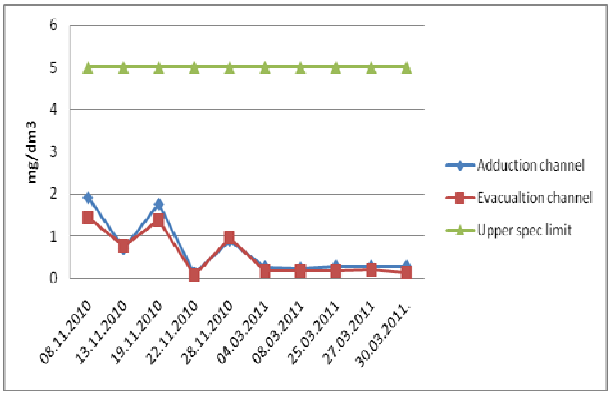


Figure 6. *Fe* level in Jiu River

According to previous figures, LEP is not a significant source of metal pollution in water terms. This situation has some exception in the periods when preliminary charging of the receptor resulted in exceeding the limits for quality indicators.

4. CONCLUSION

Air and soil pollution are important but water quality is significantly more important because life in all its forms cannot exist without water.

According to the annual report regarding the status of environmental factors in Romania in 2010 the ecological status of water within the catchment area is mainly good in Jiu River.

The charts were traced based on experimental determinations taken near Craiova's LEP. [8]

The analysis performed to the sample in the adduction and evacuation channel for power plant have shown that the LEP is not the main source of Jiu pollution. Amaradia River significant may disrupt water quality in Jiu, especially suspension materials.

Jiu River water quality is influenced by other power plant activity from Oltenia such as Turceni and Rovinari. In comparison with other energy plants, Craiova's LEP has made major investments in the new technologies leading to reduce the pollution degree.

REFERENCES

1. Hulot, N., *The syndrome of Titanic*. vol 2, Calmar Levy Publishing, 2009.
2. Lazaroiu, Ghe., *CTE impact on the environment*. Polytehnic Press Publishing Bucuresti, 2005.
3. Rosca, Daniela, *Environmental management. Sustainable development*. Press Publishing Sitech Craiova, 2011.
4. *** Al Gore, *An Inconvenient Truth*. DVD Paramount Picture, 2006.
5. *** Romania's energy strategy for 2007-2020. *Source.* Available: http://www.minind.ro/anunturi/strategia_energetica_a_romaniei_2007_2020.pdf , February, 2012.
6. *** Status of environmental factors in Romania, 2010. Available: http://www.anpm.ro /apload/48582_3.Cap.3.Apa %20 Dulce. 2010. pdf, February, 2012.
7. *** Environmental Agency Report 2009-2010.
8. *** Pollution monitoring stage report in a energetically complex area 2010-2011 Craiova

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

ENERGY SAVING WORT BOILING SISTEM IN BREWING FACTORY

Mariana Geta TOMESCU (cas. Cismarescu)*, Carol CSATLOS**

*Faculty of Food and Tourism, "Transilvania" University of Braşov, Braşov, Romania
** Faculty of Food and Tourism, "Transilvania" University of Braşov, Braşov, Romania

Abstract: *Steam is produced on boiling. This steam is referred to as (water) vapour. If the vapour is allowed to escape unhindered from the chimney, people in the neighbourhood can smell that the brewery has cast out wort again. This can be considered to be odour pollution. Moreover the evaporated water mass contains a great deal of energy which in the casa escapes through the chimney. To convert 1 kg of water at 100^0C into 1kg of stream at 100^0C, about 2260 kJ = 90 psi, are required. If the stream condenses again in the surroundings, this heat energy is released again and completely lost to the brewery.*

Keywords: *steam, energy, vapour compression, boiling,, energy saver, hot water, thermocompression.*

1. INTRODUCTION

Energy usage during wort boiling - the wort kettle is the greatest energy user in the entire wort production process.
Very careful consideration must therefore be given to how to keep the energy usage as low as possible since energy is very expensive.
Energy usage is quoted in kWh or BTU or kj. Common fuels have the following thermal values (natural gas 11,20 kWh/m3, fuel oil 10,14 kWh/l, heavy oil ll,l6 kWh/kg, hard coal 8,95kWh/kg).
In the brewhouse an 80% efficiency can be expected, i.e about 80 % of the energy is utilized in the brewhouse.
The starting point of our considerations is the energy usage obtained with a conventional copper. Energy used in conventional boiling - if the wort is boiled for 90 min at 100^0C leading to a percentage evaporation of about 12 % in the copper, theny, in conventional boiling for each 1 hl of cast wort about 14 kWh = 56,00 BTU/bbl are required. (1 kWh = 3,6MJ = 0,948 BTU)

2. VAPOUR CONDESATION

It is therefore useful to recover at least part of the heat of evaporation.
This is done by building in a kettle vapour condenser in the kettle chimney.
If the steam is condensed here the heat of evaporation is recovered. In the kettle vapour condenser (Fig.1) the steam is passed against pipes of pockets, through which water is pumped, and the water is thereby warmed whilst the steam gives up its heat of evaporation and condenses.

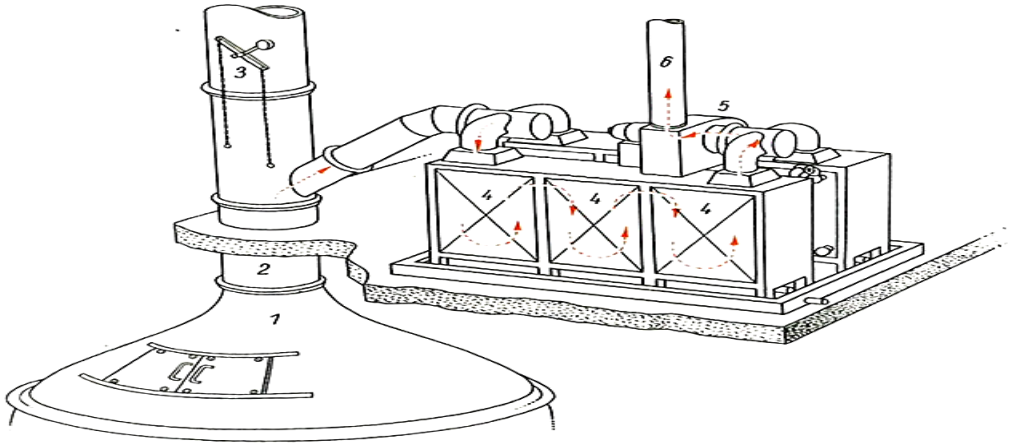


Fig.1.Kettle vapour condenser (Pfaduko)
1-wort kettle; 2-vapour chimney; 3- adjustable valve; 4-heat exchange chamber; 5-extractor; 6-blow-off pipe.

Depending on the subsequent purposes for which the heat is used,the steam is cooled in one or two stages and hot and/or warm water thereby produced. Nowadays most kettle vapour condensers are built with one stage cooling (Fig. 2.). Each hl of evaporated wort produces 0.8 hl of hot water at 80^0C.

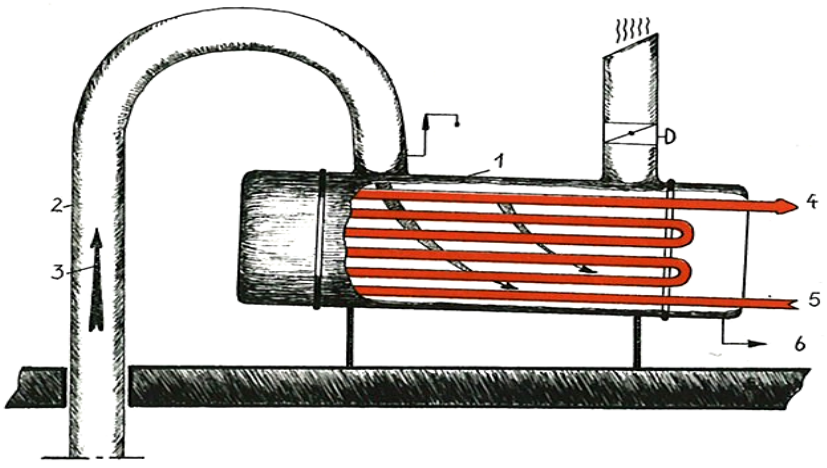


Fig. 2.Kettle vapour condenser (Pfaduko)
1-heat exchange vessel; 2-vapour chimney; 3- water vapour; 4-hot water outlet; 5-warm water inlet; 6-condensate drain.

The volume of steam is decreased considerably on condensing to form water and the water can easily be removed. Nowadays the kettle vapour condenser is often built in the form of a single-layer plate heat exchanger. The vapour flows in at the top of every second plate, and the condensed water runs out at the bottom, whilst the cooling water flows in a

counterflow from below upwards in the plates between them and is thereby heated (Fig.2.a).

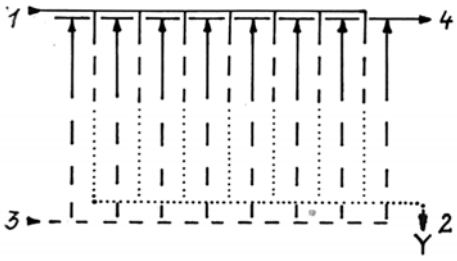


Fig.2.a.Plate heat exchanger as kettle vapour condenser
1-vapour; 2-condensate; 3-cold water; 4-hot water

On heat utilisation grounds the cooling water used is as hot as possible so that it is brought as close as possible to boiling point through the condensation of the vapour.

3. VAPOUR COMPRESSION

The vapour produced on boiling is at about 100^0C and thus can not be used any further to heat the wort. If, however, the vapour is compressed to a few tenths of a bar overpressure, the temperature of the vapour is raised to 102-108^0C and it can be used again for heating. In this way the heat consumed for evaporation in the wort boiling process can be directly recovered again.
Vapour compression is achieved either:
- by means of a mechanical compressor, in which case one speaks of mechanical vapour compression, or
- by means of a steam jet compressor which requires steam from a boiler to drive it, in this case one speaks of thermocompression.
Mechanical vapour compression is regarded as the state of the art and thermocompression is much less frequently found in breweries.

3.1 Mechanical vapour compression

The vapour produced is mechanically compressed to an overpressure of 0.2-0.5 bar (3-7psi) by a turbo, screw or rotating piston (Roots) compressor. As a result of this compression the temperature of the steam is increased and it can be used again directly for heating purposes. However a condensate is sprayed in previously to reduce the superheating. With vapour com pression steam and energy can therefore be spared since only the energy necessary to drive the compressor is needed (about 5 % of the primary energy requirement, i.e. 95 % of the primary energy requirement is spared). Heating up of the wort necessarily begins with the supply of fresh steam (Fig. 3.) from a boiler into the wort copper. The wort is forced by the circulating pump (4) through the external heater (3), heated up, and returned to the wort copper (1).When the desired boiling temperature of 102 to 106^0C is reached at the heater outlet, the compressor (2) is started and the vapour produced (9) is compressed to an overpressure of 0,09-0,25 bar 102 to 106^0C . The boiling process is thereby maintained in operation.

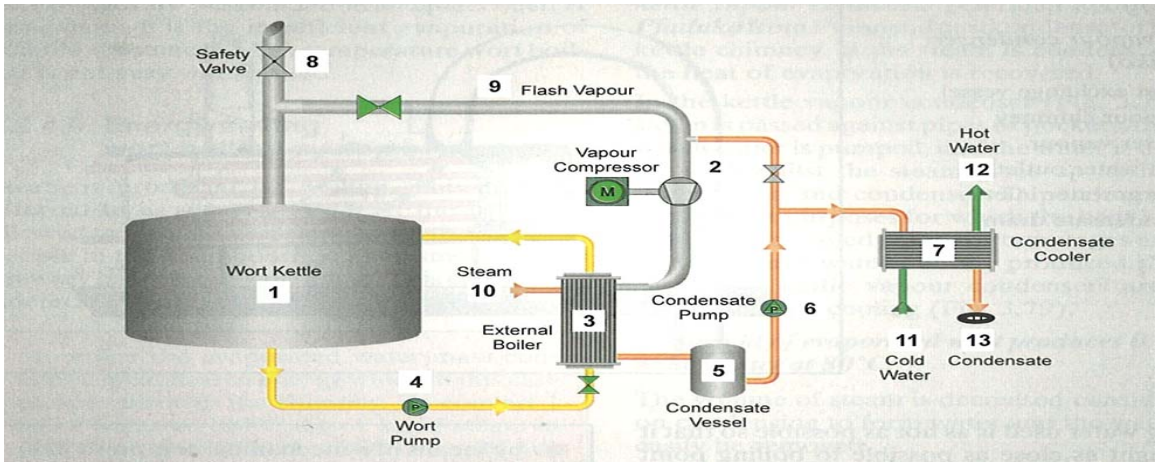


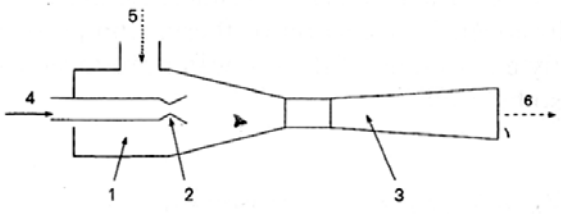
Fig.3. Mechanical vapour compression plant
1- wort kettle; 2-compressor; 3-external boiler; 4-wort circulation pump; 5- condensate vessel; 6-condensate pump; 7-kettle vapour condenser; 8-safety valve; 9- vapour; 10-live steam; 11-cold water; 12-hot water; 13-condensate

In principle the compressor only balances out the loss arising. Vapour compression can also be installed in existing plants and is also of interest to breweries which do not want to use low pressure boiling for quality reasons. There is an increased pressure in the external heater but not in the copper. However the system only operates when absolutely free of air. Consequently fully automatic air removal valves are always installed at the lowest point of the system because the heavier air sinks to the bottom. The saving of fresh steam is substantial with vapour compression. Because the heat of evaporation is used again to heat up the wort there is almost no excess hot water. A vacuum prevention system is needed for the copper to prevent air being drawn in . There are however disadvantages to set against the advantages:

- the plant engineering is complicated;
- maintenance work is necessary;
- peak electricity demands may occur as a result of the power used by the compressor.

3.2. Thermocompression

In the thermocompression process the vapour is sucked in by a steam jet pump (Fig.4) and compressed. This pump consists of a head (1) with a jet (2) through which live steam from a boiler with an overpressure of at least 8 and up to 18 bar is passed. Because of the high velocity of the live steam the vapour is entrained and in the following mixing section (3) the kinetic energy produced as a result of the increased velocity is transformed into a pressure energy of 0,1 to 0,4 bar overpressure.



Advantages with thermocompression are:

- trouble free operation with little maintenance required;
- no peaks in the electricity consumption.

Disadvantages are:

- increased production of hot water, and,
- the high steam pressure required (possibly 18 bar; new pipework needed).

Nevertheless thermocompression represents a less expensive alternative to mechanical vapour compression not only for small breweries but also for large breweries with an additional requirement for hot water. Comparisons of energy cost savings per brew (100 hl and 10% evaporation) using vapour compression instead of conventional boiling show substantial differences.

The space required for the necessary heat exchange surfaces of the internal boiler however usually causes considerable problems. Moreover, introduction of thermocompression only makes sense if the hot water produced can also be used.

Fig.4 Steam jet injector
1-head; 2-jet; 3-mixing stretch; 4-driving steam; 5-vapour; 6-mixing.

4. LOW PRESSURE BOILING WITH AN ENERGY SAVER

The heat exchange occurring at various places in general produces warm, rather than hot, water and most of this can not be used. However, very hot water is required which, if made a little hotter, can be used for heating purposes.

For this purpose it is necessary to make use of small temperature differences and to store the hot water without cooling until needed. This can be achieved with heat insulated energy storage systems (Fig. 5.).

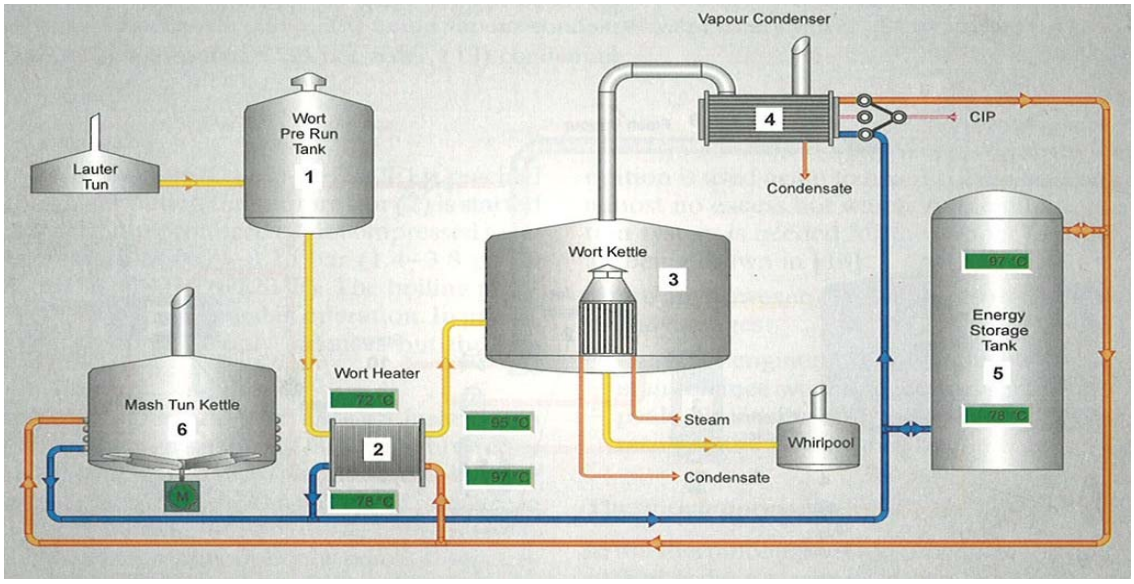


Fig.5.Energy storage system
1- wort collection tank; 2 - wort heater; 3 - wort kettle; 4 - kettle vapour condenser; 5 - energy storage vessel ; 6-mash tun kettle.

The water evaporated in the wort kettle (3) is, as vapour, condensed in the kettle vapour

condenser (4) whilst the counterflow of cooling water is heated to 97^0C. The water heated to 97^0C is fed back into the upper part of the energy storage vessel (5). The wort from the wort collection underback (1) or the mash in the mash kettle (6) can be heated up by this hot water from the upper part of the energy storage reservoir. Other hot water energy sources can also be stored - care must be taken, however, that the temperature of the stored hot water is not greatly reduced thereby. The hot water is stored in a well insulated energy storage vessel. In it the boundary between very hot water and hot water is displaced depending on requirements. The mixing zone depends on the design of the storage vessel and is only 10-20 cm in the case of narrow reservoirs. With such a storage system waste heat can be stored for long times and can be called upon at any time. It is important that by intelligent use of very small temperature differences the temperature in the reservoir is not lowered.

The saving of primary energy relative to conventional boiling without heat recovery is:

- in the case of low pressure boiling about 40-50%;
- in the case of low pressure boiling with an energy saver about 60-70 %.

CONCLUSIONS

Energy saving as a result of conversion to low pressure boiling. With low pressure boiling the total boiling time is reduced considerably because of the higher temperature and the consequently accelerated dissolving and conversion processes. If, instead of the previous 12 % (10 to 15 %) only 5 to 7 % is now evaporated, 6 kWh/hl cast wort is spared in comparison with conventional boiling so that in low pressure boiling/or each 1 hl of cast wort about 9 kWh = 36,000 BTU/bbI are required. That is a large saving which arises simply from the reduction of the boiling time.

REFERENCES

1. Back, W.: *Journal of* b*rewerwit* 42 (1995), p. 2068-2076.
2. Banu C., et.al.,(2006), *Tratat de industrie alimentara*, Bucuresti, Editura ASAB.
3. Duchek, P.: *Journal of brewerwit* 24 (1993), p. 1053-1059.
4. Meyer-Pietroff, R.: *Journal of Brewerwit* 33 (1995), p. 1618-1627

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

MEMBRANES PROCESSES USED IN BEER FILTRATION

Mariana Geta TOMESCU (cas. Cismarescu)*, Carol CSATLOS**

*Faculty of Food and Tourism, "Transilvania" University of Braşov, Braşov, Romania
** Faculty of Food and Tourism, "Transilvania" University of Braşov, Braşov, Romania

Abstract: *The purpose of this paper is to demonstrate that the membranes and separation process through membranes are used considerably in industrial processes, because there are much more efficiency and more economic than conventional tehnics. Separation processes through membranes are neconventional technologies names „clean technologies" and there are regarded as technologies of the future.*

Keywords: *filtration, membrane, microfilters, nanofilters, cross-flow.*

1. INTRODUCTION

The purpose of filtration is to make beer so stable that no visible changes occur for a long time and so the beer looks the same as when it was made.
Filtration is a process in which a turbid liquid (unfiltered liquid) is separated by a filter into a clear filtrate and a filtered residue or filter cake is left behind. The driving force for this is always a pressure difference between the filter inlet and filter outlet. The pressure at the inlet side is always greater than the pressure at the outlet side. The greater the pressure difference the greater the resistance with which the filter opposes filtration. It rises greatly towards the end of filtration.

2. SEPARATION MECHANISMS

Filtration is a separation process in which the yeast cells and other turbidity-causing materials still present in the beer are removed from the beer. At the same time substances are removed which would, in the course of the next few weeks or months, themselves precipitate and make the beer turbid.
A distinction is made between the following separation mechanisms (Fig.1):

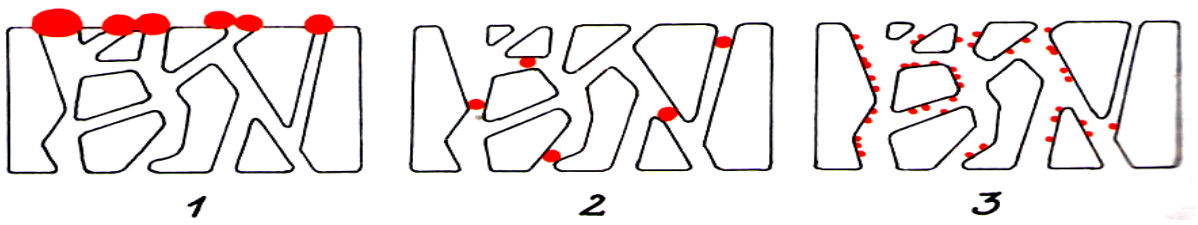


Fig.1: Filtration mechanisms
1- surface filtration; 2 depth filtration (particles are retained mechanically); 3- depth filtration with adsorption of particles

Sieving or surface filtration (1) - the particles cannot pass through the pores in the filter medium and are retained in a layer which becomes continuously thicker.
The filtration becomes increasingly fine but the volume flowing through decreases continuously.

Cross-flow filtration belongs to this type of filtration. It is discussed in more detail later.
Depth filtration -increasingly, separation media are being used which consist of very porous materials and which as a result of their very large surface and labyrinthine structure compel the liquid to take a very circuitous path.
- The particles are thereby held back by a mechanical sieving effect because of their size. They gradually block the pores (2)and thereby decrease the flowrate through the filter, or
- Fine particles are fixed by adsorption (3). This adsorption occurs because of differ ences in electrical charges between the filter and the material retained. Sieving and adsorption effects usually occur together.

2.1. Filters

Filters include**:**
- **Sieves** of all kinds, e.g. metal sieves, slotted sieves or parallel arrangements of wedge wire in candle filters.
Metal or cloth tissues-they are, however, not used for beer filtration because they can not be sterilized so well.
- **Filter sheets** made of cellulose, cotton, kieselguhr, perlite, glass fibres or other materials (asbestos, however, is no longer used on health safety grounds). Filter sheets are now very widely used and are available for very different filtration cut off limits down to sterile filtration.
- **Membranes**. These are made of polyurethane, polyacrylate, polyamide, polyethylene, polycarbonate, cellulose acetate and other substances. The membranes are very thin (0,02 to 1 μm) and are therefore applied on large-pored support layers because they would otherwise tear. They are manufactured by impregnation, spraying or deposition. The pores themselves are made: by incorporating salts which are later dissolved out again to form pores, or by etching. Because of the different manufacturing materials, nowadays membranes with any desired pore size can be made and they can correspondingly filter out materials of any chosen molecular size because these filters contain very fine pores, one speaks of:
- microfilters when the μm range is concerned (10^{-1} to 10^{2} μm) and of;
- ultrafilters or nanofilters when the nm range is concerned (10^{-3} to 10^{-1} μm).

Fig.2. shows the size ranges of particles and pores which must be dealt with here. It must be remembered that each division covers a range only one tenth that of the division to its right. Thus these membranes contain very fine pores. Naturally, beer can not be passed, as in static filtration, at right angels throught these thin layers because:
- the membrane rapidly becomes coated and,
- the pressures difference would tear the thin membrane.

Consequently the beer is passed over the membrane and washes it continuously so that only a very limited layer can build up. Microorganisms and impurities remain behind as retentate or non-filtrate, whilst the permeat or filtrate passes through the pores of the membrane. This type of filtration is called cross-flow filtration. Because only part of the liquid passes through the holes in the membrane and a very large part flows along the membrane, a very large membrane surface area is needed.

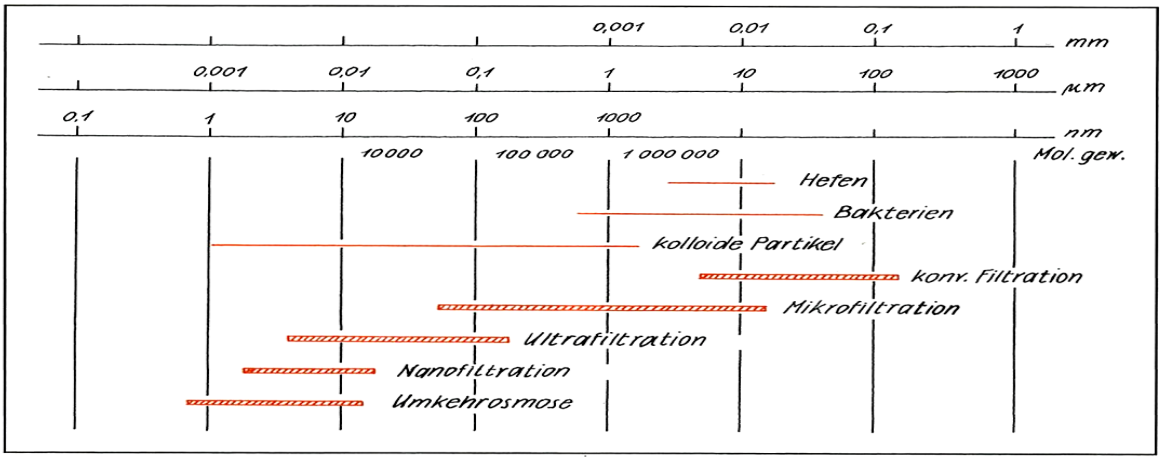


Fig. 2. Particle and filter pore size ranges

So as not to have to work with such large filter surfaces, the membranes are usually coiled. For this two membranes, bound together by porous supporting material, about 0,7 mm thick and stuck together on three sides, with an (0,5 mm) intermediate layer as spacer, are rolled up. Such a rolled combination of membranes, supporting material and intermediate layer is know as a spirally wound module (fig.3.)

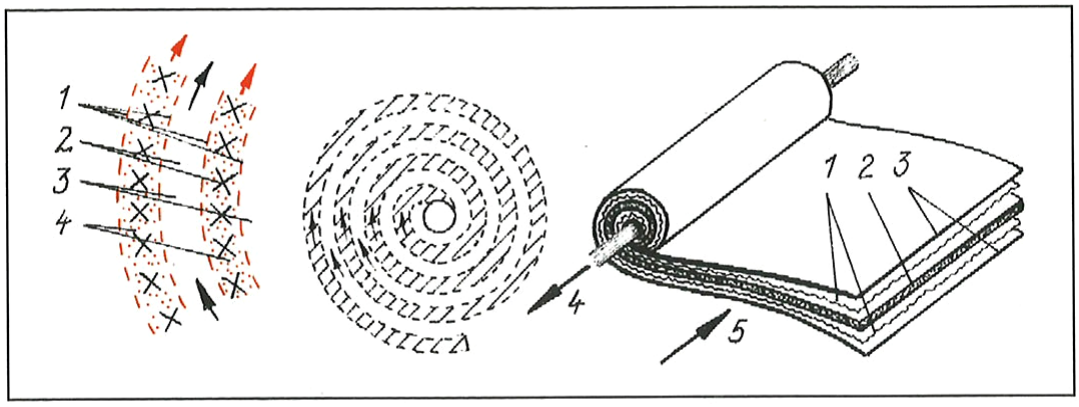


Fig.3: Spirally wound module (principle)
1-membrane; 2- porous support material; 3- intermediate layer as a spacer through which the unfiltered liquid flows; 4- nitrate outflow.

To increase the throughput of the filter several of these modules must be connected in parallel.
A micro-flow filtration unit therefore always consists of a series of such modules. A special type of membrane is the hollow fibre membrane.

The membranes have wall thicknesses of 10 to 25 μm, a diameter of 50 to 200 μm and are up to 3 m long. Hollow fibres can only be used with completely clean liquids because they are easily blocked.
Hollow fibres will be considered again when describing the dialysis process for the

production of alcohol free beer. Hollow fibre modules, which can be linear or U-shaped, make it possible to provide 20,000 m^2 of membrane surface/m^3 space.
Instead of membranes, ceramic material with very fine channels are often used for microfiltration (Fig. 4.).

In the case of the multi-channel element module shown it can be seen that each channel is surrounded by ceramic material containing very fine pores, on the fineness of which the sharpness of filtration naturally depends. Using a parallel connection of many elements and modules large throughputs can be obtained.

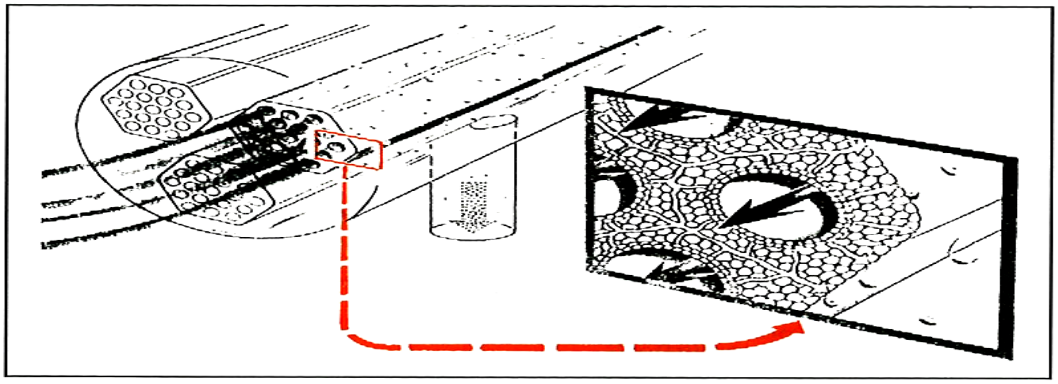


Fig. 4 Tangential flow filtration

2.2. Cross-flow filters

The delicate membranes are manufactured and used on a porous support layer to increase their mechanical stability. These membranes are used in a cross-flow process in which the liquid to be filtered is passed under pressure over the fine pore membrane. Some of the liquid passes through the membrane and all particles are thereby removed from it. The remainder of the liquid, the retentate or concentrate, which is now enriched in trub material is left behind and is led away.
But since the retentate still contains a large amount of the liquid wich can still be filtered out, the liquid is now recirculated (Fig.5).

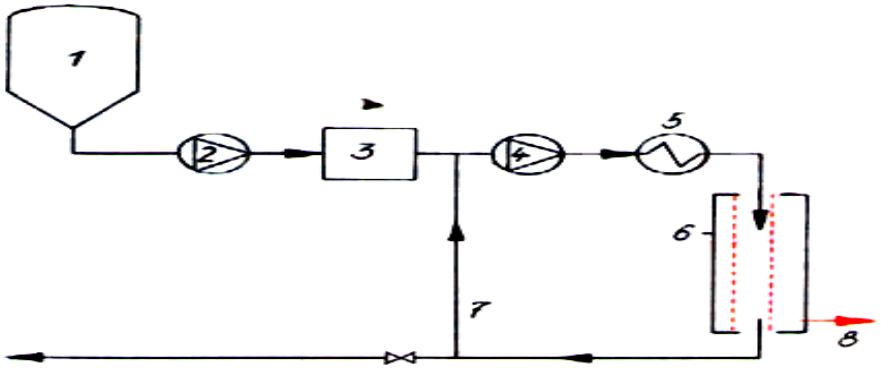


Fig. 5. Cross-flow filter (operating principle)
1- buffer storage tank; 2-feedpump; 3-prefilter; 4-circulation pump; 5- heat exchanger; 6-membrane filter; 7-circulation pipes; 8-filtrate outlet pipe.

This process necessitates a circulation pump to maintain the circulation, and a plate cooler since the use of pressure warms the liquid. In the course of filtration the surface of the membrane gradually becomes blocked (Fig.6). Filtration must then be interrupted and the surface of the membrane first rinsed with water and then treated with warm nitric acid or caustic. From this it should be clear that, as a rule, a membrane filter is installed as the final

filter so that premature blocking of the filter surface is prevented.

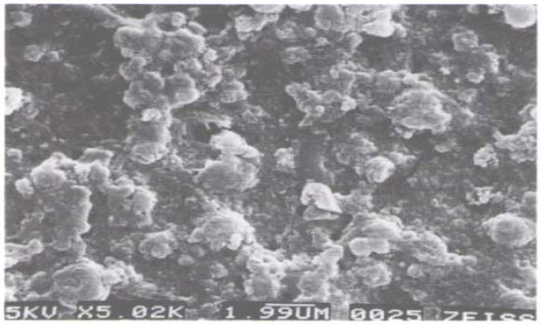


Fig.6. Particulate material deposited on the membrane surface

For prefiltration kieselguhr is almost always used. However, because of its cost and, increasingly, in many countries because of the increasing costs of disposal of the used guhr, use of kieselguhr is becoming less desirable. Recently therefore there have been more and more attempts to find replacements for kieselguhr prefiltration.

In the first place yeast removal by separators is possible. By parallel connection of several separators it is possible to obtain good preclarification of the beer and this can be followed by a further fine filtration using a module or cartridge filter.

Recently a combination of separator and cross-flow filtration has been suggested for clarification (Fig.7). The unfiltered beer (1) is here preclarified by a high performance separator (2)and the preclarified beer is conveyed by a frequency controlled feed pump (3) to tne membrane filter which performs the clarification. In this way it is possible to avoid the use of kieselguhr and also problems with its disposal.

Another possibility is to replace the kieselguhr by a filtration mass which can be regenerated consisting of cellulose, fibrils and fibres of various plastics and PVPP .

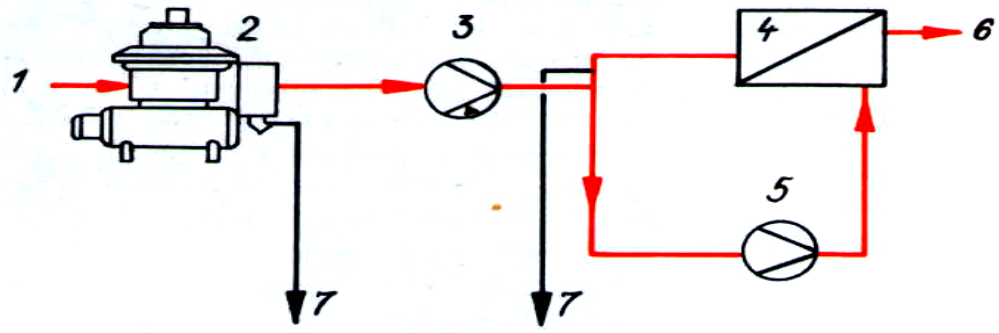


Fig.7: Combined preclarification separator and microflow filter
1-supply of unfiltered beer; 2- high performance separator; 3-frequency regulated feed pump; 4- microflow filter; 5-circulation pump; 6-filtered beer; 7- discharge.

3. CONCLUSIONS

Membrane filters are used nowadays for reverse osmosis for water purification and the production of low alcohol beers, as dialysis filters for the manufacture of low alcohol beers, as microfilters for the recovery of beer from yeast, and rarely for the final filtration of beers. The main advantage of the membrane processes is ability to separate and concentrate thermolabil compounds.

REFERENCES

1. Banu C., [2006], *Tratat de industrie alimentara*, Bucuresti, Editura ASAB.
2. Banu C., et.al.(1992), *Progrese tehnice tehnologice in industria alimentara,* Bucuresti, Ed. Tehnica.
3. Wolfgang, K., [1996],*Technology brewing and malting*, Berlin, VLB Berlin.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

PHOTOCATALYSIS PROCESSES USED FOR DISINFECTION. A MATHEMATICAL APPROACH

Violeta VASILACHE *, Elena AGHINIȚEI, Laura LELUȚIU***, Marius Dan BENȚA*****

*Stefan cel Mare University of Suceava, ** Industrial School Group Rasnov,
***Transilvania University of Brasov

Abstract: *In last decades, photocatalysis processes induced by titanium dioxide under UV and Visible electromagnetic radiation have shown a great potential in disinfection of water and air, also in degradation of many pollutants, especially organic pollutants. The procedure is a low-cost one, environmental friendly and sustainable. The energy consumption is almost zero or very low, because sometimes only solar radiation needed. Photocatalysis is an advanced oxidation technology which could remove persistent organic compounds and microorganisms from water and air. The mechanism of photocatalytic reactions need to be clarified, in particular inactivation of bacteria.This paper reviews some mathematical models of disinfection, which correlates experimental data with theoretical suppositions and hypothesis. The biochemical processes are very complex and a lot of parameters need to be taken into account. A mathematical model has to be as simple as it is possible. The aim is to utilize a multi-variables optimization approach to find the optimum parameters needed to control and enhance the photo-disinfection efficiency process.*

Keywords: *photocatalysis, kinetics, bacteria inactivation, mathematic models*

1. INTRODUCTION

Degradation and pollution of the environment forced research in the field of protection and restoration. Advanced oxidative processes offer good perspectives in degradation of pollutants and disinfection. Photocatalysis is an advanced oxidative process which consists in production of high reactive species under the action of UV or Visible radiation on a photo catalyst surface. Titanium dioxide is the most important photo catalyst due to specific properties as width of the band gap, low cost and abundance. Figure 1 presents a scheme of the photocatalytic process [1, 2].

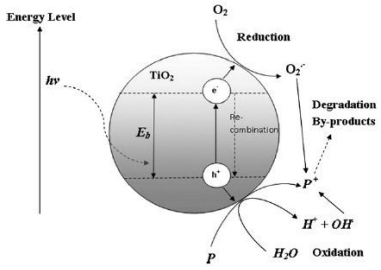


Figure 1. Photocatalysis: electron-hole pairs on titanium dioxide surface and reactive species forming

The stages of photocatalytic reactions are presented as follows:

a. Generation of mobile charge particles under the action of a radiation with hν>3.16 eV (E_g value for TiO_2 anatas): electrons (e^-) in conduction band and holes (h^+) in valence band:

$$2TiO_2 + h\upsilon \Leftrightarrow TiO_2(e^-) + TiO_2(h^+) \quad (1)$$

b. Recombination of electron-hole pairs:

$$TiO_2(e^-) + TiO_2(h^+) \Leftrightarrow 2TiO_2 + heat, light \quad (2)$$

c. Reactions on photo catalyst surface:

The holes are strong reducers and directly oxidize compounds, or react with electron donors like water or hydroxyl ions, forming hydroxyl radicals (reaction 3). Hydroxyl radicals form on TiO_2 surface by reaction through holes from valence band and water molecules or adsorbed hydroxyl ions (reactions 4-5).

$$TiO_2(h^+) + \mathrm{Re}\,d_1 \Leftrightarrow Ox_1^+ + TiO_2 \quad (3)$$

$$TiO_2(h^+) + H_2O \Leftrightarrow OH* + H^+ + TiO_2 \quad (4)$$

$$TiO_2(h^+) + HO^- \Leftrightarrow OH* + TiO_2 \quad (5)$$

Photogene rated electrons react with oxygen forming superoxide radicals (O_2^-*) (reaction 6). Superoxide radicals react with protons forming free radicals HO_2* (reaction 7) which further forms O_2 molecules and H_2O_2 (reaction 8). Electrons from conduction band react with oxidative species (reaction 9).

$$TiO_2(e^-) + O_2 \Leftrightarrow O_2^{-*} + TiO_2 \quad (6)$$

$$O_2^{-*} + H^+ \Leftrightarrow HO_2^* \quad (7)$$

$$2HO_2^* \Leftrightarrow O_2 + H_2O_2 \quad (8)$$

$$TiO_2(e^-) + Ox_2 \Leftrightarrow \mathrm{Re}\,d_2^- + TiO_2 \quad (9)$$

d. Degradation:

Radicals and ions formed on photo catalyst surface could:

► react with adsorbed compounds on photo catalyst surface;

► diffuse from photo catalyst surface into solution to participate further on chemical reactions;

► recombine by electrons transfer reactions – this process has to be limited because it is responsible by low efficiency of photodegradation process.

2. KINETICS AND MODELING

Kinetics and mecanism of photocatalytic reactions in photomineralization or photo-disinfection rate of the water contaminants are useful to study the whole process. Different kinetics and rate model for both photomineralization and photo-disinfection are discussed in this section [3-5].

2.1. Kinetisc of photocatalytic reactions: photomineralization and photo-desinfection

Kinetic or mechanism studies about irradiated TiO_2 surfaces usually focussed only on a single constituent model organic compound. It was found that Langmuir-Hinshelwood (L-H) kinetic describes satisfactory photocatalyitc reactions. According this model the photocatalytic reaction rate (r) is proportional to the fraction of surface coverage by the organic substrate (Q_x), k_r is the reaction rate constant, C is the concentration of organic species and K is the Langmuir adsorption constant:

$$r = -\frac{dC}{dt} = k_r\theta_x = \frac{k_r KC}{1+KC} \quad (10)$$

Eq. (10) could be solved considering initial concentration C_0 in a reference point, as follow:

$$\ln\left(\frac{C}{C_0}\right)+K(C-C_0)=-k_rKt \quad (11)$$

The value for K could be obtained by linearization of Eq. (10), where 1/r is rated at 1/C:

$$\frac{1}{r_0}=\frac{1}{k_r}+\frac{1}{k_rKC_0} \quad (12)$$

When the concentration of organic compounds is low, and noted k' = k_rK,

$$r=-\frac{dC}{dt}=k_rKC=k'C \quad (13)$$

$$C=C_0e^{-k't} \quad (14)$$

$$\ln\left(\frac{C_0}{C}\right)=-k_rKt=-k't \quad (15)$$

This could be represented as in fig.2 (rate constant k vs. catalyst loading), and it is satisfactory for designing great majority of photochemical reactors.

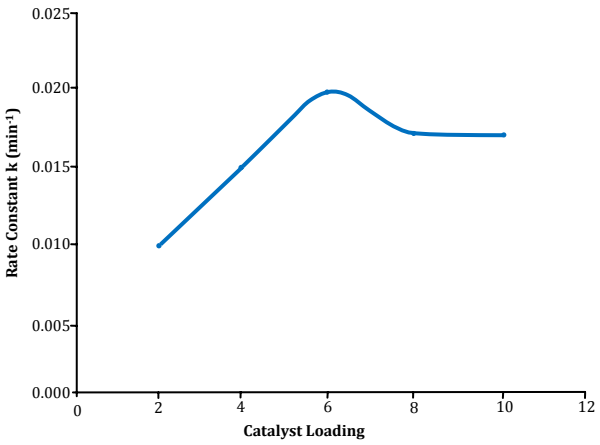


Figure 2. Usually representation of saturation kinetic for degradation of an organic compound in a photocatalytic reactor

2.2. Kinetics of photo-disinfection reactions

Eq. (16) describes a photo-disinfection reaction, assuming that the concentration of the photo catalyst is constant during irradiation.

$$\frac{dN}{dt}=-kmN^xC^nT^{m-1} \quad (16)$$

where dN/dt is inactivation rate, N is number of surviving bacteria after irradiation time t, k is experimental constant rate, C is concentration of used photo catalyst and m, n, x empiric constants. Chick-Watson (C-W) model is the most used for studies about photo-disinfection in a simple hypothesis regarding the mechanism and it is described by Eq. (17).

$$\frac{\log N}{N_0}=-k'T \quad (17)$$

C-W model describes photo-disinfection rate like a linear function of bacteria number and photo catalyst charge. Fig. 3 shows a representation of C-W model, fig. 4 the modified C-W equation (Eq. (18)).

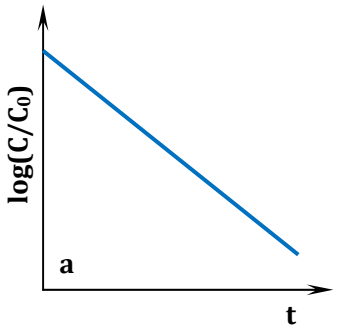


Figure 3. Chick-Watson model representation

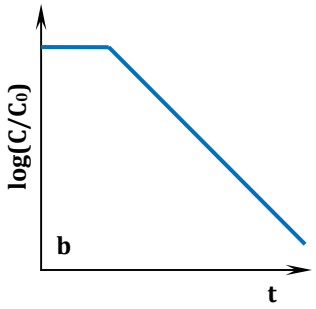


Figure 4. Modified C-W model representation

$$\frac{\log N}{N_0} = -k' C^n T^m \qquad (18)$$

Eq. (19) characterizes Hom model, represented in fig. 5 while fig. 6 presents the modified Hom model (Eq. (19)).

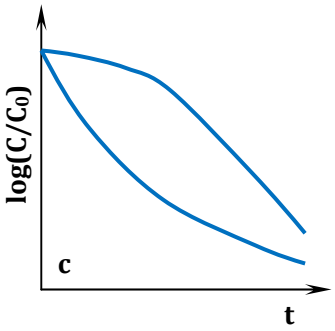


Figure 5. Hom model representation

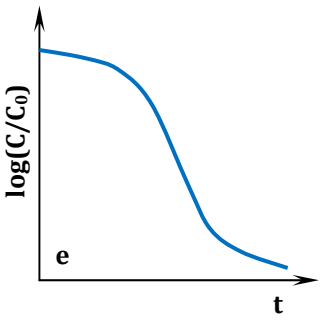


Figure 6. Modified Hom model representation

$$\frac{\log N}{N_0} = -k_1 \left[1 - \exp\left(-k_2 t\right)\right]^{k_s} \qquad (19)$$

Marugan et al. (2008) found in their studies those three regions (a shoulder, a linear one and the tail) specific in many photo-disinfection processes [6]. They used a commercial form of the titanium dioxide, named Degussa P-25. The first region is an initial delay, called "shoulder" which could be explain like a resistance of the bacteria before chemical reactions will perforate their cellular membrane. For the second region, a linear behavior was observed in the great majority of studies. The third region or the "tail" is not understood completely. Some researchers justified it like a competition through different secondary compounds which appear during photochemical reactions and other reactions caused by degradation of inactivated bacteria cells. Other researchers explained the "tail" as

a resistance of a number of bacteria from whole population.

Even the processes have to be clarified in the terms of accuracy, the empiric experimental and theoretical data could offer information for designing photocatalytic systems for disinfection.

3. CONCLUSIONS & ACKNOWLEDGMENT

Photocatalysis offers good perspectives regarding depollution and disinfection of air and water.It is an environmental friendly procees. The mechanism and the kinetics of reactions have to be clarified. Mathematical models provide information for designing practical disinfection systems.

This paper was supported by the project "Progress and development through post-doctoral research and innovation in engineering and applied sciences– PRiDE - Contract no. POSDRU/89/1.5/S/57083", project co-funded from European Social Fund through Sectorial Operational Program Human Resources 2007-2013.

REFERENCES

1. LANCASTER M., Green chemistry: An introductory text, Royal Society of Chemistry, London, (2010).

2. HUNGER M., HUSKEN G., BROUWERS H.J.H., Photocatalytic degradation of air pollutants — From modeling to large scale application, *Cement and Concrete Research* 40. 313–320 (2010).

3. SANCHEZ F., SOBOLEV K., Nanotechnology in concrete – A review, *Construction and Building Materials* 24. 2060–2071 (2010).

4. LAMBERT R.J.W., JOHNSON M.D., The effect of interfering substances on the disinfection process: a mathematical model, *Journal of Applied Microbiology* 91. 548-555 (2000).

5. CHOMG M.N., JIN B., CHOW C.W.K., SAINT C., Recent developments in photocatalytic water treatment technology: A review, *Water Reseearch* 44. 2997-3027 (2010).

6. MARUGAN J., van GRIEKEN R., SORDO C., CRUZ C., Kinetics of the photocatalytic disinfection of Escherichia coli suspensions, *Applied Catalysis B: Environmental* 82. 27-3 (2008)

5. *AIR FORCE*

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

COOPERATIVE LEARNING APPLICATIONS IN AUTOMATIC CONTROL COURSE

Aydemir Arısoy*, Mustafa Er, Rıdvan Kahraman*, Erol Duymaz***

*Engineering Faculty, Turkish Air Force Academy, Istanbul, TURKEY
**Foreing Language Department, Turkish Air Force Academy, Istanbul, TURKEY

Abstract: *This study includes the cooperative learning practices in Automatic Control Course which is a core course in the curriculum of Electronics Engineering Department of Turkish Air Force Academy (TurAFA). These practices with the results obtained and the students' opinions collected are examples of active learning techniques in an engineering course. TurAFA cadets are unique engineering students in that they will be future officers with an engineering degree and be assuming operational responsibilities under severe conditions. So, the contributions of active learning techniques to the TurAFA cadets who need to develop problem-solving skills for tough conditions are also depicted in this study. This study shows that through case-based scenarios it is possible to enable cadets to write poems summarizing the content studied in an engineering course. The feedback received from participants of the study proved the active learning practices enhance the quality of learning.*

Keywords: *cooperative learning practices, active learning techniques*

1. INTRODUCTION

Cognitive psychology has emerged as a reaction to behaviorism since the early 1970s. Unlike behaviorists, constructivists think that learners construct their own knowledge. Constructivism is proposed by cognitive psychologists who claimed knowledge is not independent of people and constructing knowledge means that students are active participants in a learning process by seeking to find meaning in their experiences. In a literal sense, learners construct their subjective experiences, and this result becomes knowledge (Sener, 1997). In addition, according to the constructivists knowledge is constructed in the socio-cultural context within the framework of the learners' experiences and their present knowledge. Constructivism regards the individual learner as the core element of learning process and learners build the knowledge by forming links to the ground to which former knowledge structures are attached. In other words, learners transfer new knowledge structures to their own mental schema by taking advantage of their prior knowledge and experiences and ability to create meaningful structures by synthesizing old and new.

According to constructivists, learner has an active role in teaching-learning process. Constructivist classroom environment, therefore, is not a place to transfer the information, is a place where students' active participation is provided, inquiry and research are conducted and problems have been solved.

So, classroom environment should be arranged to allow students to live rich learning experiences (Demirel, 2002).

Constructivist approach is based on Piaget's theory of cognitive development. According to Piaget, cognitive development is the result of activities rather than the words. According to him, activities with real experiences should be given in the lessons rather than verbal symbols of expression.

The conception of learning as an inherent process mediated by cognitive processes rather than environmental factors led to changes in the perception of learning which in return changed the perception of teaching. As a result, studies in the field of education have focused on cognitive processes and their roles on learners (Açıkgöz, 1996).

Constructivists concerned with the issue of teaching and learning and interested in the nature of knowledge, how information is configured and factors influencing cognition process. Constructivist theory explains how students learn but does not state the procedures to be applied in constructivist classrooms. Active learning model developed on the principles constructivist theory sets techniques and procedures to apply constructivist theory in the classroom. Active learning is an approach to learning and it claims the existence of an important relationship between knowledge and social interaction (Elby, 2000).

Evaluation of Group Process: It should be decided which member acts of the group contribute to reach the group goals and which of them should be changed or eliminated.

Equal Opportunity for Success: Contribution of students by developing their own performances. Scoring individual efforts can be used to ensure this goal (Açıkgöz, 1992).

At first glance, cooperative learning can be thought as a single method such as lecture and discussion. However, cooperative learning has various techniques such as student teams, ask together-learn together and writing poems (Açıkgöz, 2007).

1.1. Effectiveness of Cooperative Learning

Within the past 90 years more than 875 researches examining the effects of cooperative learning on students have been carried out. Participants of those studies were of various economic class, age, gender, and cultural background.

Richard M. Felder-North Carolina State University Department of Chemical Engineering Faculty Instructor, Gary N. Felder-Stanford University Department of Physics Instructor and E. Jacquelin Dietz-North Carolina State University Department of Statistics Instructor carried out a research exploring the use of active learning practices in higher education in 1990. This study carried out in North Caroline State University, USA and lasted for five consecutive semesters in five field courses given by the same instructor. Participants of the study were 123 chemical engineering students. The aim of the research was to determine the degree of effectiveness of active learning practices on chemical engineering students' academic performance and their attendance to the program. In the study participants are assigned to control and experimental groups. Experimental group students received intensive active learning practices whereas the control group students are taught via traditional teaching methods. The researchers concluded that active learning practices of which effectiveness are proven by numerous researches led to positive learning and teaching experiences for the participants (Felder, Felder, Dietz, 1998). The results of the survey are summarized below:

- Attendance and graduation rates of the experimental group students attending chemical engineering program are quite high compared to control group students.
- Students in the experimental group have developed critical skills. Some of these skills are open-ended inter-disciplinary problem solving skills, to predict differences between the actual situation and estimated designs, leadership, communication, conflict resolution and team-work skills.

