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ICAICTSEE – 2015

November 13 – 14th, 2015

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ICAICTSEE-2015

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DEPT. OF INFORMATION TECHNOLOGIES AND COMMUNICATIONS

UNIVERSITY OF NATIONAL AND WORLD ECONOMY

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1700 SOFIA, BULGARIA

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ISSUED FOR PUBLICATION: AUGUST 15TH 2016

SIZE: JIS-B5

QUIRES: 45

PAGES: 725

VOLUME: 100

ISSN 2367-7635 (PRINT)

ISSN 2367-7643 (ONLINE)

PUBLISHING COMPLEX - UNWE

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Dear Colleagues,

On behalf of the Conference Committees I have the honor and pleasure to thank you all for your true participation in the work of the 5th International Conference on Application of Information and Communication Technology and Statistics in Economy and Education (ICAICTSEE-2015), http://icaictsee.unwe.bg/, which took place on November 13-14th, 2015 at the University of National and World Economy (UNWE), Sofia, Bulgaria.

I would like specially to express my gratitude to all of the program committee members for their genuine support without which it would never had happened.

Due to the current state of scientific development in all spheres of human activity, the constant knowledge and skill actualization of the academia and researchers in the field of Information and Communication Technology (ICT) is an obligatory necessity, especially when the world is in a global economic and financial crisis. The definition of long-term scientific research tasks in this area has a strategic importance, which is even truer for young researchers, lecturers and Ph.D. students.

The conference aims were conducting analysis of the current problems and presenting results of the ICT application in different areas of economy, education and related areas of scientific knowledge; outlining the existing possibilities for the application of modern ICT tools, methods, methodologies and information systems in economy and education; discussing advanced and emerging research trends with a long-term importance in the field of ICT application in economy and education.

The conference has established an academic environment that fosters the dialogue and exchange of ideas between different levels of academic and research communities.

The conference outcome is 102 published research papers (44 from foreign participants), the explosion of fresh ideas and the establishment of new professional relations.

I do hope to meet you all again at ICAICTSEE – 2016 (http://icaictsee.unwe.bg/)!

Dimiter G. Velev
ICAICTSEE-2015 Chair

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ICAICTSEE - 2015
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WOULD THE EDW BE DROWNED IN THE OPEN-SOURCE "DATA LAKES"?

Krum Daskalov

ScaleFocus Analytics Practice Lead
and Director of the Analytics Department

Would the EDW be drowned in the open-source "data lakes"?

Krum Daskalov - ScaleFocus' Analytics Practice Lead and Director of the Analytics Department

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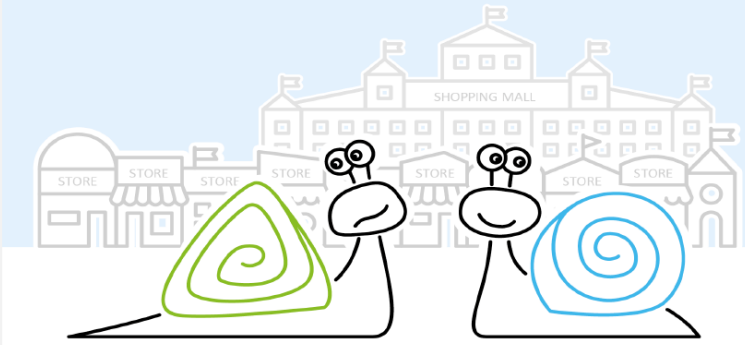

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