- With the help of teaching method applied to the experimental group peer-learning is ensured. It is indicated that peer-learning is very important factor affecting the academic development in undergraduate education. It has also shown that peer-learning not only increases the participants GPAs, but also it improves leadership ability, developing analytical problem – solving and communication skills.

In this article, cooperative learning practices applied in Automatic Control Course which is part of Air Force Academy-Department of Electronics engineering junior class curriculum are described. The transition process from traditional to active learning method in the Air Force Academy will be presented in part two. Participants of the study, and cooperative learning techniques used are described part three. Findings of the study and interpretations of the findings are described in part four and the results are given in part five.

2. ACTIVE LEARNING IN AUTOMATIC CONTROL COURSE

After the completion of the staff's in-service training program, active learning practices in automatic control course are carried out within the framework of the preset design.

2.1. Participants

In this study, all participants are junior class students of Automatic Control Course that is a core part of Air Force Academy's Electronic Engineering Department curriculum. Cooperative learning techniques started to be applied in the Automatic Control Course with 70 students in the 2008-2009 academic years. The study continued in the following academic years 2009-2010 with those 70 students and 2010-2011 academic years with 60 students. The total number participants during these three years are 200 and they are all male students.

2.2. Method

Faculty members play a vital role in successfully sustaining a new teaching method. For an instructor who has taught a course via traditional lecture method for years to shit to a new method is quite demanding. For the instructors the hardest part is to adapt the new techniques to their subject matters and classroom activities.

Active and cooperative learning practices explained below helped the learners to comprehend the content of the Automatic Control Course which is a notorious course with a heavy theory requiring mathematics proficiency.

2.3. Cooperative Learning Applications

Automatic Control Course is a four hour 3.5-credit course with three hours of theory and a practice hour. It is a sixteen-week semester course with a two additional exam weeks. Course topics covered are as follows; introduction (definition and the history of automatic control, open loop and closed loop concepts and the effects of feedback), the mathematical bases of automatic control, transfer functions, block diagrams and signal flow diagrams, mathematical modeling of physical systems, stability of control systems, control systems' time domain analysis and root-locus technique.

Cooperative Learning Classroom:

Cooperative learning techniques comprising real life activities are reflections of the constructivist approach. So, Automatic Control Course is given in Electronic Engineering Department's Control Laboratory to provide cadets with a classroom environment offering real life experiences. Control Laboratory is a place where the graduate and undergraduate control laboratory projects are implemented. This laboratory is

also equipped with chairs convenient for group formation, a traditional blackboard and a smart board ready to use in Control Courses. It was understood from the student feedback (student opinions obtained at the end of the semester by the written student course evaluations) that courses given in the laboratory motivate the students to participate the classroom activities. In the control laboratory which is used as cooperative learning environment there are also electronic materials i.e. classroom realia related to course topics in addition to classical teaching materials. The most important control system element of the automatic control course applications is feedback components such as different types of sensors (operative sensors or damaged sensors, Li-Po batteries, motors in different sizes etc.) which are used as course materials during the presentation of the new subject matters. During the time domain analysis a modular servo control experiment set contributes to comprehension of the subject. Most important of all, the presence of an ongoing project in the lab to which the students are expected to contribute by giving ideas make students highly motivated to the lesson.

Case-Based Scenarios:

Automatic control course sessions start with the presentation of the unit by the instructor and goes on with the appropriate form of cooperative learning techniques embedded in case-based scenarios.

The first two weeks of the semester, students are informed about the course content and they are motivated to course. The history of automatic control is given by slide presentations in the introduction part of the course. After discussing application areas of automatic control in detail, it is emphasized with examples that the course is not only related to the fields of electrical, electronic, or mechanical engineering but also it is used in economics and even in social sciences. Together with the concept of feedback open loop and closed loop control system are also defined. Afterwards students get in groups. Students in groups are expected to produce ideas about automatic control projects and to prepare a project including the control system elements. After the completion of the group projects, the group spokesman describes the project. Thus, a fruitful discussion ground is provided for other students to criticize the presented project by demonstrating the weaknesses of the project. In return the presenter team is given chance to defend their projects.

During the following weeks students are engaged in cases given by the instructor and they are expected to handle with the given cases using the techniques such as problem-solving and classroom discussion. The sample cases and the tasks given are as follows;

- To create a block diagram in order to control pitching movement of a space shuttle,
- Time domain analysis for passenger aircraft and fighter aircraft and the performance expectations,
- Control system elements of air platforms that are capable of vertical landing.

As it can be seen from the above cases, the groups are given tasks directly related to the Air Force and cadets' prospective careers. This aspect of the cases is an additional motivating factor for the cadets taking the course.

Other Active Learning Techniques:

In automatic control course sessions, all of the following activities are carried out in the laboratory which is used as a classroom for student centered activities.

- Preparing multiple choice and open ended questions with short answers,
- Designing projects and realizing those projects,
- Producing different solutions to the problems given on Control Projects carried out in the laboratory,
- Making a demonstration using a modular experiment system as a group work,
- Writing a poem related to the subject matter studied in class.

Writing Poems:

A cooperative learning technique which may be interesting and even difficult to implement in an engineering course is writing poems. Actually it was successfully applied as a group work in Automatic Control Course for the topic called Stability Analysis. Upon the

presentation of the topic by the instructor, this technique entails students in groups to write a line related to the topic by taking turns. The rule is all lines added to the poem should contain some piece of new information about the topic. By the contribution of each single team member the poems are completed by each group. Some groups wanted to write their poems as a whole group work. This was allowed because that also required close cooperation which is the essence of a group work.

When the instructor told the students that they are going to write a poem for the topic studied, almost all of the students found the idea of writing poems in an engineering course strange. Some of them said that they thought that they cannot do this. But after the application they said that they really got surprised. Some of the groups wrote stability analysis poems composed of seven stanzas. This might be a reflection of cognitive and affective integrity achieved by a cooperative learning technique. One of the poems entitled "Towards Stability", written by a group of four students is given below as a sample poem:

Towards Stability

A stable system is like sunrise
The characteristic equation giving us all the information
We write all the parameters on table
In the way of uncle Routh's, *s* cube, *s* square

Instability is a case to tender minds
To solve this case it is necessary to find stability
Changing one sign infects the entire compliance
All must be the same, this gives meaning to compliance

Systems are temporary, but it must be stable
Unknown parameters must be enlightened
How big you are Routh that you show us the way
You portrayed unknown numbers easily

Exceptions do not break the rule
We apply this rule in the zero-line
Oh zero! You cause trouble for us
We just go to the next line
We continue our way with the helping equations

We look at the first column from top to bottom
If there is a change on the basis of sign
Then roots are on the right-half plane
Leads system to instability

Passes through zero both the virtual and the real axis
Confused heads work for you
Conjugate roots in virtual axis always swing
The only way to stop it lets close the system

O the left half-plane how vast you are
You perish the system with all your roots
That is the time we say we have become an engineer
We rise to the skies with new inventions

3. RESULTS AND COMMENTS

At the end of the Automatic Control Course practices, students' views on these practices are collected using a questionnaire including five open-ended questions developed by the researcher. Participants were not given any clue in open-ended questions in order to get deep and original responses (Best, Kahn, 1989). Students' opinions on the

implementation of cooperative learning techniques are presented below.

- The way course is given and classroom environment are very beautiful and motivating. My interest in this course increased even more when I figured out the possible uses of Control Systems in the field of aerospace and aviation.

-Active-learning techniques applied to the course were really useful and I believe they will help us not to forget the things we learned. Especially poems we wrote on the issue of stability are very effective in better understanding of the subject and in permanency of what we learned. Supporting the course with the multimedia (video, photos, slides, etc.) makes the lessons more interesting. Learning the course in the laboratory and seeing the usage of what we learn on the projects expands our perspective.

- Automatic Control Course that I took this semester has attracted my attention due to the different techniques implemented. Writing poems, preparing questions or using of multimedia elements in presentations lead better understanding of the course content. We think that lessons are more meaningful when they involve real-life examples embedded in the units.

- In my opinion, using these techniques should continue while teaching the lesson. Also, active learning techniques create very different atmosphere in class. These techniques are useful for the development of the students.

- I think the most beneficial applications were active learning practices. Through those practices lessons became interactive as we engaged in group works. One day, we wrote poems on the subject and it was so funny. It was not only funny but also an educational activity. For example, I wrote a poem line about stability and I think with the help of it I won't forget the subject. At the same time we got mentally relaxed.

Even those sample students' comments given above show that when active learning techniques are used appropriately in the course, we get positive student responses. Active learning approach with cooperative learning techniques applied to 200 students in the Automatic Control Course in three years and they increased students' interest in the course. Almost all of the students took part in this study responded active learning techniques positively. They also think that active learning techniques applied in the course increased the course attendance rates.

4. CONCLUSION

In order to fulfill their missions assigned to them, educational institutions should spend time not only on what issues should be taught but also how this content should be taught. It is also essential for those institutions to have instructors compatible with 21st century needs and requirements. The findings of this study showed that through active learning techniques even in engineering courses, which are usually perceived as difficult and mechanic, students can be motivated to participate actively in classroom activities and develop positive attitudes towards the course. Within the framework of the Automatic Control Course practices in engineering curriculum, it can be concluded that those practices should also be applied in the rest of the engineering courses to increase student participation in classroom activities and help the students achieve deep learning.

5. REFERENCES

1. Harvey, L., Moon, S., & Geal, V. (1997). Graduate's work: *Organizational change and students' attributes.* Birmingham, UK: Centre for Research into Quality and Association of Graduate Recruiters, University of Central England.
2. Romizowski, A. J. (1981). Designing Instructional Systems: *Decision making in course planning and curriculum designing.* London: Kagan Page.
3. Akbaş, O. (2007). *Eğitime Yönelik Yazılar (İnceleme 24).* İzmir: Hv.Eğt.K.lığı Hrk.Eğt.Bşk.lığı ARGE Ş.Md.lüğü yayını.
4. Demirel, Ö. (2002). *Kuramdan uygulamaya eğitimde program geliştirme.* Ankara: Pegem Yayıncılık.
5. Açıkgöz, K. Ü. (1996). *Etkili öğrenme ve öğretme.* İzmir: Kanyılmaz Matbaası.

6. Elby, A. (2000). *What students' learning of representations tells us about constructivism?* The Journal of Mathematical Behavior, Volume 19, Issue 4, 4th Quarter 2000, pp.481-502.

7. Haack, K. (2008). UN Studies and Curriculum as Active Learning Tool. *International Studies Perspectives 9*, pp.395-410.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

ORGANIZED CRIME, SUPPORT FOR TERRORIST PHENOMENON

Ion BĂLĂCEANU*, Mihaela DIN**

*Hyperion University, Bucharest, Romania, ** IGPF, drd of ,,Carol I" National Defense University, Bucharest, Romania

***Abstract**: The attack of September 11, 2001 has changed the approach to the concepts of terrorism and organized crime. Terrorism and organized crime are daily threats to international security and, therefore, it was seriously necessary to study the links between these two phenomena. By their nature, especially the objectives sought and the effects generated in society, activities in the field of organized crime and terrorism are placed, obviously, among offenses.*

***Keywords**: terrorism, the phenomenon of cross-border crime, criminal network, fight against organized crime, border police, international police cooperation.*

A definition of *organized crime* was formulated and presented at the UN Convention against Transnational Organized Crime, adopted on November 15, 2000, ratified by Romania by Law no. 565/2002, as follows*: organized crime stands for the activities of any group of at least three people who allow those in power to enrich or control territories or domestic or foreign markets by using violence, intimidation, corruption, seeking either to pursue criminal activity or to infiltrate the legal economy.*

Criminality evolves and its trends are influenced by changes affecting societies, both in time and space. This is a logical consequence because criminality is an inevitable byproduct of any society. To find the causes of increasing international crime rate is therefore necessary to consider the changes that have occurred worldwide over the last decades, especially in Europe. We might mention, as an example, demographic imbalance, economic and monetary uncertainty, distortions of rich and poor nations.[1]

Organized crime and terrorism have been considered completely distinct phenomena before the day of September 11, 2001, known as America's Black Tuesday. Committees of security studies, military and law enforcement structures approached topics of terrorism and organized crime at the strategic level. But often, these issues were addressed separately. In many debates, the growing threat of terrorism and transnational crime has been emphasized, but rarely have the links between them been highlighted. Closer analysis of the main elements did not regard the essence, as the purpose, forms, distinctions, but also complementary aspects that are highlighted for better understanding and, especially, for a more efficient counteraction.

Common issues, in phenomenology, of crime and terrorism derive mainly from their common general characteristics: subversion,

dissimulation and transnational character. *Differences* between the two phenomena, as they occur in society, are observed in origin, motivational essence and purpose of their representatives.

The main difference between terrorism and organized crime comes from the difference between weakness and / or convictions (given mainly by human nature and culture) around which ideologies or de facto behavior of each of the two phenomena representatives emerge. The common features, but also differences and complementary aspects related to terrorism and organized crime may be, however, more easily identified and evaluated, in terms of the main parameters that characterize their full manifestation in society and its normal status.

Complementary aspects of the two phenomena are, in particular, in the field of circumscribed activities of their common membership in the category of offenses / crimes against local and / or international legal standards. Regarding the origin and motivation of organized crime the prevalent desire is to achieve a material - financial win at any cost. On the other hand, terrorism is especially based on the feeling of intolerance and contempt of the individual / group to everything that is not part of its own ideology and especially to what is perceived as a threat to its current situation or aspirations, as they are outlined in the group culture.

Organized crime, at its upper structures, requires activities that can be viewed as mostly peaceful by the ordinary observer, including office work (eg white-collar case, from the sphere of economic and financial crime, for the violence to be usually felt in the lower structures of the phenomenon; revenge actions; competition to fill market segments; illegal activity, etc.).

Regarding the *objectives*, terrorism aimed mainly political-ideological or political-administrative goals, including the political-administrative takeover of states or establishing new state entities. As regards the *specific actions*, terrorism, by its specificity, requires (at least in the execution part) activities that can only be classified as violent and usually have serious implications in the management structures of society and also in the public safety feeling.

Circumscribed activities of organized crime aim for objectives with serious connotations in financial economic area. Such targets may also consist of taking control of some industries from the economic field or with great relevance to this line.

Cross-border criminality has an international character which means that a criminal group acts in several countries, and a transnational character which refers to cooperation between criminal groups of different nationalities to control certain markets. The fundamental purpose of organized crime structures is continuous capitalization, meaning the accumulation of resources by illegal means, targeting traditional areas (drug trafficking, smuggling and tax evasion) and also new areas (terrorism, arms trafficking, human trafficking, immigrants trafficking).

Transnational organized crime primarily aims for profit. To effectively prevent and combat such crime, efforts should focus on detection, freezing, seizing and confiscation of crime related products. However, these operations are difficult to be achieved, due to differences between Member States laws in this field[2]. Opening borders, loosening border controls and legal vacuum are factors that create favorable conditions to increase the crime rate.

Regarding the *means* of extremist-terrorist activities, these are means, par excellence, with a specific character, even in that they can not be regarded as peaceful (especially in the executive component of those activities). For these reasons, they can not be easily hidden / concealed among means related to activity taking place currently in a given environment (officially or unofficially) endorsed by representatives of the phenomenon. Means that are used in organized crime activity are, with some exceptions, those currently in use in the particular environment or field.

In terms of *the organizational framework*, terrorism evolves, but especially acts, in a hidden organizational framework. This fact is a consequence of the nature of the

objectives pursued by the representatives of the phenomenon and of the brutal methods of action that terrorist activities involve. Organized crime acts mainly in a framework that can be considered transparent, but this phenomenon's circumscribed activities, are included, in a discreet manner, in illicit buildings / conceptual plans and execution, usually hidden.

With regard to *staff training* in terrorist structures, it is, par excellence, a specific training, such as to enable achieving its objectives in a hidden manner. The means that are used (including the situation in which the phenomenon is transnational) also have to be hidden.

The representatives of terrorism receive special training, including the possibility of development in an environment full of activities to enable them to study a particular situation undercover and to act successfully, according to the aimed objective. Members of organized crime structures usually have a joint training with other components of the operating teams. This training is completed, however, by matters regarding their willingness to act in bad faith and their disloyalty on the formal structure, institution or state within they act.

Regarding the infiltration or imposing process of own personnel by terrorist groups, it is a difficult task because it implies previously creating specific activities. Although not a rule, if the situation requires, in order to achieve the intended objectives, terrorists can (and even manage to) gain access, through legal channels in different target structures (providing the chance to provide information in the field or to organize and trigger a terrorist action of great impact). By force of circumstances (especially because of culture and group psychology), in general, personnel of groups with activity in the terrorist area does not have the training and skills that allow easy and unnoticed access to such structures. The infiltration or imposing their own staff within objectives in organized crime, is far easier than the same action done by terrorist groups. It is possible that access to these objectives, both directly, through official channels (with respect and even exceeding the minimum standards of training required) and by using intervention / influence from other representatives of the phenomenon, to be gained from positions that allow this.

Terrorist activities are, generally, outside groups that practice, depending on the interests they serve. We find, therefore, subsidization by some states of terrorist activities directed against other states, or against segments of their populations (*state terrorism*), or by donations and grants, in various forms, from groups or organizations sharing the same ideology or the same goals (especially political-ideological or political-administrative).

An important *financing source* of terrorism represents, however, practised organized crime, typically by groups of persons of the same ethnic composition of those financed terrorist groups. In general, the activities related to organized crime are self-financed. Sometimes, they become the source of funding for other illegal activities (including extremist-terrorist) or even for some state budgets (the case of so-called tax havens).

In order to operate and develop, it is necessary that a terrorist organization receives (or provides) financial support. This can be provided by individuals, states (states, governmental and non-governmental organizations, political parties, etc.), regional or global, and may take forms such as: budgets of states supporting terrorism; indirect funds

allocated under the cover of assistance and international aid, support to democratic, progressive forces; businessmen or immigrants grants; funds collected by the parties, religious organizations, NGOs, individuals, etc., money obtained by traffickers of arms, ammunition , drugs, radioactive substances, strategic materials, human beings, works of art, fraud, tax evasion, fraudulent bankruptcy, embezzlement, forgery and money laundering, etc.; raise funds by taking hostages, threats, blackmail, burglary banks, attacking means carrying money or valuables.

Most countries affected by the phenomenon of organized crime have adopted and completed national legislation. They have complained about criminal activities of international origin: illicit drugs, smuggling of works of art and other national and world heritage values, illicit trade with firearms, ammunition and explosives, fund extortion, sale of stolen goods, frauds and currency or other valuables counterfeiting, kidnapping people to obtain financial benefit, false accounting and various other forms of financial fraud, pimping and prostitution, illegal gambling games etc..

Events in the last decade and technological progress allowed organized crime to exploit, at the right time, all the possibilities offered by geopolitical exchanges that took place in Central and Eastern Europe. Relations between police and government institutions highlight the following: organized crime is borderless; crime, similar to people, goods, capital and information flows ever more freely and without constraints; organized crime has taken a new size and shape, representing a threat to collective security and democracy; crime is closely linked to urban centers, ports and economic and political strategic zones; organized crime exploits all national and regional conflicts (in the former Yugoslavia, Ireland, the Balkans, Corsica, Kurdistan or among former Soviet republics).

Due to the complexity and speed evolution of the global phenomenon of cross-border crime, there are always new forms of manifestation, and the networks involved in illegal activities are organized increasingly better, some of which having military-type structure with specialized information services, resources and even experts in weapons of mass destruction.

Cross-border criminality is a serious threat to internal security of the European Union and its Member States. Since the adoption of the Millennium Strategy against crime in 2000, the European Union and its Member States have established principles, have enacted laws and set up police cooperation to combat cross-border crime.

Organized crime is a dynamic phenomenon. By changing the action domain and modes of operation, organized crime groups have the power to adapt to economic and social changes and the measures imposed by law enforcement authorities. The Stockholm Programme prioritized the importance of protecting European citizens against real threats of organized crime. Internal Security Strategy adopted by the European Council in March 2010 and the recent Communications of the Council on this strategy deals with organized crime as a phenomenon that manifests itself in different ways. Less serious acts such as trafficking in stolen vehicles and smuggling of counterfeit goods are manifestations of organized crime in the local organizations.

Economic recession equally affects EU citizens and groups specializing in cross-border crime. Organized crime tends to hit the legal economic activities and may affect good functioning of public administration and judiciary system, which is the worst trend of evolution of the phenomenon.

Given all this, organized crime groups have become more inventive in finding new routes, adopting new operating procedures and involving in new areas. Online betting and manipulation of sport events have become new targets for international organized crime groups.

Fight against organized crime requires well-developed policing and police cooperation. It is difficult to supervise the criminality because, as with any illegal act, one can only see the surface of the phenomenon. Criminologists are interested in various statistics on crime, despite many existing objections that the official statistics

can not provide a valid idea of the reality of crime[3]. There are different ways of doing a census of crime levels in general. On the other hand, there are very few specific cross-border crime statistics, because each state classifies its crimes under national law. According to organized crime threat assessment in the European Union - OCTA, criminal networks are divided on certain areas which sometimes overlap. Analysis of available data confirms the existence of five criminal networks with great influence on the dynamics of crime market in the EU.

The geographical center of the northwest criminal network is in the Netherlands and Belgium. Her role is the distribution of heroin, cocaine, synthetic drugs and cannabis. Its influence extends into United Kingdom, Ireland, France, Spain, Germany, Baltic countries and Scandinavia. Illegal crossings can be traced from east to west (women for sexual exploitation, illegal immigration, cigarettes, counterfeit goods, synthetic drugs) and vice versa (cocaine and cannabis).

Southeast criminal network is based on its geographic location between Asia and Europe and the important role of EU output. In terms of logistics, the importance of the Black Sea defines the network and creates opportunities for trade and organized crime. Romania can be seen as an important exit to facilitate illegal immigration into the EU, while Bulgaria occupies a central role in certain criminal markets such as illicit drugs, counterfeit currency and credit card fraud[4].

There are three factors that were clearly of a great influence in the evolution of cross-border crime in Europe: media development, increasing mobility of persons, goods and capital and the fall of the Iron Curtain. It should not be forgotten that increasing crime rate generally affects the cross-border crime rate. In 2009[5], EU Member States and associated countries within Schengen agreement reported a total of 106,200 detections of illegal border crossing of the EU external border. This represents a decrease by 33% compared to 2008 and refers to the decrease reported in the maritime borders by 23% and in land borders by 43%.

J.A.I. agencies network of EU where, apart from **Frontex** and **Europol**, **Eurojust** and other partners meet regularly to discuss issues of common interest, continued to be a useful platform for partners, regarding exchange of information and develop common approaches. In May 2009, Frontex has also signed an agreement to work with Interpol; however, cooperation is not yet exploited at its full potential.

Romania, like any other country, and as EU member as well, faces cross-border crime forms, namely human trafficking, drugs, illegal immigration, forgery of money, arms trafficking, money laundering, computer crime, etc.. The main trends that define the evolution of the phenomenon of cross-border crime refers to:

- amplification and diversification of cross-border crime, which is increasingly organized, plotted and internationalized;
- skillful speculation on existing legislation in the area and attraction of people with decision-making power in fighting customs fraud and corruption;
- the protection of illegal operations carried out and diversification in the selling of stolen products, values and proceeds;
- expansion of joining the high-income generating crimes with other violent crimes that have serious consequences and destabilizing effects on the population (terrorism, murder contract, etc.)

- extension of the range of crime in the information technology sector (IT) by fraudulently accessing databases of institutions with expertise in national security to exploit information obtained;

- permanent changing of routes used for trafficked goods or products to "market demand"; an increase is expected in drug trafficking from eastern to western Europe;

- diversification of the removal of legal and professional control over border crossing of dangerous products, endangered species of fauna and flora, of the wood and forest genetic material and not least Romania's transformation from a source of illegal workforce in a consumer for immigrants from Asia, Africa and even Europe.

In 2009, the Romanian Border Police has developed an important cooperation with the European Agency FRONTEX[6]. That year represented an increase for agency activities, new concepts have been defined for operational phase and steps have been taken to close cooperation with third countries. According to this, workers of the Romanian Border Police participated in 20 joint operations (of which 9 in our country) organized under the aegis of FRONTEX, as follows:

- *9 green border operations* (one of the most important was the fifth phase of the operation Jupiter, the Romanian border with Moldova and Ukraine, which was attended by 38 representatives of 14 European Union member states, including specific logistic means);

-4 blue border operations (note the work done by Romanian border guards participating in a ship in the CRATE reserve, Operation Poseidon 2009, organized at the maritime border of Greece in the Aegean; from 9 ships participating in this operation, the Romanian ship found 49% of all cases of illegal migration, Romanian border guards being appreciated for their professionalism);

- *7 air border operations.*

In 2010 the Romanian Border Police (RBP) conducted a series of joint activities with the Frontex Agency[7], as follows: 11 op as host (4 land, 2 sea and 5 air), 10 operations as a guest state (6 terrestrial, 4 air). Also during 2010 RBP designated 13 representatives who traveled to Orestiada and Alexandroupolis between 11.02-31.12.2010, to participate in Operation RABIT organized by Frontex Agency. The main purpose of the operation is to ensure operational response to the pressure of illegal migration on the southeastern borders of the European Union as a result of the crisis faced at the land borders of Greece with Turkey. Romanian Border Police is characterized by FRONTEX as an important partner, actively supporting and participating in projects to secure the external borders of EU.

Romania's image continues to be affected by Romanian crimes committed in other states. In the last three years, the reported number of Romanian citizens with criminal activity overseas has increased continuously, reaching, in 2009, a number of over 9000[8]. 90% of acts of crime committed by Romanian citizens abroad are registered in the territory of 8 countries (Austria, Italy, France, Spain, Ireland, Belgium, Germany and Britain). Although most illegal activities are part of the small criminality, there is occurrence of Romanian citizens that are part of transnational organized crime channels.[9]

Cooperation between national police forces of states is not limited to tracking, capturing and extradition of criminals on international pursuit, but also covers other aspects. International fight against crime, especially against organized crime means unified actions by national police forces of all countries that have signed treaties, conventions or are part of international organizations specialized in the fight against crime. Thus, one can say that the notion of international police cooperation includes: international studies of correct identification of threats, the coordination of institutions involved, increased information sharing, harmonization of criminal procedural legislation of the States, international legal assistance in criminal matters, the development and execution of procedural acts required by the Letter of Request, to exchange data and intelligence and direct cooperation between the police in different states.

To conclude, criminality evolves and its trends are influenced by changes affecting societies, both in time and space. This is a logical consequence because crime is an inevitable byproduct of any society. To find the causes of increasing international crime is therefore necessary to consider the changes that have occurred worldwide over the last decades, especially in Europe. We might mention, as an example, demographic imbalance, economic and monetary uncertainty, distortions of rich and poor nations.

BIBLIOGRAPHY

[1] Activities analysis in the PFR in 2010.
[2] Cusson M., Rise and fall of crime, P.U.F., Paris, 1990, pp. 14-26.
[3] Council Framework Decision 2005/212/JHA of 24 February 2005 on confiscation of the instruments and assets related to crime.
[4] H.G. No. 1040 of 13 October 2010 National Strategy for public policy in 2010 - 2013.
[5] OCTA Report 2009.
[6] Picca G., International aspects of the evolution of crime, International Review of Criminology and Technical Police, no. 2, 1994, p.145
[7] Frontex General Report - 2009.
[8] Council Framework Decision 2005/212/JAI of 24 February 2005 on confiscation of the instruments and assets related to crime.
[9] Online source: http://www.politiadefrontiera.ro.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

TRENDS IN THE INTERNATIONAL SECURITY ENVIRONMENT

Prof.univ.dr. Ion BĂLĂCEANU*, drd. Adrian CASIAN**

*Hyperion University, Bucharest, Romania, ** IGPF, drd of ,,Carol I" National Defense University, Bucharest, Romania

***Abstract**: The current security environment is very dynamic and constantly changing. Regionally, in the Central, Eastern and South-Eastern Europe there are tensions that persist or grow, caused either by transnational criminality or by old ethnic, religious, territorial or separatist disputes to contest existing borders.*

***Keywords**: global security environment, diagram of power relations; regional powers, security structures, globalization, risks and asymmetric threats, international stability.*

Global security environment is mainly characterized by the following major trends: the acceleration of globalization and regional integration, along with the persistence of actions that aim for state fragmentation; reasonable convergence of efforts to establish a new stable and predictable security architecture, accompanied by heightened anarchic tendencies in some regions; renewed efforts by states to preserve their influence in the dynamics of international relations, along with developing new forms of intervention and increasing number of non-state actors in international relations dynamics. Global change, a concept with multiple meanings, must have the stability and world security purpose, based not on the balance of power, like in the old bipolar order, but on legitimacy.

Knowing the forces and identifying trends that manifest in the current security environment is extremely important to understand the kind of "new international order" that mankind is heading to. This should be also done in order to find out appropriate ways to strengthen global, regional and national security. Forces acting on domestic and international environments often have divergent or antagonistic tendencies, which contribute to the destabilization of the security system, and sometimes are the cause of confrontations that can develop into war starting conflicts. It is time that the serious problem of security is approached from a neutral position, without stereotypes and misconceptions.

Currently, there is a *reconfiguration in the diagram of power relations*: from a bipolar world, in which the U.S. and USSR fulfilled the role of superpowers and regional powers had little significance, a turn is made to another type of global security system. In the first possible variant of evolution, a single superpower, a megapower, ie U.S., must meet the demands and challenges that sometimes occur from the rising regional powers, creating a unipolar global security system. The second trend of evolution of the global security environment, to multipolarity, is dependent on the capacity and interests of some regional powers [1].

A number of states and non-state entities are included in the category of regional

powers. These are situated on two continents - Europe and Asia – and are quite numerous: EU, China, Russia, Japan and India. World evolution from bipolarity to multipolarity coincides with the transition from nuclear to the informational era, specific to post-industrial society. These two trends in the evolution of international environment generate substantial changes in perceptions of national security and international status by political leaders, public and media in various countries.

In addition to the superpowers and regional powers (whose number is increasing and have centrifugal tendencies to the dominant superpower, establishing an independent course of action, or at least of a large autonomy), there are also *niche* powers. These are states and *non-state* entities or actors who have developed a high capacity in a relatively narrow and limited domain, that enable them to influence, sometimes decisively, short-term evolution of the international environment.

Increasingly more non-state entities are situated between *niche* powers, including terrorist organizations. Terrorist organizations produce major effects on the relations between different actors in the international arena, both through great emotional impact that terrorist actions have on people and politicians, and through their media (such as the attacks of September 11, 2001 in the U.S., those in Spain, Turkey, Egypt and the UK).

After the attacks of September 11, 2001, the possibility of new terrorist attacks using biological and chemical weapons induced real psychosis for American population and media. It was proved that unconventional and asymmetric means used by terrorist organizations often catch authorities unprepared in national security responsibilities. In this context, with numerous risks, dangers and threats, building an extensive and comprehensive security system is a priority for all European democracies. Today, security system is based on the UN, NATO and EU enlargement and aims to strengthen the implementation of the concepts of security and collective defense by asserting the two regional organizations as the main guarantee of stability and democratic development.

Worldwide, the Cold War ending determined, at least in military terms, the shift to a unipolar world, in which the U.S. are dominant at very great distance from any other State. However, recent period showed that no state, not even a superpower like the United States, can address global security issues alone. In this context, after 1990 and especially after 1998, the EU has given attention to efforts to strengthen security and establish the European defense dimension.

Developing a common foreign and security policy included the idea of establishing a common defense policy, explicitly mentioned in the Treaty of Amsterdam. It marks a new era in which Europe is unified, reborn from West to East, becoming more stable and prosperous, continuing its “pillar of regional stability” status and security and its relations with the international security environment become essential for security stability.

The dynamics of achieving European security in recent years shows an increase in efforts to build regional stability, as an intermediate stage of the process of global stability. At this level one can say that the international security environment has evolved since 1990 to increase the complexity and dependencies of international relations. As a result, today's international stability can not be conceived without cooperation at various levels in the international community and especially through dialogue in an institutional framework, through increased involvement of major international organizations in defining the world security status. In the '90s, cooperation and institutionalized dialogue occurred, especially in the following organizations:

- NATO, which has played a key role in strengthening Euro-Atlantic security after the Cold War; the political-military cooperation was opened and developed; dialogue with the former enemy countries, including Romania, was strengthened; it was interested in accepting new members; it has demonstrated its commitment to contribute to conflict prevention and crisis management,

including peace support operations (we consider the actions of the Balkans);

- UN, especially through the Security Council, which had an important role in international dialogue on global security and stability; in 2001, the Nobel Peace Prize went to the UN Secretary-General;

- OSCE, which represented the most comprehensive regional security institution and played a significant role in promoting peace and stability through cooperation, in strengthening security and promoting democracy and human rights across Europe. The OSCE has been particularly visible in areas of diplomacy, conflict prevention, crisis management and post-conflict rehabilitation.

Efforts by the international community for peace in the Balkans, Middle East and Africa are conclusive and highlight the concerns of international security institutions. Situation management in this region was mediated by political, economic and military control of NATO, EU and OSCE. These bodies should use the available instruments (political, economic and military), for European stability and development, for developing interstate relations, collaboration and cooperation among them and, not least, the imposition of decisions and judgments globally.

Changes and trends in the security environment are difficult to predict, but we can emphasize some general aspects of evolution and the current security environment new configurations as follows:

- nations, even the great powers, can not avoid transnational threats alone (institutional coalitions - NATO and EU, ad hoc regional coalitions will still be possible and actual);

- the role of security structures (UN, OSCE, NATO, EU)is increased and diversified, in prevention and management of unstable situations. This involves new guidelines regarding military coalitions, operations strategy (imposing, maintenance, post-conflict stability) and the modes of intervention in different operations;

- migration, with destabilizing effects, can be a threat in terms of liberalization of movement of persons, leading to perpetuation of conflicts and economic crises in Central and Southeastern Europe;

- territorial disputes are still a source of instability and a permanent increase in risk situations;

- old tensions, prejudices, traumas and revenge desires are conserved, fact that perpetuates regional or zonal conflict states (Bosnia and Kosovo conflicts, terrorist activities in Spain, Russian Federation, Turkey and the former Soviet Union);

- great progress of communications and information technology allows almost unlimited, difficult to control access to information of terrorist groups, specialized in organizing the destabilizing actions;

- security is no longer a problem exclusively related to states, no longer limited to war and peace, but also includes non-military actions that have a great impact on society, becoming a major concern of security structures, in cooperation with the States concerned;

- U.S. will continue to be the world's leading political, military and economic force, able to solve major problems of the current security environment;

- for the next period, Russia will continue to be a strategic partner of the United States and will develop special relations with the EU and China;

- terrorism will remain a constant threat, manifested both as a tool for mafia clans and for violent political pressure (Madrid, Kosovo, Chechnya).

Following the development of international trade and investment flows, developments in technology and the spread of democracy, a growing number of states, nations and peoples received the privilege of freedom and prosperity after 1990. These positive evolutions also had as a consequence a greater involvement of non-state groups and parties in international affairs. However, many issues from the past remained unresolved, and others worsened. Thus, regional conflicts have continued to remain a significant source of instability and to affect economic activities.

New security challenges affect the *dynamics of European security environment* since Europe can bring both direct and indirect additional stability, because the risks of traditional military confrontation on the European continent are diminished. The explanation for this development lies in two aspects: current security interests and objectives of European countries are not generating conflict, rather they promote cooperation and solidarity; the international security environment is positively influenced by European and Euro-Atlantic integration processes and, in fact, by the expanding community of states that share and promote the values of democracy and market economy in the context of deepening regional cooperation.

EU can respond to new security threats by three strategic objectives: *providing stability and good governance in the immediate vicinity; creating an international order based on effective multilateralism; prepare a response to a new type of threats* [2].

One of the objectives of the EU must be developing a stronger international society, characterized by the existence of effective international institutions and the existence of an international order based on rule of law and on the principles emphasized in the UN Charter. The quality of international society depends on the quality of the constituent governments. The best defense for European security is given by the existence of a world composed of well-managed democratic states. Therefore, spreading good governance, fighting corruption and abuse of power, establishing the rule of law and protecting human rights are the best ways to strengthen world order. In this context, *transatlantic cooperation* is an important element of this new international order.

Regional security environment analysis reveals several types of security threats that equally concern states in the area and the international community, mainly the EU and NATO: unresolved conflicts, instability or failure of new states, terrorism, organized crime, significant conventional arsenals, illegal migration flows.

Fragility of security in South-Eastern Europe is determined mainly by internal factors related to poor governance of the new state entities arising in this area: the inability of state institutions to enforce the law, economic instability and alarming rate of the informal economy; inequitable distribution of resources in society, corruption, violation of human rights and minorities, ethnic and religious enclaves. Tensions embodied in local conflicts that followed the fall of the *Iron Curtain* in 1991-1992, deeply influenced configuration of the Western Balkans and the former Soviet Union. Initially defined as conflicts with internal, historical, ethnic and / or religious reasons, frictions became regional in scale and difficult to control by conventional military means.

Former Soviet Union region of the Black Sea continues to be crushed by local conflicts, mostly internal: Transnistria, Abkhazia, Ossetia, Crimea, Chechnya, Nagorno-Karabakh. Unlike the Western Balkans, the crisis have not yet acquired a regional character, but, given the rationale of ethnic, religious, economic and historical reasons, it may cease being a latent crisis, resulting in uncontrollable developments and consequences that are difficult to quantify. Institutional coherence of the states in the Black Sea area is marked by the proliferation of trafficking, illegal migration, organized crime, especially due to economic difficulties and collapse of social protection systems. In addition to this, ethnic and religious tensions lead to the endemic instability in the region[3].

The volume of international migration has increased dramatically, especially caused by the economic causes, on the South-North

route. Criminal and terrorist groups have taken control of this phenomenon, have introduced new organizational elements, have the means of falsification of documents and control the shipping, rail and road transport companies, turning everything into a highly profitable industry. An extremely volatile situation occurs in Transnistria (Moldova), because the province became an attractive market for the terrorist groups and organized crime, which can acquire weapons of any kind, including missiles or radiological loads.

Asymmetric threats to the security environment in South-Eastern Europe and particularly to the States engaged wholeheartedly in the fight against international terrorism, organized crime and proliferation of weapons of mass destruction will continue, due to: logistic disparities between states, in terms of border security; legislative gaps or imperfections in the legal framework regarding counterterrorism and combating cross-border crime. To overcome the difficult situation, the South-Eastern European countries chose the integration into European and Euro-Atlantic as a guarantee for national security. The 'open doors' policy, promoted by the United States within NATO and successful models of countries in the region in entering the EU justify hopes that Balkan peacekeeping and European and Euro-Atlantic region is a feasible project.

Asymmetric risks and threats are amplified in intensity and range of expression, and their prevention will remain a priority for both democratic countries and international security organizations. It is expected that international security organizations, especially UN and OSCE, adapt to new demands and conceptual structure of the current environment. In this context, NATO and the EU will continue the extensive and complex process of transformation and modernization. Along with these, they will increase the capacity to adopt new approaches needed to manage crisis prevention and combat asymmetric threats and challenges.

Based on assessments of situations in the present security environment one can **conclude** the following[4]: the main scourge of global security and stability will still be international terrorism, together with arms, drugs and persons trafficking; the campaign against terrorism will continue and will require a substantial involvement of democratic states and international security organizations; asymmetric risks will enhance and vary and the incidence of the phenomenon of terrorism and organized crime will increase; on short and medium term, the risk of a regional war affecting Romania, NATO Alliance and the EU is minimal, and our country's engagement in a major conflict in the coming years is improbable; integration processes in international security organizations (NATO, EU) will continue and will guarantee the viability of regional stability; fulfilling security objectives at European level is becoming more predictable; Romania's participation in international missions security includes risks for the Romanian staff engaged in these operations, which will require specific measures and actions.

BIBLIOGRAPHY

[1] Badalan Eugen-*National security of Romania,* second edition, CIEA Publishing House, Bucharest, 2007.
[2] Frunzeti Teodor and Neag Mihai, *Sustainable development and human security perspective,* „Nicolae Bălcescu" Land Forces Academy Publishing House, Sibiu, 2009.

[3] Nicuta Valeriu, *Implications of the security environment on the European stability, contributions to regional and global security development*, scientific session, NDU, Bucharest, 2005

[4] The National Security Strategy of Romania, 2007.

[5] www.globalsecurity.org.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

MECHANICAL PROPERTIES OF PLAIN WEAVE FABRICS

Clement CABOS *, Amado STEFAN **, Ciprian LARCO **

*University "Paul Sabatier", Toulouse, France,** Military Technical Academy, Bucharest, Romania

Abstract: *The aim of this work is to develop accurate finite element models of plain weave fabrics to determine their mechanical properties. The geometric models needed for finite element discretization of the plain weave fabrics are developed for glass-epoxy plain-weave reinforced laminate for which experimental data is available in the literature. These include single lamina composites from three sources, as well as laminates in iso-phase and out-of-phase configurations. The procedures to determine the elastic moduli using iso-strain, and classical lamination theory are presented.*

Keywords: *composite materials, fiber, matrix*

1. Theoretical aspects

Textile preforming plays an important role in composite technology providing glass, aramid, carbon, and hybrid fabrics that are widely used as reinforcing materials. The main advantages of woven composites are their cost efficiency and high processability, particularly, in lay-up manufacturing of largescale structures**.** However, on the other hand, processing of fibers and their bending in the process of weaving results in substantial reduction of material strength and stiffness. As can be seen in Fig. 1, where a typical woven structure is shown the warp (lengthwise) and fill (crosswise) yarns forming the fabric make angle α with the plane of the fabric layer.

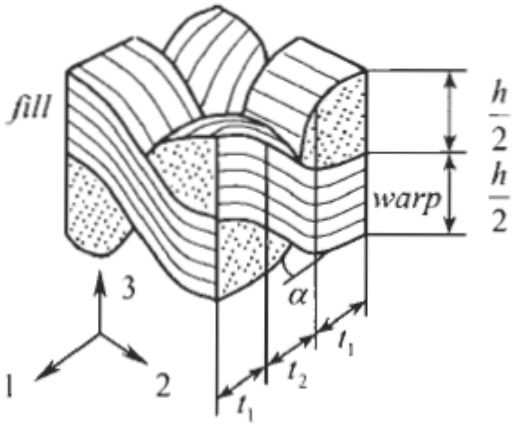


Fig. 1. Unit cell of a fabric structure.

To demonstrate how this angle influences material stiffness, consider tension of the structure shown in Fig. 1 in the warp direction. Apparent modulus of elasticity can be expressed as

$$E_a A_a = E_f A_f + E_w A_w \qquad (1)$$

where $A_a = h(2t_1 + t_2)$ is the apparent cross-sectional area and

$$A_f = \frac{h}{2}(2t_1 + t_2),$$

$$A_w = \frac{h}{4}(4t_1 + t_2)$$

are the areas of the fill and warp yarns in the cross section. Substitution into Eq. (1) yields

$$E_a = \frac{1}{2}\left[E_f + \frac{E_w(4t_1 + t_2)}{4(2t_1 + t_2)}\right].$$

Because the fibers of the fill yarns are orthogonal to the loading direction, we can take $E_f = E_2$ where E_2 is the transverse modulus of a unidirectional composite.

Compliance of the warp yam can be decomposed into two parts corresponding to t_1 and t_2 in Fig. 1, i.e.,

$$\frac{2t_1 + t_2}{E_w} = \frac{2t_1}{E_1} + \frac{t_2}{E_\alpha},$$

where, E_1 is the longitudinal modulus of a unidirectional composite, while is

$$\frac{1}{E_\alpha} = \frac{\cos^4\alpha}{E_1} + \frac{\sin^4\alpha}{E_2} + \left(\frac{1}{G_{12}} - \frac{2\nu_{21}}{E_1}\right)\sin^2\alpha\cos^2\alpha \quad (2)$$

The final result is as follows:

$$E_a = \frac{E_2}{2} + \frac{E_1(4t_1 + t_2)}{4\left\{2t_1 + t_2\left[\cos^4\alpha + \frac{E_1}{E_2}\sin^4\alpha + \left(\frac{E_1}{G_{12}} - 2\nu_{21}\right)\sin^2\alpha\cos^2\alpha\right]\right\}} \quad (3)$$

For example, consider a glass fabric with the following parameters: $a = 12°$, $t_2 = 2t_1$. Taking elastic constants of a unidirectional material from Table 3.5 we get for the fabric composite $E_a = 23.5\,\text{GPa}$. For comparison, a cross-ply [0°/90°] laminate made of the same material has $E = 36.5\,\text{GPa}$. Thus, the modulus of a woven structure is by 37% less than the modulus of the same material but reinforced with straight fibers. Typical mechanical characteristics of fabric composites are listed in Table 1.

Table 1 - Typical properties of fabric composites.

Property	Glass fabric-epoxy	Aramid fabric-epoxy	Carbon fabric-epoxy
Fiber volume fraction	0.43	0.46	0.45
Density (g/cm3)	1.85	1 .25	1 .40
Longitudinal modulus (GPa)	26	34	70
Transverse modulus (GPa)	22	34	70
Shear modulus (GPa)	7.2	5.6	5.8
Poisson's ratio	0.13	0.15	0.09
Longitudinal tensile strength (MPa)	400	600	860
Longitudinal compressive strength (MPa)	350	150	560
Transverse tensile strength (MPa)	380	500	850
Transverse compressive strength (MPa)	280	150	560
In-plane shear strength (MPa)	45	44	150

Stiffness and strength of fabric composites depend not only on the yarns and matrix properties, but on material structural parameters, i.e., on fabric count and weave, as well. The fabric count specifies the number of warp and fill yarns per inch (25.4 mm), while the weave determines how the warp and the fill yarns are interlaced. Typical weave patterns are shown in Fig. 4.81 and include plain, twill, and satin. In the plain weave (see Fig. 2a) which is the most common and the oldest, the warp yarn is repeatedly woven over the fill yarn and under the next fill yarn. In the twill weave, the warp yarn passes over and under two (as in Fig. 2b) or more fill yarns in a regular way. A structure with one warp yarn passing over four and under one fill yarn is referred to as a five harness satin weave (Fig. 2c).

Being formed from one and the same type of yarns plain, twill, and satin weaves provide approximately the same strength and stiffness of the fabric in the warp and the fill directions. Typical stress-strain diagrams for a fiberglass fabric composite of such a type are presented in Fig. 3. As can be seen, material

demonstrates relatively low stiffness and strength under tension at the angle of 45° with respect to the warp or fill directions. To improve these properties, multiaxial woven fabrics, one of which is shown in Fig. 2d, can be used.

Fabric materials whose properties are more close to those of unidirectional composites are made by weaving a great number of larger yarns in longitudinal direction and fewer and smaller yarns in the orthogonal direction. Such weave is called unidirectional. It provides materials with high stiffness and strength in one direction, which is specific for unidirectional composites and high processability typical for fabric composites.

Although microstructural models of the type shown in Fig. 1 and leading to equations similar to Eq. 3 have been developed to predict stiffness and even strength characteristics of fabric composites (e.g., Skudra et al., 1989), for practical design and analysis, these characteristics are usually determined by experimental methods. Elastic constants entering constitutive equations written in the principal material coordinates are found testing strips cut out of fabric composite plates at different angles with respect to the orthotropy axes. The 0° and 90° specimens are used to determine moduli of elasticity El, E2 and Poisson's ratios v12, v21 (or parameters of nonlinear stress-strain diagrams), while the in-plane shear stiffness can be obtained with the aid of off-axis tension.

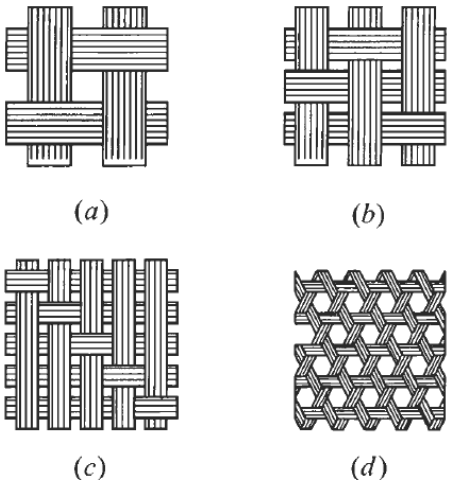


Fig. 2. Plain (a), twill (b), satin (c), and triaxial (d) woven fabrics.

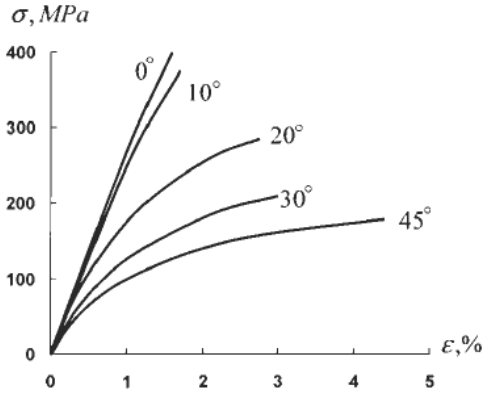


Fig. 4. Stress-strain curves for fiber glass fabric composite loaded in tension at different angles with respect to the warp direction

Assuming that there is no shear-extension coupling ($\eta_{x,xy}=0$) we can write the following equations:

$$\frac{1}{E_x}=\frac{1+\nu_{21}}{E_1}\cos^4\phi+\frac{1+\nu_{12}}{E_2}\sin^4\phi- \\ -\frac{\nu_{21}}{E_1}+\frac{1}{G_{12}}\sin^2\phi\cos^2\phi \qquad (4a)$$

$$\frac{\nu_{yx}}{E_x} = \frac{\nu_{21}}{E_1} - \left(\frac{1+\nu_{21}}{E_1} + \frac{1+\nu_{12}}{E_2} - \frac{1}{G_{12}} \right) \sin^2\phi \cos^2\phi \quad (4b)$$

$$\frac{1+\nu_{21}}{E_1}\cos^2\phi - \frac{1+\nu_{12}}{E_2}\sin^2\phi - \frac{1}{2G_{12}}\cos 2\phi = 0 \quad (4c)$$

Summing up the first two of these equations we get

$$\frac{1+\nu_{yx}}{E_x} = \frac{1+\nu_{21}}{E_1}\cos^2\phi - \frac{1+\nu_{12}}{E_2}\sin^2\phi + \frac{2}{G_{12}}\sin^2\phi\cos^2\phi$$

Using the third equation we arrive at the remarkable result

$$G_{12} = \frac{E_x}{2\left(1+\nu_{yx}\right)} \quad (5)$$

similar to the corresponding formula for isotropic materials. It should be emphasized that Eq. (5) is valid for off-axis tension in the x-direction making some special angle ϕ with the principal material axis 1. Another form of this expression follows from the last equation of Eqs. (4) and (5), i.e.,

$$\sin^2\phi = \frac{\frac{1+\nu_{yx}}{E_x} - \frac{1+\nu_{21}}{E_1}}{2\frac{1+\nu_{yx}}{E_x} - \frac{1+\nu_{21}}{E_1} - \frac{1+\nu_{12}}{E_2}} \quad (6)$$

For fabric composites whose stiffness in the warp and the fill directions is the same ($E_1 = E_2$), Eq. (6) yields $\phi = 45°$.

2. FINITE ELEMENT MODELING

A representative volume element (RVE) encompassing one full wavelength in the warp and fill directions (two pitches, or 2a, which is twice the length shown in Fig. 5), exhibits geometric and material periodicity. Therefore, it can be used to analyze the composite by imposing periodicity conditions on its boundary.

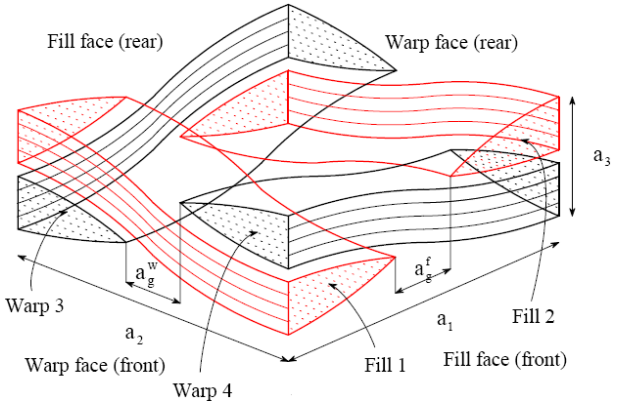


Figure 5. Schematic representation of the Fabric geometry

The RVE dimensions are $a_1 = a_2 = 870\,\mu m$ and $a_3 = 190\,\mu m$. The fill and warp fibers are the same and for the geometrical construction it used seven sections (figure 6).

The 3D geometric models are meshed using 8 node solid brick under the parametric mesh option in COSMOSM (SOLID element) – Figure 8. Each node has 3 degrees of freedom, u_x, u_y and u_z.

For computation of the axial moduli and Poisson's ratios, symmetry conditions are imposed on one warp face (perpendicular to the warp tows) and on one fill face (perpendicular to the fill tows). Coupling conditions (CP) are used to keep the remaining warp and fill faces plane as they deform under load. This is necessary to avoid violating the symmetry conditions on those faces.

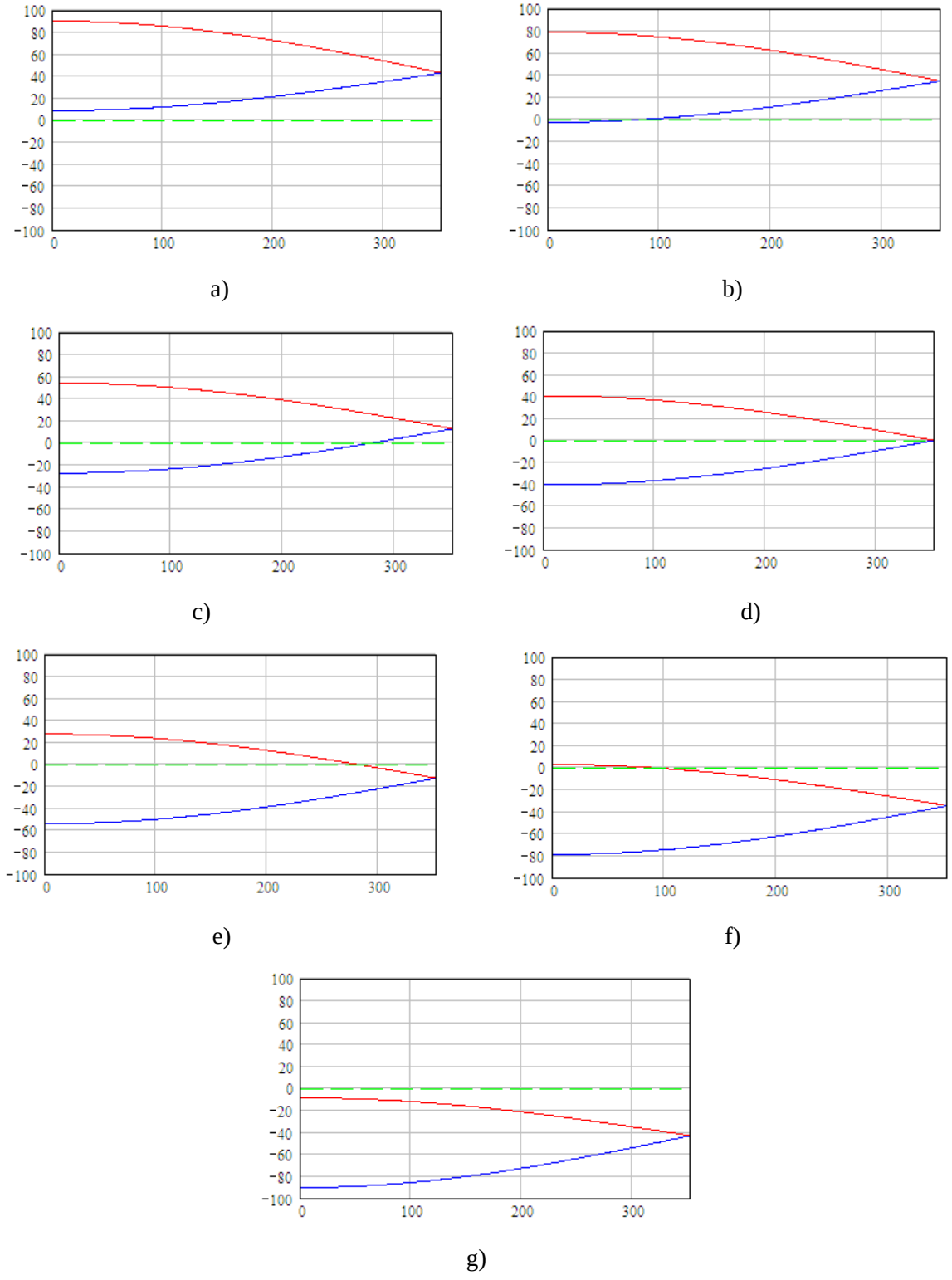


Figure 6. The position of the section in respect whit middle plane of RVE

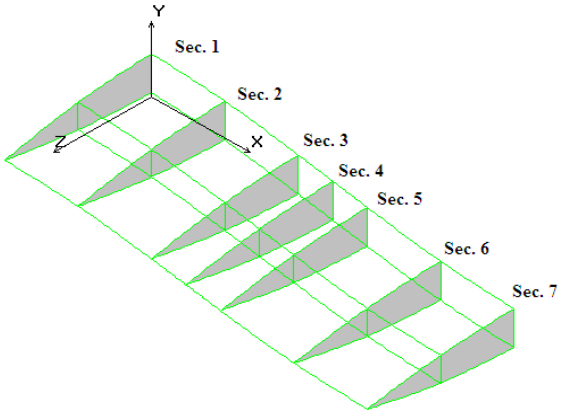


Figure 7. 3D representation of a fiber

Elastic moduli can be computed by imposing either a uniform average stress (isostress) or uniform average strain (iso-strain). For computation of the axial moduli and Poisson's ratios, iso-stress conditions are applied by imposing a concentrated force to one face at a time, while displacements in the direction of the force are coupled so that the applied force effectively translates into an average stress. All remaining faces are let free but coupled so that their deformation remains plane. This results in a set of displacements that, by virtue of the coupling conditions, results in a set of average strains.

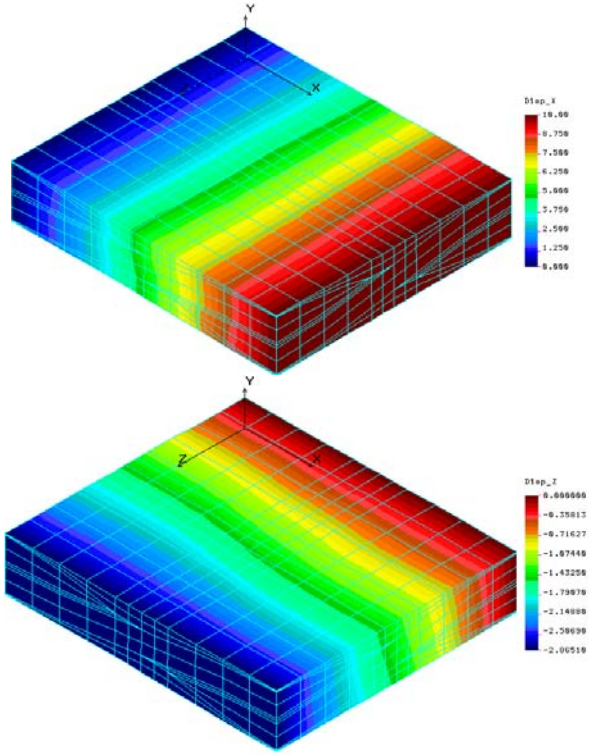


Figure 8. Ux and Uz displacent

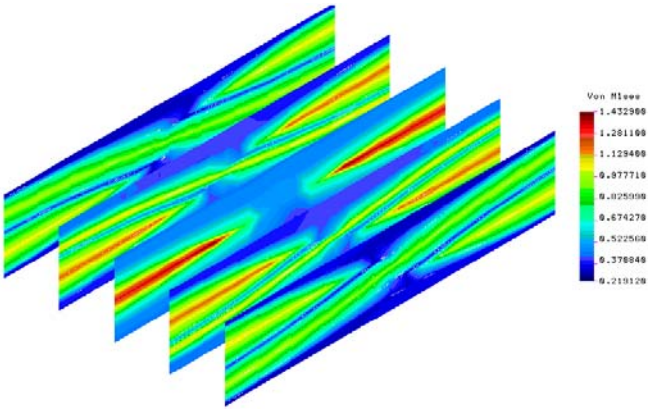


Figure 9 Von Misses stress

3. Numerical determiantion

The cross sectional areas of RVE are

$$A_1 = a_2 \cdot a_3 \qquad A_1 = 0{,}165\left(\text{mm}^2\right)$$
$$A_2 = a_1 \cdot a_2 \qquad A_2 = 0{,}757\left(\text{mm}^2\right) \quad (7)$$
$$A_3 = a_2 \cdot a_3 \qquad A_3 = 0{,}165\left(\text{mm}^2\right)$$

Imposing an $\Delta x = 8{,}7\mu\text{m}$ displacement on fill face

$$\varepsilon_x = \frac{\Delta x}{a_1} = \frac{8{,}7\mu\text{m}}{870\mu\text{m}} = 0{,}01 \qquad (8)$$

The resulted reaction force on the opposite face is

$$R_x = 18{,}434\left(\text{N}\right) \qquad (9)$$

and the average stress

$$\sigma_x = \frac{R_x}{A_1} = 111{,}719 \quad \left(\frac{\text{N}}{\text{mm}^2}\right). \qquad (10)$$

The mesasured contractions on the RVE are

$$\begin{cases} \Delta y = -0{,}508 \quad (\mu\text{m}) \\ \Delta z = -1{,}256 \quad (\mu\text{m}) \end{cases} \qquad (11)$$

and the average strains are

$$\begin{cases} \varepsilon_y = \dfrac{\Delta y}{a_3} = -0{,}00683 \\ \varepsilon_z = \dfrac{\Delta z}{a_2} = -0{,}00142 \end{cases} \qquad (12)$$

For the ortotrophic material case it results a 3 equation system with 9 unknowns:

$$\begin{Bmatrix} 111{,}719 \\ 0 \\ 0 \end{Bmatrix} = \begin{bmatrix} C_{11} & C_{12} & C_{13} \\ C_{21} & C_{22} & C_{23} \\ C_{31} & C_{32} & C_{33} \end{bmatrix} \cdot \begin{Bmatrix} 0{,}01000 \\ -0{,}00683 \\ -0{,}00142 \end{Bmatrix} \qquad (13)$$

By repeating the procedure for the other two principal directions the system can be solved, resulting the mechanical properties of the RVE.

The shear moduli are calculated by imposing two displacements u_1 and u_2 on fill and warp faces, and the average shear strain is:

$$\gamma_{xy}^0 = \frac{u_1(x, d_2, z)}{d_2} + \frac{u_2(d_1, y, z)}{d_1} \qquad (14)$$

the reaction force f_1 and f_2 on the two faces leads to average shear stress:

$$\tau_{xy}^0 = \frac{f_1(y=0)}{a_1 a_3} = \frac{f_2(x=0)}{a_2 a_3} \qquad (15)$$

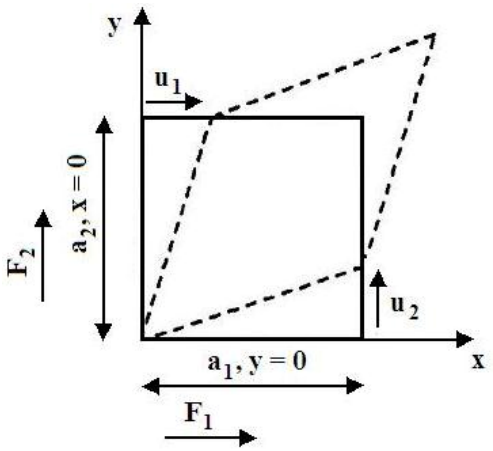


Figure 10. The condition used for shear moduli determination

For

$$\begin{cases} d_1 = a_2 = 870(\mu m) \\ d_2 = a_3 = 190(\mu m), \\ d_3 = a_1 = 870(\mu m) \end{cases} \qquad (16)$$

the average shear strain:

$$\gamma_{xy}^0 = \frac{u_1}{d_2} + \frac{u_2}{d_1} = 0{,}048 \qquad (17)$$

For reaction forces:

$$\begin{cases} f_1 = F_{yx} = 85{,}587(N) \\ f_2 = F_{xy} = 18{,}691(N) \end{cases} \qquad (18)$$

the average shear stress:

$$\tau_{xy} = \frac{\tau_{yx} + \tau_{xy}}{2} = 113{,}075\left(\frac{N}{mm^2}\right) \qquad (19)$$

and

$C_{66} = 0{,}048/113{,}075$.

The elastic properties for the RVE are

$E_x = 11{,}172(GPa)$	$G_{yz} = 2{,}338(GPa)$	$\upsilon_{yz} = 0{,}188$
$E_y = 7{,}8410(GPa)$	$G_{xz} = 4{,}391(GPa)$	$\upsilon_{xz} = 0{,}143$
$E_z = 11{,}165(GPa)$	$G_{xy} = 2{,}357(GPa)$	$\upsilon_{xy} = 0{,}268$

4. Conclusions

The geometric model is based on microphotograph measurements that are translated into a solid model and a FEM model using commercial software. The elastic moduli of the plain weave fabric-reinforced laminates are obtained using finite element analysis. The values predicted by the FEM models compare

favorably with the experimental values. The model is simple; as it is based on microphotograph measurements and the stiffness values of a unidirectional composite that can be obtained from standard tests.

Bibiograpy

1. Barbero E.J. (1999), Introduction to Composite Materials Design, Taylor and Francis, Philadelphia, PA.

2. Naik N.K. and Ganesh V.K. (1992), Prediction of On-Axes Elastic Properties of Plain Weave Fabric Composites, Composites Science and Technology, 135-152, Vol.45.

3. Chou T.W., Ito M. (1998), An Analytical and Experimental Study of Strength and Failure Behavior of Plain Weave Composites, Journal of Composite Materials, 2-30, Vol.32.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

LEGAL DIMENSION OF THE ACTIONS SPECIFIC TO PSYCHOLOGICAL AGGRESSION

Dumitru DINU

Air Force Academy "Henri Coanda", Brasov

Abstract: *The actions specific to psychological aggression are, usually found within the scope of ruses of war and thus, in accordance with the provisions of international humanitarian law, are not prohibited. Therefore, they can be used freely against enemy troops.*
Keywords: *psychological aggression, perfidy, ruses of war*

INTRODUCTION

It can be said that psychological warfare blows up the classic distinction between war and peace. It is an unconventional war, not according to the international law and rules of war, it is a total war is that confuses lawyers and pursues its objectives under the protection of their code.

We often hear the phrase „permitted means and methods of warfare leading or, on the contrary, prohibited means and methods of warfare ". This aspect of permitting or prohibiting means and methods of war is approached by a number of norms of internal law and especially international law.

In fact, if we could be as correct as possible, we should not question the permitted means and methods of warfare, and this, because, by the Briand-Kellogg Convention of 1929, the war is prohibited, placed outside the law.

1. LIMITING THE STATES' RIGHTS WITHIN THE SCOPE OF WAR WAGE

Life highlights the fact that the rule, the norm, is frequently violated, war still waging under various pretexts. However, through legal norms, it was aimed to limit the right of states to resort discretionarily means and methods meant for war. Thus, within the international humanitarian law, there were formulated and consolidated the fundamental principles governing the matter, such as:

- choosing means and methods of war - parties in an armed conflict have no an unlimited right;
- achieving a clear distinction between military objectives, on one hand, and civilians on the other hand, so that armed actions to proceed only against the first;
- limiting, to a minimum, the sufferings produced to the combatants, as well as the damage caused to them.

We might interpret that the methods and means which can cause unnecessary harm to win in a battle are prohibited, as well as of those producing non-discriminating effects (between military objectives, civilians and civilian goods), or not allowing these methods and means whose effects extend over large areas, on a long period of time and, sometimes, irreparably for the natural environment.

All these rules are based on the idea according to which, war is a complex of actions at whose origins there are the states

and governments and, therefore, it would be natural to leave out everything that is not directly related to its performance and conduct.

If, concerning the conventional traditional means of warfare, we can say that most of them are known, not the same thing happens with the insidious ones, having psychological effects. As such, let us see what is allowed and what is not in the latter view. We propose, in other words, to perceive the psychological aggression phenomenon, this time in terms of its legal dimension, the perfidious means occupying an important place in the economy approach.

2. PERFIDY VERSUS RUSES OF WAR

From the conceptual point of view, **perfidy** is defined as *"that trait that hides evil, deceit, dishonesty, a bad and evil deed "*, but within the international law norms, it assumes other valences. The broader rules on perfidy (as a distinct problematic of psychological implications among the own troops or enemy troops) were made in art. 37 of ***Geneva Protocol of 1977***, which establishes as a general rule, the prohibition "to kill, injure or capture an adversary by resort to perfidy ".

The following acts are ***examples of perfidy:***

- the feigning of an intent to negotiate under a flag of truce or of a surrender;
- the feigning of an incapacitation by wounds or sickness;
- the feigning of civilian, non-combatant status;
- the feigning of protected status (journalist, doctor) by the use of signs, emblems or uniforms of the United Nations, or of member States or other States not Parties to the conflict.

There are also other articles that incriminate deeds under perfidy jurisdiction, such as: **art. 38** - It is prohibited to make improper use of the distinctive emblem of the Red Cross and Red Crescent, or of other internationally recognized protective signs (flag of truce provided, the protective emblem of cultural property, a.s.o.)

Art. 39 – it is prohibited to make use in an armed conflict of the flags or military emblems, insignia or uniforms of neutral or other States not Parties to the conflict or adverse Parties.

Art. 40 - combatants are obliged to carry weapons openly; there are also presented a series of rules that prohibit placing military objectives from attacks shelter, serving to protected persons or property.

At the same time, within the doctrines of international humanitarian law, it is considered that the concept of perfidy includes other facts such as:

- recruitment of hired assassins
- offering tempting rewards for capturing or killing opponents;
- prescription and outlawry of an opponent;
- request of sparing by treachery;
- simulating death, injury or disease.

Unlike the perfidy, the means of deception of the enemy, that is the "***ruses of war***", which are based on the insight, ingenuity, and stratagem are permitted by international humanitarian law. Because it is a difficult to draw a dividing line between perfidy and cunning, they were called the "gray zone" of military operations.

Under current interstate military conflict, it seems that the role of the ruses of war is increasingly reduced, but in those of non-state entities, where tactics is founded, above all, on surprise, ambush, deception, uniforms alterations, enemy incitement to rebellion, the use of ruses is paramount.

In addition, Regulation Annex of the Hague Convention of 1907 provided: the "*ruses of war and the use the necessary means to obtain information on enemy and terrain are considered legitimate."*

Art. 37 of the Protocol I of Geneva of 1977, stipulates the following: "ruses of war are not prohibited. Such ruses are acts which are intended to mislead an adversary or to induce him to act recklessly but which infringe no rule of international law applicable in armed conflict and which are not perfidious because they do not invite the confidence of an adversary with respect to protection under that law".

3. ACTIONS HAVING PSYCHOLOGICAL EFFECTS PERMITTED BY THE INTERNATIONAL LAW

The following deeds, contained in different military manuals, having psychological effects, are examples of permitted ruses of war:
- surprise attacks, ambushes, simulated land air, maritime operations;
- simulation of rest or inactivity, or of weather conditions adverse to attacks (fog, snow);
- construction of plants which are not used;
- installation of false airfields (guns, armored etc.);
- imitation of mine fields;
- deployment of smaller subunits so that they seem important troops;
- transmission by radio or press of inaccurate information;
- intoxicating opponent with false documents, plans of operation, having no connection to reality;
- using the enemy's wavelength, telegraph codes to transmit false instructions;
- parachuting or supply imitation;
- moving terminals or falsifying road signs;
- using false signals to deceive enemy;
- using of psychological war means, inciting opposing soldiers to rebel or to desert;
- inciting the civilian population in military operations;
- using natural forces in the own advantage;
- imitating the enemy commanders' orders and others.

We consider appropriate that the commanding officers, the commanders know and acknowledge the means and methods allowed or banned during the military action and that is because their whole conduct must be firm when the situation requires. They must not hesitate, but the action be reported at norm, and the spectrum of the responsibility must not astound them in a negative way.

REFERENCES:

*** *Geneva Protocol* of 1977.

*** *Regulation Annex of the Hague Convention*.

*** *Dicţionarul limbii române contemporane, vol. III*, Bucureşti,1957, p.385.

*** *Agresiune şi apărare psihologică*, Editura AISM, Bucureşti,1994, p. 20-28.

*** Collection of the Magazine Infocom, 1993-1996.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

ELECTRONICS ENGINEERING EDUCATION IN TURKISH AIRFORCE ACADEMY

Erol DUYMAZ*, Rıdvan KAHRAMAN*, M.Kemal BAYRAKÇEKEN*, Aydemir ARISOY*

* Engineering Faculty, Turkish Air Force Academy, Istanbul, TURKEY
{e.duymaz,kahraman,k.bayrakceken,a.arisoy}@hho.edu.tr

Abstract: *Turkish Air Force, to carry out air defense and attack mission undertaken by the Turkish Armed Forces effectively and as quick as possible, have to be well equipped with all kinds of technological possibilities and capabilities. It is only by well-trained manpower to use of electronic systems with infrastructure of the complex architectures in an effective way. Generally speaking electronic systems lay mainly on the control and communication engineering that are areas interacting each other and the basic disciplines to be trained for pilots considering that they are in the center of all flight operations. Turkish Air Force Academy Electronics Engineering department trains future aviators in communication and control engineering to meet the needs of the best graduate education. In this paper Electronics Engineering Education in Turkish Air Force Academy is described by its program definition, projects, learning technics, laboratories and other facilities in detail.*

Keywords: *electronics engineering, education, air force*

1. INTRODUCTION

In twenty first century both the individuals and organizations are exposed to rapid change. The change in needs also changes the expectations. In this context, mission of educational institutions taking responsibility for educating people in accordance with the needs of their communities is being questioned. Growing and changing demands of the outside world are pushing educational institutions to graduate students who are learning constantly instead of memorizing academic or encyclopedic information. In such a constantly changing world, the most fundamental responsibility of universities is to provide students with appropriate education for real life situations. Graduates of higher education institutions are expected to be skilled in problem solving, compatible with team work and well informed about time management and communication technologies (Harvey, Moon, Geal, 1997).

The traditional view of education is far from meeting the needs of the new century. Behaviorism is the traditional approach to education and it shaped educational practices for nearly 50 years from 1920s until 1970s. The behaviorists tried to explain human behavior with the data obtained from experiments on animals and they have neglected affective and cognitive domain by only focusing on observable and measurable human behavior. The behaviorists, who consider human-beings as machines, claimed that learning will take place with the regulation of environmental conditions and explained the term of learning as the reaction of the

organism to the effect from the environment. Throughout the behaviorist reign, mental processes are all ignored and process of teaching is regarded as a black box that cannot be explored. So, behaviorists focused on the process-product paradigm (Romizowski, 1981).

Contemporary approach to learning points out the importance of deep learning and rejects the idea of memorizing the information presented by the instructor. Learning to learn and versatile mental development are also emphasized in educational understanding adopted by the contemporary approach. In learning processes dominated by behaviorist approach relationships between the particles of information are ignored and failures are encountered with in the process of making sense of the new information and perceiving the whole. Today, behaviorist reign has lost its dominance in educational settings and constructivist learning theories came to the fore. In learning environments, meaningful learning, experiential learning, contextual learning, learning to think, research and discovery, problem solving and project-based learning concepts have come to the stage and replaces traditional tools like reinforcement and meaningless repetition (Akbaş, 2007).

Life is different in 21st century than it is in previous eras because of technology. To well aware of all technological innovations is main purpose for all nations. Electronics with quick improvements is the impact or dominant factor that changes world. Since electronics engineering is essential departments for all education institutes and military schools. Turkish Air Force Electronics Engineering education is main scope of this paper.

2. PROGRAM DEFINITION

Electronics Engineering Department aims to provide cadets with essential engineering skills in order to cultivate their academic background and know-how they acquire under electronics discipline, thus incorporate this knowledge to put forward future plans and insightful ideas for Turkish Air Force, manage high order technical and organizational processes, cope with ambiguous problems and difficult situations of our times and future. Besides academic education every cadet is firmly adherent to Principles of Atatürk, Turkish Republic founder, hence believes in thrust, faith, honor, morals and health as building blocks of a prospective officer.

Air Force, abiding to its operative mission, is equipped with latest technology systems. These systems can only be successfully managed, maintained and improved by well-trained personnel. Turkish Air Force Academy merges PhD and MSc degree officers from Turkish Air Force and selected academicians from universities in Istanbul to accomplish this mission.

Electronics Engineering Department possesses two options; Control and Communication Systems. In a closer look, control and communication are two main disciplines which are vital for flight related activities and pilots at the center of all.

NO	CODE	COURSE	H	CR
1	ELK 424	CONTROL SYSTEMS THEORY	(3 0 0)	3,0
2	ELK 431	DIGITAL CONTROL	(3 0 0)	3,0
3	ELK 441	MEASUREMENT ANDDETECTION TECHNIQUE	(3 0 0)	3,0
4	ELK 443	POWER ELECTRONICS	(3 0 0)	3,0
5	ELK 471	CONTROL SYSTEMS DESIGN	(3 0 0)	3,0
6	ELK 472	CONTROL SYSTEMS LABORATORY	(0 0 2)	1,0
7	ELK 488	MICROPROCESSORS BASED SYSTEM DESIGN	(3 0 0)	3,0
8	ELK 491	INTRO TO AVIONICS SYSTEMS	(3 0 0)	3,0
9	ELK 492	FLIGHT CONTROL SYSTEMS	(3 0 0)	3,0
10	ELK 493	INTRO TO ROBOT CONTROL SYS.	(3 0 0)	3,0

Table1.Control System Option Elective Courses

Control Systems Option

Control Systems are devices, machines and systems which incorporate hardware and software, collect sensor data from environment, make decisions based on the fused data and operator support. All aircrafts, weapons and support systems in Turkish Air Force inventory are examples of control systems. These systems together with pilotage

and operator abilities directly effect the power factor of the Turkish Air Force. The table of elective courses of the option is given in Table1.

Communication Systems Option

Communication Systems are composite structures which are in charge of transmission and receiving of signals regardless of environmental situations. Air traffic control. airfield management, aircraft and satellite systems are examples of complicated communication systems. In addition, new generation UAVs designed for reconnaissance and surveillance missions are high technology systems forming the basis of future defense scenario. The table of elective courses is given in Table2.

3. FACILITIES

Electronics Engineering Department located in Engineering Faculty with its classrooms and laboratory sections.

Since application in electronics engineering education is crucial, industrial projects, science festivals and laboratory courses are supplementary training actions.

Signal Processing and Microprocessors Laboratory

Signal Processing and Microprocessors Laboratory holds Intel based one server and 20 workstations, microprocessor and microcontroller experimentation sets. This laboratory is equipped for demo presentations and in-class activities regarding Fundamentals of Electrical Engineering, Analog/Digital Signal Processing and Microprocessor courses. Graduate studies are also carried out in this laboratory.

Communication Systems Laboratory

Housing eight advanced communication systems experimentation sets and multipurpose setups with interchangeable circuit cards, communication systems laboratory provides a well-equipped environment for both graduate and undergraduate studies.

Supporting theoretical courses with comprehensive experiments and presenting the practical side of knowledge, communication systems laboratory proves to be an interactive classroom.

Fig.1.Signal Processing and Microprocessors Laboratory

NO	CODE	COURSE	H	CR
1	ELK 421	ANTENNAS AND PROPAGATION	(3 0 0)	3,0
2	ELK 422	MICROWAVE CIRCUITS	(3 0 0)	3,0
3	ELK 423	REMOTE SENSING	(3 0 0)	3,0
4	ELK 461	RADAR TECH. AND ELECTRONIC WARFARE	(3 0 0)	3,0
5	ELK 464	ANALOG COMMUNICATIONS	(3 0 0)	3,0
6	ELK 466	DIGITAL COMMUNICATIONS	(3 0 0)	3,0
7	ELK 467	COMMUNICATION SYS. LAB.	(0 0 2)	1,0
8	ELK 481	ELECTRONIC CIRCUITS IN COMM. SYS.	(3 0 0)	3,0
9	ELK 491	INT. TO AVIONIC SYSTEMS	(3 0 0)	3,0

Table2. Communication System Option Elective Courses

Fig.2. Communication Systems Laboratory

Control Systems Laboratory

Real-time control systems development equipment, multipurpose experimentation sets and interactive classroom activities promote the motivation of the cadets and courage learning. Besides serving as a classroom and a demonstration area for senior class students, control systems laboratory houses an intermediate level shop to carry out graduate and undergraduate theses and projects. Rich assortment of materials and projects in the

laboratory provides an insightful laboratory atmosphere.

Fig.3. Control (left) and Electronics (right) Laboratory

Electronics Laboratory

Electronics Laboratory has 10 multipurpose experimentation sets which enable performing analog and digital electronics laboratory courses. In addition, rich amounts of different measurement equipment are available for general use.

4. TEACHING TECHNIQUES

Active Learning

Active learning improves the quality of students' learning and through active learning applications students can achieve deep learning desired in higher education (Haack, 2008). In order to use active learning model, use of student-centered teaching strategies is a necessity. Case based scenarios and cooperative learning are mostly used to actively involve students with course content. In case-based education scenarios based on real events and stories are used to help the students to improve decision making and critical thinking skills. Case-based education is student-centered and it entails students to engage in real life situations by interacting with each other. Case-based education is widely used in the fields of law, medicine and business as an alternative of traditional education (Artan, 2007).

Cooperative Learning

Active learning is a model based on constructivist approach. Understanding of the models depends on understanding of the methods developed under the models and techniques presented by these methods. In this section we will focus on cooperative learning techniques shaping classroom practices of active learning model. Cooperative learning which is an applicative form of active learning is a method of teaching that allows students to learn in small groups by helping each other (Tan, Sharan, Lee, 2006). In cooperative learning activities are evaluated by students' learning levels and contributions to collaborative work. Additionally, students are offered opportunity to learn and to teach team-mates by working in a team (Slavin, 2000).

Cooperative learning can be considered as students' learning process by working in small groups and helping each other. Students' effort to develop both themselves and their friends to the end of their capacity is what makes group works cooperative learning. This is quite different from students' learning alone. During group works, by interacting with each other, students have the opportunity of living important learning experiences-such as asking questions, giving examples, making explanations, making critics-which they cannot experience alone. Working in small groups is not enough for students to realize cooperative learning and all group works are not cooperative learning. Some group works cannot be regarded as cooperative learning for the following reasons:

- ***Social loafing:*** Some group members share the success of others providing no contribution to group work.
- ***Exploitation:*** Some group members feel that they are doing others' work and so they feel unhappy.
- ***The enrichment of the rich:*** Group members who have a high level of success are always doing much of the work and they benefit from group work more than the others. Group members who have a low level of success namely slow learners cannot do this, and they become weaker and weaker day by day.
- ***Lack of Respect:*** Group members who have a high level of success pay no attention to others' statements and recommendations (Açıkgöz, 2007).

Cooperative learning is a method by which students work in small groups to solve a problem or to accomplish a task. It is only

under the following conditions that a group work can be cooperative learning;

Group Award: To be successful it is a must for members to have a group with success. In other words groups must be successful in order to be members of the group to be successful.
Positive Interdependence: Creates a situation that individuals combine their efforts for reward and common purpose. Each group member has a unique contribution to make to the joint effort because of his or her resources and/or role and task responsibilities.
Individual Accountability: Group success depends on each individual's learning. Each student should have the responsibility of learning all the material and doing what is s/he is expected to do.
Face-to-Face Interaction: Group members encourage each other and facilitate each other's effort.
Social skills: Students should be taught how interpersonal relations should be and they should be encouraged to use them.

Turkish Air Force Academy is a military academy training future pilot candidate air force officers and providing the cadets with an undergraduate education in the fields of Electronics, Aerospace, Computer and Industrial Engineering.

The purpose of engineering undergraduate education of the academy is to train students capable of coping with the prospective challenges by the help of leadership skills acquired in the academy. Air Force Academy cadets by completing the academy program, get the rank of lieutenant with a bachelor's degree in engineering. In this respect, these students are quite different from other university students. So these engineer officers should develop problem-solving and teamwork skills as future team leaders. So, the academy witnessed a great instructional paradigm shift from traditional to active in the year 2008. The senate also decided to apply active learning in engineering courses at all levels of instruction i.e. freshman, sophomore, junior and senior classes. On the basis of this decision active learning practices would cover at least 50% of the engineering courses and 100% of the social science courses.

In an educational institution teachers play a major role in starting up a new program and the success of this program. In the Air Force Academy, in order to be apply active learning techniques successfully, it was a must to teach the academic staff. So, an active learning expert i.e. a professor invited to the academy and all the teaching staff attended a seven week active learning in-service training program. Active learning training program comprised the theoretical background, discussion of theory and practice teaching sessions followed by discussions. This program totally lasted three months with 21 hours face to face training.

Other Active Learning Techniques:

All of the following activities are carried out in the laboratories used as a classroom for student centered activities.

- Preparing multiple choice and open ended questions with short answers,
- Designing projects and realizing those projects,
- Producing different solutions to the problems given on Control Projects carried out in the laboratory,
- Making a demonstration using a modular experiment system as a group work,
- Writing a poem related to the subject matter studied in class.

5. CONCLUSIONS & ACKNOWLEDGMENT

Turkish Air Force Academy seeks better education opportunities in many ways such as facilities and laboratory improvement, conductance of detailed researches both in control and communication engineering or new teaching techniques such as active learning and cooperative learning..

REFERENCES

1. Artan, A.E. (2007). Case base discussions in an educational psychology course: *Problem solving processes and interactions*. Unpublished doctoral dissertation, University of Pittsburg, USA.
2. Tan, I. G., Sharan, S., and Lee, C. K. (2006). *Group investigation and student learning.* An experiment in Singapore schools. Marshall Cavendish International, Singapore.
3. Slavin, R. E. (2000). *Educational Psychology Theory and Practice*. Boston: Allyn and Bacon.
4. Açıkgöz, K. Ü. (2007). *Aktif Öğrenme*. İzmir: Kanyılmaz Matbaası.
5. Açıkgöz, K. Ü. (1992). *İşbirlikli öğrenme: kuram, araştırma, uygulama*. Malatya: Uğurel Matbaası.
6. Felder, R. M., Felder, G. N. ve Dietz, E. J. (1998). *A longitudional study of engineering student performance and retention:* comparisons with traditionally-taught students. *Journal of Engineering Education*, 87, 469-480.
7. Best, J. W. & Kahn, J. V. (1989). *Research in Education*. Needham Heights, MA: Allyn and Bacon.
8. Sener, J. (1997) Constructivism: Asynchronous Learning Networks. *ALN Magazine, 1:1*.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

TRAGEDY OF CARPATHO-UKRAINE

Róbert HURNÝ

Armed Forces Academy of General Milan Rastislav Štefánik, Liptovský Mikuláš, Slovak Republic

Abstract: *Subcarpathian Ruthenia (Subcarpathian Rus´) was an integral part of Czechoslovakia in the interwar period. On the basis of the peace treaty contracted in Saint-Germain-en-Laye (September 10, 1919) and the Constitution of the Czechoslovak Republic (February 29, 1920), Subcarpathian Ruthenia should have had an autonomous position in the political-juridical system of Czechoslovakia, its autonomous council and an autonomous government corresponding to the council. The central government in Prague was hesitating to impose a real autonomy of Subcarpathian Ruthenia within the republic because it did not demonstrate satisfying political, national, confessional and economic conditions and represented a continual threat of irredentism from various Carpathoruthenian elements and revisionism emerging from the neighbouring states – mainly Hungary. The central government established it only after Munich Agreement which considerably weakened Czechoslovakia as for its power. The government made an effort to consolidate Czechoslovakia by declaring autonomy of Slovakia and Subcarpathian Ruthenia. This had not happened until the moment when Czechoslovakia was on its way to cease. These autonomous tendencies had its place in a compex game of the neighbouring countries (Germany, Poland, and Hungary) whose main objective was to destroy Czechoslovakia. Finally when Subcarpathian representatives` dreams about their own country were fulfilled, it came to its early end.*

Key words: *Subcarpathian Ruthenia, Carpatho-Ukraine, autonomy, democracy, state, autonomous government, national identity, constitution, political-juridical system, irredentism, territorial revisionism.*

Following The Munich Conference, which was held on 29th – 30th September 1938, the Czechoslovak government accepted ultimatum presented by four powers (Germany, Italy, France and United Kingdom) regarding the withdrawal of sizeable part of Czechoslovak territory predominantly populated by Sudeten Germans. There were several internal political changes in the Czechoslovak Republic. The President of the Republic, Edvard Benes, abdicated on 5th October 1938. In the following few days, the process of long-term effort to autonomy of Slovakia and Subcarpathian Ruthenia within the Czechoslovak Republic was completed.

Finally, on 11th October 1938, the population of Subcarpathian Ruthenia witnessed the first Subcarpatho-Ruthenian autonomous government. Brody`s autonomous government had to face a lot of problems. Dealing with these problems caused resistance and polarized the situation in the government as well as in the society. Brody`s manoeuvre with the manipulation of the law concerning self-determination in the form of plebiscite seemed to be a real detonator on internal political scene. On 23rd October, the autonomous government decided to carry out general plebiscite in accordance with the rights of peoples to self-determination as the only possibility of maintaining the integrity of Subcarpathian Ruthenia. The document was signed by all the members of autonomous government. The idea of plebiscite was openly supported by Russophile and pro-Ruthenian parties and associations, Jewish society, Byzantine- Catholic and Orthodox

Churches. Pro-Ukrainian parties and societies took action against it. The autonomous government defended the approach, declaring the Czechoslovak government breaches out international obligations enshrined in the Peace Treaty of Saint-Germain to protect the integrity of Subcarpathian Ruthenia by its inability and thus the autonomous government is entitled to seek their own solutions. The decision of the autonomous government about to carry out the plebiscite was in legal terms unconstitutional, moreover Subcarpathian politicians did not have a good reputation in Prague governmental circles.[1]

The question of arbitration and plebiscite became the subject of negotiations of the Prague government and ministers of autonomous governments of Slovakia and Subcarpathian Ruthenia on 25th October 1938. The majority of the present spoke for German – Italian arbitration. While majority of Ruthenians adopted a proposal of arbitrage, Andrej Brody found himself in isolation, because he insisted on plebiscite under international supervision and came with a request to connect region *Prjasevscina* with Subcarpathian Ruthenia in case of possible loss of Uzhhorod and other towns. On the same day Brody was accused of treason by the Czechoslovak Ministry of Justice. He was deprived of immunity and the Prime Minister Jan Syrovy removed Brody from the position of President of the Autonomous Government on 26th October. The Central Government decided to appoint Peter Zidovsky, Russophile and pro-Ruthenian politician, to the position.[2]

Czechoslovak authorities probably received information from German Intelligence Services confirming that A. Brody was an agent paid by Budapest. During the search of his flat a half of a million pengő and a letter, in which Budapest guaranteed Brody the title of Baron as soon as the Hungary establishes its authorities in Subcarpathian Ruthenia, were found. It was proved that *Autonomous Agricultural Union* led by Brody received fifty thousand crowns monthly as a financial support. It was paid out by Hungarian Consulate in Bratislava. Brody and his minister, who was found guilty of receiving high financial amounts from the Polish ambassador in Prague (from 1927 to 1935) - Waclaw Grzybowski, were arrested.[3] That was the story of the first infamous autonomous government in Subcapathian Ruthenia.

On 26th October, Prime Minister Jan Syrovy appointed a new government led by Avhustyn Voloshyn, who took the oath of fidelity to the Republic to the Prime Minister by a phone call. Instead of originally selected candidate, Peter Zidovsky, the government finally agreed to appoint A.Voloshyn, who was recommended by Berlin. In his government there were also Edmund Bachyns´kyi as an interior minister and Julian Revay as a communication minister and a minister of public work, health and social care. Such composition of the government suited Nazi German policy, taking advantage from the cooperation with strong Ukrainian emigration. The overall composition of the government differed from Brody`s government substantially, especially by their prevailing Ukrainian orientation. At the same time as proposed by J. Revay the central Government stopped the activities of all political parties. The only political organization which remained was *Ukrainian National Union*, a top body of all pro-Ukrainian organizations.

On 2nd November 1938, German-Italian Arbitration took place in Vienna (First Vienna Award). According to resulting protocol, sizeable part of Southern Slovakia and Subcarpathian Ruthenia had to be surrendered within the days from 5th– 10th November. Subcarpathian Ruthenia lost 1 523 km^2, the towns Uzhhorod, Mukachevo a Berehovo, all in all 97 villages with 173 233 inhabitants.[4] Khust became a new seat of Voloshyn`s government. Although Voloshyn was disappointed with arbitration results, he built up his essential political line on the basis of cooperation with Nazi Germany. Voloshyn`s focus on Berlin also resulted from the distribution of international powers after Vienna Arbitration. Hungary and Poland were still dissatisfied with territorial changes and continuously strived to absorb Subcarpathian Ruthenia. Hungarian and Polish agitators continued in their sabotage activities.[5]

In mid November the Hungarian government led by Bela Imredy decided to take actions against Subcarpathian Ruthenia. Horthy gained understanding in person of German ambassador, but General Staff of Hungarian Army had certain concerns. The Czechoslovak Army moved troops

[1] Pop, Ivan: *Dějiny Podkarpatské Rusi v datech*. Praha: Libri, 2005, p. 365.
[2] *Ibidem*, p. 366.
[3] Švorc, Peter: *Zakliata krajina. Podkarpatská Rus 1918-1946*. Prešov: Universum, 1996, p. 95.
[4] Pop, Ivan: *op. cit.*, p. 370.
[5] Suško, Ladislav: Podkarpatská Rus ako autonómna krajina pomníchovskej – druhej ČSR. In *Česko-slovenská historická ročenka 1997*. Brno: Masarykova univerzita, 1997, p. 159.

from the other regions massively and they became subordinated to General Oleg Svatek. Only Tiso`s Slovak autonomous government did not believe in maintaining Subcarpathian Ruthenia and proposed to replace Kosice, Nove Zamky and Roznava for Subcarpathian Ruthenia. Hungarian occupation was supposed to be conducted on the days from 20th -21st November 1938. Hungarian diplomacy managed to fool Mussolini and was promised to receive 96 jet fighters.[6] However, this action was not coordinated with Germany cause a sharp reaction in Berlin. Nazi leadership resolutely cracked down on upcoming event. This action was unacceptable for Berlin because it would have demonstrated Hungarian independence too much. Therefore Berlin in cooperation with Rome made it impossible by sending resolute diplomatic demarches and identified forthcoming invasion of Hungarian Army in Subcarpathian Ruthenia as the violation of Vienna Arbitration. The Nazis used the argument about inability to discredit prestige of Germany and Italy as arbitrators.[7] In Budapest it was understood that the rest of Subcarpathian territory can be obtained only at cost of further reinforcing of continuing relationships with Berlin. It was rather a great disgrace for Imredy`s government and a few months later the government resigned.[8]

Nazi Germany used Subcarpathian Ruthenia as a trump card in the political game against Poland, Hungary and the Soviet Union. Expectations and hopes of Subcarpathian population were not taken seriously by Berlin. Even accounts concerning the use of Subcarpathian Ruthenia as so called "Ukrainian Piemont" in the process of creating of *Great Ukraine* were not clear, since German leadership did not have clear idea about forming Great Ukraine.[9]

On the days 19th to 22nd November 1938 both chambers of National Assembly passed constitutional laws about Slovak autonomy and autonomy of Subcarpathian Ruthenia (Law n. 328/1938 Collection of laws and regulations from 22nd November 1938). The official name of the state was changed into Czecho-Slovakia. Representatives of pro-Ukrainian political orientation strived to enforce the change of the title into a new one – *Carpatho-Ukraine*, the effort was not successful. The former titled maintained. Constitutional Law also cancelled the Governor and vice-Governor`s offices as well as Gubernial Council of Subcarpathian Ruthenia. Within five months from the date the law was declared the election to the Council of Subcarpathian Ruthenia was to be announced. The first session of the Council was to be summoned by the President of the Republic within one month form the day the elections were held. The members of the Government were to be appointed by the President of the Republic proposed by the Council Presidency. Autonomous government was to be responsible for its actions to the autonomous Council of Subcarpathian Ruthenia.[10]

Autonomy Act consolidated and stabilized the position of the autonomous government and the powers which stood behind the government. Even before 28th October, the government had stopped the activity of 14 political parties and organizations, with the biggest impact on Russo-Ruthenian political orientation. The mainstay of the regime was represented by *Ukrainian National Union* headed by Fedor Revay and *Carpathian Sich*[11] by Dmytro Klympush. After the clash with Polish police Carpathian Sich was strengthened by a number by refugees from Halych, who fled to Subcarpathian Ruthenia. Carpathian Sich caused Voloshyn`s government serious problems. Their

[6] Sterčo, Petro: *Karpato-Ukrajins´ka deržava. Do istoriji vyzvoľnoji boroťby karpats´kych ukrajinciv u 1919-1939 rokach.* Ľviv: Atlas, 1994, p. 177.
[7] *Ibid.*, p. 179.
[8] Suško, Ladislav: *op. cit.*, p. 160.
[9] Kotowski, Albert S.: „Ukrainisches Piemont"? Die Karpatenukraine am Vorabend des Zweiten Weltkrieges. In *Jahrbücher für Geschichte Osteuropas*, 49/2001, p. 67 *etc*.
[10] Pop, Ivan: *op. cit.*, p. 375.
[11] About paramilitary organization *Carpathian Sich (Karpats´ka Sič)*, its structure, commanders and officers see more Sterčo, Petro: *Karpato-Ukrajins´ka deržava. Do istoriji vyzvoľnoji boroťby karpats´kych ukrajinciv u 1919-1939 rokach.* Ľviv: Atlas, 1994, p. 80 *etc*.

ideas went completely outside of the vision kept by local population as well as Khust government. They did not represent support but on the contrary, often an obstacle to the consolidation of the situation in the country.[12]

On 25th November, the autonomous government issued the regulation about the introduction of Ukrainian language as the official language on the territory of Subcarpathian Ruthenia, which was outside its jurisdiction.

On 30th November, Emil Hacha was elected a new president. On 1st December, the President appointed a new central government led by Rudolf Beran and a new autonomous government in which A.Voloshyn and J. Revay remained the members of the government. E. Bachins´kyi, the representative of Russophile-Ruthenian orientation, lost the position in the government.

Voloshyn`s government strove to enforce the stability of the country from inside and outside. In foreign policy Voloshyn tried to achieve stability by increased orientation on cooperation with Germany. On 30th December 1938, autonomous government issued a regulation concerning the official title of the country, which stated that the term *Carpatho-Ukraine* can be used up to the Council`s definitive decision on the title of Subcarpathian Ruthenia (from 1927 as the *Subcarpathian Land*). This was another violation of constitutional law n. 328/1938 Collection of laws and regulations by the autonomous government.

Tension, however, did not disappear. Ukrainian movement worsened the relationships with Poland which had certain worries about formation of "Great Ukraine". Central Prague government understood the situation in Subcarpathian Ruthenia was serious and thus on 16th January 1939 the President Hacha appointed on the Government`s proposal General Lev Prchala a minister of autonomous government which was met with considerable resistance. However, the compromise was achieved when General`s competence was formally narrowed only to the Ministry of Transport. As a matter of fact, in case of need it was an order to suppress Ukrainian nationalist movement.

On 20th January 1939, the Decree to the elections to the Council of Subcarpathian Land/Carpatho-Ukraine was published. Application of particular political parties to participate in the elections had to be sent until 22nd January. Decree confidentiality was intentional. Autonomous government assumed that Russophile-Ruthenian opposition would fail to register application on time and thus would be automatically excluded from the participation in elections. At the meeting of the representatives of former Russophile-Ruthenian parties and organizations in Khust, *Association of Subcarpathian Ruthenians* was established, which managed to submit an application and the list of candidates to the elections to the Council. The application was not accepted and listed candidates arrested by members of Carpathian Sich. Political representatives of Russophile orientation did not agree with such election because of intimidation coming from Ukrainian nationalists and therefore asked the President Hacha to cancel the elections.[13]

Elections to the autonomous council were held on 12th February in accordance with single candidate slate whereby all the candidates of the ruling party, *Ukrainian National Union*, were included. Polling stations and census were under control of the members of Carpathian Sich. The ruling party won elections with 92.54% of all valid votes.[14]

On 6th March Beran`s government decided to intervene decisively into the conditions in Carpatho-Ukraine. On government`s proposal the president Hácha appointed a new autonomous government. Julian Revay dropped out of the government. Beside Voloshyn and Prchala, Stepan Klochurak became a new minister responsible for economics, health and social care.

On the night of 13th to 14th March so called General Staff of Carpathian Sich carried out a coup against autonomous government the Czechoslovak Army troops in Khust. However the attack of *the Sichs* on military camp was repelled. In the morning of 14th March, Hungarian troops (with the consent of Berlin) began attack along the entire length of demarcation line. General Lev Prchala ordered the counterattack. However, the situation changed at breakneck pace, Slovak

[12] Suško, Ladislav: *op. cit.*, p. 161.

[13] Request of the representatives of pro-Russian orientation to the President of the Republic for reorganization of the autonomous government and cancellation of the elections to the Council of Subcarpathian Ruthenia/Carpatho-Ukraine because of intimidation of pro-Russian supportes by Ukrainian nationalists. *Archive of the President´s Office (Archív kanceláře prezidenta republiky)* in Prague, fund of the President´s Office, box 15, inventory number 923, signature *Subcarpathian Rus´* 45/39.

[14] Sterčo, Petro: *op. cit.*, p. 129. Complete results see *ibid.*, pp. 242-252.

Council declared independent Slovak State. Subcarpathian Ruthenia/Carpatho-Ukraine as an autonomous part of the Czechoslovak Republic found itself in the state power vacuum. A.Voloshyn announced Prague by phone call that the only possibility is the declaration of independence of Carpatho-Ukraine. In his last conversation Voloshyn thanked the President Hacha to all the Czechs for twenty years of cooperation. Such a gesture was not expressed by any of minorities` leaders in Czechoslovakia.[15]

On that day A.Voloshyn declared the independence of Carpatho-Ukraine and the composition of a new government. He asked German government to take Carpatho- Ukraine under protection and establish Protectorate. On 15th October General Lev Prchala did not take hold of Chief Command of Czechoslovak troops in Carpatho-Ukraine and entrusted General Oleg Svatek to manage retreat. On the same day in the afternoon the first and the last session of the Council of Subcarpathian Ruthenia/Carpatho-Ukraine took place at Secondary Grammar School (Gymnazium) in Khust. The Council declared the independence of Carpatho-Ukraine. Avhustyn Voloshyn was appointed the President of Carpatho-Ukraine and Julian Revay in his absence the Prime Minister. In the late hours of the same day Voloshyn summoned both the first and the last session of the Government. It was agreed not to resist the Hungarian Army and hand over the power to the army. The members of the government had to decide how to proceed further. Avhustyn Volshyn effectively dissolved the Government of Carpatho-Ukraine and travelled to Khust.[16]

Czechoslovak military troops were organized to leave the territory of Subcarpathian Ruthenia. Substantial part of the troops managed to get to Slovakia while the remaining part of the troops managed to beat through ceding Hungarian Army into Romanian territory. Ceding Hungarian troops had to face beside the resistance of *the Sichs* also armed but not trained secondary school students form Sevlyush and Khust, who lost their lives there.[17] On 18th March 1939 in the late night hours, Hungarian army finished occupation of the territory of Subcarpathian Ruthenia. Hungarian Prime Minister, Pal Teleki, could declare in Hungarian Parliament on 16th October that Carpatho-Ukraine was occupied by Hungarian military troops in accordance with the "wishes Carpatho-Ukrainian people".[18] Hungarian members of the Parliament renamed Subcarpathian Ruthenia/Carpatho-Ukraine into *Carpathian Territory (Karpataljai terűlet)*, or *Karpatalja*.

Short existence of independent Carpatho-Ukraine ended up this way. Finally when Subcarpathian representatives` dreams about their own country were fulfilled, it came to its early end. In fact, disaster had already begun with Hungarian occupation of Carpatho-Ukraine before the declaration of independence. Although Avhustyn Voloshyn in Khust and Julian Revay actually directly in Budapest tried to gain guarantees for protection of Carpatho-Ukraine, it was Berlin which allowed Budapest to occupy and annex the region and this decision sealed their fate. Many had known long before, the new little country would not have a chance to survive and this was its tragedy.

BIBLIOGRAPHY

[1] Borák, Mečislav: Obrana Podkarpatské Rusi. In *Česko-slovenská historická ročenka 1997.* Brno: Masarykova univerzita, 1997, pp. 165-178.
[2] Fano, Štefan: Zakarpatská Ukrajina v politických kalkuláciách susedných štátov v období od Mníchova po marec 1939. In *Slovanské štúdie XI. História.* Bratislava: Veda, 1971, pp. 61-79.
[3] Gebhart, Jan – Kuklík, Jan: *Druhá republika 1938-1939. Svár demokracie a totality v politickém, spoločenském a kulturním životě.* Praha: Paseka, 2004.

[15] Pop, Ivan: *op. cit.*, p. 386-387.
[16] *Ibid.,* p. 389.
[17] Veheš, Mykola Mychajlovyč – Zadorožnyj, Volodymyr Jevhenovyč: *Velyč i trahedija Karpats´koji Ukrajiny*. Užhorod: Patent, 1993, pp. 45-46.
[18] Švorc, Peter: *op. cit.*, p. 100.

[4] Hořec, Jaromír (ed.): *Dokumenty o Podkarpatské Rusi.* Praha: Česká expedice,1997.
[5] Hrančak, Ivan *et al*.: *Narysy istoriji Zakarpatťa. Tom II (1918-1945)*. Užhorod: Zakarpatťa, 1995.
[6] Kotowski, Albert S.: „Ukrainisches Piemont"? Die Karpatenukraine am Vorabend des Zweiten Weltkrieges. In *Jahrbücher für Geschichte Osteuropas,* 49/2001, pp. 67-95.
[7] Koźmiński, Maciej: *Polska i Węngry przed drugą wojną światową (październik 1938 – wrzesień 1939). Z dziejów dyplomacji i irredenty.* Wrocław – Warszawa – Kraków: Wydawnictwo PAN, 1970.
[8] Magocsi, Paul Robert: *The Shaping of a National Identity. Subcarpathian Rus´1848 -1948.* London – Cambridge (Mass.): Harvard University Press, 1978.
[9] Magocsi, Paul Robert – Pop, Ivan (eds.): *Encyclopedia of Rusyn History and Culture*. Toronto – Buffalo – London: University of Toronto Press, 2005.
[10] Mosný, Peter: *Podkarpatská Rus. Nerealizovaná autonómia.* Bratislava: Slovak Academic Press, 2001.
[11] Pop, Ivan: *Dějiny Podkarpatské Rusi v datech*. Praha: Libri, 2005.
[12] Pop, Ivan: *Podkarpatská Rus – osobnosti její historie, vědy a kultury*. Praha: Libri, 2008.
[13] Sterčo, Petro: *Karpato-Ukrajins´ka deržava. Do istoriji vyzvoľnoji boroťby karpats´kych ukrajinciv u 1919-1939 rokach.* Ľviv: Atlas, 1994.
[14] Suško, Ladislav: Podkarpatská Rus ako autonómna krajina pomníchovskej – druhej ČSR. In *Česko-slovenská historická ročenka 1997.* Brno: Masarykova univerzita, 1997, pp. 145-163.
[15] Švorc, Peter: *Zakliata krajina. Podkarpatská Rus 1918-1946*. Prešov: Universum, 1996.
[16] Švorc, Peter: *Krajinská hranica medzi Slovenskom a Podkarpatskou Rusou v medzivojnovom období (1919-1939).* Prešov: Universum, 2003.
[17] Švorc, Peter – Danilák, Michal – Heppner, Harald (eds.): *Veľká politika a malé regióny. Malé regióny vo veľkej politike, veľká politika v malých regiónoch. Karpatský priestor v medzivojnovom období (1918-1939).* Prešov – Graz: Universum, 2002.
[18] Veheš, Mykola Mychajlovyč – Zadorožnyj, Volodymyr Jevhenovyč: *Velyč i trahedija Karpats´koji Ukrajiny.* Užhorod: Patent, 1993.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

INTELLIGENT SYSTEM FOR ADAPTIVE PILOT PERFORMANCE ASSESSMENT

Pericle Gabriel MATEI *, Amelia SANDU**

*Faculty of Mechatronics and Integrated Weaponry Systems, Military Technical Academy, Bucharest, Romania, ** Faculty of Mechatronics and Integrated Weaponry Systems, Military Technical Academy, Bucharest, Romania

***Abstract**: This paper will present an entirely new developed intelligent system for high precision adaptive assessments of aircraft piloting abilities. Integrated optimization components for these abilities provide the base in decision-making process concerning the pilots' hierarchy and admittance in flight training specific programs. The system is built as a complex and parametric set of tools, with hierarchical set of specific flying stimulus, weighted in the pilot's performances, acting as base of assessment process. The subjects fly in virtual environment, where receive specific visual, sound and tactile information, in a cockpit specific form. A set of basic and generic tasks is developed for building more complex scenarios, focusing on a stimulus category at one time (visual, flight, navigation, environment integration). Also, a multi-stream data acquisition system (data integration in simulated flight, physiological data and behavior data) is implemented. Data in the intelligent system is stored in relational structured databases: basic scenario database, complex scenario database, subjects' database, results database.*

***Keywords**: flight simulators, pilot assessment, intelligent systems, aviation*

1. GENERALITIES

The main goal of the intelligent system is to allow high precision assessments of aircraft piloting abilities, by integrating optimization components and aiming to provide the base in decision making process concerning the pilots' and navigating candidates' hierarchy and their admittance in flight training specific programs. This system is built as a complex and parametric set of tools, used for the assessment of pilots' flying capabilities in different training stages during the flying school, and for the assessment of pilot candidates' flying potential. It will assist the specialized staff in the decisional processes of pilots' selection. The base of assessment process is a hierarchical set of specific flying stimulus. For generating this hierarchy the stimulus type is weighted in the pilot's performances. The environment where the subject will fly is a simulated one, where the subject will receive specific visual, sound and tactile information, in a cockpit specific form. For this, a set of basic and generic tasks are developed on which the more complex scenarios can be built; different flight simulations are also built based on the considered stimulus hierarchies, focusing on a stimulus category at one time (visual, flight, navigation, environment integration). All these are supported by a simulation system for the virtual environment, a flight simulation system, a multi-stream data acquisition system (data integration in simulated flight, physiological data, behavior data) and a processing, structuring, correlative

analysis of all the information and decision making system. The Intelligent System functions in a network infrastructure which includes the server (the examiner workplace), a set of computers where the subjects will perform and a physiological and behavior data acquisition and processing equipment. The data from the Intelligent System is stored in a global relational database structured by content in specific sub bases: basic scenario, complex scenario, subjects and results.

2. SYSTEM CAPABILITIES REFLECTED IN ASSESSMENT SESSION

The subject assessment session implements a stage structure: subject identification; subject accommodation with session requirements; subject's theoretical training stage; subject's theoretical knowledge assessment; simulator controls training stage; main simulation stage; optimization stage; data processing; decision stage.

The Intelligent System capabilities: building the specific flying stimulus set; building the stimulus hierarchy; weighting the stimulus types in flying performances; building the different flight simulations based on the current stimulus hierarchies; building the flying tasks set, so that the most important psychical processes involved to be covered; the simulation's scenarios manipulation; the relevant parameters set elaboration for flying capacity optimization; building the relevant psycho-physiological set of parameters (EEG, EKG, FC, pressure on the controls, brain signals, visual focus, pulse, blood pressure, local temperature, local resistance – see Fig.1) which best describes the tested subjects general panel; working with complex models for the acquired data, aiming to minimize the dimension of information universe without losing content.

The main challenges approached during developing the system: creating the generic flight simulator, with a specific interface; the functional integration of the intelligent system; generating of investigation, simulation, data processing and optimization procedures; elaborating the decision procedures; elaborating database manipulation procedures.

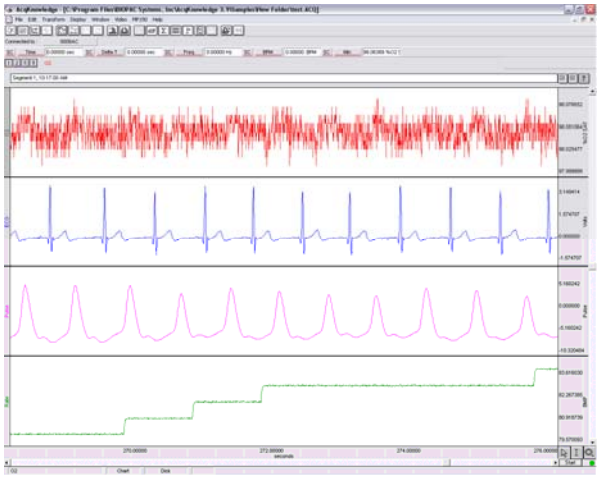


Fig. 1: Physiological stream interface

3. DATA PROCESSING INSIDE INTELLIGENT SYSTEM

The intelligent system provides a genuine set of knowledge regarding the human factor performances quantification, mainly his behavior in the act of flight. Also, it builds dimension reduction models of the information field acquired in assessment sessions, with data loss minimization, respectively with the extraction of that information that has a major impact in previsions elaboration and performances hierarchies setting. Furthermore, it contributes to drawing the separation line between the flight school and aviation specialized programs admitted personnel and the rejected one. The feedback and post assessment analyze procedures implemented provide knowledge regarding aircraft piloting technique ability optimization.

The acquired data processing models are statistic, presuming a minimum and maximum distribution analyses, an average data analyses, respectively kurtosis and skewness, which will be applied at specific deviations level to each candidate, deviations acquired in the simulated flight process, under the real trajectory deviations form of the imposed specific mission trajectory. In analyzing the candidate behavior related to the statistical group to whom he belongs, specific box-plot representation analyses are performed. Also, three-dimensional viewing models of the real and imposed trajectories are implemented, on

mission assembly and primary components (flight type: horizontal, in climbing-descent, turning, takeoff – landing), with the possibility to dynamically modify the observer's position related to the trajectory – see Fig.2. In addition, the deviations in focus will be displayed, too. The statistic analyzing models are applied also to all candidate controls (stick, rudder and throttle). The acquired information are related to the results of the theoretical knowledge exam which is taken during the assessment session time. Overall, the resulting information is related to the specialty knowledge obtained through other methods from the flight personnel, active or in different school training stages and aviation programs.

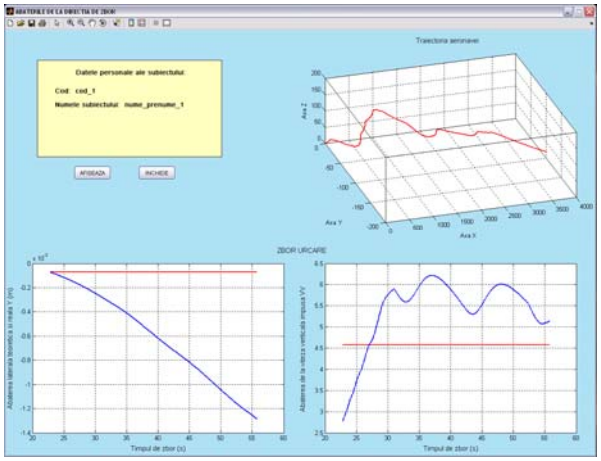


Fig. 2: Post flight flying data stream analysis

The Intelligent System comes with a series of novelties:

- The assessment session complexity: the subject runs through a series of stages: database registration and the coherence and identity checking; virtual environment training through the simulated cockpit construction; theoretical knowledge exam; training on the simulator; virtual environment and simulated flight; acquired data volume (real flight, simulated flight, commands, training and exams results, physiological profile); dimensional reduction models for acquired data volume, keeping only the data with an impact on the assessment, prediction and optimization; candidate control behavior analyze and optimization;
- Board instruments and cockpit database are dynamic; theoretical tests database is dynamic;
- The Scenarios Generator and the included scenarios database permit, practically, the use of an unlimited number of flight scenarios;
- Inclusion of data analyzing models and physiological data sets;
- Acquired data statistic analyze models generation: extreme values, average values, kurtosis, skewness on the candidate distribution data, respectively box-plot model analyze for candidate position analyze related to the significant group to which he belongs, positioning him on a part or another of a marker (for example admitted, rejected) ;
- Post assessment analyze models generation, with three-dimensional graphic (dynamic position of the observer), at a whole flight mission level, at a primitive trajectory section level, respectively with deviations graphic analyze and box-plot representation technique.

The implementation of Intelligent System requires two sides dynamically integrated, regarding the acquisition of valid results, sustained by real investigations, on pilots or flight school candidates, on who's basis the subject's profile estimation can be made, regarding their abilities in flying an aircraft, taking into account the subject's complete panel: physical, physiological and of simulated environment integration. The first implications appear in the performance optimization at candidate group level, and at selected pilot

level, simultaneous with the costs minimization bound on the flying personnel training. The multiple side integration problem – the simulation technology, the adaptation of the simulated environment to the flying specific stimulus hierarchy with the physiological profiling, all leading to the decision taking mechanism implementation – represents a strong part of the Intelligent System.

4. MODULAR ARCHITECTURE OF INTELLIGENT SYSTEM

- Generic flight simulator, with specific interface, functioning on subjects' dedicated computers and intended for acquiring the entire information set which will be used by the intelligent system in assessment – see Fig.3. The subject's interface is based on:
  - visual component which simulates the environment, different depending on the specific stimulus weight in flight performance – see Fig.4;
  - specific flight controls component (stick, pedals, throttle);
  - audio component (engine noise, cockpit noise);
  - physiological parameters acquisition component (specific sensors set spread all over the body for blood pressure, pulse, humidity, flight control pressure, visual area focus, EEG).
- Functional integration module: the Intelligent System has to function properly as a whole. All the software packages communicate with each other, the databases can be managed and interrogated, the IT equipments form the network's nodes communicate.
- Specific flight stimulus set elaboration module: there are visual, audio, tactile and psychological stimulus. The last ones are implemented through different simulated environment models, which will stress on individual factors: different simulation environments are included according to the current mission: flight, navigation, retention.
- Flight data set elaboration, integration in simulated environment and physiological parameters elaboration module.

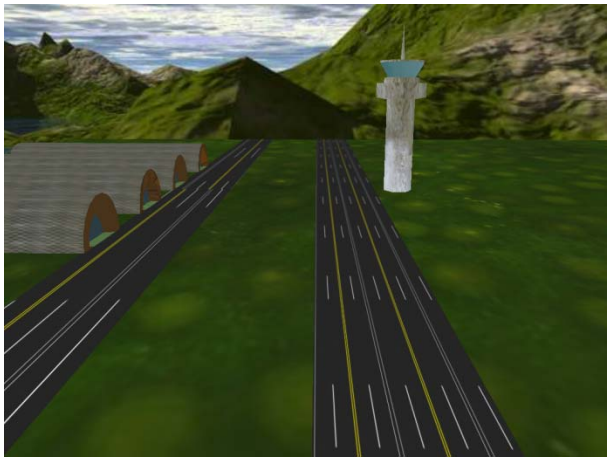


Fig. 3: Virtual airport

Fig. 4: Virtual flight environment

- Investigation, simulation, data processing and optimization procedures elaboration module. The flight data set contains the mission type, the imposed trajectory's parameters (the aircraft's current position according the mission in the 3D space), the real trajectory's parameters flight by the subject (the aircraft's current real position in the 3D space) carrying-off from the trajectory, the flight commands, the real time aircraft's configuration, distinct important time periods, criteria for each mission to be considered achieved.
- Database management module: the database initialization, adding new data, modifying the existent data, applying the

access restrictions, the interrogation capabilities implementation.

- Decision making models module.

5. CONCLUSIONS

Intelligent System for Aircraft Piloting Capability assessment allows high precision assessments of aircraft piloting abilities, by integrating optimization components, aiming to provide the base in decision making process concerning the pilots' and navigating candidates' hierarchy and their admittance in flight training specific programs. It is built as a complex and parametric set of tools, used for the assessment of pilots' flying capabilities in different training stages during the flying school, and for the assessment of pilot candidates' flying potential.

The current version of Intelligent System used in operational stages of flight simulator for pilot performance assessment with standard flight scenarios (climbing or descending flight, with fixed flight path data, initial flight altitude, final flight altitude, glide/slope angle, indicated speed) showed it's consistency in operational tasks.

REFERENCES

1. Adams, C.. The Avionics Behind the Avionics. *Avionics Magazine.* July (1998).
2. Evans, B.. Cockpit Automation: The Good, the Bad and the Ugly. *Avionics Magazine.* May (1998).
3. Matei, P.G., *On Board Equipment: Navigation, Gyro and Data Processing Systems.* Bucharest: MTA Press (2010).
4. Matei, P.G.. Integrated Flexible System for Flying Profiles Assessment. *Aerospace Science Conference „Aerospace 2008"*. October (2008).
5. Matei, P.G., Popa M.. Flight Performance Optimizing System by Improving Pilot – Aircraft Coupling. *National Conference „Aerospace 2005 – Aerospace Science Symposium"*. October (2005).
6. Racoveanu, N., Stoica, A.. *Aircraft Automation.* Bucharest: EDP (1990).
7. Wensley, J.H.. Error Tolerance Implementation. *Fall Joint Computers Conference.* Montvale: AFIPS Press (1995).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

ADAPTIVE PILOT PERFORMANCE OPTIMIZING: VALIDATION AND HUMAN BEHAVIOR ADJUSTMENT

Pericle Gabriel MATEI *, Ophélie BOREL **

*Faculty of Mechatronics and Integrated Weaponry Systems, Military Technical Academy, Bucharest, Romania, **Mechanical, Production and Aerospace Engineering Faculty, University Paul Sabatier Toulouse, Toulouse, France

***Abstract**: This paper will present the final preliminary stage of validation results and human behaviour adjustment build on data acquired during pre-production use of an intelligent system able to improve assessments of aircraft piloting abilities. Optimized components of these abilities are provided, along with the base for decision making process concerning the pilots' and candidates' hierarchy and their admittance in specific flight training programs. Data analyzed and results emerge from the system recorded performance parameters based on measuring the differences between ideal trajectories according to assigned missions and the real trajectories in simulated flights. These differences were measured in 3D space (on each axis: Ox – longitudinal axis, Oy – transversal axis, Oz – vertical axis). The data acquisition stream rate is 2 samples per second. Each of these variables is afterwards processed so that a set of performance data can be synthesized (e.g.: average values, symmetry and form of distributions). All results are thoroughly analyzed, as well as their psychological meanings and consequences for final release of intelligent system.*

***Keywords**: flight simulators, pilot assessment, intelligent systems, aviation*

1. GENERALITIES

The main goal of this paper is to present the final preliminary stage of validation results build on data acquired during pre-production use of an intelligent system able to improve assessments of aircraft piloting abilities. Optimized components of these abilities are provided, along with the base for decision making process concerning the pilots' and candidates' hierarchy and their admittance in specific flight training programs. Also, the specialized staff involved in decisional processes of flight personnel selection will widen the support requested by this more and more demanded activity.

2. GLOBAL ASSESSMENT AND SESSION FRAMEWORK

The main framework is related to subject assessment session, stages structured:

- subject identification;
- subject accommodation with session requirements;
- theoretical training;
- theoretical knowledge assessment;
- simulator controls training;
- main simulation;
- optimization;
- data processing;
- decision.

The environment where the subjects fly is a virtual one, populated with specific visual, sound and tactile information, in a cockpit specific form. Complex scenarios are provided, as well as an effective tool for developing particular ones based on a set of primitive trajectories. Different flight simulations may also become available by gathering together the considered stimulus hierarchies, focusing on a stimulus category at one time (visual, flight, navigation and environment integration).

All these are supported by a simulation sub – system for the virtual environment generation and dynamics, a main flight simulation system, a multi-stream data acquisition sub – system (data integration in simulated flight, physiological data and behavior data) and a structured processing and correlative analysis sub – system. Beside these, the decision making sub – system acts as a whole data integrator.

The acquired data processing complex models are statistic, presuming a minimum and maximum distribution analyses, an average data analyses, respectively kurtosis and skewness, which are applied at specific deviations level to each candidate, deviations acquired in the simulated flight process. In analyzing the candidate behaviour related to the statistical group to whom he belongs, specific box-plot representation analyses can be performed. Also, three – dimensional viewing models of the real and imposed trajectories are implemented, the deviations in focus being displayed and the statistic analyzing models being applied to all candidate controls (stick, pedals and throttle).

The acquired information is reported against the results of the theoretical knowledge exam applied during the assessment session time.

Technologically speaking, high tech computers, networks and software with distributed information share the huge amount of data processed. Over all, the system integrates a package of equipments able to deal with acquisition, processing and making available the volume of information requested for quantizing the subject's panel. Only data showing strong predictive character is extracted and passed on efficiently to the component responsible with optimizations.

At a national scale, this approach is absolutely new, coming to lead the decision system on a new level of performance and to optimize the subjects` behaviour regarding the following of imposed flight mission and his behaviour from physiologic viewpoint. This intelligent system presents interests in priority domains of aeronautics and medicine.

By using this system the level of subjects' safety, the flight security level, the pilot's training level increase, simultaneously with decreasing the training and license maintenance costs.

3. METHOD USED AND RESULTS

The current release used is the final preliminary operational stage of intelligent system for pilot performance assessment in a standard flight scenario: climbing or descending flight, with fixed flight path data (initial flight altitude, final flight altitude, glide/slope angle, indicated speed). As many as 65 pilot students (among them 19 from Air Forces Academy) voluntary passed thru the flight program at the simulator. All subjects hold the same experience on training aircrafts. There also exist recordings of pilot performance assessments in real flights for each one.

The system recorded the performance by measuring the differences between ideal trajectories according to assigned missions and the real trajectories in simulated flights. These differences were measured in 3D space (on each axis: Ox – longitudinal axis, Oy – transversal axis, Oz – vertical axis). The data acquisition stream rate is 2 samples per second. Each of these variables is afterwards processed so that a set of performance data can be synthesized (e.g.: average values, symmetry and form of distributions).

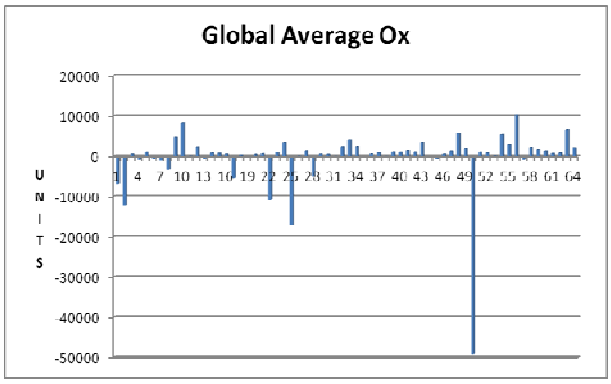


Fig. 1: Global Average Deviations: Ox

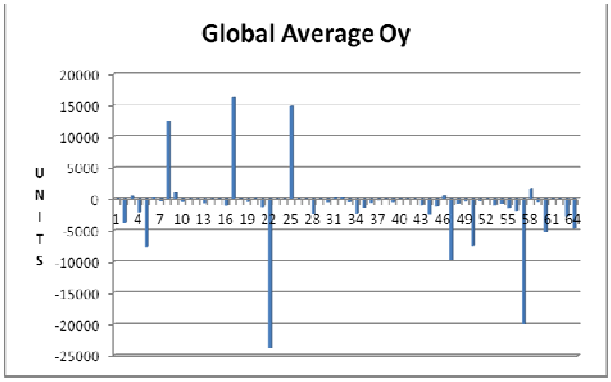


Fig. 2: Global Average Deviations: Oy

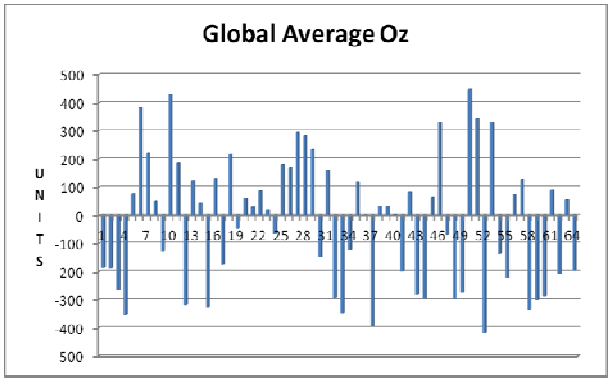


Fig. 3: Global Average Deviations: Oz

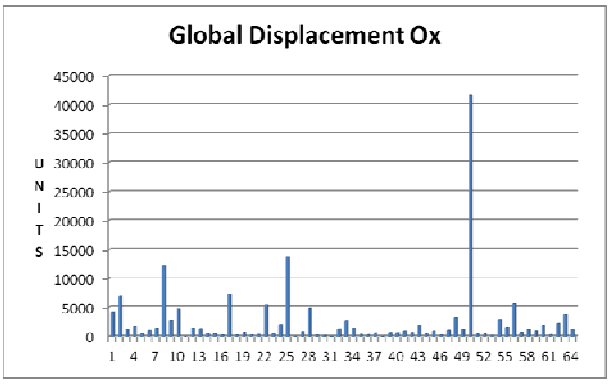


Fig. 4: Global Displacement Ox. Absolute values

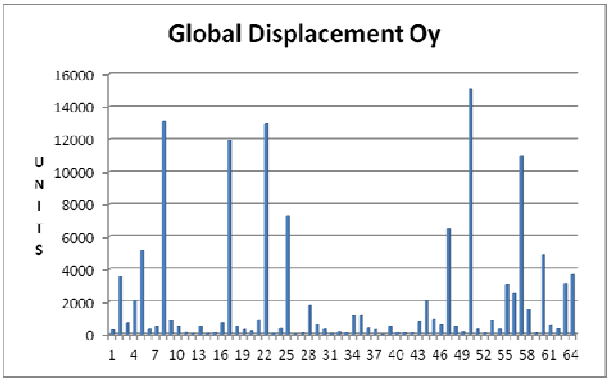


Fig. 5: Global Displacement Oy. Absolute values

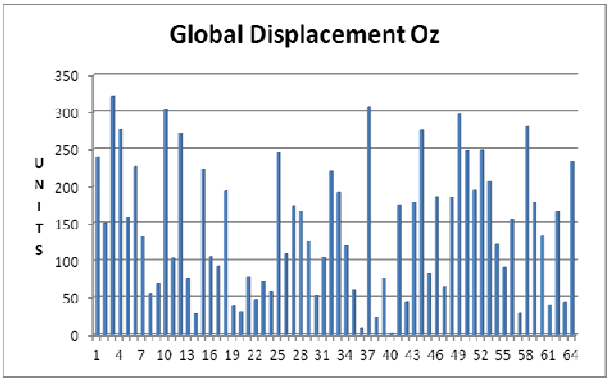


Fig. 6: Global Displacement Oz. Absolute values

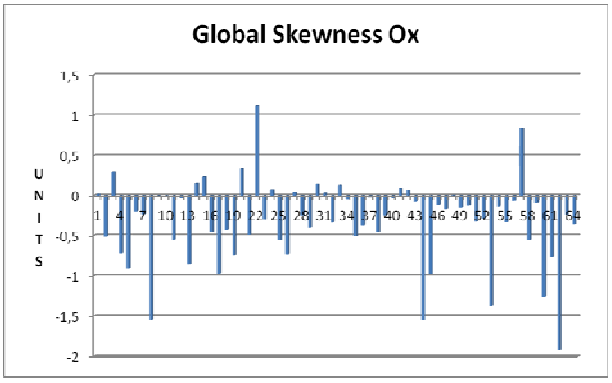


Fig. 7: Global Skewness: Ox

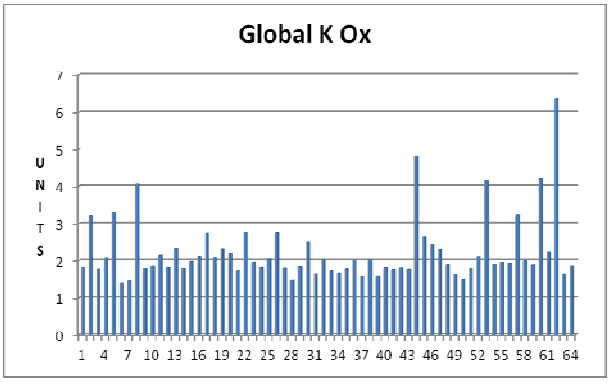


Fig. 10: Global K: Ox

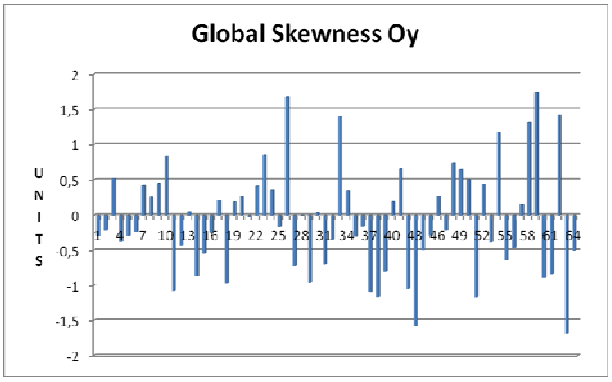


Fig. 8: Global Skewness: Oy

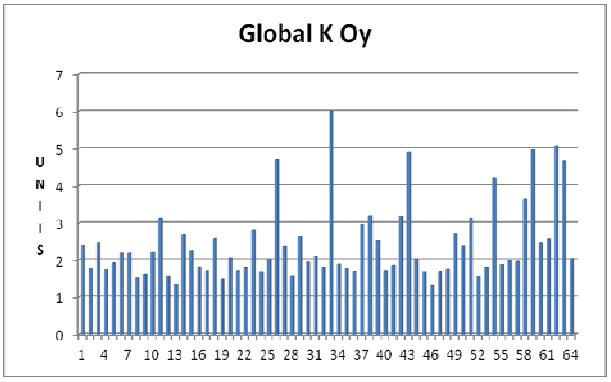


Fig. 11: Global K: Oy

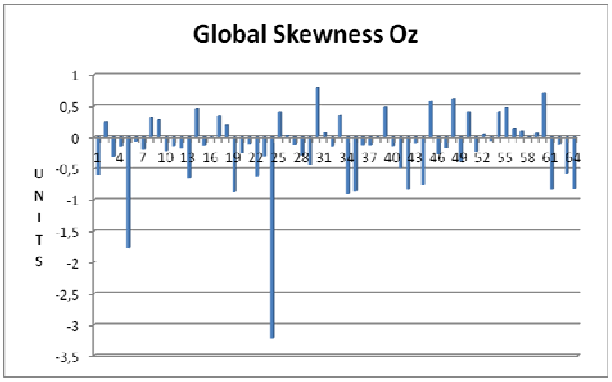


Fig. 9: Global Skewness: Oz

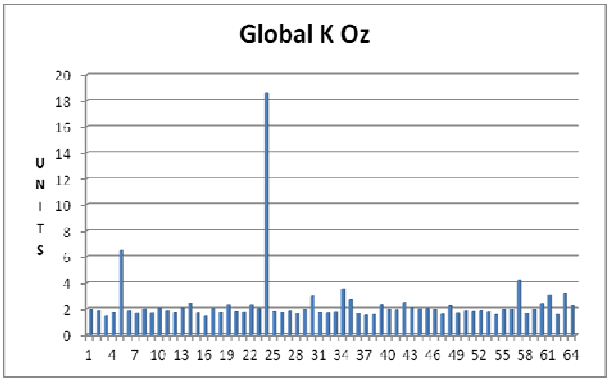


Fig. 12: Global K: Oy

4. CONCLUSIONS

The performance parameters exposed by intelligent system indicators were correlated with real in flight performance and with the results of coordination in multi-tasking test (Double Maze Bonnardel).

The results of Kendall correlations confirmed a significant association for differences between ideal and real trajectories

on Oy axis (differences in horizontal plane), in all three stages of flight: first third (r = +0.40, p = 0.023), middle third (r = +0.50, p = +0.004) and final third (r = +0.62, p = +0.001). Also, the average global variation on Oy axis positively correlated with real in flight performance (r = +0.60, p = +0.0005). The multiple regression coefficient calculated for the four predictors is R = 0.82 (F = 7.69, p = 0.002).

The correlation with performance in Bonnardell shows moderate associations, taking values around 0.3÷0.4, with the ones between performance at simulator indicators and the number and duration of test errors.

All results are thoroughly analyzed, as well as their psychological meanings and consequences for final release of intelligent system.

REFERENCES

1. Adams, C.. The Avionics Behind the Avionics. *Avionics Magazine.* July (1998).
2. Evans, B.. Cockpit Automation: The Good, the Bad and the Ugly. *Avionics Magazine.* May (1998).
3. Matei, P.G., *On Board Equipment: Navigation, Gyro and Data Processing Systems.* Bucharest: MTA Press (2010).
4. Matei, P.G.. Integrated Flexible System for Flying Profiles Assessment. *Aerospace Science Conference „Aerospace 2008".* October (2008).
5. Popa, M., Matei, P.G., Radu, V., Merode, C., Panțîru, S., Ionescu, V.. Flying Capabilities Assessment System in Virtual Environment: Preliminary Validation. *International Conference "Psychology and Society: Applied Psychology".* September (2007).
6. Matei, P.G., Popa M.. Flight Performance Optimizing System by Improving Pilot – Aircraft Coupling. *National Conference „Aerospace 2005 – Aerospace Science Symposium".* October (2005).
7. Racoveanu, N., Stoica, A.. *Aircraft Automation.* Bucharest: EDP (1990).
8. Wensley, J.H.. Error Tolerance Implementation. *Fall Joint Computers Conference.* Montvale: AFIPS Press (1995).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

BORDER CRIME IMPLICATIONS ON SECURITY, SURVEILLANCE AND CONTROL POLICIES OF THE EUROPEAN UNION BORDER

Ovidiu MOŞOIU*, Mihaela DIN**
*"Henri Coanda" Air Force Academy, Brasov, Romania, ** IGPF, drd of „Carol I" National Defense University, Bucharest, Romania

Abstract: *Romania should participate more actively to the opening of the European free circulation road, which involves finalizing and implementing the Integrated System for Border Security, which is an efficient tool for preventing and combating illegal cross-border actions. To achieve this goal requires the active involvement of all state institutions and other nongovernmental organizations with border responsibilities. Based on the principle of complementation, the EU accession on January 1, 2007, is an important step for Romania's future.*

Keywords: *space of freedom, security and justice; community policies of integrated management; integrated system for securing the state border.*

1. The adaptation of the state border control and surveillance national policy

With the acquisition of the EU membership, Romania has the obligation to implement the community policies on the state border integrated management domain in order to become an integrating part of the area of freedom, security and justice. The purpose is to achieve an appropriate border security level. In this regard, the *Romanian Inter-ministerial Group for Integrated State Border*, called GIRMIFS, set the overall design and ensured the unitary coordination, based on *The national strategy of integrated border management of the Romanian state* and on the actions and measures conducted by public authorities and institutions involved in these tasks in order to achieve state border management.

The main instrument for the exercise of the integrated management of the Romanian state border is the Integrated System for Border Security (ISBS). By its nature, ISBS belongs to a category of complex systems - system of systems - and it consists of multiple complex autonomous subsystems that are found in a close interrelationship, different in terms of technology, context, operation, geography and conceptual framework. The realization of this system constitutes a priority to Romania, in order to secure its national borders and the external borders of the E.U, for the integration into the European area of freedom, security and justice. It is appropriate according to the integrated border security model developed by the Schengen Catalog *External border control, extradition and readmission.*

The best practices and recommendations[1], ISBS envisages in a unitary concept all 4 complementary filters that bring together activities carried out by all the national institutions with attributions in the field of integrated management of borders[2].

In applying the Schengen acquis provisions for the implementation of the European Commission recommendations and the measures included in the Schengen Action Plan (revised in 2006), ISBS involves upgrading the infrastructure and the equipment of all Romanian Border Police (RBP) structures at all levels, thus ensuring a high level of external borders security in the Eastern part of the country.

Border surveillance implies ensuring observation and specific border actions through the implementation of technologies based on sensors, cameras or a combination of these. Information from sensors is transmitted to control centers through the use of communications subsystems and processed by the IT subsystem. Border surveillance is based on mobile platforms and fixed platforms.

The integrated management of the border involves combining control mechanisms and the use of tools based on the flows of people traveling towards the EU and entering it. This requires actions to be taken at Member States' consulates located in third countries, measures taken in cooperation with neighbor countries, measures taken at the actual border and measures taken within the Schengen area.

Third country nationals who need a visa for short-term are checked in the *Visa Information System* (the VIS), which will be fully operational as early as 2012, inclusive at consulates and border crossing points.

The European Parliament and the E.U Council have reached a political agreement on the legal basis of the VIS. Its formal adoption was expected in the first half of 2008[3]. The main objectives of the VIS are to check at entrance the authenticity of the visa and the identity of its holder.

Given the progress in terms of reaching an agreement on visa information system and its release, the EU should establish a system of *input / output* for all third country nationals who were allowed short-term stay. This requires changes in the *Schengen Borders Code* to ensure the systematic recording of data input and output in all external crossing points and the inclusion of biometric recognition elements at borders for nationals of third countries who do not need a visa as a compulsory entry condition. Furthermore, if the registered traveler program is implemented, the Schengen Borders Code should allow for a simplified control of travelers who have been granted this status.

The Emergency Ordinance no. 102 of 14 July 2005 on free circulation in Romania of citizens of EU Member States and The European Economic Area, sets the conditions under which EU citizens and Member States of The European Economic Area and their family members may exercise their right of free circulation, residence and permanent residence in Romania, as well as limits on the exercise of these rights for reasons of public order, national security or public health[4].

The measures for the prevention of illegal migration and cross-border crime must be continued within the EU Member Area through enhanced searches, control and surveillance based on information in accordance with the national law, where possible based on police cooperation agreements.

Given the fact that problems of migration and crime are not subject to geographical restrictions, international trafficking routes should become in the future the main areas of activity for national police force according to its own law. Wherever the adopted policy and the national security requires, E.U Member States can adopt for a limited time, an appropriate inspection of the internal borders. In this regard the border *control and border surveillance activities* are defined.

Border control means controls carried out in the established crossing points and border surveillance represents the monitoring activity between border crossing points done with systems and special policies.

The control of individuals shall include not only verification of travel documents and other documents relating to entry, residence, work and quit but also checks for detecting and preventing threats to national security and public policy of the Schengen States. Such controls will be applied to vehicles and objects in the possession of persons crossing the border.

Border crossing control implies ensuring the control at border crossing of persons and property that they possess, as well as over the

means of transportation. This includes the mobile control of border crossing points such as harbors, railways and in the area of competence of the RBP. To achieve this objective, IT subsystems will be used, available as an online subsystem for all institutions responsible for border management, based on open systems standards to achieve the interconnection of the IT systems used by these institutions and with international IT systems.

The IT system of the R.B.P. supports the institutions in fulfilling their duties when it is relevant to combat cross-border crime, illegal migration and identifying the persons and goods wanted - for example, it provide access to information in the NIS system, compatible with SIS II, for checking in normal controls cases, border crossing controls and others, offering both levels of command and execution the information necessary for the management of events relating to the control and supervision of the state border of Romania[5].

The mobility of the actions involves the land-naval-air platform that will be used for the border security system and includes all transport modes that are destined for surveillance and intervention at the state border. This ensures surveillance and patrol, transportation of forces and equipment for intervention, operational transportation between different operational structures and logistical transportation for supplies and maintenance. The terrestrial mobility, naval mobility and the aerial mobility are components of the subsystem.

Sources of funding for the implementation of the National Strategy can be: State budget funds, community funds from the EU financial grants projects, funds from co-financing provided by the Romanian state along with EU states, loans guaranteed by the Romanian Government; funds allocated through the Schengen Facility; external loans which do not involve governmental guarantees, donations and sponsorships offered / accepted in accordance with the law; other sources.

The general strategy center of the border is represented by the functional management of the border that consists of control and border surveillance based on risk analysis. Article 6 of the Schengen Convention clearly establishes the implementation of the Common Manual, the two documents being complementary. The essential elements of border management are: all persons crossing external borders are to be checked systematically; border monitoring is done between checkpoints. In this regard, measures are necessary to be taken in order to ensure international security and to prevent illegal migration.

The adoption of a clear legislation in the *border management domain* is needed, such as: border law and data protection law. Likewise, regarding infrastructure, insurance of appropriate structures is necessary in order to carry out border checks and surveillance. The official persons that have these tasks have to be professionals and to have a specialized training. Furthermore, adequate human resources are needed. Specific applications depend on a series of factors (geographical location, volume of border traffic, etc..). In addition, it is necessary to have a clear concept of training and specialized skills related to practice, knowledge of legislation, foreign languages, etc.. Also an equipment that must correspond to the border situation is necessary.

Functioning internal coordination is needed at all levels (authorities that are responsible for different tasks, elimination of "black holes" of competence). Exchange of information between competent authorities (border police, customs, police, judicial authorities, prosecutors) is essential, including a mechanism for solving potential disputes between authorities on jurisdiction. In addition, operational issues are to

be taken into account(for example: the use of compatible communications equipment).

2. The alignment of Romania's principles, objectives, pathways and border security measures to the community

The need for Romanian border security is determined by the growth in size and complexity of cross-border crime, the internationalization of organized crime phenomenon and the conditions favoring their existence by the persistence of the economic crisis, social conflict and by the proliferation of terrorist actions in some states neighboring Romania or in the world.

Securing the border of the state, requires the effective participation of all state bodies and organizations with responsibilities at the border in order to achieve an integrated border management, compatible with community practices and it represents a system of measures, actions and activities at central and local level that ensure border security, maintenance of the normal, developing a safe and smooth control at the crossing of borders and the protection of the interests of the Romanian state in its relations with neighboring states, etc[6].

The measures of border security of the Romanian state, coincide with the period of training of the preconditions for becoming a party to the *Schengen Agreement* aiming to strengthen operational capacities, the specific activity of the R.B.P and inter-operability with those of national institutions with attributions at the border, with similar structures in EU member states and neighboring countries to counteract illegal cross-border facts, in the streamlining of legal passage conditions of people and goods across the border.

Currently, border security has become one of the most urgent problems of Romania as globalization requires expansion of the boundaries between countries of the world with the involved risks and consequences. Taking this into account, global liberalization of free circulation creates the premises for the development of cross-border crime, from small smugglers to large networks of organized crime and terrorist networks more than feared. These facts found in full contrast, oblige to the implementation of an integrated border security that ensures, on the one hand, free circulation for honest citizens and the *hermetic sealing of borders* for citizens outside the law.

Within the R.B.P., an institution directly responsible for border security (border control and surveillance), conceptual clarifications were initiated which led to concrete measures for ensuring the integration of legislative, organizational, operational, logistical support, human resource management, both inside and outside, with national institutions with attributions at the border with neighboring countries, European countries and other countries, placing in the forefront national specificity, but combining harmoniously achievements at national, European, regional and global levels.

The fundamental objectives, perceived through the implementation of *the integrated border security system* and in the perspective of effectively combating cross-border crime are: achieving and improving the legal and administrative planning and operational coordination, consistent and coherent, at a national and local level of the cross-border phenomena; regulation by law of the framework of cooperation between national institutions with responsibilities in the Romanian integrated border management domain; the tight integration and unitary coordination of the tasks carried out at the border and of those carried out by other authorities within the national territory, full harmonization of national legislation specific to the EU border protection acquis, migration and asylum; completion of the development of administrative capacity of institutions with responsibilities at the border through appropriate specific unitary training of human resources; achievement of proper infrastructure at the border, complete communications subsystems, information technology, surveillance and control adapted to the specific of borders (terrestrial, aerial, maritime)and the providing of interconnection and interfacing equipment required in an integrated system; progressive implementation of specific procedures for border protection, migration and asylum, the appropriate harmonization of internal normative acts with the community acquis; enhancing international cooperation on border management with member states, neighboring countries as

well as other countries; implementation and effective use of an effective mechanism of monitoring and evaluation of the integrated border management at all levels.

In line with EU requirements to achieve the objectives set forth is urgent to achieve a *consistent and coherent policy regarding the integrated border management* based on: a common mechanism for coordination and operational cooperation; common integrated risk analysis; human resources unitarily prepared and inter-operational equipment; legislative harmonization; efforts of all institutions. Carrying out these actions aims to strengthen operational capacities for specific activity of the PFR and inter-operability with those of national institutions with attributions at the border, with similar structures in EU member states and neighboring countries, to counteract illegal cross-border facts, under legal conditions of streamlining the crossing of people and goods across the border.

The structures of the R.B.P act in a delimited social environment, providing public services in order to meet the needs of national and European taxpayers, therefore the structures are sensitive to their reactions. In the modern vision the R.B.P carries out its tasks in an integrated system. Integrated systems, *systems of systems* or *families of systems* are determined by the complexity and magnitude of the environmental factors, such as cross-border organized crime.

Integrated systems have evolved following the steps specific to independent and interoperable systems. From this perspective of approach it results that border police structures act in an integrated framework inside them first, second in the national cooperation framework with other institutions with attributions at the border, but also in the international framework with similar structures from neighboring countries, EU countries and other countries;. The aim of this integrated cooperation is to combat. organized crime, which has become increasingly complex and difficult to combat.

Integrated system for border security is part of a complex systems category and it represents an ordered set of processes and elements characterized by numerous interconnections and interactions capable to meet the primary objective - the Romanian state border security. It is a complex cybernetic system, characterized by multiple components interconnected through numerous channels of information able to meet the new challenges of the Romanian border security.

The guiding principles of the integrated system are: forecasting; organization; coordination; control; evaluation; accountability; increase in efficiency; decentralization; cooperation, harmonization and synchronization of joint activities of the R.B.P with national and international authorities with border attributions, to achieve and maintain a state of normalcy in the area of competence; continuity; legality, proportionality; objectivity; priority of preventive measures; approaching the community; professional competence and motivation of staff; respecting the rights and freedoms of human communication and transparency.

The main objective of the R.B.P is to provide surveillance and border control that meet the requirements of the community and starting early actions to meet as soon as possible preconditions for the application of the provisions of the Schengen acquis and getting into the Schengen space. In this respect it is necessary to perform an effective management that is necessary for the implementation of the objectives set through the National Strategy for the Integrated Border Management of State in 2010-2015. This includes the following ***directions of action***:

- application of internal legislation, specific to the RBP, in accordance with the EU acquis in the Justice and Home Affairs domain;

- application of the *Schengen Action Plan* modified in accordance with the Schengen acquis and that meets the deadlines laid;
- implementation and modification, as appropriate, of the existing provisions on internal borders with provision of the Schengen Code, clarifying the concept of internal border, setting a schedule and procedures for the entry into force of measures related to the elimination of internal border controls in accordance with the timetable for Schengen accession, removing any references to bilateral agreements and clarifying the situation of terrestrial and / or fluvial temporary border crossing points;
- elaboration of the needed documents and the initiation necessary for the steps for the negotiation and conclusion of treaties, agreements, conventions, protocols and agreements concerning the the state border of Romania, its legal status, border police cooperation, the movement of persons in EU context;
- application of the Schengen Borders Code and of the Regulation no. 562/2006 of the European Parliament and of the Council of 15.03.2006, concerning the creation of a Community Code on the rules governing the free circulation of persons;
- ensuring an appropriate infrastructure appropriate for preventing and combating illegal migration, cross border crime or any violation of the legal regime of state borders;
- implementing the best practices for combating illegal migration and cross-border crime by using the latest equipment;
- intensification of activities regarding data exchange with foreign and domestic partners under the MATRA program, the working groups TRIDENT and REFLEX and the European Agency for the Management of Operational Cooperation at the External Borders of the EU;
- development and use of the network of bureaus, centers and contact points;
- increasing the role of international transporters in preventing the illegal entry / exit to / from Romania of the citizens of third countries;
- supporting institutions with competences in international transport;
- improvement of their staff training in order to discover counterfeit documents and visas, in accordance with the practices of Member States;
- conducting periodic risk assessments and adopting effective measures to eliminate the risk of transporting persons without valid documents.

In the context of ongoing efforts for the security of national borders and achievement of *measures on legal traffic flow of persons and goods at the border*[7], Romania aims to implement the best practices of the EU by applying specific methodologies in order to support completion of the task of external border controls, by reducing the information-decision-action cycle (elimination of procrastinations, delays, bureaucracy and indecision).

The Schengen catalog describes the general agreement of border management as a whole and uses the term risk analysis as a tool for optimization of border management and as a reliable way to provide information on the state border. In this respect the management of the integrated risk should be part of the strategy of each institution with responsibilities at the border, so that the taking of strategic decisions should lead to the achievement of the overall national objectives on the line of security.

Achieving the objectives laid down above should lead to: preparation of policies and strategies to combat illegal migration, initiation and optimization operative measures, tactical and strategic cross-border crime combating; substantiation of the points of view necessary for the Romanian delegation participating in international profile events. However R.B.P. will follow the measures provided for in the *Government Decision* no. 231 of 30 March 2005 approving the National Anticorruption Strategy and Action Plan for implementation of the National Anticorruption Strategy, aiming to achieve the following ***objectives***:
- design and identification of working tools able to identify risks that generate or facilitate corruption of the RBP staff and efficient management of information obtained; reviewing internal control tools and investigations to improve the monitoring activities of risk factors that generate or facilitate corruption in the RBP staff;
- design tools to prevent corruption among own personnel and in the disciplinary management; reducing the risk of entry and retention in the system of prone to corruption

or corrupt staff by providing recruitment and selection practices in accordance with legal rules, orders and instructions into force, implementation and monitoring at the level of RBP of the measures designed to prevent violations by border guards of the rules governing the conduct and corruption; boosting staff for outstanding achievements by providing rewards;

- attracting the civil society in managing anti-corruption measures adopted at the level of the RBP by designing and implementing tools to increase transparency of the activities that generate corruption among staff;

In conclusion, the purpose of these goals is to establish policies, principles and objectives towards common, consistent and efficient management of the state border of Romania, in line with the EU requirements, which ensures increasing the security of citizens , respecting their fundamental rights and freedoms, streamlining the flow of legal traffic of people and goods at the border and fulfilling, as soon as possible, the conditions necessary for applying the Schengen acquis and for getting into the Schengen space.

BIBLIOGRAPHY

1. DECISION no. 324 of 28 March 2007, approving the National Strategy for integrated border management of the Romanian state in the 2007-2010
2. "Frontiera" Magazine no. 6 to 7/2007 published by the Border Police, Bucharest, 2007.
3. G.O. 104/2001 and G.O. 105/2001 regarding the state border of Romania, Bucharest, 2001.
4. National Security Strategy of Romania, European Romania, Euro-Atlantic Romania, for a better life in a democratic, more secure and prosperous, Bucharest, 2007.
5. O.U.G. nr. 102 din 14.07.2005 privind libera circulație pe teritoriul României a cetățenilor statelor membre ale Uniunii Europene şi spatiului unic European.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

PROFESSIONAL TRAINING OF ANTITERRORIST AND COUNTERTERRORIST FIGHTERS

Ovidiu MOŞOIU*, Adrian CASIAN**

*"Henri Coanda" Air Force Academy, Brasov, Romania, ** IGPF, drd of „Carol I" National Defense University, Bucharest, Romania

Abstract: *The process of training anti-terrorist fighters harmoniously blends training, development, skills improvement, abilities and specific battle skills with the relentless training and development of the capacity to overcome difficult situations with intense demands. The possibility to prepare in order to overcome the unknown is synonymous in battle with mental strength.*

Keywords: *professional training, general military training, military performance, military profession skills, counterterrorist fighters, counterterrorism group.*

By repeatedly overcoming difficulties, the fighter realizes that problems without any solution are rare. He feels and is aware of the fact that by overcoming difficulties he has gained more encouragement, energy, patience, speed of execution, smoothness of movement, strength, perspective, intellectual ability, higher availability for complex actions, more courage and boldness, and better knowledge of self and comrades. In this sense, the training and instructing of counterterrorist fighters is done in specially designed firerange, where the tactical field and the stresses under which they work are very similar to those that may be encountered during operational missions.

1. Fighter training - Each fighter must be aware of his individual value, the value of his teammates, his team leader value and the value of the entire team. Fear of the unknown can be conquered only by the feeling of superiority next to a potential enemy. For this reason, general military training, the level of special training and the performance rates of each special forces fighter should not be less than very good.

Normally, the conduct of ordinary people found in extreme situations can be quantified as follows: 10 to 15% keep their capacity to act, 70-80% have a limited combat capability and 10% are practically paralyzed or act chaotic. While an army of masses can afford the luxury to throw in fight such soldiers, admitting that 25-35% of losses will be caused by combat stress and the stress within the battle, for the special forces, who are numerically smaller, these numbers can not be taken into account. Each fighter in these structures is mandatory, subject to overcoming stress factors which incapacitate military performance. This can be done by being able to surmount: fear of the unknown, the waiting, an instant threat or a surprise attack, by having the capacity to deal with the responsibility towards himself and towards his comrades, by resisting fluctuations of tempo and the inhibitory uncertainty, and by managing to

overcome the obsession that failure could mean pain, disgrace or death.

If in ordinary military structures every soldier receives a qualification and is trained rather after a method that resembles with prefabrication and after that he is discarded and lost in a inhomogeneous mass of soldiers similar to him, while for professional elite fighters things are totally different. His professional training includes in addition to traditional training categories of any military (firing instruction, physical training, sanitary training, topography, protection against weapons of mass destruction, camouflaging, etc.) - but which have a different composition, emphasizing specific aspects of the counterterrorism fight - a special training involving: solid knowledge of pyrotechnics, communications, patent in parachuting, diving and climbing, technical and automobile training , specific psychological training, knowledge of foreign languages, knowledge regarding the psychological warfare .

The product of such a complex and complete training clearly resembles with a war machine. Thus, counterterrorist fighters are trained and prepared to become specialists in hand to hand combat, elite snipers with weapons from their own endowment and that of potential adversaries, owners of solid knowledge of pyrotechnics, technical communications, topography, notions of first aid, capable of driving different types of vehicles and even to fly aircraft, masters in camouflage and dissimulation, speakers of foreign languages and capable to get by in an environment different from those already experienced. Their preparation and training in general, is based on two precepts beloved by the instructors and commanders of these special structures*: more sweat in training will make less blood flow in battle and what does not kill you will certainly strengthen you*.

Through the practice of such complex and almost real situations, it is intended to form the skills and capabilities of the counterterrorist fighters as well as his psychophysical hardening, emphasizing in particular the ***following dimensions***:

- Keeping calm and self-control in complex and difficult situations when the fighter is requested simultaneously from different directions, when events take place fast, when "terrorists" have been able to achieve the surprise;
- Ability to shoot accurately from all positions, in any conditions of time or season, standing or moving, rested or after intense efforts, by direct aiming or no aiming on fixed targets that appear and disappear, or on targets that move at different speeds and angles;
- Ability to shoot accurately from vehicles that are still or moving or from helicopters at a height that allows an effective shooting against targets;
- Bearing the effects of cold, heat and dust, vibration, rain, smoke, unpleasant odors and other stress factors;
- The courage to show initiative in situations in which it can not receive orders, when there is no direct contact with comrades or the direct head;
- Resistance to momentary or prolonged physical effort;
- Ability to operate effectively in conditions of deprivation of sleep, water, food and even in the case of some nearby explosion;
- Bearing long loneliness, darkness, screams of the wounded, without losing the ability to act;
- Learning to work quietly in the dark or light;
- Development of the spirit of brotherhood, team, self-help and mutual trust between the group members (team);
- Learning to act rationally, calmly, and to take responsibility;
- Courage to save people in difficult places and to provide first aid;
- The skill to put into service and effectively use unknown firearms;
- The determination to fulfill the received mission, even in minimum conditions of success;
- Long patience while waiting for an delayed event to occur;
- Mobile attention, concentrated, with a large volume, with a wide field of view, stable in the presence of strong disturbance;
- Guidance capacity in complex buildings, with many floors and corridors, studied earlier after schemes, drawings, photographs, plans, models, oral reports, and early unstudied constructions;

- Ability to spontaneously notice and correctly use opportunities of housing available in the area in order to not be observed or fired at by terrorists;
- Targeting ability, during day or night, in open fields, plan or kneaded, in areas built or covered with vegetation;
- Good storage capacity of the spatial layout of objects and objectives in the field, changes in the setting of the landscape;
- Ability to recognize from crowds individuals seen in photos, films and vice versa;
- Good memory of voices, noises and characteristic sounds, with professional significance (gunshot, emissions stations, etc..) as well as human figures and all that involves them (gestures, mimic, tics, etc.);
- Strict adherence to a plan of intervention for a particular objective, in the established time and fulfillment of the entrusted tasks during the mission;
- Ability to communicate non-verbally during missions when the situation does not allow for normal communication;

2. The training system - does not seek the creation of automatic features, as you might think but every fighter is constantly aware of every move he makes in order to discern and respond to any changes in the situation. Although in the acquisition of skills, abilities and in the formation of the psychophysical characteristics mentioned above, the fighter puts great emphasis on individual training while collective training and applications have a great importance. During these, especially in quarterly applications, the aim is to synchronize and to conjugate the efforts of the participating forces, and that is why the participation of all counterterrorism structure personnel is very important. Also, a real interest in the applications in which they are involved, in addition to counterterrorism forces, catch at other forces that participate directly in solving terrorist crises (police, gendarmes, firemen, etc..). Besides hot training of fighters, very important for training and testing reflexes and the ability to fire are simulated shootings, executed with devices specifically designed for this purpose.

A special preparation in the shooting domain is done with snipers. A great responsibility falls on the head of elite snipers during missions. Selected carefully between the experienced fighters, armed with special weapons, equipped with a very effective gear and sighting devices, these fighters are not allowed to fail. Along with their colleagues they do not know how to lose and they believe in only one way to end all that they undertake or make: to emerge victorious.

Even though approximately 35-40% of the counterterrorism fighter training program is occupied by shootings, however, the motto of these fighters training process requires the weapon to be the last thing that will be used.

A great emphasis in the education / training process is placed on trust. In essence, every counterterrorist fighter must trust in: his own physical and psychical capacity of effort, his level of military profession knowledge and skills, the subunit and unit to which he belongs, his commanders, the quality and performance of the armament and technique he is equipped with; the legitimacy of the received missions; his family. All this contributes to the formation of a strong moral support to the belief that the fighter should possess mastery, that he is the best, that nobody could resist him in direct confrontation. It should be pointed out the fact that some foreign special structures use unconventional methods along with traditional methods in the preparation / training of counterterrorist fighters. It comes to subliminal stimulation through short audible

and visual messaging, learning during sleep (especially on the background of "α" waves) and others.

While the preparation for war of such fighters is meant to be as complete as possible, it can be concluded that it will never be perfect. The important thing is to not lose sight of one basic fact, namely, that the fighter must be sure that what he learns and practices will be useful and will help him in battle.

The rapidity with which details of the problems change at the beginning of this millennium, influences one more than ever to think about how the future will look. And as the subject of the topic is the antiterrorist intervention fighter of our days, one can sincerely wonder whether today's image of the fighter will be valid over time, or whether his human qualities that serve him in his professional success today will be the requirements of tomorrow. One has the entitlement to ask himself the question mentioned earlier, because despite the explosion and diversity of new weapons and technology - which tempts one to look different at tomorrow's battlefield - one may amazingly find out that special forces fighting heads towards the First Wave[1] style instead of evolving. This is explained by their instruction, which focuses on physical strength, unit cohesion -creating strong links between the members of each team - along with efficiency in close combat. And still, technology and future technology will change the fighting tactics of these special forces and the image of the battlefield.

With a number of collectors mounted on his protective helmet, the counterterrorist fighter of the future will receive information about the battlefield, the position of the enemy and commands transmitted from the command post. A camera, placed sideways on the headset will provide images taken in infrared on a small screen, as well as his commander provisions. Next to the bulletproof vest the fighter will have a computer capable of distinguishing between friends and foes, detecting possible chemical or biological weapons, mines placed on the field while indicating the position of the fighter during the combat. The future Counterterrorist fighter will be equipped with a computer and individual sensors for detecting, preventing and responding to threats in any situation. Such a warrior will have the following possibilities: to launch and order a small plane equipped with cameras and transmitters; to send to his commander an email and / or photos of the object with its GPS coordinates(Global Position System); to order firearms that can launch small devices in which flying beetles can be found in order to neutralize terrorists (scheduled to attack from angles and at different times) or computer viruses that can be implanted in the command(launch) circuits of the enemy's weaponry in order to destroy it when it is used[2].

In the anti-terrorist operation area, bacteria will be spread, bacteria which is programmed to attack metals and that has in its memory terrorists devices and that will make the terrorist devices unusable in a few hours. Also in the counterterrorist battle the use of psychologic weapons, synthetic telepathy, infrasound influence devices or the use of other unconventional weapons is not excluded. Even if these images briefly presented, may seem detached from a science fiction scenario, one should confess that the antiterrorist technique has passed long ago from ultra secret laboratory files into the firing fields.

3. The counterterrorist group - military groups, and these elite groups have been in the interest of specialists not only for the dynamic matter and its specific phenomena, but especially in terms of the efficiency and the effectiveness that the group must show in critical / tensioned moments. The counterterrorist group which is mainly based on formal criteria, is characterized by a less numerous composition (4-6 fighters). Group members are engaged in a joint activity and therefore, communication relations are mostly direct. This leads to a better mutual knowledge of its members, to the emergence of affective relations, norms and group processes. Once done, the cohesion provides a great unity of thinking and acting, contributing in large measure to the increase of the group's labor.

In building up counterterrorist groups there is a tendency towards achieving a high degree of cohesion. The selection of the fighters which are about to join a group is done in

accordance with the number of affinities and mutual rejections that each fighter accumulates[3]. Also, another principle taken into account when building these special groups, consists in achieving, whenever possible, consistency between formal leadership and natural management. In this way, the natural authority enjoyed by the leader will ensure a greater discipline, contributing directly to achieving better results in the activity and to the elimination of negative influences. However, the purely formal character of these groups predominates in the sense that institutionalized relations prevail over personal relationships.

The insurance of the counterterrorist group cohesion is done through the correct coordination and distribution of individual and collective tasks, by close emotional ties between its members and a deep attachment for the common cause. After integrating in the counterterrorist teams, fighters find out the true values of the body spirit. Mostly coming from a society more and more individualistic and pragmatic, fighters accepted among special forces discover the true meaning of compassion, mutual aid, fellowship, spirit of sacrifice, agreement and mutual respect. Only in these conditions the sense of personal importance can be developed in the relation with the membership group, because the fighters from special units are infused with the conviction that they are necessary, that other team members are relying on them, that they represent a gain for the common good of the structure to which they belong to. By respecting their colleagues, the fighters end up respecting each other, experiencing the feeling of self-realization, which is placed so high in the Pyramid of Maslow.

The most important feature of these groups is that they tend to react as a unified organism to all demands addressed to them This is revealed not only by the similarity between the group's functions and those of the individual (information functions, decision functions, response functions, self-control and adjustment functions, and certain peculiarities of character and personality) but also from the practical findings of the phenomenon. The quality of the counterterrorist military fighter requires a rigorous understanding and compliance of the military and moral conduct. Under the pressure of the opinion of the group, each fighter tends to conform to its internal rules. Therefore, the higher the standards are the better the individual performance will be. The morality of these fighters has not only a personal character, because deviations from it can cause great harm to the entire military environment, reflecting upon all those who wear the same uniform.

The morale of such groups is high, which means strong convictions about the justice of the common cause, complete confidence in the power of the group, firm faith in success, enthusiasm, courage and mobilization of all energy in joint actions. The morale is also proved by the compliance with the ethical rules and the building and supporting of the morale among the fighters, and it represents an important task for commanders and instructors[4].

Inside the counterterrorist group, the distribution of tasks and responsibilities is very clear and strict, depending on every status / role within it (squad leader, sniper, driver-fighter, etc.),each fighter being aware that in critical moments their survival will depend on the fulfillment of tasks .Shaping the attitudes and the opinions of the fighters, of these groups is made through methods that cover the entire collective, and less through methods that address individually to each fighter . in this sense the commanders and trainers of the counterterrorist forces know that facts are

more convincing than words, so they act according to this motto.

In conclusion, the anti-terrorist intervention fighter of tomorrow - warrior of the future - the mental and moral characteristics required to ensure the professional success will remain the same even if the fighter will be better equipped, better trained, more mobile, and will have an impressive logistical support , because true human qualities and military values are perennial. Moreover, its specific activity requires a special psychological assistance and training, with characteristics will be highlighted eventually.

BIBLIOGRAPHY

1. Alvin Toffler, *Război şi antirăzboi, Supraviețuirea în zorii secolului XXI*, Bucharest, Editura Antet, 1995.
2. Cindy C. Combs, *Terrorism in the Twenty-First Century,* New Jersey, Prentice Hall Publishing, 2003.
3. *Hamas şi Jihadul Islamic îşi reunesc forțele*, Adevărul, Monday 15th of December , 2003.
4. Jean-Luc Marret, *Tehnicile terorismului*, Bucharest, Editura Corint, 2002.
5. *International Encyclopedia of Terrorism*, 1997.
6. The National Security Strategy of Romania, 2007.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

COMPOSITES MATERIALS FOR AVIATION INDUSTRY

Roxana NEDELCU*, Pierrick REDON**

* Military Technical Academy, Bucharest, Romania, ** Paul Sabatier University, Toulouse, France

Abstract: *The paper presents the generality of the composite materials, in particular those used in the aviation industry. It is presented some aspects about their composition, properties, to their use by way their advantage and their manufacture.*

Keywords: *composite materials, fiber, matrix, composites manufacturing, recycling*

1. INTRODUCTION

Today there are over 50,000 different materials available to engineers to design and build everything around us. These materials can be classified into four major categories: metals, plastics, ceramics and composites. Each of these materials have characteristics that are their specific and their choice of application is based on these characteristic.

The industries of aeronautics have chosen to focus on a crucial point in the conception: design and manufacture of aircraft as light as possible while guaranteeing the safety of passages. Indeed over a plane is light it consumes less fuel, reduction of this consumption represents a major economic first order. He therefore had to find a material that combines light weight and high mechanical property capable of supporting the very high stresses which is subject aircraft during the flight.

Those thanks to this new way of designing that we could see appear in the 1960`s from a composite material in new airliners. Representing only 5% of the total weight in that early day, it now represents about 53% of the total weight of the Airbus A350 for example. The Figure 1 shows this evolution for the group Airbus Industry.

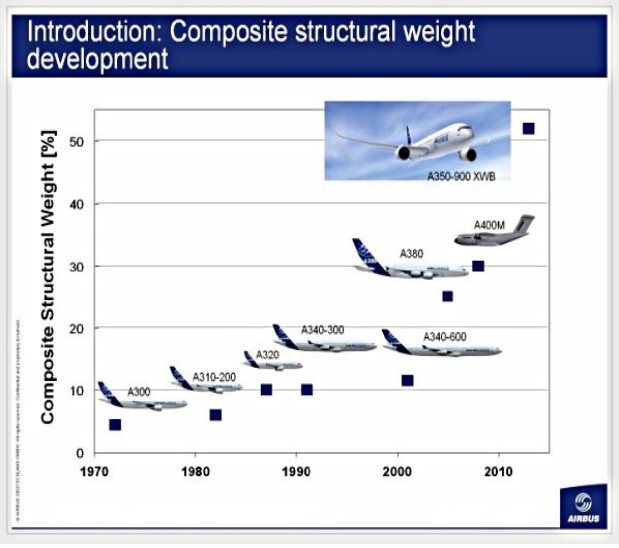


Fig.1 Proportion of composite in Airbus Aircraft [4]

2. COMPOSITES STRUCTURE DESIGN

A composite material is made by combining two or more materials to give a unique combination of properties. The above

definition is more general and can include metals alloys, plastic co-polymers, minerals and wood.

The main concept of a composite is that it contains matrix materials. Typically, composite material is formed by reinforcing fibers in a matrix resin as shown in figure 2.

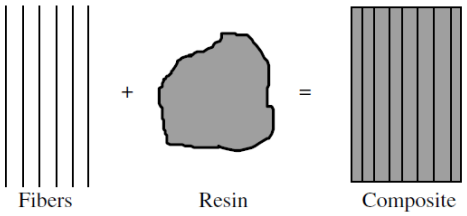


Fig. 2 Composite's components [3]

The reinforcements can be fibers, particulates, or whiskers, and the matrix materials can be metals, plastics or ceramics. The reinforcements can be made from polymers, ceramics and metals. The fiber can be continuous, long or short.

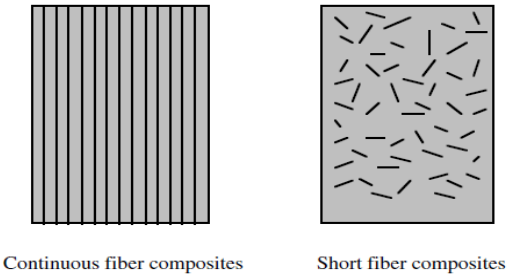


Fig. 3 Continuous or short fiber composite [3]

Composites made with a polymer matrix have become more common and are widely used in various industries. They can be thermoset or thermoplastic resins.

2.1 Fibers

The main functions of the fibers in a composite are:

- to carry the load. In a structural composite, 70 to 90% of the load is carried by fibers.
- to provide stiffness, strength, thermal stability, and other structural properties in the composites.
- to provide electrical conductivity or insulation (depending on the type of fiber used).

Table 1. Characteristics of fibers [5]

Renforts	Filament diameter (µm)	Density (kg.m^{-3})	Longitudinal modulus of elasticity (MPa)	Shear modulus (MPa)	Poisson's ratio	Tensile strength (MPa)	Elongation at break %	Coefficient of thermal expansion (°C^{-1})
	d	Mv	E	G	k	C_T	A	α
Glass E	16	2 600	74 000	30 000	0,25	2 500	3,5	$0,5*10^{-5}$
Glass R	10	2 500	86 000		0,2	3 200	4	$0,3*10^{-5}$
Carbon HM	6,5	1 800	390 000	20 000	0,35	2 500	0,6	$0,08*10^{-5}$
Carbon HR	7	1 750	230 000	50 000	0,3	3 200	1,3	$0,02*10^{-5}$
Kevlar 46	12	1 450	130 000	12 000	0,4	2 900	2,3	$-0,2*10^{-5}$
Boron	100	2 600	400 000			3 400	0,8	$0,4*10^{-5}$
Alumina silicate	10	2 600	200 000			3 000	1,5	
Polyethylene		960	100 000			3 000		

2.2 Matrix

The important functions of a matrix material include following:

- the matrix material blinds the fibers together and transfers the load to the fibers.
- the matrix isolates the fibers so that individual fibers can act separately. This stops or slows the propagation of a crack.
- the matrix provides protection to reinforcing fibers against chemical attack and mechanical damage.
- the matrix provides a good surface finish quality and aids in the production of net-shape or near-net-shape parts.

3. SPECIAL FEATURES OF COMPOSITES

Composites have been routinely designed and manufactured for applications in which high performance and light weight are needed.

They offer several advantages as we can see below:

- Composite materials provide capabilities for part integration. Several metallic components can be replaced by a single composite component.
- Composite materials have a high specific stiffness (stiffness-to-density ratio). Composite offer the stiffness of steel at one fifth the weight and equal

the stiffness of aluminum atone half the weight.

- The specific strength is much higher for composite materials. Steel and aluminum alloys exhibit good fatigue strength up to about 50% of their static strength. Unidirectional carbon/epoxy composites have good fatigue strength up to almost 90% of their static strength.
- Composite materials offer high corrosion resistance.
- Composite materials offer increased amounts of design flexibility.
- Complex parts, appearance, and special contours, which are sometimes not possible with metals, can be fabricated using composite materials without welding or riveting the separate. It offers greater manufacturing feasibility.

4. COMPOSITES MANUFACTURING PROCESS

There are four basic step involved in composites part fabrication. All composites manufacturing processes involve the same four steps, although they are accomplished in different ways.

4.1. Impregnation

In this step, fibers and resins are mixed together to form a lamina. In a hand lay-up process, prepregs that are already impregnated by the material supplier in a controlled environment are used. In a wet lay-up process, each fabric layer is wetted with resin using a squeezing roller for proper impregnation.

The purpose of this step is to make sure that the resin flows entirely around all fibers. Viscosity, surface tension and capillary action are the main parameters affecting the impregnation process.

4.2. Lay-up

In this step, composite laminates are formed by placing fiber resin mixture or prepregs at desired angles and at places where they are needed. The desired composite thickness is built up by placing various layers of the fiber and resin mixture. In a prepreg lay-up process, prepregs are laid at a specific fiber orientation, either manually or by machine.

The purpose of this step is to achieve the desired fiber architecture as dictated by the design. Performance of a composite structure relies heavily on fiber orientation and lay-up.

4.3. Consolidation

This step involves creating intimate contact between each layer of prepreg or lamina. This step ensures that all the entrapped air is removed between layers during processing. Consolidation of continuous fiber composites involves two important processes: resin flow through porous media and elastic fiber deformation.

4.4. Solidification

The last step is solidification, which may take less than a minute for thermoplastics or may take up to 120min for thermosets. Vacuum or pressure is maintained during this period. In thermoplastics, there is no chemical change during solidification and therefore solidification requires the least amount of time. In thermoplastics processing, the rate of solidification depends on the cooling rate of the process.

The above four step are common in thermoset as well as thermoplastics composites processing. The methods of applying heat and pressure, as well as creating a desired fiber distribution, are different for different manufacturing methods.

5. FABRICS

There are two major types of fabrics available in composites industry: woven fabrics and nonwoven (noncrimp) fabrics.

5.1. Woven fabrics

These fabrics are woven yarns, roving or tows in mat form in a single layer. Common weave styles are shown in following figures.

The amount of fiber in different directions is controlled by the weave pattern.

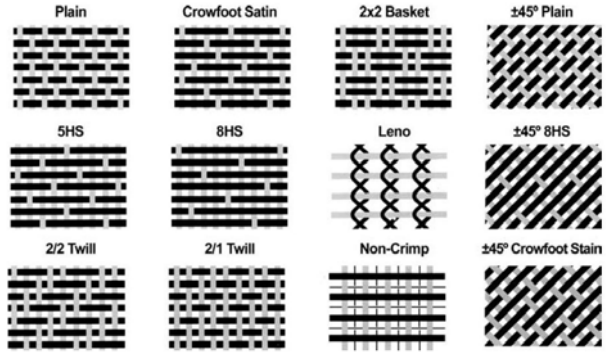


Fig. 4 Main woven fabrics [3]

5.2. Noncrimp fabrics

In noncrimp fabrics, yarns are placed parallel to each and then stitched together using polyester thread. Warp unidirectional fabric is used when fibers are needed in one direction only for instance, in stiffness-critical applications such as water ski applications where the fabric is laid along the length of the ski to improve resistance to bending.

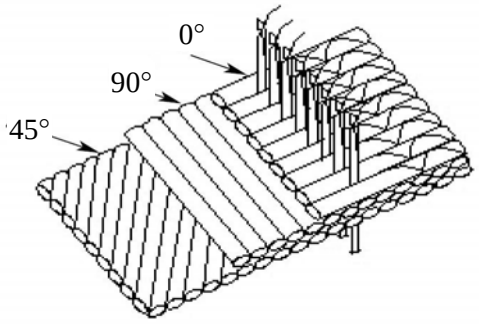


Fig. 5 Schematic of noncrimp fabrics [3]

6. MACHINING OF COMPOSITES

Composite materials offer the benefits of part integration and thus minimize the requirement for machining operations. However, machining operations cannot be completely avoided and most of the components have some degree of machining. Machining operations are extensively used in the aerospace industry.

Machining of metals is very common and is easily performed. However, the machining of composites poses many difficult very specific:

- Machining of composite creates discontinuity in the fiber and thus affects the performance of the part.
- The temperature during cutting should not exceed the cure temperature of the resin for thermoset composites to avoid material disintegration. Glass and Kevlar fibers have poor thermal conductivity and such high temperature may lead to localized heating and degradation.
- Machining exposes fibers to chemicals and moisture.

The tool used for the composite machining are the same who the tool used in metal machining.

7. JOINING OF COMPOSITE MATERIALS

In any product, there are generally several parts or components joined together to make the complete assembly. Parts are connected with each other to make the final product. The purpose of the joint is to transfer loads from one member to another, or to create relative motion between two members. Joints are usually avoided in a structure as good design policy. In any structure, a joint is the weaker area and most failures emanate from joints.

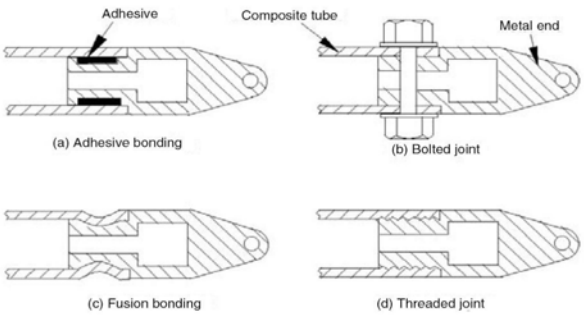


Fig. 6 Various types of joints for joining a metal end with a composite tube [3]

In adhesive bonding, two substrate materials are joined by some type of adhesive (epoxy, polyurethane or methyl acrylate). The parts

that are joined are called substrates or adherents. The most common type of joint is a single lap joint wherein the load is transferred from one substrate to another by shear stresses in the adhesive.

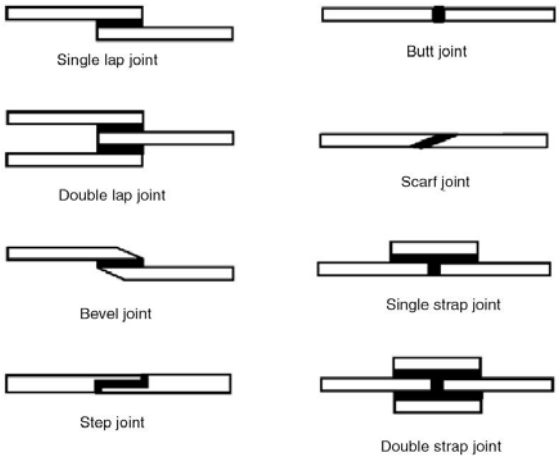


Fig. 7 Adhesive bonding [3]

8. RECYCLING OF COMPOSITE

With the increase in the use of composite materials in various industrial sectors, the scrap materials and composite waste parts cannot just be landfilled; instead, these need to be recycled for a better environment. Currently in many business sectors, composite wastes are landfilled with little regard for recovering fibers and plastics for future use. Governments and customers are becoming aware of the environmental pollution created by these materials and passing strict regulations for recycling of plastics and composites waste. Germany, England, France, Italy and other European countries have mandated that plastics and composites waste must be recycled.

There are several Categories of Dealing with Wastes of Composite materials as landfilling or burying, incineration and recycling.

8.1. Aerospace recycling infrastructure

At present, the most common method of scrap disposal is landfilling. Landfilling has been the most common way of handling waste. In this process, the waste is carried to a specific place and unloaded there. Because plastics and composites are not biodegradable, they cause environmental pollution. This method is becoming increasingly restricted by governments.

Several programs have started to enhance the recycling activities in aerospace industries. In France, TARMAC Aerospace is the first aircraft recycling company around the world. This firm is developing the PAMELA's project (Process for Advanced Management of End-of-Life Aircraft).

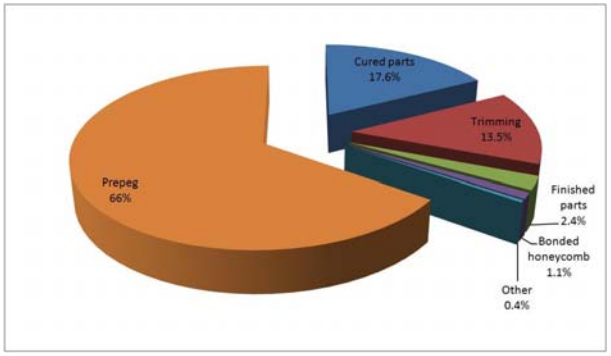


Fig. 8 Average distribution of composite wastes in aerospace industries [7]

9. CONCLUSIONS

There are many reasons for the growth in composite applications, but the primary impetus is that the products fabricated by composites are stronger and lighter. Today, the largest user of composite materials is the transportation industry.

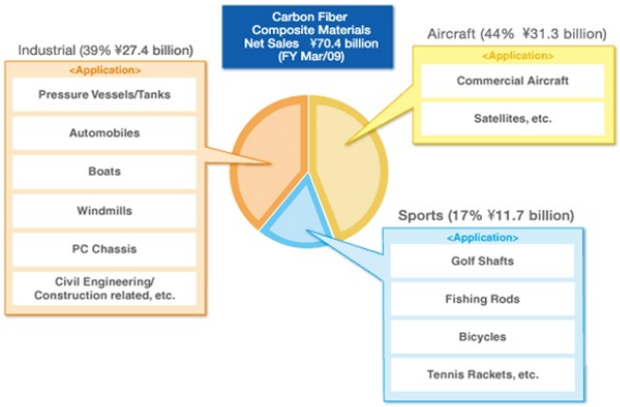


Fig. 9 Carbon fiber composite material's distribution all around the world according to Net Sales [6]

The aerospace industry was among the first to realize the benefits of composite materials. Airplanes, rockets and missiles all fly higher, faster and father with the help of composite.

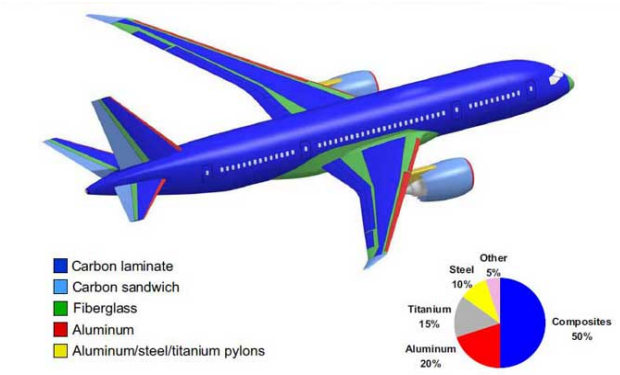


Fig. 10 Materials in the Boeing 787 [8]

Military aircrafts use composite materials to lower the weight of the structure. The composite components used are horizontal and vertical stabilizers, wing skins, fin boxes, flaps and various other structural components.

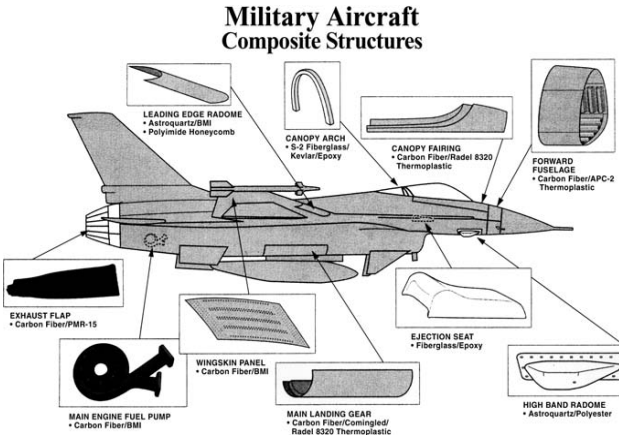


Fig. 11 Typical composite structures used in military aircraft [3]

REFERENCES

1. Fuiorea I., *"Composites materials. Mechanical response project"*, Military Technical Academy Publishing House, Bucharest, 1999;
2. Harper, A., Charles, Petrie, M., Edward *"Plastics materials and Processes. A Concise Encyclopedia"*, John Wiley & Sons, U.S.A., 2003;
3. Mazumdar, K., Sanjay, *"Composites Manufacturing – Materials, Product and Process Engineering"*, CRC Press LLC, U.S.A., 2002;
4. http://www.si.ens-cachan.fr
5. http://www.caraibesindustrie.com
6. http://www.toray.com
7. http://www.ce-mag.com
8. http://rescoll.fr

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

HOW POPULATION'S REDUCTION INFLUENCES ROMANIA'S SECURITY

Mihail ORZEAȚĂ
Air Force Academy "Henry Coanda"

Generally, population's reduction is caused by political, economic, social and natural factors. The profound cause of Romania's population reduction is the economic and moral crisis of the society!

The emigration of our countrymen that poses good skills, a high level of education and potential for development is beneficial for adoptive states. Those states will receive and fructify immigrants' ideas, solutions, services and products.

The Romania's political, economic and social situation may evolve from bad to worst because too many of us are engaged in personal battles – for positions, privileges, salaries etc. – instead of focusing our common efforts against our ,,common enemy" – crisis.

We should invest in the future considering "lessons learned", because a wise man learns from other's experience whilst someone that has low level of education is not able to learn even from his own experience.

Keywords: *emigrants, economic crisis, morale crisis, education, lessons learned, national security.*

1. How Different is Romania's Situation from other States' one?

According to some experts, period between 1870 and 1913 was the first stage of globalization. During that period the USA and some Latin-American countries registered an economic boom and they needed more workforce. So that they received about 60 million emigrants,[1] out of witch USA had 25 millions,[2] most of them from Europe. The emigration wave caused diminishing of indigenous salaries and growth of the inequity between locals' incomes. The period that followed year 1980 marked an intensification of globalization's rhythm and a growth of the emigration's flow, especially from Africa, Asia and Latin-America towards USA and Western Europe, because emigrant's destination countries were facing, like nowadays, a low rate of birth and a rising of ageing population.[3] The immigration was encouraged during Western Europe economic boom and also because some jobs were not attractive for indigenous population. Currently, "*the uncontrolled spectrum of immigration from Africa and Asia, spread fear inside of many westerners' hearts (...) People fear that their culture could be radically changed if they will receive a population possessing a different culture (...) they are afraid of labor force's increase (...) they are afraid also of and increasing criminal activity (...) and potential suicidal attackers will hide among honest immigrants*."[4]The author of the previous considerations believes that all these fears could be eliminated, if mankind will impose capital and pollution control simultaneously with elimination of immigration's barriers, because that measure will stimulate world's economies.[5] Additionally, the immigrants could be tempted to come back to their native countries once they do not have any problem to emigrate again there where they are better paid, according to their skills.

The world of 2004 counted 175 million immigrants and 20 million refugees[6], the most preferred destinations being Western Europe and the USA[7]

Generally, migration is caused by political, economic, social, natural and demographic factors. The most important causes of emigration are overpopulation, followed by poverty. Practically, the two causes permanently influence each other. Overpopulation has become one of the most urgent problems of the world. Many solutions that have been studied and implemented failed. Family planning implemented in China and India was not satisfactory. China decided to adopt the solution of birth control and to limit the number of children to one per family. India adopted the solution of sterilization[8] Despite such solutions, the population of the two countries continues to grow and represents nowadays almost 40% of the world's population. Most people live in the poorest countries of the world[9]. Thierry P. Millemann believes that "*the only solution for those populations would be death, war, to appropriate the neighboring countries' wealth or, more simply, emigration to salvation zones like developed countries*."[10]

Although globalization helps us to better communicate and to know each other, the so-called "local patriotism" still exists and some people are tempted to be reluctant or even to reject foreigners, especially immigrants. Immigrants are seen as unfair competitors for jobs and resources allocated from the central budgets of the states to local communities. Also, immigrants and even countrymen from other regions may interfere with, or even change local traditions, a situation considered unacceptable, especially by certain conservative communities.

Some politicians set themselves the goal of building a successful political carrier on the immigration issue. They were successful by promoting the integration of immigrants into western societies. Other politicians sustain the expulsion of immigrants, invoking the high rate of unemployment and the devastating effects of the economic-financial crisis. However, the situation is controversial and the most convincing example is the attitude of some western countries, especially France,[11] against gypsy population originated from Bulgaria and Romania.[12] The expulsion of Romanian and Bulgarian citizens from France leads to a Decision of Ministerial Committee of Europe, on the European Committee for Social Right's report from 29.06.2011. The Decision recalls France that Romania and Bulgaria are EU members so that their citizens have the rights to freely travel and work in any other UE member country.

In principle, I mean that considering the fundamental human rights, any immigrant needs assistance from the other state's authorities. It is a principle recognized by all UN member states. On the other hand, the social situation of local populations in all states, even in the developed ones, is rather difficult, because of economic and financial crisis, and so it will be necessary to include some additional criteria for judging the attitude of western countries' citizens. Many people have lost their jobs; the economic recession has created problems in all areas and the resources available for social programs have diminished dramatically. The need for domestic and foreign assistance is increasing and the allocated resources cannot cover all needs. These and other motivations, nurtured by extreme right parties,[13] have determined some ordinary citizens from European countries to sustain the idea of expelling illegal immigrants and refugees. Other westerners, usually the ones that sympathize with the left parties, appreciate that the solution is not the expulsion but the realistic policies to restart economy's growth and then immigrants as well the locals will have a chance to work. Right now, the riots and clashes in North-African and some Arab states have caused waves of refugees in Europe. The sympathetic attitude towards refugees is helpful but this is not a long term solution. Nobody knows when the struggles in North-African and Arab countries will come to an end. If one compares the situation in Kosovo (1999), Afghanistan (2001) and Iraq (2003) with the current one, then the possible conclusion is that the refugees as well as immigrants could stay for some decades in their adoptive countries. All this time, a few of them will probably get jobs to support themselves and their families, the others will live at the expense of the adoptive countries.

This situation will create tensions between locals and immigrants, and the extreme right parties will profit from it to gain more supporters and votes for the Parliaments of the states. Although it is less probable, it might not be so surprising if some elections promote extreme right parties in leading positions in some European countries. The prognosis is based on: the negative effects of the economic crisis; the apparently inefficient measures of the current governments; the ability of the extreme right parties to attract on their side the dissatisfaction of the citizens, and the growing number of refugees from North-Africa and Arab countries that put a supplementary burden on the European citizens, especially on the westerners.

All in all, immigrants will not be easily accepted because of the already mentioned reasons and also because of the differences between their culture and the locals' one. Unity in diversity sounds good in principle, but takes time to be really accepted and implemented, maybe more than we expect. At their turn, immigrants have many adaptation problems starting with communication, because they do not know the language of the adoptive country and have to learn it. The process of adaptation will be finalized when the immigrants will modify their concepts about life, I mean to erase the major differences between their and locals' culture as well as behavior. Many immigrants, especially their descendents, are forced to live between two cultures, i.e., the one they come with and the adoptive country's one. Sometimes they are rejected by both former countrymen and the ones from the adoptive country. Former countrymen consider them "contaminated" by the foreign culture, which in some countries is unacceptable, because differences come to conflict. For instance, if a Muslim changes his religion, he might be sentenced to death by his former religion members. The citizens of the adoptive country may not accept immigrants because they are not fully accustomed to the new rules, language, traditions, and so on. Some immigrants do not manage to fully integrate themselves into newly communities because their cultural heritage and the adoptive country's ethic as well as juridical norms cannot harmonize to each other, and then some choose the way of isolation into a sort of ghettoes or enclaves. These problems could be speculated by organized crime and terrorist organizations that will give incentives to immigrants to enroll in these organizations in order to gain resources to live in better conditions and to revenge against those who would not accept them as equals inside the new societies. The immigrants' and the refugees' situation could be considered a "social bomb" for the entire mankind. Nobody knows when, where and how it will explode. The solution is not to accept and integrate numerous immigrants, but to help them live in better conditions in their own countries. That is to say, developed countries – which are the most preferred destination for the immigrants – have to invest in developing and underdeveloped countries to create jobs, to increase the level of education and health care, and to democratize their societies.

2. Romania' Population Is Diminished by the Emigration

The EU experts that work for Romanian institutions earn more money for a working day than any Romanian expert or official for an entire month.[14] This situation generates frustration among indigenes and stimulates them to emigrate in order to be paid at EU experts' level. Approximately 11% of Romania's citizens would like to emigrate, a Gallup poll from 2010 revealed. This percentage is equal with the Irish one and places Romania and Ireland on 8th place

among EU member states. Spain and Portugal are the first with 15% of their citizens willing to emigrate, followed by Hungary and Luxembourg with 13% and Bulgaria and Lithuania with 12%.[15] There are no statistics about nationality of the Romania's citizens that would like to emigrate but historian Viorel Achim believes that the gypsies will emigrate massively during the next years[16] An World Bank report tells us that 2,77 million Romanian citizens had emigrated between 1990 and nowadays, most of them towards Spain, Italy, Hungary, Israel, USA, Canada, Austria, France and Great Britain.[17]

I think that most of those people that emigrate, no matter their level of education, have no willing to fight against life's burden and do not truly love their country. They seem to be guided by the dictum "my country is there where I feel good." Usually they would like to have a good and easy life. Also, they seem to think that having money means to escape from all the problems. Perhaps they live under the auspices of the dictum "*money makes everything*."[18] Some of the emigrants might realize that they were wrong and then may appear the desire to return home country but proud and shame may stop this feeling. So that emigrants from this category will remain with nostalgia of some beautiful memories which could be revealed from time to time to their friends or family members. What a pity that some people that emigrated do not makes difference between country's leadership and people of the country as did many emigrants that leaved Romania before 1989. They may blame country, trying to justify their decision to everybody that listen to them or read their written opinions, pretending that their native country does not merit them. In the end, the most active emigrants that blame Romania will fail in their trap and will believe their lies. Something similar happened to Stalin before World War II when he order to NKVD to set up a story of betrayal to his Marshal Thukacevsky and finally he believed the fake story and sentenced to death the marshal.

Quite many Romanians emigrate under the influence of friends and relatives, attracted by the mirage of a better life. Those people usually belong to the category that leave themselves at the mercy of life and sometimes manage to find the Promised Land and another time fails into mediocrity and oblivion.

Valuable Romanians that decided to leave the country do not have enough patience to wait and fight until their value is fully recognized by the society. Also, their decision could be influenced by the labor force market from Romania that is not too generous and does not offer many options for somebody looking for a better job.[19] People belonging to this category are eager for change, also they have ideas and intellectual resources for implementing them. Unfortunately bureaucracy and tendencies of some individuals to steal their ideas or to benefit unilaterally from their creativity, make them choose the emigration way, hoping that the world from "beyond the borders," usually the Occident is ruled by the law and discrimination dos not exist. Soon they will discover that perfect society does not exist and will adapt to newly societies and manage to succeed. Some of them, not very many so far, desire to return to Romania aiming to change her into a better society. Those performing people could be the nuclei that might gather nation's positive and creative energies that lead to hers rebirth.

3. The Causes of Romanian Citizens' Emigration

The real and profound cause of Romanian citizens' emigration is the morale crisis of the society! It seems to me that many of our countrymen have kept in their minds just a part of the education process namely the one dealing with citizens' rights. I have this perception because too many of our countrymen seem to be concerned about their rights and interests, both individual and group ones, and do not care too much of learning how to produce goods, services and solutions for our common future. I do believe that this attitude reflects well the real quality of Romania's education. How else could we assess the education's level whilst 53% of the high schools' graduates manage to pass the baccalaureate exam in 2011?[20] What could

we say about morale quality of the teachers that had sex with their minor students? [21]. What can we say about Romanian pupils that did not manage to successfully accomplish the tests for „Progress in International Reading Literacy – PIRLS,"[22] causing the undesired 36th rank out of 45 participant states? It seems that the situation of education is similar in some other countries because people are disappointed that many pupils "*do not know to read but know very well how to kiss.*"[23] Unfortunately, the young generation's mentors consist on schools' teachers as well as street itself. The street is so many times populated with protesters from all political orientations, including schools' teachers. It is their right! However, it seem to me that most of us were thought how to protest and do not care too much about the others that live next to us to whom we suppose to harmonize our rights. Strike is, or it should be an extreme form of protest against injustice, in order to push those people empowered to take appropriate measures for eliminating malfunctions, abuses, and any type of discrimination. During last period of time protests chained, especially those so-called "spontaneous," aiming to solve some existing problems. What a pity that these actions too often neglect other citizens' rights. The protesters seem not to care too much that other citizens suffer and, more than that, those citizens cannot contribute in any way to solving protesters problems. So what! Some people like to show up on TV or in newspapers and who knows they might be noticed and may manage to change the position of protester to one of a decision-maker. There are quite many precedents and I do not think that those practices will be stopped soon. People's concern for their public image seems to be a trend of our times, launched by western experts in public relations. Those experts managed to transform someone that was nobody into a celebrity.[24] In Romania there are people characterized as "*without high intellectual and moral statue*,"[25] but managed to impose themselves by numerous show ups on TV and speeches in public meetings. More and more people look interested in building an image from words, especially in TV programs. The urge of "*pretend to work*,"[26] addressed by a "colleague" to another one in a TV program from December 1989, is contagious for more Romanian citizens. Everybody wants to earn more money and to have a better life, but I do think that it is decent to assess our desires in accordance with legal and morale norms of the society.

Some experts with international recognition pointed out that greedy and lack of prudence are the most important causes of the global economic and financial crisis. Despite of this conclusion, it seems that "the diagnosis" did not have a strong echo among Romanian citizens. Corruption and fiscal evasion, estimated by competent authorities from Romania and EU at 42% from GDP,[27] makes national budget poorer and so the necessary resources for developing educational, infrastructural, and health care as well as the ones meant to create new jobs does not exist. Most of us complain that there is not economic growth but society does not take appropriate measures for stopping illegal business such as sealing cigarettes, false fiscal papers and other sort of merchandise provided by the smugglers. They do this illegal activity almost everywhere: in markets; in common transportations vehicles; at the streets corners etc. and make profit without any taxes. We criticize others but do not care too much about own behavior. We laugh even about unfortunate situations hoping to pass them easily and so the "garbage" is put under carpet, instead of taking measures to eliminate any custom that hurt us as well as

the other that expect from us to be role models.

4. God Helps Us but … Does Not Put Anything in our Bag!

I do believe that economic and financial crisis is not correctly approached, from morale point of view. It seems to me that too many countrymen are engaged in personal battles – for social positions, for salaries and privileges[28] - which mean that they do not understand that crisis termination is more beneficial for everybody. In other words, we fight against each other worsening the society vulnerability, meaning that the negative effects of the economic recession are prolonged too much, instead of coordinating our efforts to fight against the "common enemy" – crisis itself.

I hope to be wrong but I have the feeling that many of our countrymen wait for EU help because a poll initiated by ziare.com, between 31.10.2011-08.11.2011, and having corruption as the main topic, revealed that 13.63% of the participants declared that corruption in Romania could be stopped only with the EU intervention, whilst 36.25% believe that this pledge could be eliminated only with the participation of all country's citizens.[29] The results of the above mentioned poll confirm some of the opinions written by Alina Mungiu who think that Romanian citizens seem not to be capable of active engagement unless they have to act against one of their ethnic origins which differentiate himself by his attitude that is meant to force them to make efforts they do not want to perform.[30] From my point of view, I do think that EU will not help us more than we should help ourselves. It would be against logic and the spirit of free competition and initiative. It seems to me that those experts and politicians that negotiated the EU and NATO admission, as well as many Romanian citizens, have forgotten the awareness of the representatives of the two organizations: "There is no free lunch in this world!" The end of the crisis will be possible when we, as Danila Prepeleac -the popular character of one story written by Ion Creanga – will discover that "need teaches us," or, as our ancestors said "*When the poor strives, The God fills up his bag*."[31]

5. How Emigration Affects Romania's Security?

Negative influence against Romania's security could be accurate measured only during a study performed by a group of researches that will investigate the emigration for 4-5 years. I do not have precise data about the effects in all the dimensions of the security but I do think that emigration affects negatively Romania mainly: politically, diplomatically, economically, socially, psychologically and militarily.

5.1. The Effects within the Political and Diplomatic Dimensions of National Security

At international level, Romania's image is negatively affected because of massive emigration of hers citizens. The states that received immigrants from Romania are displeased that they have to spend more funds for social assistance of newcomers. More than that, quite many Romanian citizens are involved in crimes in their adoptive states and the authorities take hard measures. The most recent are the forced expulsion of the gypsies, having Bulgarian and Romanian citizenship, from France and Italy, as well as the extension of restrictions for hiring Romanian and Bulgarian citizens in Ireland, Great Britain, The Nederland and Belgium.[32] Although does not seem to be connection between emigration of the Bulgarians and Romanians and The Nederland's refuse to accept admission of the two countries into Schengen space, written press suggest that hers attitude is caused by the corruption as well as emigration flow from Romania and Bulgaria.[33]

Corruption and low economic efficiency are among the most important causes that make up the minds of many Romanian citizens to emigrate. Also, because of the same causes some international companies decided to relocate their production facilities from Romania to other states and, more than that it seems that foreigner investors are discouraged to start business in our country.

All in all, Romania's political leadership credibility is in a descendent trend at international level as a result of low efficiency of its solutions in macroeconomic terms. That is to say, the solutions adopted do not match the situations citizens, institutions and economic companies confront in real life.

Internally, the struggle between governing parties and the opposition's ones intensifies and may push the country into a political crisis. The rising of external debt, the negative tendency of living level and the uncertainty of economic recovery are the main issues that create divergence at political level. Political leadership is also blamed by an important part of the population because of its precarious economic and social situation. They believe that these are the main causes for many citizens to emigrate. It is the case for citizens with creative potential i.e. college and high school's students awarded at international Olympic contests for chemistry, mathematics, physics, informatics and so on, as well as people that won medals at innovative international contests. To all these above mentioned people that decided to emigrate we have to add some other categories that posses a very good skills such as physicists, engineers, scientific researchers etc. Emigration of all these people may reduce Romania's chances for economic recovery in the near future. I do think that there is a risk of some populist measures taken by the government in the year 2012 – which is an election one - in order to gain more votes by favoring short term solutions of improving social situation of poor citizens. In such a situation I believe that political leadership may postpone the country's evolution toward a negative tendency in political, economic and social terms.

5.2. Economic Effects of the Emigration against National Security

What looses Romania because hers citizens emigrate? In short term we will be poorer three times. First Romania will loose the benefits resulted from ideas, solutions, goods and services produced by the emigrants that will be "transferred" to their adoptive countries. Secondly, Romania will loose the investments in educating the emigrants because the investments will produce effects for their adoptive countries. Thirdly, Romania will loose time invested in educating and training emigrants, which is necessary for educating and training some other people at the level of the emigrants. So, paradoxically, Romania sponsored developed countries, and perhaps will continue to do it in the near future, because of its brain drain in the benefits of those countries.

Economic stagnation or low economic growth will keep down population's level of living and will amplify poor citizens' dissatisfaction. A nonperforming economy does not attract too many investors and those that assume risks of investing in a country with such an economy almost sure will ask for many incentives such as exemption for taxes and so on that will guarantee their high profits. In this case the budget incomes will be rather modest and there will not be enough money for funding social and economic projects such as improving health care and education, developing economy and creating new jobs and making armed defense more performing.

5.3. Social Effects of the Emigration against National Security

Most of the emigrants are adult, well educated, possess a good skills and they could contribute substantially to economic, morale and social recovery of the country if they will decide to work in Romania instead of

emigrating. Leaving the country, those emigrants will diminish hers chances for a rapid economic and social recovery. More than that, an extended economic decline, stagnation or an insignificant economic growth will raise number of the unemployed people that will increase budget's burden. Some of the unemployed people could be tempted by some dishonest investors to work illegally, in order to avoid fiscal taxes and to make important profits. The low level of education might be one of the main causes that justify the unemployed people's enrolment into criminal activities, individually or in different gangs that use to practice drugs, people and merchandises trafficking as well as money laundering, blackmail and fleecing private entrepreneurs. So that, those kind of people may contribute to rising of country's criminality level. Low level of living for majority of the people, as well as continuous reduction of resources allocated for population's social assistance may amplify protest activities both in number of protests as well as number of participants. The most likely participants in protest activities could be union's members and the poorest people. Protesters may ask for strong and efficient measures for recovering economy, eliminating corruption and improving education and health care. The increasing differences between have and have not people will contribute to diminishing social cohesion of the population as well as people's participation to the political life of the society. As a result of this complex situation it might be difficult to gain majority of the population's support for implementing important political measures that suppose to influence entire nation.

5.4. The Emigration Effects against Armed Defense of the Nation

Massive emigration of Romanian citizens, added to economic and financial crisis will cause negative effects for country's security within the armed defense as well as within all the other dimensions that support defense efforts – economy, finances, education, human resources management etc. The most significant consequences of Romanian citizens' emigration, especially of those that possess creative potential and highly qualification over the armed defense are the following:

- intensification of potential exodus of personnel from Armed Forces – especially the high qualified ones – towards other countries, other governmental structures and private sector that offer better salaries and benefits than Department of Defense (DoD);

-possible reduction in number and quality – from education level and personal competence point of view – of the candidates for military education institutions, and even of the volunteer because of uncertain carrier perspectives such as: job stability; existing jobs; professional development; less attractive salary than in another organizations and countries; high risks of the jobs etc.;

-partial reduction of the professional competence, both at individual as well as at the organization level, as a result of the high qualified people's exodus to other countries and because of scarce resources for performing training exercises in an appropriate number and complexity;

-unsafe level of security as well as incidents and accident likelihood rising during live exercises and activities with high pace, risk and complexity because of reducing in number of the highly trained personnel, especially the leading and combatant ones;

-increasing risk for diminishing the Armed Forces credibility as a whole, because of: the high likelihood not to accomplish NATO and E.U. standards and minimum military requirements for personnel;

-possible reduction in winning chance during live and simulated fights and firings because of reduction in number of the very skilful personnel;

-potential rising risk for failing to participate in Alliance's live exercises as a result of personnel's training level and skills which might be under the safety standards required by the organizers.

-possible reduction of the interoperability level with the allies and partners which may cause an amplified risk for failing to achieve the assumed commitments against UN, NATO, E.U.,

OSCE and other international organizations because of less than necessary fighters, staff officers as well as leaders with appropriate level of skills.

What have to be done?

Any crisis contains a positive part, if we are able to identify and fructify it. In this case, the positive part is the brutal weak up to the cruel reality and utilizing the nation's existing energies but not fructified or inefficiently used yet. More precisely, on short and medium term, the loss suffered trough emigration of our well educated and dynamic countrymen should aggravate economic, financial and morale crisis to the point which will make both decision-makers and ordinary people to understand that this course of action cannot be accepted any longer. Then, hopefully, as ultimate chance, decision-makers will take appropriate measures to use personal value, professional competence, integrity, responsibility and earnestly for eliminating corruption, imposture, politicians' chameleonic attitude and lack of responsibility. How far is that moment? It is hard to estimate but I do think that it may take at least a generation for rebuilding everything that was destroyed so frenzy within morale and education domains.

Education is hardly suffering. Many educators are too far from role models so that their pupils and students do not respect them, do not learn and train in accordance with the required norms. We should not be so amazed because "*school makes the man*"[34] – according to the teachers' value and behavior. How could we expect educators to teach their students or pupils common sense rules and respect for the norms, human values and laws, while they have sexual relationships with their minor pupils? It seems to me that education is a true Cinderella of the society despite the fact that majority of the prime-ministers and even a former president of the country were and are university professors. The most important decision is to rebuild education, having performance, integrity and science tendencies' evolution as its most important objectives. Science had always an important role in mankind's evolution but currently knowledge and information are the true power multipliers. People, organizations and nations that do not understand at the right time this truth and will not take correct measures for adapting to the mankind's evolution tendencies will not have any chance to win competition initiated by the globalization. The way for avoiding the decline of the society is competitively rising from individual to organization and community level by adequately preparing human resources at all the levels, from decision-makers to people that prepare and implement decisions. The solution is to invest in the future considering lessons learned because a wise people learn from other's experience, while a dummy does not learn from his own experience. The Americans discovered the concept of "smart nation,"[35] but I do think that we need a well educated nation which means that our citizens should have adequate level of knowledge, the required skills, integrity and will for fructifying knowledge at the appropriate level. I also think that we no longer need persons that promise, give opinions and solutions for everything, especially on TV programs, but when they are in charge they prove to be incompetent or inefficient.

No long time ago it was a belief that a wrong decision is better than lack of decision. Currently, this belief is no longer adequate and has to be removed because a wrong decision could cause a heavy burden for one or even more generations. Any decision based on voluntarism instead of real capabilities will have important negative effects. That is why society has to be continuously transformed in

accordance with mankind's evolution's tendencies in all the domains – political, economic, social, morale and military. This is the only way to keep viability of the society.

1. Guillermo de la Dehesa, *Învingători şi învinşi în globalizare*, Historia Press, Bucharest, 2007, p. 303.
2. Pierre Milza & Serge Berstein, *Istoria secolului XX*, volumul 1, All Press, Bucharest, 1998, p. 14.
3. Guillermo de la Dehesa, *Învingători şi învinşi în globalizare*, p. 302.
4. Robert van de Weyer, *Islamul şi Occidentul – o nouă ordine politică şi religioasă după 11 septembrie*, Allfa Press, Bucharest, 2001, p. 86.
5. *Ibidem,* p. 95.
6. Moises Naim, *Illicit*, Anchor Books, New York, 2005, p. 89.
7. Jean-Claude Berthelemy, Monica Beuran & Mathilde Maurel, *Aid and Migration: Substitute or Complements? Global Patterns and European Perspective,* in: *The Romanian Economic Journal*, Academy of Economic Studies Press, Bucharest 22-24 November 2007, p. 53.
8. Thierry P. Millemann, *La face cachée du monde occidental (The Hidden Face of the Western World)*, Pro Editură and Tipografie Press, Bucharest, 2008, p.19.
9. David Bender and Bruno Leone (eds.), *21st Century Earth, Opposing Viewpoints Collection*, Greenhaven Press Inc., San Diego, California, SUA, 1996, pp. 21-22.
10. Thierry P. Millemann, *The Hidden Face of the Western World*, p. 22.
11. Sebastian Moffett, *France Expels Groups of Gypsies to Romania*, in *Wall Street Journal*, 20 August 2010, http://online.wsj.com/article/SB10000 14240 , accessed on 26.12.2011.
12. xxx, *Consiliul Europei: expulzarea romilor din Franța reprezintă o încălcare gravă a Cartei Societății Europene*, comunique of Ministerial Committee of Europe, Strasbourg, 10 November 2011, http://www.mediafax.ro/consiliul-europei-expulzarea-romilor-din-franta-reprezinta-o-incalcare-grava-a-cartei-societatii-europene , accessed on 29.12.2011.
13. xxx, *Deputat al partidului extremist olandez: dacă ar fi fost după partidul nostru, România şi Bulgaria ar fi fost expulzate imediat din UE*, 24.12.2011, http://www.agerpres.ro/media/index.php/intrenational/item/97458/deputat-al-partidului-extremist-olandez-daca-ar-fi-fost-după-partidul-nostru-romania-si-bulgaria-ar-fi-fost-expulzate-imediat-din-ue/ , accessed on 29.12.2011.
14. Tom Gallagher, *Balcanii în noul mileniu. În umbra războiului şi a păcii*, Humanitas Press, Bucharest, 2006, p. 261.
15. xxx, *O treime din români ar emigra, dacă ar avea ocazia*, 15.12.2010 http://www.ziare.com/romania+emigrare , accessed on 21.12.2011.
16. Ion Ioniță, Ovidiu Nahoi, *Istoricul Viorel Achim"Marea migrație europeană a țiganilor abia acum începe,"* http://www.historia.ro/exclusiv-web/ovidiu-nahoi/articol/istoricul-viorel-achim-marea-migrație-a-țiganilor-abia-acum-incepe, accessed on 22.12.2011.
17. www.worldbank.org.ro/WEBSITE/EXTERNAL/COUNTRIES/ECAEXT/ROMANIAEXTN , accessed on 22.12.2011.
18. Iuliu Zanne, *Proverbele românilor din România, Basarabia, Bulgaria, Ungaria Istria şi Macedonia* volume V, Scara Press, Bucharest, 2004, p. 65.
19. Ion Dragomir, *Impactul globalizării asupra pieței forței de muncă*, comunicare ştiințifică publicată în volumul *Securitatea şi apărarea spațiului sud-est european, în contextul transformărilor de la începutul mileniului III*, Editura Universității Naționale de Apărare „Carol I," Bucureşti, 2006, p. 237.

20. Ioana Dogaru, *Luni începe un nou an universitar*, http://www.romaniaactualitati.ro/luni-incepe-un-nou-an-universitar-33716 , accessed on 25.11.2011.
21. Cristian Marcu, *Proful „violator" trimis în judecată*, in *Click* journal from 16.12.2011.
22. xxx, *Studiu PIRLS: Educaţia în România sub nivelul mondial al mediocrităţii*, http://www.euractiv.ro/uniunea-europeana/articles%7CdisplayArticle/articleID-14822/Studiu-PIRLS-educatia-in-romania-sub-nivelul-mondial-al-mediocritatii/ , accessed on 26.12.2011.
23. Eric Laurent, *The Secret World of Bush*, Vivaldi Press, Bucharest, 2005, p. 27.
24. Eric Laurent, *The Secret World of Bush*, pp. 62-63.
25. Alina Mungiu, *Românii după '89. Istoria unei neînţelegeri*, Humanitas Press, Bucharest, 1995, p. 58.
26. Alina Mungiu, *Românii după '89. Istoria unei neînţelegeri*, p. 25.
27. xxx, *România – locul 2 în UE la evaziune fiscală*, emisiune difuzată de *Antena 1* pe 01.08.2011, accesibilă pe http://www.a1.ro/news/externe/romania-locul-2-in-ue-la-evaziune-fiscala-163867.html , accessed on 23.12.2011.
28. Patrick Lencioni, *The five Temptations of a CEO*, Jossey Bass Inc. Publishers, San Francisco, California, USA, 1998, pp. 112-118.
29. xxx, *Corupţia poate fi oprită doar dacă se implică toţi românii*, 10.11.2011, http://www.ziare.com/articole/coruptie+romania , accessed on 20.12.2011.
30. Alina Mungiu, *Românii după '89. Istoria unei neînţelegeri*, pp. 151-153.
31. Iuliu Zanne, *Proverbele românilor din România, Basarabia, Bulgaria, Ungaria Istria şi Macedonia* volume V, p. 563.
32. xxx, *Lucrătorii români au continuat şi în 2011 să se confrunte cu restricţii în unele state ale UE*, http://www.agerpres.ro/media/index.php/intrenational/item/97597-lucratorii-romani-au-continuat-sa-se-confrunte-si-in-2011-cu-restrictii-in-unele-state-membre-ale-ue , 27.12.2011, accessed on 28.12.2011.
33. xxx, *Ironiile unui ziar olandez: Dragi bulgari şi români, felicitări, tocmai aţi picat la examen*, http://www.stirileprotv.ro/ironiile-unui-ziar-olandez-dragi-bulgari-si-romani-felicitari-tocmai-ati-picat-la-examen/ , from Dutch journal *Volkrant*, accessed on 27.12.2011.
34. Iuliu Zanne, *Proverbele românilor din România, Basarabia, Bulgaria, Ungaria Istria şi Macedonia* volume V, p. 585.
35. Massimo Calabresi, *Hillary Clinton and the Rise of Smart Power*, in *Time Magazine*, 07.11.2011, http://www.time.com/time/magazine/article/0,9171,2097973.html , accesed on 29.12.2011.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

ASPECTS REGARDING THE UNSTEADY AERODYNAMICS AND ITS APPLICATION TO HELICOPTER ROTOR BLADE

Constantin ROTARU*, Valentin JAULIN, Vicent MONOT**,**

*Mechatronics and Armament Integrated Systems Faculty, Military Technical Academy, Bucharest, Romania, ** Mechanical Engineering Faculty, "Paul Sabatier " University, Toulouse, France

Abstract: *The principal focus of the presence study is to describe the key physical features and techniques for modeling the unsteady aerodynamic effects found on helicopter rotor blade operating under nominally attached flow conditions away from stall. The unsteady effects were considered as phase differences between the forcing function and the aerodynamic response, being functions of the reduced frequency, the Mach number and the mode forcing. For a helicopter rotor, the reduced frequency at any blade element can't be exactly calculated but a first order approximation for the reduced frequency gives useful information about the degree of unsteadiness. The sources of unsteady effects were decomposed into perturbations to the local angle of attack and velocity field.*

Keywords: *aerodynamics, unsteady models, helicopter*

1. INTRODUCTION

The classical unsteady aerodynamic theories describing the observed behavior have formed the basis for many types of rotor analysis. The tools for the analysis of 2-D, incompressible, unsteady aerodynamic problems were extended to compressible flows, being a basis for developing linearized unsteady aerodynamic models applicable to compressible flows. But, while the classical theories assume linearity in the airloads, the assumption of linearity can probably be justified for many of the problems encountered on the rotor, in practice. The advent of nonlinear methods based on CFD solutions to the Euler and Navier-Stokes equations has provided new results that justify and define the limits of the linear models and may give guidance in developing improved and more practical unsteady aerodynamic models for future use in helicopter rotor blade airloads prediction, aeroelastic analysis and rotor design. At the blade element level, the various sources of unsteady effects can be decomposed into perturbations to the local angle of attack and velocity field. At low angle of attack with fully attached flow, the various sources of unsteady effects manifest as moderate amplitude and phase variations relative to the quasi-steady airloads. At higher angles of attack when time-dependent flow separation from the airfoil may be involved, a phenomenon characterized by large overshoots in the values of the lift, drag and pitching

moment relative to the quasi-steady stall values, may occur.

One important parameter used in the description of unsteady aerodynamics und unsteady airfoil behavior is the reduced frequency, k, defined as $k = \omega \cdot c/(2V)$, where ω is the angular frequency, *c* is the chord of the airfoil and V is the flow velocity. According to the dimensional analysis, the resultant force, F, on the airfoil chord *c* can be written in functional form as $F/(\rho V^2 c^2) = f(Re, M, k)$. For $k = 0$ the flow is steady and for $0 \le k \le 0.05$ the flow can be considered quasi-steady, that is, unsteady effects are generally small. Flows with characteristic reduced frequencies above of 0.05 are considered unsteady.

For a helicopter rotor in forward flight (fig. 1), the reduced frequency at any blade element can't be exactly calculated, but a first order approximation for k, can give useful information about the degree of unsteadiness.

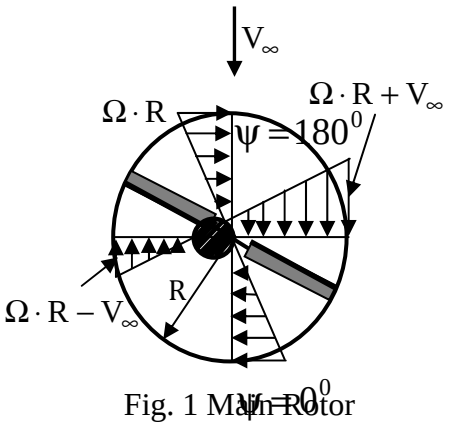


Fig. 1 Main Rotor

The approach to modeling of unsteady aerodynamic effects through an extension of steady, 2-D thin airfoil theory gives a good level of analysis of the problem and provides considerable insight into the physics responsible for the underlying unsteady behavior. The Laplace's equation for incompressible flow is eliptic, therefore the unsteady aerodynamic theories cannot be obtained in a corresponding analytical form.

2. THE AIRLOADS ON AN OSCILLATING AIRFOIL

The oscillatory motion of the airfoil can be decomposed into contributions associated with angle of attack which is equivalent to a pure plunging motion (fig. 2) and contributions associated with pitching (fig. 3).

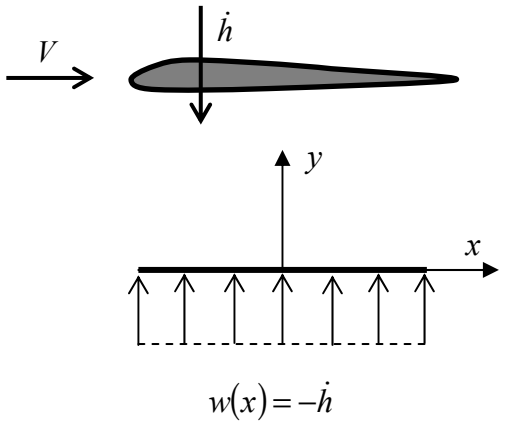


Fig. 2 Plunge Velocity

A plunge velocity $\dot{h}$ produces a uniform velocity perturbation w, that is normal to the chord, $w(x) = -\dot{h}$ and the pitch-rate term produces a linear variation in normal perturbation velocity.

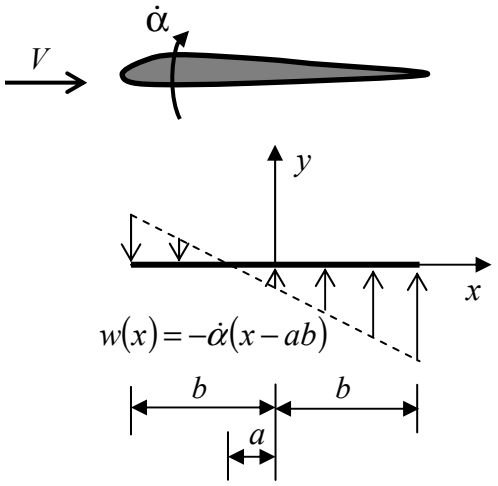


Fig. 3 Pitch Rate

For a pitch rate imposed about an axis at "a" semi-chords from the mid-chord, then $w(x) = -\dot{\alpha}(x - a \cdot b)$, so that the induced chamber is a parabolic arc.

The problem of finding the airloads on an oscillating airfoil was solved by Theodorsen, who gave a solution to the unsteady airloads on a 2-D harmonically oscillated airfoil in inviscid, incompressible flow, with the assumption of small disturbances. Both the airfoil and its shed wake were represented by a vortex sheet with the shed wake extending as a planar surface from the trailing edge downstream to infinity. The assumption of planar wake is justified if the angle of attack disturbances remain relatively small. As with the standard quasi-steady thin airfoil theory, the bound vorticity, γ_b, can sustain a pressure difference and, therefore, a lift force. The wake vorticity, γ_w, must be force free with zero net pressure jump over the sheet. According to the Theodorsen's theory, the solution for the loading γ_b on the airfoil surface under harmonic forcing conditions is obtained from integral equation

$$w(x,t)=\frac{1}{2\pi}\int_0^c \frac{\gamma_b(x,t)}{x-x_0}dx+\frac{1}{2\pi}\int_c^\infty \frac{\gamma_w(x,t)}{x-x_0}dx \quad (1)$$

where w is the downwash on the airfoil surface. At the trailing edge, $\gamma_b(c,t)=0$, and the airfoil circulation $\Gamma(t)$ is given by

$$\Gamma(t)=\int_0^c \gamma_b(x,t)dx \quad (2)$$

So long as the circulation about the airfoil is changing with respect to time, the circulation is continuously shed into the wake and will continuously affect the aerodynamic loads on the airfoil. For a general motion, where an airfoil of chord $c=2b$ is undergoing a combination of pitching $(\alpha,\dot{\alpha})$ and plunging (h) motion in a flow of steady velocity V, Theodorsen's solution for the lift coefficient and pitching moment coefficient corresponding to mid-chord, $M_{1/2}$ are

$$\begin{cases} c_l=\pi b\left[\frac{\ddot{h}}{V^2}+\frac{\dot{\alpha}}{V}-\frac{b}{V^2}a\ddot{\alpha}\right]+ \\ \quad +2\pi\left[\frac{\dot{h}}{V}+\alpha+\frac{b\dot{\alpha}}{V}\left(\frac{1}{2}-a\right)\right]C(k) \\ c_{m1/2}=\frac{\pi}{2}\left[\frac{ba\ddot{h}}{V^2}-\frac{b^2}{V^2}\left(\frac{1}{8}+a^2\right)\ddot{\alpha}\right]+ \\ \quad +\pi\left(a+\frac{1}{2}\right)\left[\frac{\dot{h}}{V}+\alpha+b\left(\frac{1}{2}-a\right)\frac{\dot{\alpha}}{V}\right]C(k)- \\ \quad -\frac{\pi}{2}\left[\left(\frac{1}{2}-a\right)\frac{b\dot{\alpha}}{V}\right] \end{cases}$$

where a is the pitch axis location relative to the mid-chord of the airfoil, measured in terms of semi-chord and $C(k)=F(k)+iG(k)$ is the complex transfer function (known as Theodorsen's function) which accounts the effects of the shed wake on the unsteady airloads.

$$C(k)=\frac{H_1^{(2)}(k)}{H_1^{(2)}(k)+i\cdot H_0^{(2)}(k)}= \\ =\frac{J_1(J_1+J_0)+Y_1(Y_1-J_0)}{(J_1+Y_0)^2+(Y_0-J_1)^2}+ \\ +i\frac{Y_1Y_0+J_1J_0}{(J_1+Y_0)^2+(Y_0-J_1)^2} \quad (3)$$

with J_0, J_1, Y_0, Y_1 being Bessel functions of the first and second kind, respectively (fig. 4).

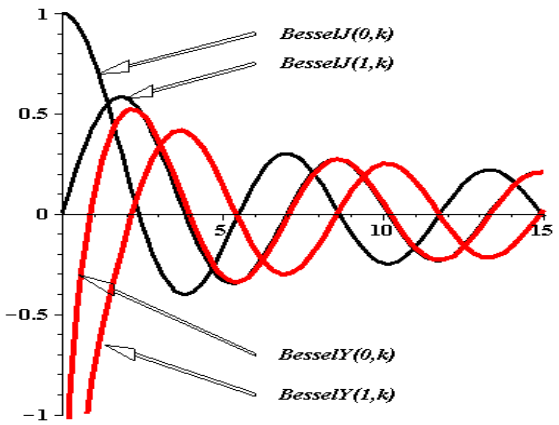


Fig. 4 Bessel Functions

The Hankel functions in above expression are:

$$\begin{cases} H_0^{(2)} = J_0 - i \cdot Y_0 \\ H_1^{(2)} = J_1 - i \cdot Y_1 \end{cases} \quad (4)$$

The real and imaginary parts of $C(k)$ function are plotted in fig. 5.

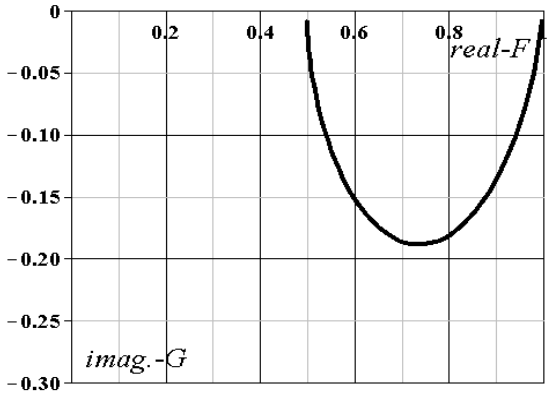


Fig. 5 Theodorsen's Function

It could be appreciated that $C(k)$ function serves to introduce an amplitude reduction and phase lag effect on the circulatory part of the lift response compared to the result obtained under quasi-steady conditions.

This effect can be seen if a pure oscillatory variation in angle of attack is considered, that is, $\alpha = \bar{\alpha} e^{i\omega t}$, so the circulatory part of the airfoil lift coefficient is given by

$$\alpha = 2\pi\bar{\alpha}C(k) = 2\pi\bar{\alpha}[F(k) + iG(k)] \quad (5)$$

For $k = 0$, the steady-state lift behavior is obtained, that is c_l is linearly proportional to α. As k is increased, the lift plots develop into hysteresis loops and these loops rotate such that the amplitude of the lift response (half of the peak-to-peak value) decreases with increasing reduced frequency. These loops are circumvented in a counterclockwise direction such that the lift is lower than the steady value when α is decreasing with time (i.e., there is a phase lag). For infinite reduced frequency the circulatory part of the lift amplitude is half that at $k = 0$ and there is no phase lag angle.

Pure angle of attack oscillations

For a harmonic variation in α, that is $\alpha = \bar{\alpha} e^{i\omega t}$, the lift is

$$L = 2\pi\rho V^2 b\left[C(k) + \frac{1}{2} i \frac{\omega b}{V}\right]\bar{\alpha} e^{i\omega t} \quad (6)$$

or, in terms of the lift coefficient, the results is

$$c_l = \frac{L}{\rho V^2 b} = [2\pi(F + iG) + i\pi k]\bar{\alpha} e^{i\omega t} \quad (7)$$

The term inside the square brackets can be considered the lift transfer function, which accounts for the difference between the unsteady and quasi-steady airloads.

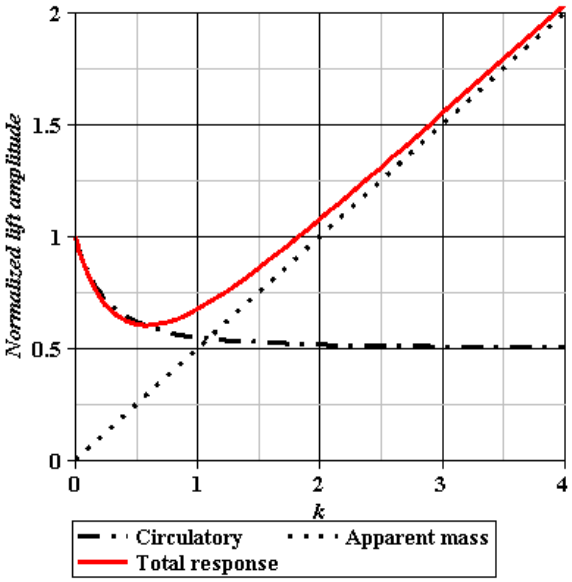


Fig. 6 Normalized Lift Amplitude

The first term inside the brackets is the circulatory term and the second term is the apparent mass contribution, which is proportional to the reduced frequency and leads the forcing by a phase angle of $\pi/2$. The noncirculatory or apparent mass terms arise from the $\partial\phi/\partial t$ term and account for the

pressure forces required to accelerate the fluid in the vicinity of the airfoil.

The normalized lift amplitude is

$$\frac{|c_l|}{2\pi|\bar{\alpha}|} = (F + iG) + i\frac{k}{2} \qquad (8)$$

The lift amplitude and phase of lift for pure angle of attack oscillations are presented in fig. 6 and fig. 7, where the significance of the apparent mass contribution to both the amplitude and phase can be appreciated.

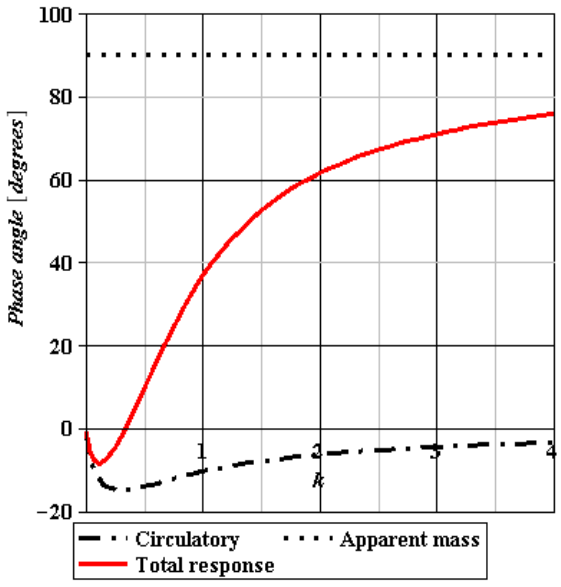


Fig. 7 Phase Angle

At lower values of reduced frequency, the noncirculatory terms dominate the solution. At higher values of reduced frequency, the apparent mass forces dominate.

Pure plunging oscillations

For a harmonic plunging motion such as be contributed by blade flapping the forcing is $h = \bar{h}e^{i\omega t}$ so that $\dot{h} = i\omega\bar{h}e^{i\omega t}$ and $\ddot{h} = -\omega^2\bar{h}e^{i\omega t}$. Substituting into the expression for the lift and solving for the lift coefficient gives

$$c_l = \left[2\pi k(iF - G) - \pi k^2\right]\frac{\bar{h}}{b}e^{i\omega t} \qquad (9)$$

The complete term inside the square brackets can be considered as the lift transfer function. The circulatory part of the lift response leads the forcing displacement h by a phase angle of $\pi/2$. Also, the apparent mass force leads the circulatory part of the response by a phase angle of $\pi/2$ or the forcing by a phase angle of π. The corresponding pitching moment about mid-chord for this case is

$$c_{m1/2} = \left(\frac{\pi}{4}\right)k^2\frac{\bar{h}}{b}e^{i\omega t} \qquad (10)$$

The results are plotted as the first harmonic normalized amplitude of the lift and pitching moment about the ¼-chord and their corresponding phase angles as functions of reduced frequency.

Pitching oscillations

For harmonic pitc oscillations, additional terms involving pitch rate $\dot{\alpha}$ appear in the equations for the aerodynamic response. The forcing is given by $\alpha = \bar{\alpha}e^{i\omega t}$ and the pitch rate by $\dot{\alpha} = i\omega\bar{\alpha}e^{i\omega t}$. In this case, the lift coefficient is

$$c_l = 2\pi\left[F(1 + ik) + G(i - k)\right]\bar{\alpha}e^{i\omega t} + \\ + \pi k\left(i - \frac{k}{2}\right)\bar{\alpha}e^{i\omega t} \qquad (11)$$

The lift amplitude initially decreases with increasing k because of the effects of the shed wake and then, for $k > 0.5$ begins to increase, as the apparent mass forces begin to dominate the airloads. This is also shown by the phase angle, which exhibits an increasing lead for $k > 0.3$.

Von Karman and Sear analyzed the problem of a thin airfoil moving through a sinusoidal vertical gust field, where the gust can be considered as an upwash velocity that is uniformly convected by the free stream. The forcing function in this case is

$$w_g(x,t)=\sin\left(\omega_g t-\frac{\omega_g x}{V}\right) \qquad (12)$$

where ω_g is the gust frequency. If the gust is referenced to the airfoil leading edge, then $x=0$ and $w_g(x,t)$ becomes $w_g(x,t)=\sin(\omega_g t)$ and if the gust is referenced to the mid-chord, then $x=b=c/2$ and

$$\frac{\omega_g x}{V}=\frac{\omega_g \frac{c}{2}}{V}=\frac{\omega_g c}{2V}=k_g \qquad (13)$$

Therefore,

$w_g(t)=\sin(\omega_g t)\cdot\cos(k_g)-\sin(k_g)\cdot\cos(\omega_g t)$,

which is equivalent to a phase shift. In this case the lift coefficient can be written as

$$c_l=2\pi\left(\frac{w_0}{V}\right)S(k_g) \qquad (14)$$

where $S(k_g)$ si known as Sear's function and the gust encounter frequency, k_g, is given by

$$k_g=\frac{2\pi V}{\lambda_g} \qquad (15)$$

and λ_g is the wavelength of the gust.

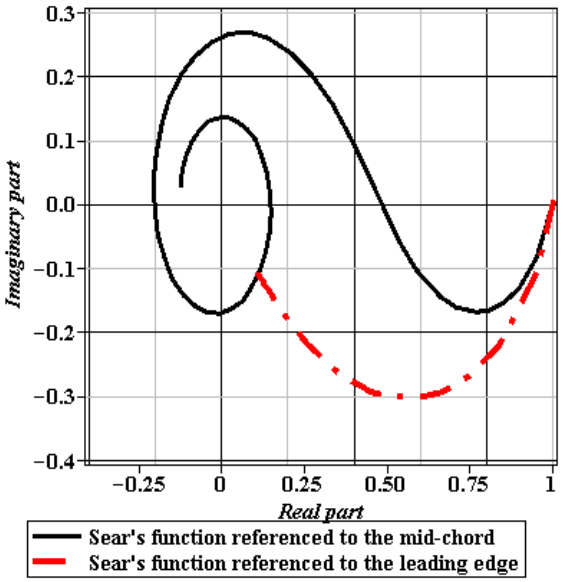


Fig. 8 Sear's Function

In terms of Bessel functions, Shear's function is given by

$$S(k_g)=[J_0(k_g)-iJ_1(k_g)]C(k_g)+iJ_1(k_g)$$

The terms of real and imaginary parts are

$$\begin{cases} Real\ S(k_g)=F(k_g)\cdot J_0(k_g)+G(k_g)\cdot J_1(k_g) \\ \text{Im}\ S(k_g)=G(k_g)\cdot J_0(k_g)-F(k_g)\cdot J_1(k_g)+ \\ \qquad\qquad +J_1(k_g) \end{cases}$$

If the gust is referenced to the leading edge of the airfoil, the function will be called S' an can be written as

$$\begin{cases} Real\ S'(k_g)=Real\ S(k_g)\cdot\cos(k_g)+ \\ \qquad\qquad +\text{Im}\ S(k_g)\cdot\sin(k_g) \\ \text{Im}\ S'(k_g)=-Real\ S(k_g)\cdot\sin(k_g)+ \\ \qquad\qquad +\text{Im}\ S(k_g)\cdot\cos(k_g) \end{cases} \qquad (16)$$

The two results are plotted in Fig. 8.The peculiar spiral shape of the S transfer function arises only when the gust front is referenced to the mid-chord of the airfoil.

CONCLUSIONS

Theodorsen's lift deficiency approach has found use in many problems in both fixed-wing and helicopter aeroelasticity. However, for a rotor analysis, Theodorsen's theory is somewhat less useful because the nonsteady value of velocity at the blade elements,

$V = U_T(y, \psi)$, that means that the argument k (the reduced frequency) is an ambiguous parameter. Wagner has obtained a solution for so-called indicial lift on a thin airfoil undergoing a transient step change in AoA in an incompressible flow. The variable s represents the distance traveled by the airfoil in semi-chords. The apparent mass contribution for a step imput appears as a Dirac-delta function $\delta(t)$. In Wagner's problem, the aerodynamic center is at mid-chord (at $s = 0$) and moves immediately to the ¼-chord for $s > 0$. Although the Wagner function is known exactly, its evaluation is not in a convenient analytic form, therefore it is usually replaced by a simple exponential or algebraic approximation.

REFERENCES

1. Leishman Gordon J., *Principles of Helicopter Aerodynamics,* Cambridge University Press, (2007).
2. Seddon J., Newman S., *Basic Helicopter Aerodynamics,* AIAA Education Series,(2001).
3. Prouty R., *Helicopter Performance, Stability and Control,* Krieger Publishing Company, Florida, USA, (2002).
4. Rotaru C., *Aerodinamică-elemente teoretice şi aplicații*, Editura ATM, (2009).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

THE OPTIMIZATION METHODS OF MODERNIZATION PROCESSES REGARDING TO THE LARGEST TECHNICAL INTEGRATES SYSTEMS

Vasile SANDRU

"Henri Coanda" Air Force Academy, Brasov, Romania

Abstract: *This article describes an optimization model of Surface-To-Air Missile System like a technical integrates system. The theoretical model of optimization describing the basic relationships between the Life Cycle Cost of the system and the frecquency of upgrades related to the moral decay, during the time. The financial crisis has forced extension of system operation even if it is obsolete. Thus have designed a new modernization*

Key words: *LITS (Large Intgrated Tehnical System); SAMS (Surface-to-Air Missile System); LCC (Life Cycle Cost); Cb(t) (unit acquisition cost related to the operating time) Cm(t) (Cumulative cost for preventive maintenance during the operating time); Cr(t) (Average unit cost for Repairs)*

1. INTRODUCTION

The approach of fundamental theme of Surface-to-Air Missile System (as a typical exemple of mobile with variable mass), the improvement of flight performances, dynamic stability, posibilyties of minimizing the guiding errors and the optimizing of upgradeing processes, can be found in the scientific activity of many other specialysts.

2. KEYWORDS:

Large Intgrated Tehnical System - LITS

Surface-to-Air Missile System - SAMS

Life Cycle Cost - LCC

Unit acquisition cost related to the operating time - Cb(t)

Cumulative cost for preventive maintenance during the operating time - Cm(t)

Average unit cost for Repairs - Cr(t)

The 21st Century presents itself like a temporal complex space defined by continuousness quantitative increasing and

qualitative changing, both contributing to the actual deployment process.

In this context intuition is not sufficient to assess the complexity of an integrated technical system; substantiating the notion itself is mandatory although it is very difficult.

The complexity of the system **S** consists of elements of complexity and, **i** = 1, 2, 3 ... n can be determined by the formula:

$$\mathbf{S} = \sum \mathbf{S_i}\,\mathbf{K_i}$$

Where K_i is the number of **i** elements and type of the system. The first large technical systems were formed in the Air Defense area. Through a careful analysis of the structure of control systems Surface-To - Air missiles from the perspective of automated systems, we can highlight their requirements and principles of operation required, in close connection with obtaining information about the parameters of movement of air targets.

Figure 1 shows a simplified diagram missile system in close contact with components that work with a purpose optimization criterion or several criteria for effectiveness.

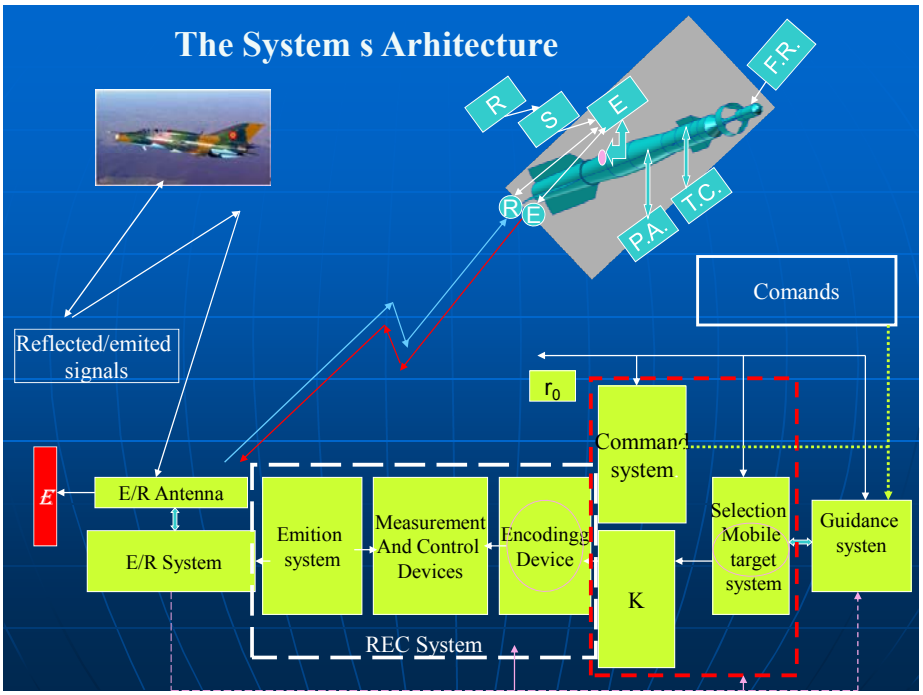


Fig. 1

Experience realization and exploitation of modern integrated military systems is a complex activity demonstrates that the organizational and technical point of view not least financially. This add for a long time - from 2 to 5 years or more depending on complexity.

To determine more precisely the connections between elements of a technical system, we must define the following:
S1-matrix of connections between input and

output
S2-matrix elements intraresi connections between the elements of the system output
S3-matrix connecting the input vector in the vector system out of the totality of elements
S4-matrix vector connecting the totality of elements in the system output vector can reunii the 4 matrix ..... In a single

S =

Structural scheme of a large technical system interconnections between the elements listed above:

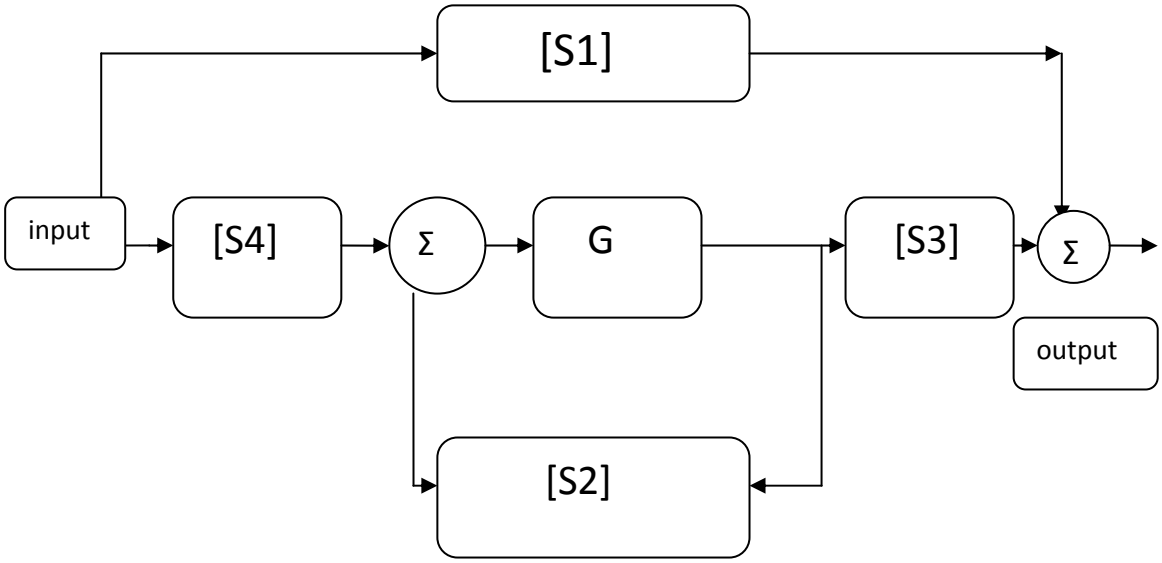


Fig. 2

Given the current economic crisis is becoming more evident prolonging service life correlated with the modernization subsystems.

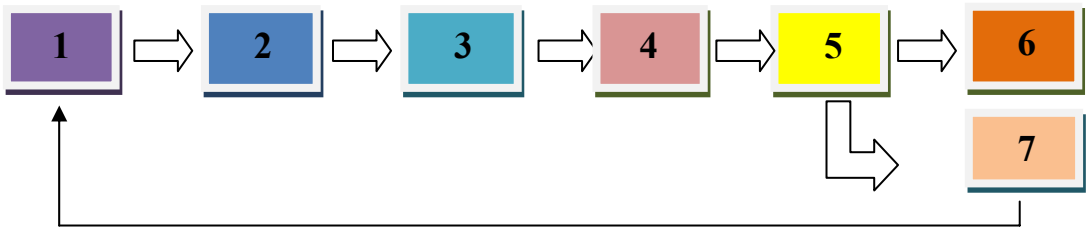


Fig. 3

1 - general conception

2 - system analysis

3 - projection

4 - achievement

5 - exploitation

6 - modernization

7 - extended service life

In large integrated systems, the effectiveness of such variant follows the structure and operation to ensure fulfillment of the mission with minimal costs.

The general form of the criterion of efficiency is the minimization of costs:

$\min C = \min M [\sum C_i] E > E_{dat}$

where C is the minimum cost of system;

C_i is the cost of part **I** of the system consists of I elements;

E_{dat} is the size efficiency is required.

The approach give a formulation of the inverse problem of the criterion of effectiveness.

In this case seeking to obtain a maximum effect given that the costs are limiting factors

Accordingly: $M [\sum C_i] < M_{dat}$

where M_{dat} is average expenditure.

Lately Surface –To- Air Missile system has undergone a series of upgrades that have focused mainly: - improving breakthrough characteristics of radar stations especially for interference with the signals reflected from fixed targets

- TV-introduction regime for air target detection correlated with reduced time to prepare their rockets.

- to improve the jamming protection subsystems

Modernization at these missions face but is strongly influenced by obsolescence according to the graph:

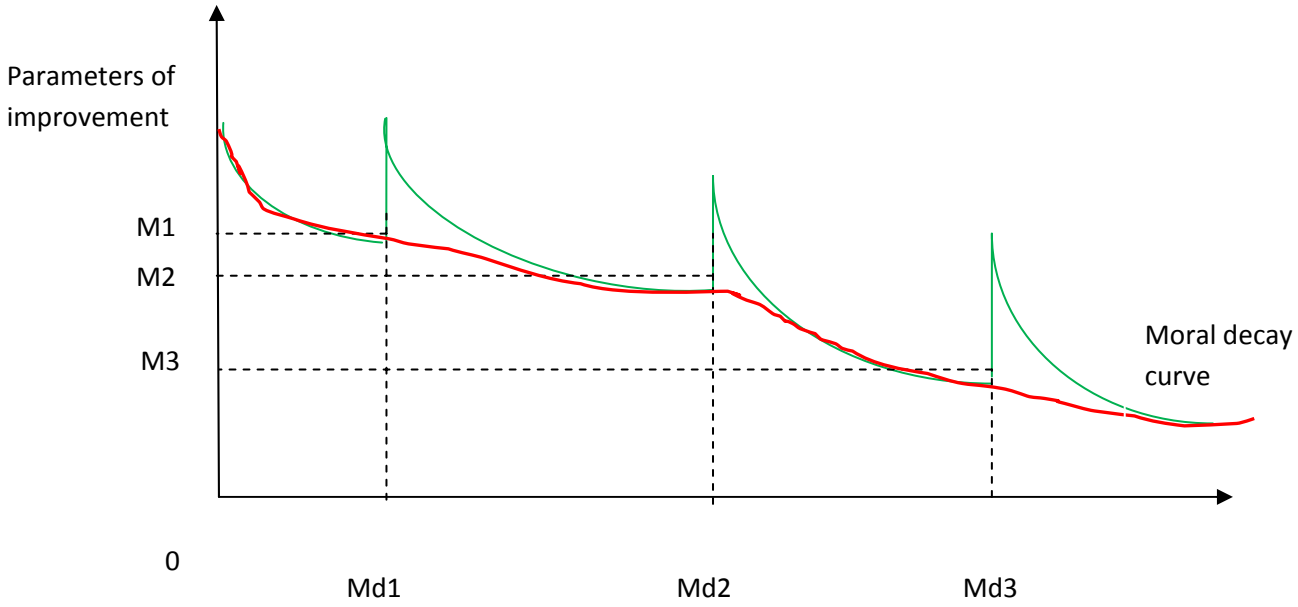


Fig. 4

Figure 3 (The upgrades related to moral decay points during the time)

Operating expenses take into account the period of operation and maintenance refer to staff and maintenance, repair, transport and storage.

The quantitative assessment of operating costs to economic efficiency using the standardized coefficient K_{ec}- increasing the accumulation time of year according to early accumulation size:

$K_{ec} = C_i\text{-}C_{i-1} / C_{i-1}$

C_i, C_{i-1} are spending in the late years i and i-1. Costs incurred in different periods of time operating the process be made at the same moment of time according to the formula:

$C_i = C_i^n (1+K_{ec})^i$

C_i^n - expenses at beginning of period

In practice it is possible that system has been consumed own set resource capacity but continues to be operative

Optimization requires proper choice of the means used for this purpose, the optimization of their characteristics and use strategy.

In the most general form, the problem can be formulated as follows:

Total expenditure for operation system C is a function that depends on the characteristics of operation and restoration x_1, ... x_n, the characteristics of quality control means, y_1, ... y_n and features control strategy, z_1, ... z_n. as is intended that the operation was run with as low a cost, the cost C must minimized:

$C = \min C(x_1,\ldots\ldots\ldots,x_n,y_1, \ldots y_n,z_1, \ldots.z_k)$

In these limiting conditions:

$G_1(x_1,\ldots,x_n,y_1,\ldots Y_{m,}z_{1,\ldots.,}z_k), [<,=,>]G_i^{(o)}$

$G_2(x_1,\ldots x_n,y_1,..y_{m,}z_{1,\ldots\ldots,}z_k), [<,=,>]G_2^{(o)}$

.....

$G_s(x_1,\ldots x_n,y_1,...y_{m,}z_{1\ \ldots\ldots,}z_k), [<,=,>]G_s^{(o)}$

Where C (x_1, ... x_n,, z_k) are total expenditure for the operation of the system

G_1, G_2, G_s ,……,criteria of system operation

$G_i^{(o)}$ $G_2^{(0)}$,……..,$G_s^{(0)}$,data values for these criteria

Operation of the system s evaluated with different general criteria such as:

- coefficient of operational status

- the likelihood of interruption-free operation

For the optimal control of authenticity, or found on these particular problems may arise optimization:

- determining the optimal set of system parameters to be controlled so that the

system to perform all financial operations and minimum material consumption

- establishing optimum accuracy for the elements that make up the operation knew sistemul.Este high precision measurement of a device increases the cost of technical maintenance sistemului.Calitatea coefficient is estimated by operational training in order to fulfill functions at any time. Coefficient of operational training the assumption of uniform distribution of is given by:

$$K_{op} = \lim \int P(t)dt$$

For the stationary operation:

$$K_{op}=M[t_f]/M[t_f]+M[t_n],$$

In this formula M [tf] is the mean value (mathematical expectation) of the operating range of the object without disturbances M [Tn] - mean the time the objects broken between two consecutive operative state.

3. ANALYSYS OF THE OPTIMIZATION MODEL

A basic condition for application of the described optimization method is to have a suitable shape of the curve Cc(t). An important condition for optimization is a sufficiently strong local minimum in point D (t opt, Cc min), which will enable relatively precise identification of a location of this point even if the tehnical-economic data are not complete.

3.1. Average unit cost for acquisition of a subsystem

Function Cb(t) expressing a dependency of average unit costs for acquisition of a subsystem upon the operatin time is defined by: Cb(t)=Cb/t.

Graphical representation of this function is an equitelateral hyperbola. As we can see the value of this function decreases with extending of operating time.

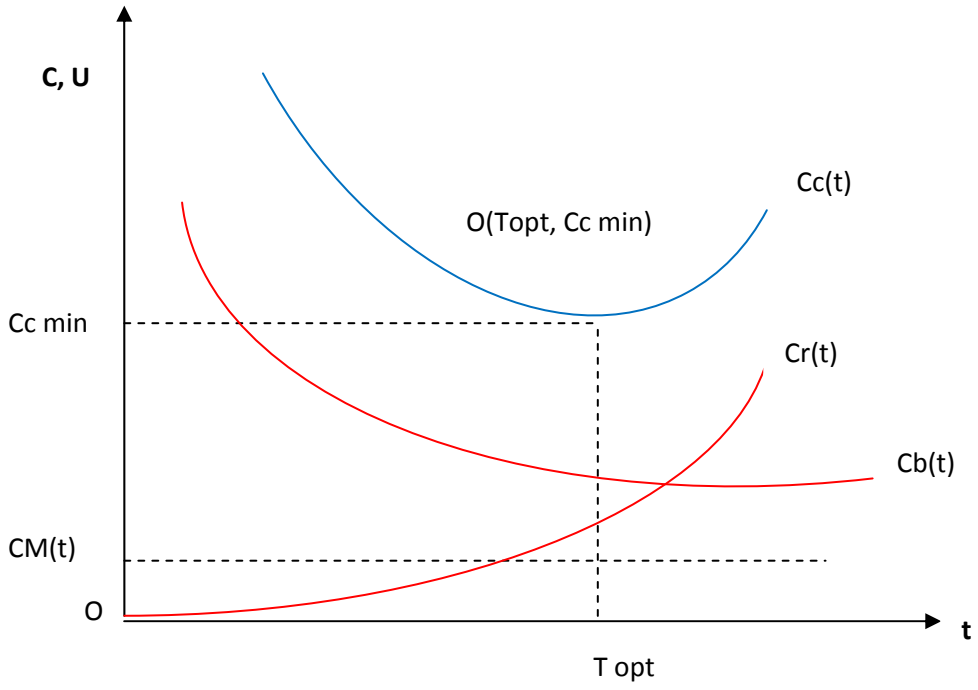


Figure 5

3.2. Average Unit Cost for Preventive Maintenance

Function CM(t) expresses the dependency of unit costs for preventive maintenance upon the operative time: CM(t)=CM(t)/t. Where CM(t) is the sum of all costs connected with execution of subsystem preventive maintenance during the operating time t.

The extent of individual preventive maintenance actions does not substantially vary with operating time, this CM can be considered constant.

3.3. Average Unit Cost for Repairs of the Subsystem

A graph of the function Cr(t) shown above intersects the co-ordinate origin and it increases within the whole scope of studied values of operating time of functions.

The notion of reparability Narrow-R reprtezinta an imprint maintenance tehnica.Ea defines a products ability to restore its operation allows duringn period of time, operating conditions, when in operation due to malfunctions occur Radiolocator intensities corresponding to a failure of subsystems are shown in the chart below

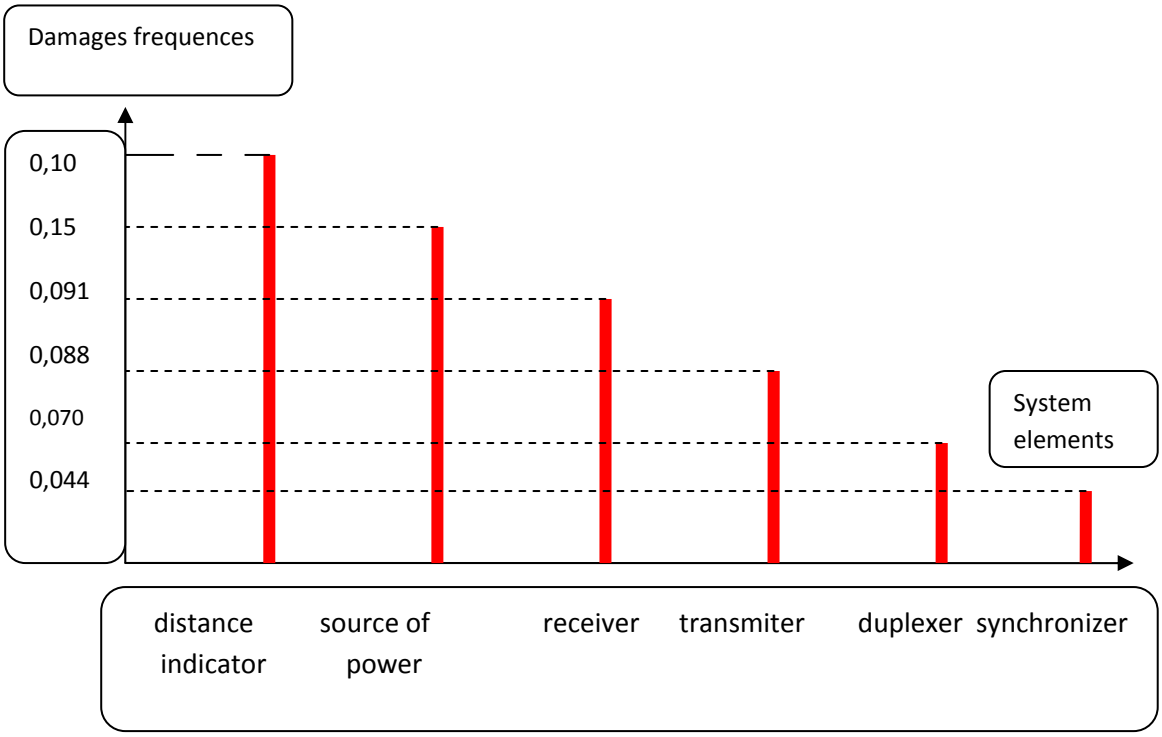


Fig. 6

- Develop an advertising system ... finding solutions for reducing time ..... and as often as constructive alternatives analyzed sadisfac no conditions imposed accountability. In this case the main ways to reduce separation time that the user has available are:
- Modularization of subsystems
- Automation of the search ....

4. CONCLUSIONS

In the end we ca say that keeping the Surface-To -Air missiles in a perfect state of function can be realized with a new upgrades following:

- digitization of computer systems

- replacement system with a netork transciever phased array antennas which would lead to a compaction of the system

- replacement of liquid fuel, which would lead to increased mentenance

5. REFERENCES

1. Ion Angheloiu, Introduction in the Large Tehnical Systems, Ed. Militara, Bucharest 1980

2. Mihailov A.V. ,Exploatationie dopuski Moskva 1970.

3. Lavrinenko V.I. Osnovi Exploatatii radioelectroni aparaturii Iz-Vo Vissaia Scola ,Moskva 1978

4. Titu I. Bajenescu Fiabilitatea sistemelor tehnice Bucuresti Matrix Rom 2003

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

IMPACT OF THE FINANCIAL CRISIS ON SELECTED EUROPEAN UNION AIR FORCES AND THEIR CAPABILITIES

Tomáš SCHÓBER*, Blažej LIPPAY, Pavel NEČAS*****

*CGCI (Central ground-controlled interception), Operation Centre, Zvolen, Slovak Republic,
** National Security Authority, Bratislava, Slovak Republic,
*** Armed Forces Academy of General M. R. Štefánik, Liptovský Mikuláš, Slovak Republic

Abstract: *Generally, it is extremely difficult for military leadership to justify investment into security and defence. In case of the European Union, it is even more obvious. European citizens prefer to spend money in sensitive areas like education or health, rather than to solve the problems in distant countries and increasing the domestic safety level. In combination with financial crisis, all European states have started reducing their defence expenditures. Therefore, it is no surprise, that western Europe countries as a one of the largest contributors to NATO expenditionary(deployable) forces are affected either. This article is giving an overview of selected Air Forces and their current problems with limited finances, reductions of aircrafts and with loss of some of their long and hard build capabilities.*

Keywords: *Air Forces, Defence, Capabilities, Aircraft, Security, Cuts*

1. INTRODUCTION

We need to rationalize and to integrate the available assets for better addressing the problems we are currently facing, and which we will face in foreseen future. Ministry of Defence is too big, overstaffed and inefficient. Our today`s forces are structured to fight the Cold war conflicts, not the low-intensity warfare increasingly confronting our armed service as a part of a coalition. These and similar statements can be heard almost every day. Impacts of the unpredicted economic crisis have equally reached all parts of the Armed Service. And their Air Forces, as main fund consumer within the Armed Forces, are suffering the most. Defence capabilities are easy and quick to get rid off, but it is extremely hard and expensive to rebuild it. With continuing economic uncertainty, the defence sector will not be the key area for any government for next years. It is clear that nor desired nor current level cannot be maintained for a long time and defence ministries will be forced to choose priorities, reduce some capabilities, investments, personnel and handle the situation with reduced finances.

2. UNITED KINGDOM

Britain, the world's sixth largest economy, has the fourth biggest defence budget and the third largest contributor after the United States (US) and Greece. Britain is also a member of one key alliance, the so-called "Special relationship" with the US. London emphasizes the imperative of closer financial, military and industry ties with France. The reason is simple. Both nations are the members of NATO, the European Union (EU), are Nuclear

weapon states and have similar national security interests. Their armed forces are of comparable size and capability and it is clear that France will remain one of the UK`s main strategic partners. [2]

The cuts have impacted all the aircrafts in its inventory – those already in use, newly purchased and planned to procure. The ageing Tornados will be reduced to five squadrons and an Operational Conversion Unit (OCU). That means the fleet is likely to number fewer than 70 machines. Moreover, between 2020 and 2025, this type will be replaced by Typhoons responsible for all Air Defense missions as Quick Reaction Alert, air superiority, fighter attack and recce missions. Then the future Royal Air Force (RAF) will rely exclusively/solely on Typhoons, with proposed number of 110 and on not more than sixty F-35C, in use by both RAF and Royal Navy (RN).

Era of the RN as a naval power has passed. After withdrawing of the Harrier fleet and retiring of the aircraft carrier HMS Ark Royal, Britain will not get involved in a potential conflict before the introduction of the new carrier and fixed-wing deck aircrafts. So London has accepted the Carrier Strike capability gap for more than a decade.

Hand in hand with aircraft reductions go the base closures. Some of them have already been closed, but there are still more to come. Actually, base closures are always a contentious issue. The sensitive loss of the Nimrod MRA4, a formidable Combat Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) platform, was the least surprising decision thanks to years of delay and rising. However, the order to stop the production caught some units in pre-finalized phase or just freshly built and the decision to abandon airborne maritime reconnaissance platform is very weird for and island state.

The future of the RAF is very uncertain. The Ministry of Defense (MoD) has apparently reached a point where income and expenditure are broadly matched, yet to do so have seen capabilities slashed in the short term with the promise of rebirth at the end of the decade. UK Defence still has several procurement minefields to negotiate on the way to fiscal prudence while delivering the capability it needs. The future strategic tanker, tactical transport aircraft, Joint Strike Fighter and new flying training platform contract are all major programmes where cost growth is not just likely, but inevitable as initial requirements change. [2]

Briefly, UK is nowadays affected with a total loss ISTAR capability, financial climate dictates that Britain must be prepared, in short term at least, to rely on her allies to provide capabilities she cannot afford alone. It can be seen from the foregoing that Britain will be fielding many fewer platforms in the years ahead and only time will tell if she will have the capability to meet future challenges.

3. BELGIUM

Of the four services making up the Belgian armed forces (BAC), the Air component will be one of the most affected by a new round of defence cuts. Interesting that no unit will be formally disbanded, but some capabilities will be scaled down by the end of 2012. Only transport will remain largely unaffected. The training of young pilots will continue in the multinational framework. The Franco-Belgian programme launched in 2004 at various French bases – Tours and Cazaux (Belgium has relocated all of its Alpha Jet trainers here) for the students selected for fighter training, Avord for transport and Dax for the future helicopter pilots.

The most numerous type in the BAC fleet remains the F-16AM/BM fighter-bomber, but in dwindling numbers. Back in 1979, Belgium ordered a total of 160 F-16s, but attrition and restructuring of the armed forces have slashed the operational inventory to 54 aircraft. Despite their age and the fact that no decision has been taken on a possible replacement – Brussels refused to join the US led Joint Strike Fighter programme or to procure European origin aircrafts. All Belgian F-16s are available for NATO and/or European Union operations – six of them are currently deployed to Southern Afghanistan to provide Close Air Support to the NATO`s ground troops. Overall, while essential assets

have been preserved for the short term, the prospects are not good for the BAC, as like many other NATO Air Forces, its capabilities are slowly being eroded. The cash strapped Belgian MoD has not launched any new acquisition programmes over the past two years and it will face, during the next decade, the difficult challenge of replacing most of its ageing fleet combat, transport and training aircraft. [3]

4. NETHERLANDS

The new round of defence cuts followed after those from 2003 and 2007 has resulted to the dramatic lost of considerable operational capacity for the Royal Netherlands Air Force (RNLAF). The 2003 plans forced the RNLAF to reduce its remaining fleet of 137 F-16s - all have been modified to Mid-Life Update (MLU) standard in the years before – to 108 aircraft. This came with one fighter and two helicopter squadrons disbandment, while two airbases were closed. The 2007 cuts were less drastic, but nevertheless the RNLAF had to give up another 18 fighters, this time reducing the fleet to just 87 aircraft.

With another 19 F-16s proposed to left the inventory, the Netherlands will have just 68 jets left, less than half of the fighter force it had eight years ago. It is important to know the fact that 10 aircrafts are permanently stationed in Tucson, Arizona for pilot training. Together with poor serviceability due to spare parts shortage in last years, available aircraft numbers will be down to somewhere around thirty to fourty percent, thus no more than thirty of them will likely to be ready for operations at a given time. And the RNLAF has always been engaged in a great number of activities worldwide, i.e. over Afghanistan, Libya, Baltic Air Policing or various international exercises.

As for the fighter fleet replacement, the MoD has never made a secret of which fighter it prefers as its future combat aircraft. The Netherlands entered the F-35 Lightning II programme in 2002 as a Level Two partner. However, acquisition of substantial numbers of F-35s remains uncertain and the final decision is scheduled to 2014, due to sensitivity of project and development delays and steadily rising prizes of the aircraft. Therefore, service entry of the new fighter is now being foreseen for 2019 and the total number of F-35s to be acquired will probably not exceed 48. Another big problem for the RNLAF is the helicopter shortage which has resulted in limited transport capacity, support of special operations and fire fighting assistance. [7]

The defence cuts will also have implications for many running or planned acquisition and modernisation projects which will be push forward at least one year. Despite being forced to work with a reduced budget, the MoD keeps looking forward and plans to invest in future developments, including unmanned aerial vehicles (UAV).

Participation of the RNLAF in numerous international operations has taken its toll and has caused budget overruns that have to be compensated for. For the time being, the Dutch Air Forces will be ready for every possible mission but within its limited capabilities.

5. FRANCE

As one of the ten richest nations in the world, France plays an important international role and a key position in the European Community. Never in its history has the French Armed Forces (FAF) been involved in so many peacetime and wartime operations around the world, with much of its staff and

aircraft dispatched to foreign locations. Moreover, France has four quick reaction alert (QRA) bases available in case of emergency or threat and at least one transport aircraft is on one hour alert in case of a hostage situation. France also maintain a nuclear deterrence, so allocated crew, aircraft and nuclear missiles are always ready. [1]

The Country is well known for operating mainly indigenous types of aircraft. The FAF is currently caught in the middle of a major renewal programme, with numerous new types now operational or about to enter service. Downsizing is also high on the agenda, with countless units to disband to free financial resources for major acquisition programmes within a given financial envelope.

France`s Defence White Paper, published in 2008, has outlined a sweeping number of changes to be introduced in the next few years to increase the flexibility of the French Armed Forces. To reduce costs and to optimize the use of resources, the Armée de l`Air`s structure was seriously reworked in the last few years, with the number of territorial, organic and operational commands reduced from nine to just four. As a part of very strict base realignment and closure policy, the Armée de l`Air is set to close a number of operational platforms and to concentrate all its assets on larger air bases in order to create economies of scale.

As a result of the cuts the FAF is planning to postpone numerous programmes including the upgrade of fighter-bombers fleet and acquisition of the new domestic Multi Role Tanker Transport aircraft. The question is how these delays will affect French combat and deployment capabilities. Now, it is the Rafale that is getting the priority among all others types of aircraft and is slowly replacing the ageing types of aircraft. On the other hand, the Rafale programme is consuming the most of the financial resources dedicated to the FAF and other squadrons equipped with Mirages are fighting against spare parts shortages and low serviceability.

By 2015, the FAF combat fleet will be reduced in numbers (around 240) and types in service, which should assist maintenance and reduce costs. Especially thanks to Rafale, from an air force with specialised squadrons, each of them accomplishing a couple of missions, units will become multi mission ready. However, due to delays and cuts, Paris will have to deal with lack of transport aircraft and with ageing jet trainer replacements.

6. GERMANY

German defence reform plans revealed a lot of changes and cuts in the Armed Forces. They would still be capable of providing the government with a broad spectrum of capabilities and options to act. While the Army will be hit most by the cuts, loosing two full divisions, the Luftwaffe (German Air Force) seems to be slightly better off, although its personnel will be reduced by almost one third. According to the latest proposals revealed in October 2011,, the Luftwaffe is going to shift its focus „away from combat against enemy air war assets“, while at the same time maintaining the capability to mount front line operations in a high intensity environment. Increased importance will be attached to „air support operations as well as reconnaissance and surveillance“. As part of this process, the Air Force`s Divisions will be restructured into Commands overseeing certain assets of capabilities.

The Luftwaffe will rely on multirole Typhoons and ageing Tornados, most likely the recce/electronic combat variant, that is going to convert to the Eurohawk UAV in near future. As of its structure, out of the three fighter and three attack wings, just one large fighter wing and one attack wing will survive. The Air Force Academy and its associated air base will close and the Academy will move to Roth. All rotary-wing assets will be concentrated with the helicopter wing at Holzdorf Air Base and all transport assets are to join together in one transport wing as well. Only the US-based pilot training centre will remain untouched. As for the Air Bases, it has not yet been decided how many and which one/s of them are on the list for closure, but the number will be four at least. [6]

One surprise is that the Air Force is going to exchange the NH-90 utility helicopters for the CH-53s, presently flown by the Army Air

Corps. The whole German army aviation is also going to downsize. There will be two regiments containing the transport utility helicopters and another regiment of Tiger attack helicopters within a new rapid reaction division, but the force will be cut to a third of its current size.

7. CONCLUSION

It is nothing new that all European Air Forces are suffering from devastating defence cuts. Impacts and consequences of these reductions for the countries mentioned above are shown here in detail. These cuts simply do not allow the current or desired high political and security ambition level to be maintained. All efforts are now aimed at rebuilding the armed forces to a "leaner and meaner" concept. Unless it is tested in wartime, we can never be certain just how much defence is enough, and we will always be in the business of trying to manage and mitigate risks, rather than eliminate them. The countries of former Western Europe are enthusiastic in its promotion of cooperation, and multinational solutions will also feature more prominently in NATO's revised defence planning system. For example, London and Paris have recently announced a major defence cooperation agreement, including nuclear testing, a combined, joint expeditionary force, and aircraft carriers. Belgium and Netherlands are negotiating about establishing a mutual transport base. Generally in Europe, the opportunity to take a truly strategic approach to defence cooperation and partnership has been missed. Nonetheless, there is every reason to expect that collaborative European projects will continue to be features of the defence landscape.

In many respects, then, the economic crisis has merely accelerated post-Cold War trends in Europe's armed forces, which have seen large warfighting military structures dismantled in favour of smaller, well-trained, deployable, sustainable and flexible units, better suited to deal with the types of conflicts we see today. European Unions' armed forces will certainly be less able to fight major wars, but they may, with the intelligent use of reduced resources – which, as already discussed, presents major challenges – be able to undertake smaller-scale military tasks more effectively and more efficiently. [5]

One important aspect of this economic crisis is that it has reminded us that there are many more risks to our security and well-being than military ones. Risks to our financial security are perhaps more likely to arise than military threats and have the potential to cause substantial and lasting damage.

REFERENCES

[1] Buyck S., 2011, *French Direction*, Air Forces Monthly, Key Publishing Ltd., ISSN 0955 7091, January 2012, pp. 48-55

[2] Cox T., 2011, *UK SDSR, one year on. Has the dust finally settled?*, Air Forces Monthly, Key Publishing Ltd., ISSN 0955 7091, No 285, December 2011, pp. 60-64

[3] Gaudin G., 2010, *On the brink*, Air Forces Monthly, Key Publishing Ltd., ISSN 0955 7091, No 269, August 2010, pp. 96-97

[4] Jezný M., Puliš P., Model design of the airport security protection, Acta Avionica, č.19, ročník XII, Letecká fakulta TUKE, 2010

[5] Lawrence T., *Europe's Defence in Times of Economic Crisis*, In: International Centre for Defence Studies, 14.1.2011, Available at: http://www.icds.ee/index.php?id=73&L=1&tx_ttnews[tt_news]=802&tx_ttnews[backPid]=100&cHash=69e1a85d1b

[6] Thiele R., *Reconsidering the Relevancy of Air Power – German Air Force Development*, ISPSW Strategy Series: Focus on Defense and International Security, Issue No.162, July 2011
[7] Van Den Mark K., 2011, *Netherlands, military cuts and consequences*, Air Forces Monthly, Key Publishing Ltd., ISSN 0955 7091, No 280, July 2011, pp. 94-97

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

MANPADS – DO THEY PRESENT REAL THREAT?

Tomáš SCHÓBER*, Matúš GREGA, Pavel NEČAS*****

*CGCI (Central ground-controlled interception), Operation Centre, Zvolen, Slovak Republic
**Armed Forces Academy of General M. R. Štefánik, Liptovský Mikuláš, Slovak Republic

Abstract: *It is nothing new that shoulder-fired missiles present a persistent threat to military aircraft. But whether or not we also need to protect the commercial airplanes against this kind of menace remains the issue of many debates among aviation experts worldwide. This paper gives a brief overview of history, types and proliferation of these weapons and focuses on possible protection and countermeasures against this threat.*

Keywords: *MANPADS, Threat, Attack, Missile, Countermeasure*

1. INTRODUCTION

Although use of less sophisticated standoff weapons, such as unguided rocket propelled grenades (RPGs) and large-caliber munitions, are also considered as a threat to civil airliners, shoulder-fired missiles are widely regarded as the most capable weapons in terrorist hands for downing a commercial airliner.

While aircraft shootings have historically been documented in the third world countries and war-torn regions, there is growing concern among some aviation security and counterterrorism experts who think that there is an emerging worldwide threat to civil aircraft from shoulder-fired weapons and perhaps other standoff weapons. While this terrorist threat in the current context of the global war on terrorism is considered greatest in regions such as in the Middle East, in the horn of Africa, in other areas of Africa plagued by political unrest, in Afghanistan and Pakistan, and in regions of southeast Asia, the potential for shoulder-fired missile attacks or attacks using other standoff weapons against civilian airliners in Northern America and Europe is likely increasing and cannot be disregarded.[3] Reason is simple. In the post 9/11 era, improved security measures at „western airports" could logically lead terrorists to commit attacks targeting the aircraft out of secured airport perimeter.

Estimates vary, but the most widely reported statistics on civilian aircraft experience with MANPADS indicate that, over the past three decades, 36 aircraft have come under attack from these weapons. Of those 36, 24 aircraft were shot down resulting in more than 500 deaths.[9] More detailed analyses concluded that only about a dozen civil-registered airplanes have been shot down during this time period and further notes that some of these aircraft were operating as military transports when they were shot down. On the contrary, available statistics may underestimate the total number of civilian encounters with shoulder-fired missiles because some aircraft shootings may have been attributed to other causes for various reasons and are not included in these statistics.

Also, it is possible that some failed attempts to shoot down civilian airliners have either gone undetected or unreported. For many incidents considered to be shoulder-fired missile attacks against civilian aircraft, there is insufficient information to make a conclusive determination if the aircraft, in fact, came under fire. In some instances, while it is widely acknowledged that the incident was a shooting, there has been no conclusive determination regarding the weapon used. For example, in some instances of aircraft shootings there are discrepancies among accounts of the event, with some reports indicating that the aircraft was brought down by a shoulder-fired missile and others claiming that antiaircraft artillery was used. Also, in many instances, there are questions as to whether the flight operation was strictly for a civilian use or may have been for military or dual use (civilian/military) purposes. Therefore, there is no universal agreement as to which incidents should be included in the tally of civilian aviation encounters with shoulder-fired missiles.

2. HISTORY & PROLIFERATION

First use of MANPADS is dated back to Vietnam era by both sides in the war, to provide military ground force protection from aircraft attacks. Historically, these weapons have been used succesfully by militaries, insurgents and terrorist groups around the world. They proved its lethality in number of conflicts over the past forty years.

At present, MANPADS are are believed to be widely available to terrorist groups throughout the world at relatively low cost through a variety of sources. They are regarded by weapons experts as formidable weapons, particularly against transport aircraft and helicopters.[3]

Over the years, twenty countries have been engaged in development or production of the MANPADS. There have been at least 30 different types manufactured, with a total production of more than a million missiles. The majority of MANPADS are either located within military arsenals; have been expended in live-fire exercises, wars, insurgencies, or other conflicts; or have been destroyed, according to State Department officials. Estimates of the global inventory of MANPADS range from 500,000 to 750,000 weapons, with approximately 1 percent outside the control of national governments, according to intelligence sources. In addition, according to the State Department, the numbers of MANPADS in the global inventory are difficult to estimate because destruction of MANPADS systems is not always publicized and the systems' effective lifetimes depend on how they are stored and maintained.[5]

3. TYPES OF GUIDANCE

Based on their method for detecting and engaging targets, MANPADS are primarily classified into three general categories.

3.1. IR guidance. IR-guided MANPADS have sensor or seeker elements that sense and track energy in specific portions of the IR spectral band emitted by target aircraft. IR guidance systems are designed to home in on a heat source on an aircraft, and the missile is typically detonated in or near the heat source to disable the aircraft, typically by impact detonator fuses. For aircraft, the predominant IR energy source is the hot jet engine and its trailing exhaust plume. However, radiant heat reflected off the aircraft's skin also generates a smaller amount of IR energy that can be detected by these weapon guidance systems, particularly among more recently introduced MANPADS. IR-guided MANPADS employ passive weapon guidance systems, meaning that they do not emit any signals to detect a heat source. This makes them more difficult to detect by targeted aircraft employing missile warning and missile countermeasure systems.[4] According to evolution of their capabilities, these types of MANPADS are generally divided into three (sometimes four) categories, or generations.

The first MANPADS deployed during the sixties (Russian Strela-2 or U.S. Redeye) of the last century used earliest homing systems capable only to guide the missile from rear side of the airplane, because their seekers can

only effectively acquire and engage target after it has passed the missile's launch position.

Second generation (Russian Strela-3 and IGLA, U.S. Stinger) use improved coolants reducing the temperature of the seeker and enabling the seeker to filter out most interfering background IR sources which greatly improves the accuracy of the missile.

Lower seeker`s temperature is also giving these weapons all-aspect capability (head-on and side engagement profiles), thus, to effectively fire on target from any angle or aspect. Some of these systems also carry backup target detection modes such as the ultraviolet (UV) mode found on the Stinger special variant.

More advanced third generation of IR-guided MANPADS (Russian IGLA-S and U.S. Stinger RMP), use single or multiple detectors to produce a multiband IR image of the target and also have the advanced capability to recognize and reject flares dispensed from targeted aircraft. Current MANPADS`s development is focusing on higher accuracy, greater range and especially on improved guidance systems resistant to IR-countermeasures. The latest guidance systems are utilizing cross-shaped targeting array or a full two-dimensional focal plane array. These systems are sometimes reffered to as fourth generation IR-guided systems.

3.2. Command Line-Of-Sight (CLOS). CLOS missiles do not home in on a particular aspect (heat source or radio or radar transmissions) of the targeted aircraft. Instead, the missile operator or gunner visually acquires the target using a magnified optical sight and then uses radio controls to "fly" the missile into the aircraft. One of the benefits of such a missile is that it is not as susceptible to standard aircraft mounted countermeasure systems which are designed primarily to defeat IR missiles. The major drawback of CLOS missiles is that they require highly trained and skilled operators.[1]

Numerous reports from the Soviet-Afghan War in the 1980s cite Afghan mujahedin as being disappointed with the British-supplied Blowpipe CLOS missile because it was too difficult to learn to use and highly inaccurate, particularly when employed against fast moving jet aircraft.[6]

According to these considerations, many experts agree that CLOS missiles are not best suited for terrorist compared to IR-guided missiles, which are sometimes referred to a "fire and forget" category of missiles. Latest versions of CLOS guided missiles use a solid state camera instead of the optical tracker to make the gunner`s aiming easier (British Javelin) and laser data link instead of earlier radio guidance (British Starburst).

3.3. Laser beam. Laser beam riding shoulder-fired SAMs use lasers to guide the missiles to the target. The missile literally flies along the laser beam and strikes the aircraft where the missile operator or gunner aims the laser. These beam riding missiles are resistant to current countermeasure systems on military and civilian aircraft. Missiles such as Sweden's RBS-70 and Britain's Starstreak, can engage aircraft from all angles and only require the operator to continuously track the target using a joystick to keep the laser aim point on the target. Because there are no data links from the ground to the missile, the missile can not be effectively jammed after it is launched. Future beam riding SAMs may require the operator to designate the target only once and not manually keep a continuous laser aimpoint on the aircraft. Even though beam riders require relatively extensive training and skill to operate, many experts consider these missiles particularly menacing

in the hands of terrorists due to the missiles' resistance to most conventional countermeasures in use today.[1]

4. POSSIBLE CONSEQUENCES

It is estimated that thousands of MANPADS even under government controls may be vulnerable to theft and possible transfer to terrorist groups because they are not subject to stringent national export standards nor do they have adequate physical security or inventory controls. Moreover, their lethality, portability, ease of use and concealment, and relatively low cost (from less than $1,000 to $100,000 each) make them attractive to terrorists for acquisition and use against commercial aircraft.

Threats to commercial aviation are numerous and varied, and the cost of instituting preventive measures for all of these threats could become quite large. A sense of the economic impact of an attack affords some context for the allocation of resources to countermeasures. Economic losses may be divided into three categories: immediate, tangible losses from the attack; losses to travelers and airlines during a subsequent air-travel shutdown (as after the 9/11 attacks); and losses to travelers and airlines from reduced demand once the industry resumes operations. Losses during a shutdown and following resumption of service are likely to be strongly conditioned by the success of law enforcement at apprehending MANPADS operators and their supporters. If arrests are made, federal officials can credibly assure the public that air travel is safe, and no further attacks follow the resumption of service, economic losses may be no greater than those shown here for a shutdown that might be as short as a week. If one or more of those conditions is not met, a longer or repeated shutdown and disproportionately larger post-resumption losses may accrue.[2]

Comparing many sources, it has been estimated that the direct economic cost of a catastrophic loss of an airplane from a MANPADS strike or an attack using some other standoff weapon would range somewhere from about $500 million to $1 billion per aircraft, depending on the size of aircraft and the number of passengers lost in such an attack. Beyond these direct costs associated with the actual destruction of property and loss of life, an attack could have a considerable impact on the airline industry and the broader economy. However, the scope and duration of such an impact is difficult to predict, and it is extremely difficult to provide a monetary estimate of the economic impact from such an attack. Possible responses to an aircraft shooting could be cancellation of certain flights, shut down certain airports, or shut down of the whole air traffic in entire region.

5. ACTIVE COUNTERMEASURES & PILOT TECHNIQUES MITIGATING RISK OF ATTACK

There are generally recognised three types of countermeasures (currently applied or under development) – flares, laser jammers and high-energy lasers. Flares may be released either preemptively (before the onset of an attack) or reactively, after an IR surface-to-air missile (SAM) launch is detected. In the case of terrorist attack, which is difficult to predict, and so for commercial applications, reactive flares are the practical consideration. While military transport aircraft employ a variety of countermeasures to mitigate the threat posed by IR-guided missiles, including smaller shoulder-fired missiles, the use of IR-countermeasures on commercial aircraft has been quite limited, and generally speaking, commercial passenger airliners are not equipped with such systems. A notable exception is in Israel, where a number of El Al aircraft were initially equipped with deployable flares in 2004, but are now being fitted with laserbased IR countermeasure systems.[7]

However, flares have generally been regarded as being too hazardous for airline operations and airport ground installations, and initiatives have focused instead on exploring the feasibility of adapting military laser-based IR countermeasures for use on commercial airliners. Proposals to deploy various aircraft-based countermeasures on civilian airliners,

however, have raised considerable policy debate across the world regarding the effectiveness of such an approach, the cost deploying and sustaining such systems, their potential impact on flight safety, possible environmental constraints on their use, and the fear that their deployment may promote perceptions that flying is not safe.

There exists also a variety of transmitters known as IR countermeasures (IRCMs) generating IR energy fields designated to fool SAMs. IRCMs, compared to flares, do not pose a fire hazard to combustible on the ground, but are similarly effective against IR-guided missiles.

Recent development in lasers have led to employment of directed infrared countermeasures (DIRCMs) which focus their entire energy on incoming missile. They are able to generate more jamming power than IRCMs and offer the most effective defense against modern MANPADS. On the othe hand, their weight, size, cost and reliability, however, may not yet make them suitable for common commercial use.

Some aircraft survivability experts believe that isolating critical systems, like redundant hydraulic lines and flight control linkages, and improving fire suppression and containment capabilities could prevent catastrophic failures cascading from the initial missile strike.[10]

Another potential mitigation technique is training flight crews in evasive maneuvers if fired upon by a shoulder-fired SAM. However, without a missile detection and warning system, it is unlikely that a flight crew would have any indication of a missile launch. Also, large transport category airplanes are generally not maneuverable enough to evade a shoulder-fired missiles. There is also concern that defensive maneuvering of large transport category airplanes could result in a loss of control or structural failure. On the other hand, specific simulator exercises using missile attack scenarios may be beneficial by preparing pilots to fly and land a damaged aircraft. Modern airliners are built with redundancy in avionics and flight control systems, and consequently, a missile strike that does not cause a catastrophic structural failure would likely be survivable if the flight crew is properly trained to handle such a scenario.[1]

Other possible passive countermeasures are a paint designed to mitigate an aircraft`s IR reflectivity and visual profile, and suppressing or mitigating the engine`s hot exhaust. Shielding or ducting an engine exhaust, or mixing ambient air with hot jet exhaust can reduce IR signature of an aircraft by 80% so it would be more difficult for terrorists to employ most types of shoulder-fired missiles. Unfortunatelly, implementation of thesemeasures into existing aircraft can unfavorably affect aircraft`s weight, balance and engine performance.

6. FUTURE OPTION

Unmanned Aerial Systems (UASs) or drones, are sophisticated pilotless aircraft that serve as the eyes and ears for our troops on the ground. These vehicles routinely embark on risky reconnaissance missions that were previously performed by pilots. UASs evolved tremendously over the years and are now an essential part of our mission, especially in remote locations where rough terrain makes things difficult.

Originally, their main purpose was to reduce the need to send pilots to risky and dangerous missions and areas. In a modern warfare, they are becoming irreplaceable. But thanks to its valuable advantages like long endurance, flexible usage and high cost-efectiveness ratio, they are now in the scope of multiple non-military sectors.

Some studies were evaluating the feasibility of equipping UASs with surveillance sensors and with weapons capable defeat heat-seeking missiles fired from ground. Project CHLOE, research and development program of the Department of Homeland Security (DHS), objective was to assess the feasibility of persistent high-altitude standoff counter-MANPADS protection of commercial aircraft and to evaluate attendant concept of operations and life cycle costs. A supporting objective was to investigate and demonstrate the feasibility of one or more UAS with Missile Warning Systems (MWS) and countermeasures stationed near airports to provide autonomous coverage for all aircraft within the MANPADS threat envelope. Secondary objectives were to investigate and demonstrate other DHS missions and payloads compatible with the CHLOE platform and operating environment, and interface with air traffic control and law enforcement for situational awareness. However, the system concepts evaluated in the CHLOE program are not conducted by follow-on development so far.[11]

7. CONCLUSION

Combating air terrorism requires the use of a wide range of organizational and technical efforts based on appropriate legislative solutions. While terrorist actions are very hard to predict, nevertheless there have been put in place universal international legal measures that are designed to help protect aviation from illegal interference. The organizational activities dealing with aviation security should also embrace prevention against terrorist assaults.

The technical elements of safety system infrastructure have to allow for the monitoring of the overall situation on an entire airfield. Such a comprehensive, integrated approach to aviation security will help to forecast the risk of terrorist attacks, and provides the best chance to adequately protect aircraft, both on the ground and in the air.

Finally, it is critical to have in place a set of clear and robust plans in order to respond to crisis situations in the air and on the ground, which must be supplemented by relevant training to learn the proper procedures for any counter-terrorist action.

However, in policy debate, it is important to note that the various countermeasures under consideration for mitigating the MANPADS threat are not designed to be effective against all types of MANPADS and are not considered to be capable of thwarting attacks using either laser beam rider or CLOS MANPADS.[3]

While the threat posed by MANPADS is really high, it represents a predicament for policymakers for several reasons.

1. Although it is well known that terrorists possess these weapons, attacks using them have been relatively rare.

2. Although probability of an attack is quite small in number, airliners remain vulnerable against this threat, because during takeoff and approach to landing they fly at low altitudes within effective range of these weapons. Civilian aircraft, unlike the military ones, carry no special countermeasures and are not agile enough to evade a missile attack. On the other hand, the odds of a large commercial plane surviving a hit from MANPADS are fairly high thanks to numerous redundant systems on board allowing the planes execute an emergency landing after an attack.

3. Even if an aircraft survive such an attack, it would be enormously difficult to restore confidence in air transport among the travelling community. Worse, a succesfull attack would have devastating and long-lasting consequences not only for entire airline industry (comparable with the 9/11 attacks), but also for whole economy.

But the decision whether or not to install additional ground and on-board countermeasures against the MANPADS due to high costs and uncertain effectiveness in protection the airliners will not be solved in near future. For example, options mentioned in this paper (or combination of them) can reduce aircraft`s vulnerability to weapons threat to some degree, but they cannot completely eliminate the threat. Probably implementation of UASs should be the right, effective and relatively cheap solution for surveillance and protection of the airport area including the adjacent departure and arrival routes.

REFERENCES

[1] Bolkcom Ch., Elias B. *Homeland Security: Protecting Airliners from Terrorist Missiles*. CRS Report for Congress, Feb. 16, 2006.

[2] Chow J. et al., *Protecting Commercial Aviation Against the Shoulder-Fired Missile Threat*. RAND. 2005. ISBN 0-8330-3718-8.

[3] Elias B. *Airport and Aviation Security*. CRC Press. 2010.

[4] Elias B. *Securing General Aviation*. Congressional Research Service. March 3, 2009.

[5] General Accounting Office. *Nonproliferation Further Improvements Needed in U.S. Efforts to Counter Threats from Man-Portable Air Defense Systems*. Report to Congressional Committees, GAO-04-519. May 2004.

[6] Gusinov T. *Portable Weapons May Become the Next Weapon of Choice for Terrorists*, In: Washington Diplomat, January 2003, p. 2.

[7] *Israeli Airliners To Replace Flares With Laser-Based Anti-Missile System*. World Tribune, October 16, 2007.

[8] Jezný M., Puliš P. *Model design of the airport security protection*, In: Acta Avionica, č.19, ročník XII. Letecká fakulta TUKE. 2010.

[9] O'Connor P. *Planes are easy targets for portable missiles*. In: Saint Louis Post-Dispatch. June 1, 2003, p. A1.

[10] Sweetman B. *The Enemy down Below*. Air Transport World. September 2003, 34-36.

[11]Wilson K. *DHS Counter-MANPADS Programs*, In: Aircraft Survivability, Joint Aircraft Survivability Program Office (JASPO). Fall 2010, p.14 .

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

THE APPROACH FOR RANDOM OBJECTS CREATION WITHIN THE FRAMEWORK OF PRIMARY RADAR SENSOR MODELLING

Miroslav ŠEBELA*, Vojtěch MÁJEK*

*****Air Defence Systems Department, Faculty of Military Technology, University of Defence, Brno, Czech Republic

Abstract: *The paper contains a description of the factors that affect the process of radar sensor modelling. The radar sensor is not modelled in terms of its technical implementation, but the attention is concentrated on the nature of the output information, which is provided by a realistic primary radar sensor. In the paper there is presented a topic related to the creation of false targets (random targets) in the process of the primary radar sensor modelling. The topic primary radar sensor modelling was solved within the dissertation thesis at Air Defence Systems Department at University of Defence in Brno. The aim of this work was to create universal models of 2D and 3D primary sensor radars which are in use of Czech forces with the subsequent use in the simulation environment for creating of plots or tracks radar datas. The model will be used as the part of the simulator for Czech air force staff training.*

Keywords: *radar sensor, modelling, simulation, modelling approach, probability of false alarm, Swerling target model.*

1. INTRODUCTION

The use of simulation technologies for training occurs at most levels of NATO armies. Simulation technologies are no longer regarded only as a supplement to real training, but they are also used in full preparation, training and evaluation of operating personnel. Within Czech forces was solved the defence research project called SIMOS - *Use of simulation technology within the framework of the Air Force operational centres*. One part of this project is oriented to radar sensor modelling. The construction of a surveillance radar sensor model may be realized in a very simple way or in a complex way. It depends all the time on our demands, but we have to focus our attention to the function of real radar system.

At the department of Air Defence (AD) systems a simulation tool MÄK, a powerful toolkit for simulating of air and ground forces, is successfully in use. This simulation tool is in use for the combat situation simulation of ground and air forces. It is possible to make either real situation simulation, or hypothetical situation simulation. It is possible to program 3D objects, put them into 3D terrain environment, to simulate their movement, fire and much more.

This simulation tool is able to work in a network, thus it is very convenient for the tactical situation simulation. It is a modular system, for which there exist a lot of

enhancements and upgrades. The most used part of this simulation tool is *VR-Forces* subprogram, which is a powerful and flexible simulation toolkit for generating and executing battlefield scenarios. It has all the necessary simulation features for use as a tactical leadership trainer, threat generator, behaviour model test bed, or Computer Generated Forces (CGF) application.

One of the marginal problems of AD warfare simulation is the modelling of AD surveillance, which should be approaching a real environment on the one hand and on the other hand should be simple and as fast as possible. In spite of contemporary computers being fast and their computing power constantly increasing, the simplicity of AD surveillance simulation process is a basic requirement for all warfare simulation models, because it is a prerequisite for simulations running in real time.

2. MODELLING OF AD SURVEILLANCE SENSOR

2.1 AD surveillance sensor model. The main type of AD surveillance sensor is a radar sensor. The radar sensor model will be in our case an element working with the simulation environment - with the MÄK simulation tool. The source of flight paths is a simulation tool MÄK, which generates conditions of tactical situation according to the predefined start point, waypoints and destination.

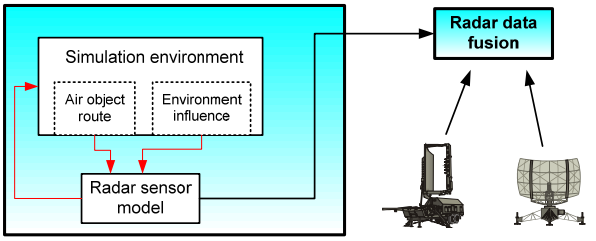


Figure 1.: Radar sensor model placement as the part of the simulation environment

The model of radar sensor makes a function of the information filter, which separates incoming information, what are a *position* and a *type* of all air objects (they differ in the size and in Swerling 1,2 or Swerling 3,4 fluctuating nature), which will be in the antenna detection area. According to the decision-making process the radar sensor model adjudicates, which objects are currently visible and which objects are in the range of the radar sensor model. Afterwards, their positions are sent to the succeeding processing encoded into the protocol ASTERIX (All Purpose Structured Eurocontrol Surveillance Information Exchange). Under the technical term “succeeding processing” it is possible to understand e.g. a radar data fusion or a system of the fire control as the part of the rocket system.

The basic structure of how the radar sensor model works can be found in the figure 2.

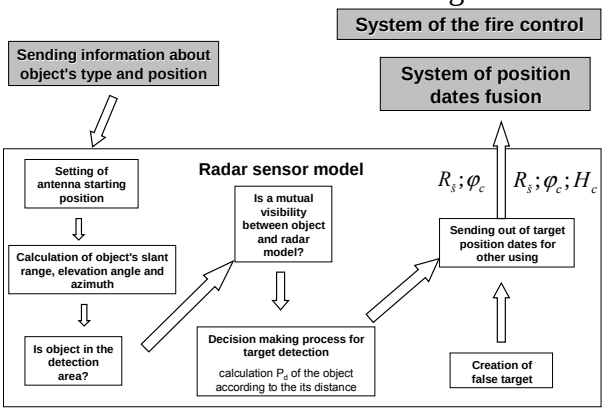


Figure 2.: Radar sensor model structure

In the simulation environment every moving object is sending its position and its type into the radar sensor model. Then, the radar sensor model solves according to some rules, if the position datas of the object will be send into the system for the other processing. Firstly, it is necessary to set up the random starting antenna position. Position of a moving object is given in Cartesian coordinates. Because of the fact that radar position data from the real radar are given in cylindrical coordinates, it is necessary to recalculate them. Then, the slant range, elevation angle and azimuth are obtained. Later, it is solved, if the object is currently in the detection area of the radar, this means if the object is in the range of the radar sensor model. If yes, it is solved, if the mutual visibility between object and radar is clear. In the other step, the value of the probability of detection is calculated according to the object distance, its size and the type of the object radar cross section fluctuation. Then, the decision making process is performed. Afterwards, the position data of the object are sent into the system of succeeding processing.

2.2 The process of the random object generation. In the output of the radar sensor model, at a certain time moment, will be generated the random object, the so called false target. During the process of radar sensor modelling, it is important to take into account the existence of the false target, because during the work of the real radar sensor, from time to time an object, which does not exist in reality, can be displayed on the screen of the radar. The probability, that this object will be displayed, is determined by the *probability of false detection (alarm)*. For current radar systems is used the value used is from $P_{fa} = 10^{-6}$ to $P_{fa} = 10^{-8}$.

When the radar antenna makes 1 turn, the space for the detection of the objects can be divided into a big number of elementary elements, which can represent a possible target. Regarding to 2D radar sensor, the number of these elements can be calculated according to:

$$P_{elem\_2D} = \frac{360°}{\Delta\varphi_c} \cdot \frac{d_R}{\Delta R_s} \quad \text{[elements]},$$

where:
d_R – radar sensor instrumental range in the distance [m],
$\Delta\varphi_c$ – radar sensor resolution ability in the azimuth [°],
ΔR_s – radar sensor resolution ability in the slant range [m].

Regarding to 3D radar sensor, the equation will be:

$$P_{elem\_3D} = \frac{360°}{\Delta\varphi_c} \cdot \frac{d_R}{\Delta R_s} \cdot \frac{\varepsilon_{\max}}{\Delta\varepsilon} \quad \text{[elements]},$$

where:
ε_{max} – maximal value of the elevation angle [m],
$\Delta\varepsilon$ – radar sensor resolution ability in elevation angle [°].

Then, for the randomly selected 2D radar sensor can be calculated:

$$P_{elem\_2D} = \frac{360°}{1°} \cdot \frac{350000m}{500m} = 252000 \text{ el.},$$

and for the randomly selected 3D radar sensor can be calculated:

$$P_{elem\_3D} = \frac{360°}{1{,}5°} \cdot \frac{470000m}{120m} \cdot \frac{20°}{2{,}1°} = 8\,928480 \text{ el.}$$

An average value of the probability of the false target occurrence M_{fc} will be defined according to the equation:

$$M_{ft} = P_{elem\_2D(3D)} \cdot P_{fa} \quad \text{[-]},$$

Now, the random target will be generated to be displayed during some number of antenna turns. The follow equation will be used:

$$G_{ft} = N_i + M_{ft} \quad \text{[-]},$$

where:
N_i – a randomly generated number from the interval <0;1> [-],
M_{ft} – an average value of the probability of the false target occurrence [-].

With this step, a random number G_{ft} will be obtained, in other steps this number is compared with the value of number „1". Then, if $G_{fc} \geq 1 \Rightarrow$ the false target will be created and send to the succeeding processing; if $G_{fc} < 1 \Rightarrow$ the false target will not be created and send to the succeeding processing.

If the random target has to be generated, it is necessary to specify the position of this target. For this step, two generators of random position are used. This means that the random object can be displayed in the range of radar at least one time, but also, it does not have to be displayed.

With respect to the 2D radar sensor model, it is necessary to determine the concrete position of the random object in the range and azimuth. For the generation of random

position in the range the modified generator $G_{distance}$ will be used:

$G_{dis\tan ce} = N_i(d_R) \cdot d_R$ [-],

where:

N_i (d_R) – randomly generated number from the interval <0,01;1> [-],

d_R – maximal radar sensor instrumental range of 2D radar sensor [km].

For the generation of random position in the azimuth the modified generator $G_{azimuth}$ will be used:

$G_{azimuth} = N_i(\varphi) \cdot \varphi$ [-],

where:

N_i (φ) – a randomly generated number from the interval <0,01;1> [-],

φ – a maximal value of azimuth of 2D radar sensor (360°) [°].

The algorithm for the 2D random target generation could be presented as:

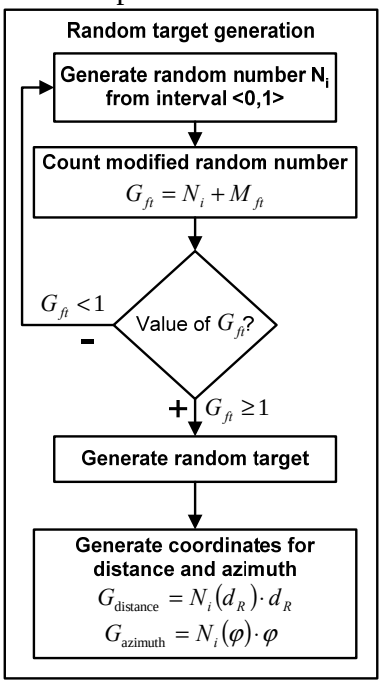


Figure 3.: Algorithm for the 2D random target generation

With respect to the 3D radar sensor model, it is necessary to determine also the concrete position of the random object in height. For this the modified generator G_{height} will be used:

$G_{height} = N_i(H_{\max}) \cdot H_{\max}$ [-],

where:

N_i (H_{max}) – a randomly generated number from the interval <0,01;1> [-],

H_{max} – a maximal value of the height of 3D radar sensor [m].

And for the 3D random target generation algorithm can be presented as:

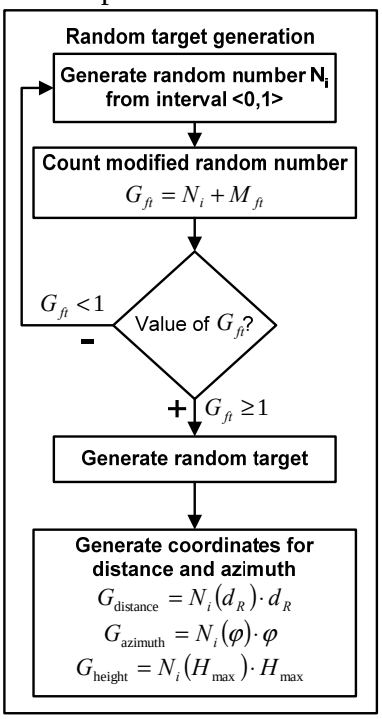


Figure 4.: Algorithm for the 3D random target generation

3. CONCLUSIONS & ACKNOWLEDGMENT

In this paper, the authors were trying to highlight the importance of the random objects generation within the framework of surveillance radar sensor model creation.

REFERENCES

1. Skolnik, M., I. *Radar handbook*. 2nd ed. New York : McGraw-Hill, Inc., 1990. 847 s. ISBN O-OT-QSVTIB-X.
2. Skolnik, M., I. *Radar handbook***.** 3rd ed. New York : McGraw-Hill, Inc., 2008. 1352 s. ISBN 978-0-07-148547-0.
3. Nathason, F., E.; Reilly, J., P.; Cohen, M., N. *Radar design principles***.** 2nd edition. New Jersey : Scitech Publishing, Inc., 1999. 724 s. ISBN 1-891121-09-X.
4. Sebela, M. *Dissertation thesis*, University of Defence, City: Brno, Czech Republic, (2012).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

CONCEPTS FOR AIR SUPREMACY & ESSENTIAL CAPABILITIES FOR MODERN AIR SUPERIORITY ASSETS

Kadir YILDIZ*, Murat BİCİL, Sadık AKKAYA***, Yavuz İSTEK******

*Operation&Intelligence, Turkish Air War College, Istanbul, Türkiye ** Operation&Intelligence, Turkish Air War College, Istanbul, Türkiye *** Operation&Intelligence, Turkish Air War College, Istanbul, Türkiye **** Operation&Intelligence, Turkish Air War College, Istanbul, Türkiye

Abstract:

The latest studies about air warfare increasingly make emphasize on air-to-ground attack capability of air power and recently performed air-to ground operations. Also, there is a corresponding dwindling of interest toward the more traditional air combat roles. On the other hand, the misperception that the uses and requirements of air power will last on this air-to-ground axis forever may result in constituting an improper force composition. Air superiority is the absolute precondition for air power being freely utilized in air-to-ground missions.

This paper examines defensive and offensive air supremacy concepts, which are two different operational approaches to gain and maintain air superiority, with a critical perspective and suggests that offensive capabilities of the fighters dedicated for air superiority must be in the foreground.

The authors conclude that low observability, manoeuvrability, operational speed, combat persistence, tactical datalink, advanced weapon systems and self protection are the essential capabilities for modern air superiority assets and makes assessments about these critical talents.

Keywords: *Air superiority, air-to-air combat, fighter aircrafts, low observability, manoeuvrability, combat persistence, tactical datalink, self protection.*

1. INTRODUCTION

In the latest studies about air warfare, it can be easily observed that there's an increasing emphasis on air-to-ground attack capability of air power and surface attack operations conducted recently. On the contrary, interest toward the more traditional air combat roles is dwindling in inverse proportion. These cyclical requirements even caused some R&D programs such as *F-22 RAPTOR* and *EUROFIGHTER TYPHOON* to convert into multi-role planes featuring sturdy air-to-ground capabilities while they were originally designed and developed for air superiority roles. But, considering that the requirements and uses of air power will last on this axis forever may lead to an improper force structure.

As mentioned in core tasks and principles of NATO's new strategic concept, "the modern security environment contains a broad and evolving set of challenges to the security of NATO's territory and populations" [8]. Since the end of the Cold War, the complex global security environment has been a stage for a number of limited wars. In these operations, air power was applied virtually

only in forms of local support to ground forces such as Close Air Support and Counter Insurgency, in addition to Deep Interdiction missions with a certain strategic impact. Common aspect of all such operations is that enemy forces rather depend on only GBAD assets and there is almost no hostile force in the air. This condition has resulted in the disappearing of the perception that air superiority is the certain pre-condition for air power being independently applied to air-to-surface missions.

There is an evident conversion of force composition towards multi-role fighters from dedicated air superiority designs amongst some European members of NATO. Norway, Denmark and the Netherlands plan to recompose their force structure with *F-35A*, which is primarily designed for ground attack missions. This course of conduct is the result of the perception that future air operations would commonly be air-to-ground support missions executed by Coalition forces with no real risk of harmful air threat and the conception that defence of the national airspace is no longer a serious matter of concern.

However, threat perceptions outside the Western countries are noticeably different. In conjunction with air superiority, air defence is still a priority mission for the air forces. Japan desires to acquire the *F-22* from USA for air-to-air role, considers the *EF-2000* as an alternative, and also seeks to develop a stealth air superiority fighter named MITSUBISHI *ATD-X SHINSHIN* [3]. China maintains an air force mostly composed of fighter aircrafts optimized for air-to-air combats although having the desire of expanding their deep strike capabilities and multi-role properties. Pakistan and India are very nearly the same. Russia aims to modernize air defence fighters like *SU-27s* and designs *T-50 PAK-FA*, which is estimated as arguably the world's second most capable air superiority fighter after the *F-22*.

2. CONCEPTS FOR AIR SUPREMACY

The need of possessing at least capable when not dedicated air superiority fighters to control the airspace over selected areas is mentioned above. In addition, one of the key points for determining the essential capabilities of air superiority assets is having situational awareness about operational functions of air power and the missions executed by such planes.

2.1 Defensive Air Superiority (DAS) Approach and Mission Considerations (Combat Air Patrol and Intercept). The conventional and most common operational concept for air superiority fighters is to attain and maintain air control over the airspace of interest and to intercept the hostile aircrafts intruding the area. Objective of the mission is to counter enemy air activity over the battleground and/or hindering air attacks inside friendly area.

DAS involves a passive approach to air combat operations. It leaves the benefit of initiative to the enemy and accepts at least some degree of harm by enemy action. It is reactive. On the other hand, limited objectives of DAS missions and the fact that the interceptor fighters operate relatively close to their bases make these missions relatively simpler. However, to be capable of intercepting intruders immediately in forward zone, area defence missions require lots of aircraft deployed at many bases spread out over friendly territory. This requirement is absolutely contrary to the trend in the Western world to decrease the amount of both active airbases and combat aircraft for financial reasons. As a consequence, if such a reduction occurs, remaining air defence fighters need both longer range and higher speed to intercept hostile aircrafts at a safe distance from their targets.

A fighter theoretically tailored for DAS can be a relatively short-range, lightweight type thus having a better air-to-air combat performance. But, it should also have a fuselage large enough to carry adequate number of air-to-air weapons and enough internal fuel for a long combat endurance. Additionally, minimum number of aircraft required to ensure Combat Air Patrol (CAP)

flights for a specific time over designated areas should also be considered.

On the other hand, DAS concept is less practical and feasible due to the widespread availability of long-range stand-off air-to-ground weapons and cruise missiles. To avoid these threats, air defence fighters should engage intruders at long distances equal to or more than the range of enemy stand-off weapons, perhaps more than 250 km, away from their targets. The demands of the case make DAS nearly impossible, especially with a scarce number of fighters operating from a few bases.

2.2 Offensive Air Superiority (OAS) Approach and Mission Considerations (Sweep and Escort). OAS is an alternative and completely different operational approach to air combat. It consists of offensive operations inside enemy territory executed by not only strike aircrafts attacking ground targets but also own air superiority fighters aimed at searching, engaging and destroying enemy air defence fighters. Thus, it forces the enemy into the defensive in its own region. When the adversary air defences have been destroyed, the enemy airspace becomes available and relatively secure for air-to-ground assets.

OAS compels the adversary to concentrate most of its aircraft potential including both dedicated air defence fighters and multirole fighter bombers to defend strategic assets such as energy production plants and transport infrastructure as well as the military forces. By limiting substantial amount of the enemy resources to allocate for its own offensive operations, OAS is also a kind of active defence.

OAS missions such as sweep and escort essentially require fighters with long combat radius and a significant level of low observability. Additionally, OAS fighters should be capable of operating independently from support assets such as Airborne Early Warning&Control and Electronic Warfare platforms while also not depending on any ground control unit. Thus, they need advanced on-board sensors and defensive systems.

Fighters designed for OAS missions will also perform many of the required capabilities when assigned in DAS roles. For instance, significantly long endurance on station in CAP missions could be maintained by full fuel load while short range intercept missions would be performed with a reduced fuel percentage. OAS is a modern defence tool against any crisis requiring demonstration of force, and is characterized by speed, flexibility and effectiveness.

3. ESSENTIAL CAPABILITIES FOR MODERN AIR SUPERIORITY ASSETS

3.1 Low Observability (LO) or Performance. The only air superiority fighter with considerable built-in LO characteristics currently in service is *F-22 Raptor*. Differing from previous LO types (*F-117 and B-2*), the design of *F-22* carries superior LO features without compromising from high flight performance mandatory for its main air superiority role.

In comparison with the *F-22*, the Russian fighter *T-50 PAK-FA* seems to be a more moderate and less determined approach to LO requiring minimum compromise in flight performance. This approach is whether the result of a purposeful design selection or the indication of the Russian incapacity to develop a fighter as stealth as *F-22*. But it is the fact that the *T-50 PAK-FA* will have some weak points about LO performance [4].

On the other hand, the possible negative impact of a categorical LO design approach on other obligatory features for an air superiority

fighter is still an arguable question, as well as its costs. Debates about the cost of *F-22* include not only acquisition costs and high R&D investments in stealth materials, but also the maintenance of the fragile RAM coating with concerns about reliability and availability.

The features that characterize a LO fighter can be analysed as below:

* Overall shape designed with due regards to both LO and flight performance.

* Alignment of the airframe's shape along limited reference lines (i.e. leading and trailing edges of wing and horizontal stabilizers), with due regards to aerodynamics.

* Radar Absorbing Material applied scarcely where really valuable, as the interior surfaces of the air intakes. Increase on the total weight, cost of acquisition/application and burden of maintanence should be considered.

* Sensors and antennas integrated with the airframe.

* Two dimensional nozzles.

* Capacity of internal weapons carriage.

* Divertless intakes that provide fuel-efficient, supercruise performance while presenting low radar reflectivity.

* Thrust Vectoring Control may enable the reduction in dimensions or complete exlusion of vertical and horizontal stabilizers in the future. Therefore, it may strongly reduce radar observability, too.

Other extreme design choices to further lower the RCS entailing considerable performance penalties and production costs would better be avoided.

3.2 Speed and Manoeuvrability. In design of most recent air combat fighters, the capability to sustain maneuvers up to 9g and to achieve extreme angles of attack is aimed rather than highest speed [1]. These capabilities should be seen in relation to the contemporary short range AAMs with IIR seekers and capable of high off-boresight target engagements especially when associated with Helmet Mounted Display (HMD).

High manoeuvrability is instinctively related with Close-In Combat (CIC). But it has also an import role as a "last ditch" defence option in BVR (Beyond Visual Range) combat as well. To avoid medium-range AAMs possessing the required terminal energy for engaging maneuvering targets even at the end of their trajectory, fighters should have high maneuver performance.

On the other hand, it is stated in a study aimed at determining the design characteristics of *F-35* that high turn rate is an ability that supports survivability against former generation SAM systems and BVR missiles but has a little impact on survivability of the aircraft against latest generation threats. In addition, it is asserted that high performance short-range AAMs integrated with HMD system are more vital than high turn rate in result of CIC. Thus, the required turn rate value decided for *F-35* can be reduced due to cost-effectiveness regarding the capabilities of weapons like *AIM-9X* and *ASRAAM* [10].

To combine speed and maneuver advantage in attack, a quick turn away from the target, after launching a missile, can be performed at supersonic speed, and it rapidly increases the range which the returning adversary missile must cover. Speed also reduces the time passing on the way between airbases and CAP areas and thus increases the reproduction of sortie rate. In addition, to be able to catch and escort the strike package again after engaging and defeating enemy air defence fighters that may endanger the package, high speed is a necessity for air superiority fighters.

3.3 Combat Persistence. An important assessment criteria for a fighter is its combat persistence. It can be explained as the number of hostile aircraft which can potentially be engaged in one sortie. Thus, there are two parameters related with combat persistence. One of them is the number and diversity of weapons carried in a typical air combat configuration. The other is combat radius and combat endurance on internal fuel [6]. The fighters need to get rid of external fuel tanks as soon as arriving at the expected combat area since they impact maneuver, speed and LO negatively.

Combat radius seems to be an undervalued performance criteria, especially in European fighter models. European air staffs have accepted a DAS concept in which friendly fighters would only take off when the adversary is just beyond the border for attack

while OAS was never considered. Consequently, the latest three European fighters - the *EF2000*, the *RAFALE* and the *GRIPEN* - have all short combat radius despite being very well designed by other measures.

Using external fuel tanks may be a solution for range but they induce additional drag which consumes up to 20-25% of the additional fuel. This drag effects maximum speed, service ceiling, acceleration and manoeuvrability negatively. Additionally, the number of available stations that carry weapons decrease by loading external tanks to them.

These limitations make Conformal Fuel Tanks (CFT) far more attractive. Although a decrease in the maneuver performance has to be accepted, the drag index is nearly the same as for the "clean" aircraft. Thus, they impose a little penalty to total aircraft performance. LOCKHEED MARTIN introduced them for the latest *F-16s* and it seems an elegant solution [2]. Similar CFTs are ready to be used by *RAFALE* and it is claimed that CFTs for *EF-2000* and *GRIPEN* are also being designed.

3.4 Networking and Datalink. In air operations, various assets participating in a given mission need to share information about the tactical situation and the potential threats. The modern complicated systems used for this purpose are known as datalink and are really essential for both DAS and OAS missions.

Automatic datalink systems are installed onboard most of modern combat aircrafts and this ability can be accepted as a force enhancement feature. Assisting datalink's functionality, Multifunction Displays (MFDs) are used to present the pilots both the big picture of tactical scenario and what they need inside it.

The opportunity of sharing data about tactical scenario and targets yields some significant operational capabilities, particularly in air-to-air combat. For example, a mission commander can command and control the large-force package tactically by analyzing the big picture of the combat area and allocating the favorable assets for engagement with the specific targets, while flying in the backseat of a fighter. Considering its contribution at a higher level, processing and merging of sensor data receiving via datalink from various aircrafts in different geographical positions provides the ability of positive identification and engagement of targets out very long ranges.

Datalink is also used between the launching aircraft and BVR missiles, to update target position data during inertial guidance phase of the missile. Furthermore, missiles like *AIM-120* and *METEOR* are being designed to confirm to the launching aircraft achievement of target lock-on with their active radar seekers [5]. It means that two-way missile datalinks will be in use in the foreseeable future.

3.5 Weapon Systems. Whether a fighter really requires an internal gun system or not has been a matter of discussion for a long time. However, considering some factors, it is assessed that internal gun is a requirement for fighters. Any missile, including the most capable one with high off-boresight lock-on capability, would always have a minimum engagement range in which a pilot wouldn't be able to launch it. In addition, it is not possible to use an AAM as a warning shot though gun can be used like a warning sign. Also, an AAM can't be used against both air-to-air and air-to-ground targets while gun offers this elasticity. However, a few hostile aircraft have been killed by gun attacks in aerial combats since the Vietnam War. As an example, only 5% of the air-to-air kills accomplished during

Operation Desert Storm in Iraq were accomplished using the gun [7].

HMDs compatible with the most recent short range AAMs are considered as lethal as the missiles and may be more effective than them in Close-in Combat (CIC). Although some air combat specialists claim that "dogfight era" is over, the probability of coming across an enemy aircraft at short range can't be ruled out. Actually, such encounter risk and possibility will become higher between similar LO-featured aircrafts due to substantial amount of reduction in their sensors search and tracking capability.

The goal of developing multiple impulse rocket motors for BVR missiles is to extend the engagement range and, more importantly, to obtain high maneuver capability through its trajectory, even in the terminal run to target. This feature enables a fighter to effectively execute the long-range precision engagement which is theoretically called as a distinctive capability of air and space power. But while long range and terminal manoeuvrability problems of AAMs are being solved, positive identification of targets at so long distances before engagement remains a big issue for air superiority fighters.

3.6 Self Protection. The ongoing increase in both the effective range and the precise guidance of latest generation AAMs is a crucial threat that needs to be considered while analyzing BVR and WVR air-to-air combats.

Current countermeasures taken for preventing lock-on and diverting the approaching missile away from its target generally consist of on-board IR/radar warning and deception systems, Miniatur Air Launched Radar Decoy-Jammers (MALD-J) and Towed Radar Decoys (TRD). Also, a tail warning radar has been installed in the rear side of some Russian fighters like the *SU-32FN* and the *SU-34* to cover the rear hemisphere. It is assessed that such an application will be part of *T-50 PAK-FA* defensive system [4].

Besides, there are active self-defence systems such as ELBIT *C-MUSIC* and NOTHROP GRUMMAN *AN/AAQ-24(V) DIRCM*, installed on some large transports and air-liners, aiming at physically destroying the incoming missile's seeker rather than jamming it [9]. Although conceptually similar systems are not currently practical for fighters due to concerns about size, weight and aerodynamic drag, it remains as a vital requirement.

4. CONCLUSION

Air supremacy permits friendly air and ground forces freedom of maneuver and attack. Air superiority fighters are key elements of a nation's defense and deterrent capability. Hostile nations recognize that airpower composed with an OAS concept can strike their vital centers with impunity which enhances all other government instruments of power. This is the timeless paradox of deterrence and the best way to avoid war is to demonstrate to the adversaries that you have the capability and will to defeat them. Hence, OAS is a kind of active defence.

The air superiority fighters possessing essential capabilities such as low observability, manoeuvrability, speed, combat persistence, tactical datalink, advanced weapon systems and self protection ensure accessing, surviving and achieving the effects necessary to win in integrated, high-threat environments.

REFERENCES

1. Carter, B.R. *Time-Optimization of High Performance Combat Maneuvers*. Monterey: Publishing House. (2005).
2. Defense Update. Conformal Fuel Tanks for Advanced F-16 Block 50/52/60. *defenseupdate.com.* [online]. Available: http://defenseupdate.com/products/c/F-16-CFT.htm (January, 2012).
3. Fisher, R. J. Japanese Military Technology Advances. *strategycenter.net* [online]. Available: http://www.strategycenter.net/research/pubID.173/pub_detail.asp (December, 2011).
4. Kopp, C. Assessing the Sukhoi PAK-FA. *ausairpower.net.* [online]. Available: http://www.ausairpower.net/APA-2010-01.html#mozTocId256798 (January, 2012).

5. MBDA. Meteor. *mbda-systems.com.* [online]. Available: http://www.mbda-systems.com/mediagallery/files/Meteor_ds.pdf (January, 2012).
6. Meilinger, P. S. *Range and Persistence: The Keys to Global Strike*. Air & Space Power Journal. (Autumn, 2008).
7. Moore, C. *The Need for a Permanent Gun System On the F-35 JSF*. Alabama: Maxwell Air Force Base. (2007).
8. NATO. *Strategic Concept for the Defence and Security of the Members of the North Atlantic Treaty Organization.* Lisbon. (2010).
9. NORTHROP GRUMMAN. Making Missiles Toast For 50 Years *es.northropgrumman.com* [online]. Available: http://www.es.northropgrumman.com/solutions/nemesis/ (December, 2011).
10. RAND. *The Next Generation Attack Fighter*, Washington D.C: RAND Corporation. (1997).

6. *DEVELOPMENTS IN THE FIELD OF UAS's*

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

ENHANCING CONTROL EDUCATION WITH REAL-TIME EXPERIMENTS

M. Kemal Bayrakceken*, M. Ozgur Kizilkaya, Aydemir Arisoy***

*Electronics Engineering Dept., Turkish Air Force Academy, Istanbul, Turkey,
** Aeronautics and Space Technologies Institute, Turkish Air Force Academy, Istanbul, Turkey,

Abstract: *In this paper, real-time experimentation platforms for enhancing the control education are presented. Electronics Engineering Department in Turkish Air Force Academy aims to motivate cadets by control experiments especially on flight related platforms. In this paper, real-time lever and quadrotor UAV experimentation sets with PD control are presented. The lever experimentation set is used as an introductory study before starting experiments with the quadrotor, since the dynamic equations of the lever is only a simplified version of the quadrotor and control method is the same. The structures of both systems are custom manufactured in laboratory according to educational requirements. They are considered to enhance the motivation of control related courses and laboratories.*

Keywords: *UAV, quadrotor, control, education*

1. INTRODUCTION

Turkish Air Force Academy (TurAFA) follows engineering discipline and has four departments, which are electronics, computer, aeronautical and industrial engineering. Upon graduation students get bachelor degree in one of those departments. Logically, basic motivation of cadets is concentrated around flight and pilotage every educational activity in the Air Force Academy should have a rich sense of applied flight practices where possible. Automatic Control Systems, Control System Theory and Design, Introduction to Robotics, Control Systems Laboratory and other control related courses are enriched with experimentation sets.

In recent years four rotor mini unmanned air vehicles has become very popular. There are several reasons behind this popularity some of which are; reduced mechanical complexity compared to helicopters, ease of manufacturing and maintenance, presenting a good control problem due to coupled and highly non-linear dynamics [1]. The quadrotor platform is utilized as an educational setup in TurAFA. The processor platform used is an industrial standard in real-time control systems, dSpace ds1103. Some advantages relating to educational aspect are; very high real-time processing power which is not available under PC architecture [2], programming in a well-known software MATLAB/Simulink with block diagrams and compiling directly to dSpace target [3], using dSpace ControlDesk GUI based software to modify Simulink variables in real-time, monitor and record data easily [4].

The presented quadrotor experimentation set has various types of usage for both graduate and undergraduate level education. The lever mechanism is an introductory set for

the quadrotor UAV. It is first aimed to make cadets familiar with rotor based platforms. The effect of vibration, thrust vector and propellers are investigated and then quadrotor UAV is introduced.

The paper is organized as follows. First, dynamic model of both systems are given. Then the control method is explained. Finally the educational environment is depicted and the experimental results are given.

2. DYNAMIC MODEL

The quadrotor experimental system described here is fixed on a 3DOF (Degree-Of-Freedom) universal joint with ±10° freedom in roll and pitch, ±360° freedom in yaw axis. Currently there is no movement in z-axis. Roll, pitch and yaw movements are accomplished by simply varying rotor angular velocities. This phenomenon is depicted in Figure 1. Bigger and smaller circles represent faster and slower rotors respectively. Roll and pitch movements are obtained by increasing and decreasing opposite (1-3 and 2-4) rotor the speeds.

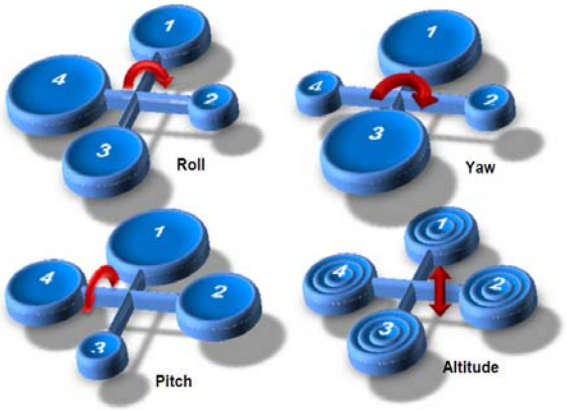


Figure 1 Basic maneuvers vs. angular velocities

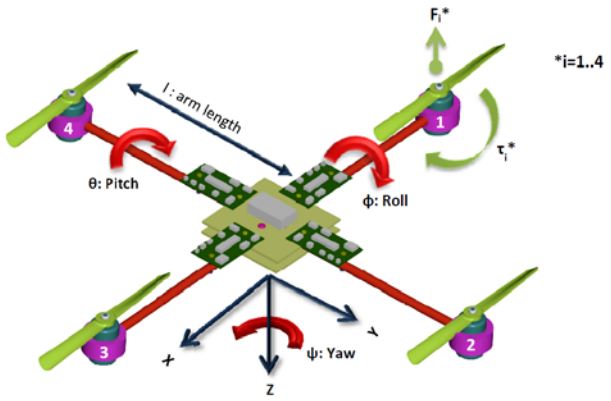


Figure 2 Quadrotor coordinate system

The simplified dynamic equations in accordance with the above assumptions and small angle approximation are [5]:

$$\ddot{\phi} = \frac{I_{rotor}\dot{\theta}(\Omega_1 + \Omega_3 - \Omega_2 - \Omega_4)}{I_{xx}} + \frac{I_{yy} - I_{zz}}{I_{xx}}\dot{\psi}\dot{\theta} + \frac{bl(\Omega_2^2 - \Omega_4^2)}{I_{xx}} \quad (1)$$

$$\ddot{\theta} = \frac{I_{rotor}\dot{\phi}(-\Omega_1 - \Omega_3 + \Omega_2 + \Omega_4)}{I_{yy}} + \frac{I_{zz} - I_{xx}}{I_{yy}}\dot{\psi}\dot{\phi} + \frac{bl(\Omega_3^2 - \Omega_1^2)}{I_{yy}} \quad (2)$$

$$\ddot{\psi} = \frac{d(-\Omega_2^2 - \Omega_4^2 + \Omega_3^2 + \Omega_1^2)}{I_{zz}} + \frac{I_{xx} - I_{yy}}{I_{zz}}\dot{\theta}\dot{\phi} \quad (3)$$

In equations (1-3); ϕ, θ and ψ are roll, pitch and yaw angles respectively. Ω_{1-4} represent rotor speeds, b stands for the thrust coefficient, d is the drag coefficient and l is the arm length Body inertia values are denoted with I_{rotor}, I_{xx}, I_{yy} and I_{zz}. Due to symmetrical properties of the quadrotor body, inertia matrix is diagonal, I_{xx} and I_{yy} are assumed to be equal. From equations (1-3) all forces and moments acting on the body can be written as seen in **Error! Reference source not found.**.

$$F_i = b\Omega_i^2 \qquad b\text{: thrust factor} \quad (4)$$

$$\tau_i = d\Omega_i^2 \qquad d\text{: thrust factor} \quad (5)$$

$$\tau_{\phi:roll} = bl(F_2 - F_4) = bl(\Omega_2^2 - \Omega_4^2) \quad (6)$$

$$\tau_{\theta:pitch} = bl(F_3 - F_1) = bl(\Omega_3^2 - \Omega_1^2) \quad (7)$$

$$\tau_{\psi:yaw} = d\sum_{i=1}^{4}\tau_i = d(\tau_1 - \tau_2 + \tau_3 - \tau_4) = d(\Omega_1^2 - \Omega_2^2 + \Omega_3^2 - \Omega_4^2) \quad (8)$$

The lever mechanism is much simpler than the quadrotor. There is only 1DOF with ±30° freedom. The movement might be considered as either roll or pitch. The equations of motion are same for both cases. The dynamic equations of the lever mechanism are obtained by equating all parameters related to pitch and yaw axis to zero in equation (1). The resulting formulas are given below.

$$\ddot{\phi} = \frac{bl(\Omega_{lever1}^2 - \Omega_{lever2}^2)}{I_{lever}} \quad (9)$$

$$\tau_{lever} = bl(F_{lever1} - F_{lever2}) \quad (10)$$

$$bl\left(\Omega_{lever1}{}^2 - \Omega_{lever2}{}^2\right)$$

To avoid confusion with the quadrotor formulas, the parameters related to rotors are named as lever. All control method and related formulas are derived using these equations.

3. CONTROL METHOD

A PD control scheme is utilized for the quadrotor and the lever experimentation set. Similar control approach for quadrotor platforms is widely used [5,6]. Control architecture for the quadrotor and the lever mechanism are given in Figure 3 and Figure 4 respectively.

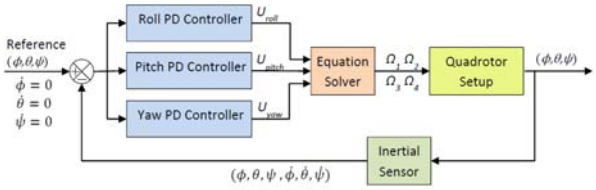


Figure 1 Quadrotor Control Architecture

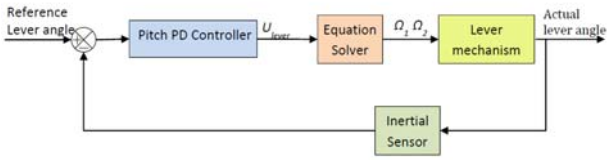


Figure 2 Lever Mechanism Control Architecture

Main PD control block has three separate loops for roll, pitch and yaw. The resulting control signals $U_{\varphi:roll}$, $U_{\theta:pitch}$ and $U_{\psi:yaw}$ are the moments (6-8) of their axes as written in following equations (9-11).

$$U_{\varphi:roll} = K_{p\varphi}\left(\varphi_{ref} - \varphi\right) + K_{d\varphi}\left(-\dot{\varphi}\right) = bl\left(\Omega_2{}^2 - \Omega_4{}^2\right) \quad (11)$$

$$U_{\theta:pitch} = K_{p\theta}\left(\theta_{ref} - \theta\right) + K_{d\theta}\left(-\dot{\theta}\right) = bl\left(\Omega_3{}^2 - \Omega_1{}^2\right) \quad (12)$$

$$U_{\psi:yaw} = K_{p\psi}\left(\psi_{ref} - \psi\right) + K_{d\psi}\left(-\dot{\psi}\right) = d\left(\Omega_1{}^2 - \Omega_2{}^2 + \Omega_3{}^2 - \Omega_4{}^2\right) \quad (13)$$

A similar control approach is used for the lever. The lever angle is controlled by the difference of thrusts, which are generated by the two motors. Hence this difference is equal to the control signal that is the output of the PD loop.

$$\left(Lever_{ref} - Lever\right) + K_{dlever}\left(-\dot{Lever}\right) = bl\left(\Omega_{lever1}{}^2 - \Omega_{lever2}{}^2\right) \quad (14)$$

The MATLAB Simulink model for the whole system and the PD control block is given in Figure 3. Same model is used for the lever by equating pitch and yaw axes parameters to zero.

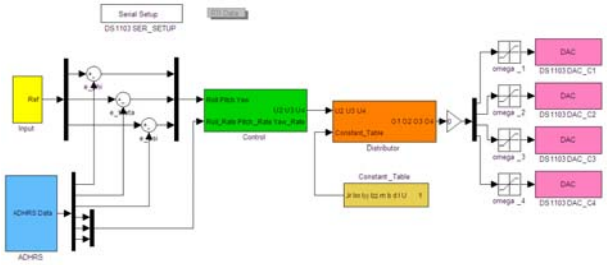


Figure 3 MATLAB Simulink model

4. EDUCATIONAL ENVIRONMENT AND EXPERIMENTAL RESULTS

Control Desk provides a comprehensive GUI for students as well as researchers. The most commonly used ControlDesk layout of the experimentation platform can be seen in Figure 4.

The quadrotor UAV and the lever mechanism experimentation set photos are given in Figure 5.

Sample experimental results for the quadrotor and the lever mechanism are given in Figure 8 and Figure 9.

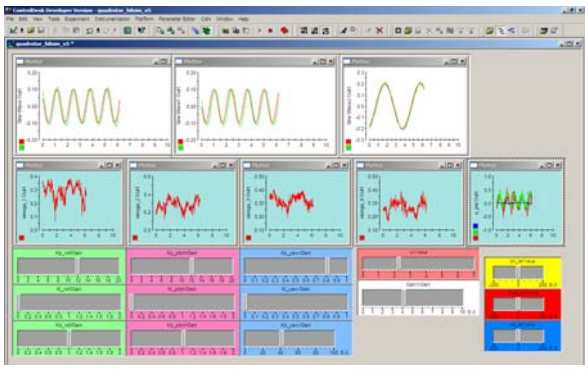


Figure 4 ControlDesk layout

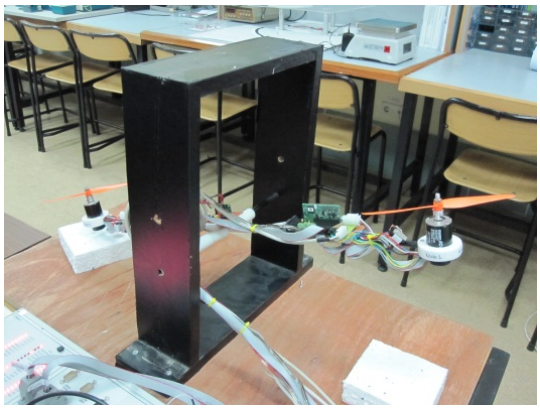


Figure 5 The Quadrotor and Lever Experimentation Sets

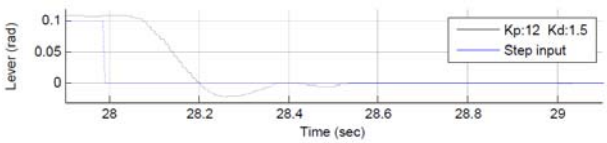


Figure 6 Lever angle step response

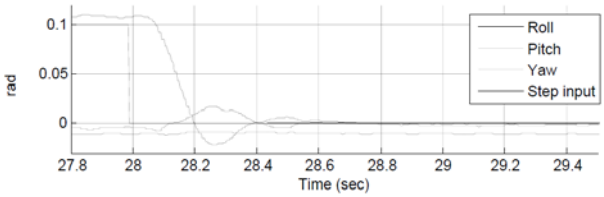


Figure 7 Roll angle step response

5. CONCLUSION

As explained in related paragraphs, both experimentation sets are intended to be a real-time working environments for various control laboratory practices in TurAFA. They are designed, built and tuned in the laboratory according to the educational and academic requirements of both undergraduate students and graduate researchers who are and will be involved in pilotage or flight related activities. The sets are considered to support the engineering education in TurAFA.

REFERENCES

1 M. K. Bayrakceken, M. K. Yalcin, A. Arisoy, and A. Karamancioglu, "HIL simulation setup for attitude control of a quadrotor," in Mechatronics (ICM), 2011 IEEE International Conference on, Istanbul, 2011, pp. 354-357.

2 A. Tekin, F. Ata, and M. Gökbulut, "Remote control laboratory for DSP-controlled induction motor drives," Computer Applications in Engineering Education, 2010.

3 C. Versèle, O. Deblecker, G. Bury, and J. Lobry, "Implementation of advanced control schemes using dSPACE material for teaching induction motor drives," International Journal of Electrical Engineering Education, vol. 47, pp. 151-167, 2010.

4 A. L. Ellermeijer, T. Ellermeijer, A. J. P. Heck, A. Heck, E. Kedzierska, and E. Kedzierska, "Design and implementation of an integrated computere working environment for doing mathematics and science," Journal of Computers in Mathematics and Science Teaching, vol. 28, p. 147+, 2009 Summer 2009.

5 S. Bouabdallah, "Design and control of quadrotors with application to autonomous

flying," PhD, STI School of Engineering, EPFL, Lausanne, 2007.

6 A. Tayebi and S. McGilvray, "Attitude Stabilization of a VTOL Quadrotor Aircraft," IEEE Transactions on Control Systems Technology, vol. 14, pp. 562-571, 2006.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

THE RELATIONSHIP BETWEEN THE UAV FLEET OF EUROPEAN COUNTRIES AND THEIR GEOPOLITICAL POSITION

Melih Cemal Kushan*

*Faculty of Engineering and Architecture, Eskisehir Osmangazi University, Eskisehir , Turkey

Abstract: *Parallel to the conventional weapons technology, the usage of Unmanned Aerial Vehicles/UAV's in many countries is also increased widely. Because UAVs were the fastest-growing segment of the aerospace sector in 2008, with a worldwide value of more than $3.4 billion (USD). More than 42 countries have gone on record as producing at least one UAV airframe, and nearly 1,000 systems exist today, worldwide. So many different type of UAV are developed by many companies all over the world. While some of them are state of the art the others ones are very primitive. Nevertheless, all of them are used widely as usefull vehicles in civil and also military applications. In this study, the subject is the usage of UAV fleet of Europian Countries with their special causes problems and geopolitical positions especially.*

Keywords: *UAV,Unmanned Aerial Vehicle, Air Forces of Europian Countries*

1. INTRODUCTION

UAV use in Europe has been slower to emerge than in the US and in Israel. However, experience of using mature UAV systems on operations in Iraq and in Afghanistan has dramatically improved the European perspective on their utility, and the military market is growing at a significant rate.

Whilst it has been the major European military powers of UK, Russia, France, Turkey, Germany and Italy who have taken the lead in the procurement of military UAVs, there are growing signs that their popularity is reaching a wider market. In the EU accession state, Romania is gaining significant experience on UAV operations; Hungary has experimented with UAVs in civil applications such as fire fighting and a number of SMEs with an interest in the area are emerging.

Military procurement was initiated principally by the conflict in the former Yugoslavia and, as a result, European forces have focussed on the tactical level UAV such as the Sperwer and Phoenix rather than choosing to acquire the full spectrum of UAV systems. The experience of using these tactical systems has been instrumental in shaping requirements for a broader range of UAVs, and in the development of CONOPS in their use. Over time, however, European military forces have progressively expanded their inventory of UAV systems to include mini-UAVs (in the case of UK, France, Germany, Sweden, Italy), and MALE UAVs (in the case of UK, France and Italy). They have also been examining the potential for weaponising current UAV models as well as for acquiring UCAVs – Unmanned Combat Aerial Vehicles.

2. UNMANNED AERIAL VEHICLE

The UAV is an acronym for Unmanned Aerial Vehicle, which is an aircraft with no pilot on board. UAVs can be remote controlled aircraft (e.g. flown by a pilot at a ground control station) or can fly autonomously based on pre-programmed flight plans or more complex dynamic automation systems. UAVs are currently used for a number of missions, including reconnaissance and attack roles. For the purposes of this article, and to distinguish UAVs from missiles, a UAV is defined as being capable of controlled, sustained level flight and powered by a jet or reciprocating engine. In addition, a cruise missile can be considered to be a UAV, but is treated separately on the basis that the vehicle is the weapon. The acronym UAV has been expanded in some cases to UAVS (Unmanned Aircraft Vehicle System). The FAA has adopted the acronym UAS (Unmanned Aircraft System) to reflect the fact that these complex systems include ground stations and other elements besides the actual air vehicles.

2.1. UAV Types

Target and decoy - providing ground and aerial gunnery a target that simulates an enemy aircraft or missile

Reconnaissance - providing battlefield intelligence

Combat - providing attack capability for high-risk missions.

Research and development - used to further develop UAV technologies to be integrated into field deployed UAV aircraft

Civil and Commercial UAVs - UAVs specifically designed for civil and commercial applications.

2.2. Degree of Autonomy

Some early UAVs are called drones because they are no more sophisticated than a simple radio controlled aircraft being controlled by a human pilot (sometimes called the operator) at all times. More sophisticated versions may have built-in control and/or guidance systems to perform low level human pilot duties such as speed and flight path stabilization, and simple prescripted navigation functions such as waypoint following.

Autonomy technology that will become important to future UAV development falls under the following categories:

Sensor fusion: Combining information from different sensors for use on board the vehicle

Communications: Handling communication and coordination between multiple agents in the presence of incomplete and imperfect information

Motion planning (also called Path planning): Determining an optimal path for vehicle to go while meeting certain objectives and constraints, such as obstacles

Trajectory Generation: Determining an optimal control maneuver to take to follow a given path or to go from one location to another

Task Allocation and Scheduling: Determining the optimal distribution of tasks amongst a group of agents, with time and equipment constraints

Cooperative Tactics: Formulating an optimal sequence and spatial distribution of activities between agents in order to maximize chance of success in any given mission scenario

Under the NATO standardization policy 4586 all NATO UAVs will have to be flown using the Tactical Control System (TCS) a system developed by the software company Raytheon.

2.3.UAV Endurance

Because UAVs are not burdened with the physiological limitations of human pilots, they can be designed for maximized on-station times. The maximum flight duration of unmanned aerial vehicles varies widely. Internal combustion engine aircraft endurance depends strongly on the percentage of fuel burned as a fraction of total weight (the Breguet endurance equation), and so is largely independent of aircraft size. Solar electric

UAVs hold the potential for unlimited flight, a concept championed by the Helios Prototype, which unfortunately was destroyed in a 2003 crash.

Many people have mistakenly used the term Unmanned 'Aerial' System, or Unmanned 'Air Vehicle' System instead of Unmanned Aircraft System [2].

3. OVERVIEW OF THE CURRENT SITUATION IN EUROPE

Military procurement was initiated principally by the conflict in the former Yugoslavia and, as a result, European forces have focussed on the tactical level UAV such as the Sperwer and Phoenix rather than choosing to acquire the full spectrum of UAV systems. The experience of using these tactical systems has been instrumental in shaping requirements for a broader range of UAVs, and in the development of CONOPS in their use. Over time, however, European military forces have progressively expanded their inventory of UAV systems to include mini-UAVs (in the case of UK, France, Germany, Sweden, Italy), and MALE (medium-altitude long-endurance) UAVs (in the case of UK, France, Turkey and Italy). They have also been examining the potential for weaponising current UAV models as well as for acquiring UCAVs – Unmanned Combat Aerial Vehicles (see Table 1).

Table 1: UAV fleet of military in Europe

	Krunk	Hermes 450	RQ-5 Hunter	Skylark	Searcher	Raven	Harfang	Global Hawk	Heron	Pegasus	Predator	Reaper	Shadow	PCHELA-1T	Reis	Ranger	Gnat 750	Anka	Desert Hawk	Total
Armenia	15																			15
Azerbaijan		10																		10
Belgique			6																	6
Cyprus					2															2
England												5							1	6
Estonia						1														1
Finland																1				1
France							4													4
Georgia		7																		7
Germany								5	3											8
Greece										5										5
Hungary				9																9
Italy											4	2								6
Romania													7							7
Russia					5									10	5					20
Serbia		2		6																8
Sweden				1									1							2
Swiss																24				24
Turkey									10		1	4	6				18	1		40
∑ UAV																				181

The success of UAVs in providing real-time information to commanders on the battlefield has contributed to both mission effectiveness and in protecting personnel. It is their effectiveness in these roles which has encouraged European countries to commit to the use of military UAVs to an extent that will support rapid market growth during the next ten years. In many respects, it is this successful operational use that is causing problems for the development of the UAV industry in Europe. The industry has suffered from a lack of research investment in a context where customers want mature, battle-proven equipment at low cost and in a short time frame, and national governments as well as

Europian institutions have often not done enough to support UAV development activities, especially in the civilian sector. This has encouraged European industry to focus on partnerships with Israeli or US companies at the expense of developing a native, European alternative. This trend has broad implications for the further development of expertise within the European skills base and the competitiveness of European companies in the emerging global marketplace.

A notable characteristic of the rapid growth in the procurement of military UAVs over the forthcoming ten years will be the shift towards MALE category platforms. This shift poses a significant threat to European industry, which has tended to focus on the tactical level. Between 2008 and 2016, the European Military UAV market is expected to see procurement of:

- Up to 600 tactical UAV aircraft
- Up to 200 MALE UAV aircraft
- 5 HALE UAV Aircraft
- ~10, 000 Mini-UAV aircraft

This corresponds to an estimated market value of around €8 billion up until 2016 (see Fig.1 and Fig. 2) [1].

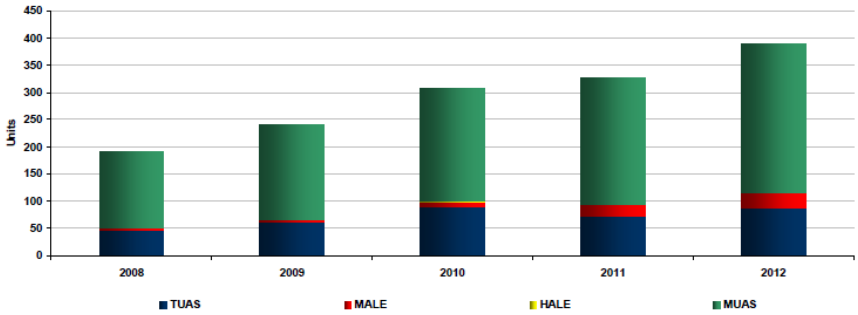


Figure 1: European UAS Procurement, 2008-2012 [1].

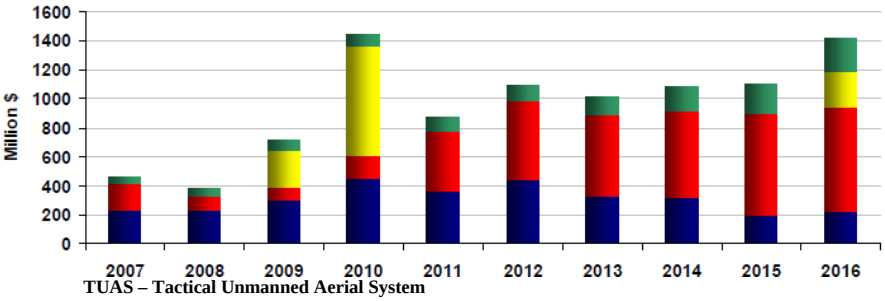


Figure 2: UAS Market Revenues (Europe), 2007-2016 [1].

3.1.The Role of the Europian Countries on the Global UAV/UCAV Market

The global market for UAVs has grown dramatically in the last 10 years and is expected to maintain high growth rates in the coming decade when existing possessors expand their use of UAVs and when more countries acquire them. This opens up possibilities for Europian producers to improve on their previously poor track record and export their products to non-Eurpian countries. As Figure 3 shows, only a small proportion of global UAV acquisitions from foreign sources in the last 10 years concerns Europian producers exporting to other countries. An estimate for 2006 gave EU producers only a four per cent share of the global market, almost all from national or intra- Europian sales. Most of the global export market is covered by the US [3] (in 2006, US producers accounted for some 60 per cent of the total global market - including the huge US market [4]) and Israel (IAI's MALAT division pronounces that it 'leads the

market in UAV experience, technology and reliability', and has over 29 customers.

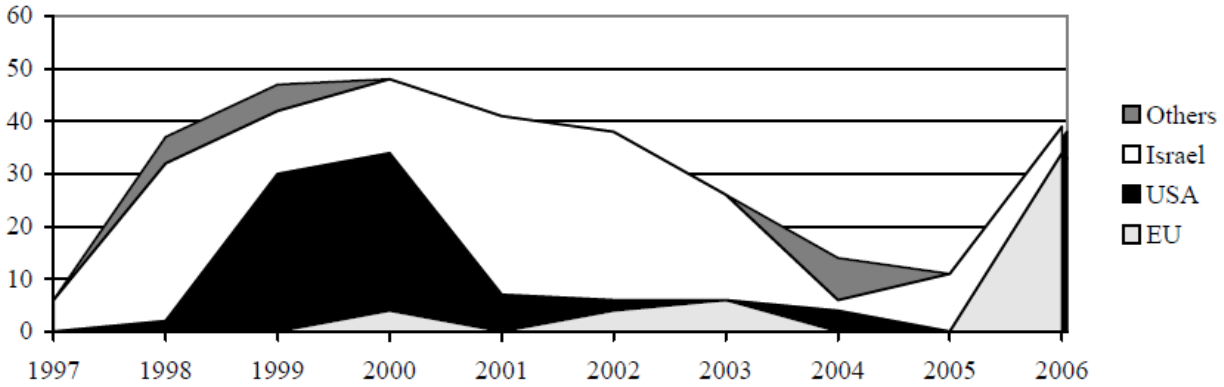


Figure 3: Global exports of UAV 1997-2006 [3]

4. EUROPEAN COUNTRIES, THE CAUSES OF UNMANNED AERIAL VEHICLE OF SERVICE IN EUROPEAN COUNTRIES

Allowing routine and safe access of UAVs to civil airspace involves numerous issues that touch on nearly every aspect of the aviation technical, operational, and legal system. Presented here is a framing of those issues organized into five major groupings: safety, security, air traffic, regulatory, and socio-economic. Within these groupings are specific issues. Each contains a discussion of the issue, potential mitigating factors (i.e., research), and an assessment of the issue relative to the overarching goal of full integration into civil airspace. At the end of each assessment is a table containing a summary of the safety criticality, technical complexity, socio-political risk, and economic cost, rated on a scale of high, medium and low.

4.1 Safety

Successful integration of UAVs in civil airspace will require assurances that they can safely operate within the constructs of a commonly shared aviation system and environment. As such, UAVs must demonstrate that they do not pose an undue hazard to other aircraft or persons on the ground. They must, in short, provide for an equivalent level of safety to manned aircraft. But defining this equivalency in terms of requirements is difficult. UAVs operate differently from manned aircraft. And because the pilot is no longer at risk in a UAV accident, the question arises as whether UAV systems can or should be held to the same safety standard as manned aircraft.

4.2 Security

UAVs may present unique security issues. The wide variation in flight environments, missions, and vehicle sizes make the secure control of UAV flights a challenge. Security requirements of the ground control station, data link infrastructure, vehicle and even the data must be a fundamental consideration in system design and operational policies and procedures of UAVs. In addition to being vulnerable to security breaches, UAVs themselves are also a potential security threat. And as the cost of UAV systems fall and the capabilities increase, a proliferation (or at least wide availability) of highly capable UAVs could further exacerbate security concerns.

4.3 Air Traffic

Assuring the safe and efficient integration of UAVs into air traffic operations will require UAVs to operate within the constraints of the evolving air traffic system. Assessing the potential impact of UAVs on air traffic operations will depend on the UAV types, numbers, operating environments, frequency of flights, performance characteristics, and equipage levels as they relate to the air traffic infrastructure and operations—current and planned. Because operations of UAVs to date have been limited in numbers and have purposefully remained clear of air traffic, it is difficult to assess impacts other than through analysis, modeling, and simulation.

4.4 Regulation

Regulatory requirements will ultimately define the operational boundaries of UAV certification, flight operations, and operator qualifications. To date, there are only a few countries having regulations pertaining specifically to UAV operations. Whatever regulatory structure is implemented, it will be a major defining factor in the evolving UAV market and its affect on air traffic operations.

4.5 Socio-Economic

Economic, political, and social issues simultaneously drive and restrain the UAV market. Demand for government use of UAVs (e.g., military, homeland security, law enforcement, and scientific research) is influenced mostly by the availability of fiscal resources and political will. Commercial markets, on the other hand, are dependent on the business case, which is linked to consumer demand, regulatory approval, airspace/airport restrictions, and public acceptance [5].

4.6 Geopolitics

To remain credible, and to prevent the disintegration of their own system, the European Countries will have to integrate, develop and refine their military assets – especially naval capabilities and long-range and unmanned combat aircraft (UAV) – far more rapidly and effectively over the next two decades than they have over the last. In particular, new overseas military installations may be required, especially in those areas where new energy transmission pipelines from foreign gas fields and commercial distribution routes from distant manufacturing centres are built to supply the European economy. Accordingly, as Map 1 shows, new European military stations may be required in the Caucasus and Central Asia, the Arctic region, and along the coastlines of the Indian Ocean. The intention behind these installations would be to contribute to a comprehensive 'forward presence': firstly, by representing – *á la* Mahan – a certain determination on the part of the European Union to exercise a latent but permanent power within the 'Grand Area'; secondly, by exerting a calming influence throughout the zone to encourage expectations of peaceful change on the part of local governments; and finally, to discourage the encroachment of larger external powers into the region, whose intentions may be predatory and/ or antithetical to the European agenda and the general peace[6].

The Table 1 shows that there are 5 countries in Europe which have got more then 10 UAV. These countries; Azerbaijan (10), Armenia (15), Russia (20), Swiss (24) and Turkey (40). Azerbaijan and Armenia can search mountanious borders eachother via their UAV fleets which so cheap and effective method; thus, both of them have got too many UAV for their security. Swiss also have got remarkable number of UAV although it is a little country in Europe. Because also it is former disconnected country and peter of world. Swiss must be achieved its border security effectively and the best method is the UAV control for board for this.

Turkey is the biggest UAV fleet country all of the Europe with its 40 vehicles. Because Turkey has been affected the influence of terrorist groups for years. And, Turkey needs to acquire more and smaller unmanned aerial vehicles (UAV) to prevent large-scale attacks by the outlawed Kurdistan Workers Party (PKK) against Turkish military units near the borders with Iraq and Iran [7]. So, it is necessary to have a strong UAV flet because

of its effectively mission and cheap running coast.

5. CONCLUSIONS & ACKNOWLEDGMENT

In spite of the generally accepted notion that adapting military platforms for civil use is likely to be a key driver for the industry in the near future, most of the current market players believe that they have no choice but to concentrate most of their efforts on military UAS (unmanned aerial system) applications due to the bad visibility of what the future civilian market may hold.

This has in many cases shifted efforts away from areas of development that can be considered strategic for the civil side. European efforts to transform military capabilities have had to occur in the context of expensive and longterm acquisitions, and ongoing operations with constrained budgets, with the following results:

1. MoDs (Ministry of Defence) have often encouraged industry to shift towards utilising Commercial-Off-The-Shelf (COTS) technology;
2. Urgent Operational Requirements (UOR) have shortened acquisition cycles that favour companies with existing mature solutions;
3. European Primes have sought partnerships with international suppliers, to speed up delivery of mature capability and to reduce investment costs and cost to the customer.

Therefore, in many cases the current civil/military technological synergy stems from necessity rather than choice. This is expected to change once the technological development for sense-and-avoid and other required solutions finally reaches a level where they will be generally applied and demand for civilian UAVs crosses a significance threshold. Once that happens, the majority of solutions will come from dedicated, civil-orientated sources and will possibly even be re-adapted for military purposes.

NATOs work on STANAG 4671 (UAV operations) and STANAG 4670 (UAV training) have been extensively used as precursors for application of guidelines within the civilian sector. STANAG 4671 was based upon work originally sponsored by France's DGA to develop USAR (UAV Systems Airworthiness Requirements) for fixed-wing UAVs.

These efforts indicate that insertion of UAVs into non-segregated aerospace is now of equal priority to civil and military institutional players, and the response from industry indicates that they now share this view. Therefore, the efforts by EDA should continue and must be encouraged.

Funding on the security side can be channelled through existing institutions such as FRONTEX or EUROPOL and directed towards specific areas of research. For example, FRONTEX could play a role similar to EDA in terms of both equipment procurement support and support for border security-specific sensors and equipment development. It can serve as a channel to voice Member States' requirements and to inform the relevant actors of new technological developments. Finally, FRONTEX could pool UAS and other resources already available to Member States and direct them to EU border areas where they are most needed at that point in time[1].

REFERENCES

1. Europian Commission, Enterprise and industry directorate – General, *Study analysing the current activities in the field of UAV* [online]. Available: http:// ec.europa.eu/enterprise/ policies/ security/ files/ uav_ study_ element_1._en.pdf (March, 2012).
2. *The UAV* [online]. Available: http:// www.theuav.com/ index.html (March, 2012).
3. Wezeman, S., UAVs and UCAVs: Developments in the european union. *European Parliament briefing paper*, October 2007.
4. Dickerson, L., UAVs on the rise, *Aviation Week & Space Technology*, 15 January 2007.
5. DeGarmo, M., T., Issues Concerning Integration of Unmanned Aerial Vehicles in Civil Airspace, *Mitre Coorporation Center for Advanced Aviation System Development*, November 2004.
6. Rogers, J., A new geography of european power, *Egmont Royal Institute for International relation*, January 2011.
7. Mortimer, G., More UAS for Turkey, *sUAS News*, [online]. Available: http://www.suasnews.com/ 2011/ 10/ 9365/ more-uas-for-turkey/ (March, 2012).

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

"GENERAL M.R. STEFANIK"
ARMED FORCES ACADEMY
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

RESEARCH REGARD UPGRADE OF UAV IN LOW COST CONCEPT

Vasile PRISACARIU[*], Mircea BOŞCOIANU[**], Ionică CÎRCIU[**]

[*]Transilvania University Braşov,[**]Air force Academy "Henri Coanda" Brasov, Romania

Abstract. *Unmanned Aerial Vehicles (UAVs) have seen unprecedented levels of growth in military and civilian application domains. Fixed-wing aircraft, heavier or lighter than air, rotary-wing (rotorcraft, helicopters), vertical take-off and landing (VTOL) unmanned vehicles are being increasingly used in military and civilian domains for surveillance, reconnaissance, mapping, cartography, border patrol, inspection, homeland security, search and rescue, fire detection, agricultural imaging, traffic monitoring, to name just a few application domains.*
Keywords. *Unmanned aerial vehicles (UAVs), upgrade, low cost, FPV/OSD*

1.INTRODUCTION

Unmanned Aerial Vehicles (UAVs) have seen unprecedented levels of growth in military and civilian application domains. Both civil and military authorities have a substantial interest in UAV robots that are able to operate with lowcost.

1.1.Types of UAV

Fixed Wing: Though this type of vehicle has intrinsic stability it is difficult to get it to operate effectively due to the slow flight speeds required.

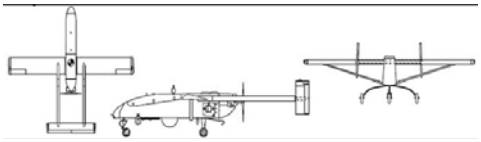


Fig. 1 The RQ-2B Pioneer designed by Pioneer UAV Inc. and operated by the US Marine Corps

Rotary Wing: These are by far the most common configurations currently being explored for this type of mission though few if any are in service. Rotary wing aircraft are inherently unstable which leads to complex flight control systems.

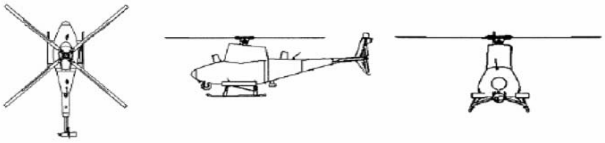


Fig. 2 The RQ-8A/B FireScout. It is designed by Northrop Grumman

Para foils wing. These Para foils have been used to deliver cargo to otherwise inaccessible areas or propaganda leaflets to enemy troops.

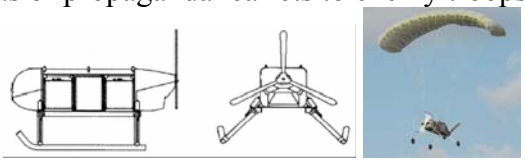


Fig 3. The CQ-10 Snow Goose built by MMIST

Dirigibles: These are lighter than air vehicles usually filled with helium. To lift a significant payload they tend to be large and while stable and maneuverable they are very subject to air movements and temperature variations [1].

Fig. 4 Advanced Airship Flying Laboratory developed by the American Blimp Corporation

as a test bed for improving airship systems technologies, sensors, communications

1.1. Sketch of the UAVs

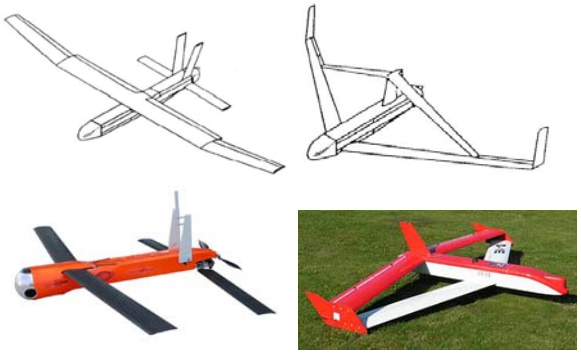


Fig. 5 Variable span and joined wing

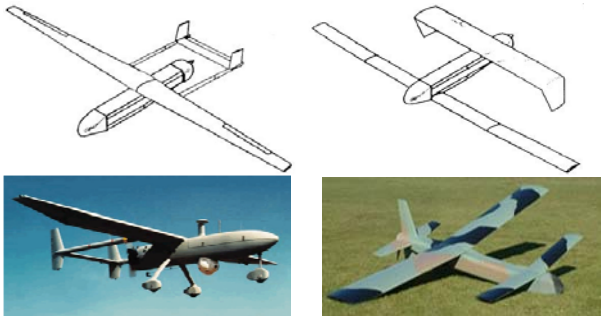


Fig. 6 Twin boom and tandem

2.RESEARCH REGARD UPGRADE LOW COST CONCEPT FOR ATM-1M IN ATM-1V

Upgrade concept is about total performances of the unmanned aerial vehicles, how is in fig. 7

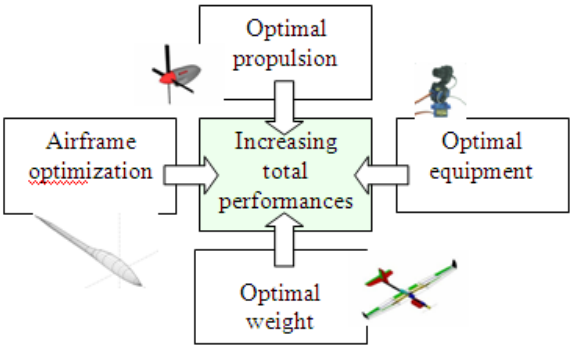


Fig. 7 Method of the increasing total performances

For increasing performances make upgrade at present UAV call ATM-1M, he is an old vector for Romanian Army, in present retired. In the next figure is present upgrade design (parasol wing) for increasing lateral stability.

a. b.

Fig. 7 Upgrade ATM-1M in ATM-1V
a. old version UAV, b. new version UAV

Comparative technical data [2]

Tehnical data	**Old ATM-1M**	**New ATM-1M**
Span	2600 mm	2600 mm
Length	1750 mm	1650 mm
Height	580 mm	580 mm
Empty weight	6 kg	4 kg
Total weight	8 kg	7 kg
Andurance	40 min	90 min
Max. speed	150 km/h	190 km/h
Min. speed	70 km/h	50 km/h
Cruising speed	110 km/h	90 km/h
Operational ceiling	2000 m	3500 m
Max. distance	2500 m	5000 m
Engine	1,2 CP	2,4 CP
Missions	aerial target	aerial target, data acquisition
Ground crew	1	

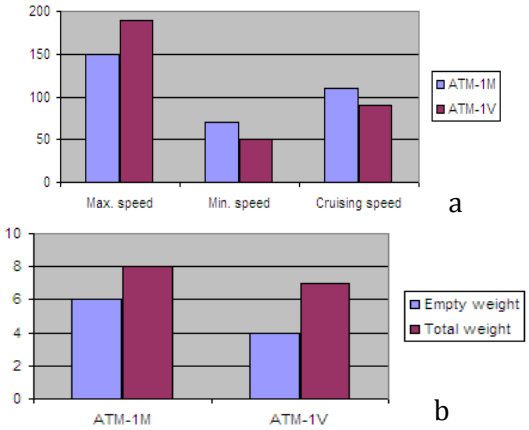


Fig.8 Speed (a) and weight (b) comparation

2.1.Engine and equipment.

This gas engine, are: 2 pcs. aluminium crankcase, Walbro butterfly type carburetor, auto-advance CDI ignition, one GF26i Gasoline Airplane Engine, auto-advance CDI Electronic iginition. [2]

Fig. 8 Engine GF 26 (26 cm^3)

Tehnical data

Capacity	26 cm^3
Power	2,4 CP – 9000 rpm
Weight	1250 g – 1700 g
Bore x Stroke	34mm x 28.6mm
Rotation	1600 – 9500 rpm
Carburator	Walbro pump
Equipment	auto-advance electronic iginition,
Propeller	16x8, 16x10, 17x8 17x10

2.2. Radio control system:

Futaba T-6EX FM 35/40 MHz or 2,4 GHz .

Fig 9. Transmitter Futaba, S3003 servo and Receiver

Specifications:

T6EXAP Transmitter with software [4]
Transmitting on 35, 40, 41, or 72 MHz.
Operating system: 6-channel system.
Power supply: 9.6V Ni-Cd / LiPo.
Current drain: 250mA.
Receiver: R127DF or R136F.
Receiving on 35/40/41/72 MHz band.
Power requirement: 4.8V or 6V.
Current drain: 9.5mA @ 4.8V,
Size: (33.4x50.3x18.1mm),
Weight: / R136F- 0.98oz (27.8g).
Servo: S3003 standard
Power requirement: 4.8 or 6V
Output torque: 3.2kg-cm @4.8V.
Operating speed: 0.23sec/60°@4.8V
Size: 40.4x19.8x36mm
Weight: S3003- 1.3oz (38.0g).

2.3. Electronic systems, equipment image acquisition and FPV system

Electronic failsafe, electronic Battery Switch. Is an electronic safety switch that provides power to a receiver in two packages of 4 or 5 cell NiCd or NiMH. If the battery of the end or suffer a break (so no longer receive current receiver) when the Battery Switch automatically switches the other battery pack .

Fig. 10 Battery switch [3].

Specifications:
- Weight: 18 g
- Working voltage: 4.8 - 6 Volt
- Current: 3.5 A continuously, 5A max.
- Dimensions: 53 x 21 x 13 mm

2.4.Sistem for mission and flyght.

FPV system. The flow chart (fig.11) show all components onboard (minimal equipment).

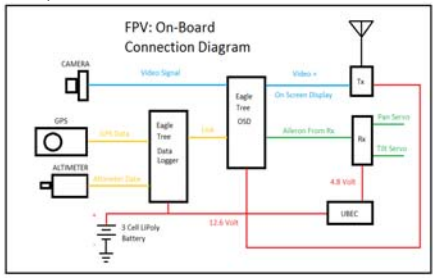


Fig. 11 Sistemul FPV (first visual person)

The OSD system show flight data with datalink FPV and onboard sensors (image online, speed, altitude, RPM, temperature, GPS data)

Fig. 12 OSD onscreen (minimal and full equipment)

3. COSTS FOR UPGRADE ATM- 1V

The estimate costs for a new equipment and new missions show in the next table.

Components	**Price**
Engine	200
Radio control system	250
Electronic failsafe	30
Battery pack	30
Materials and supplies	150
Equipment image acquisition	90
FPV system	300
Total cost euro	**1000**

4. CONCLUSIONS

Implementation, exploitation and the difference in default and equipment lead to differences in costs and capabilities of these aircraft already have a history own evolution alongside the other known types of aircraft.

In future is necessary to take into account the folowing aspects:

- Integration of UAV into the national airspace system;
- Communications with UAV operators;
- Identification of UAVs;
- Airworthiness and maintenance.
- Pilot training, experience and qualifications
- Required navigation performance (RNP) and a dependence on good and reliable GPS coverage;
- Flight termination systems;

ACKNOWLEDGMENTS

The authors wish to thank the "Transilvania" University Braşov and "Henri Coandă" Air Force Academy for their support in research activity for this article.

REFERENCES:

1 Advances is unmannend aerial vehicles, editor Kimon P.Valavanis, University of South Florida Tampa, Florida, USA

2 Tehnical Book for UAV ATM-1M, IPL Tg Mureş, 1981;

3 http://www.sierra.ro

4 *Instruction manual for Futaba 6EXAP6-channel*, PCM/PPM(FM) selectable, Radio control system for aircraft, 2005, 24 p

5 *Unmanned Aircraft System (UAS) ROADMAP 2005-2030*, US DoD, Washington DC, 2005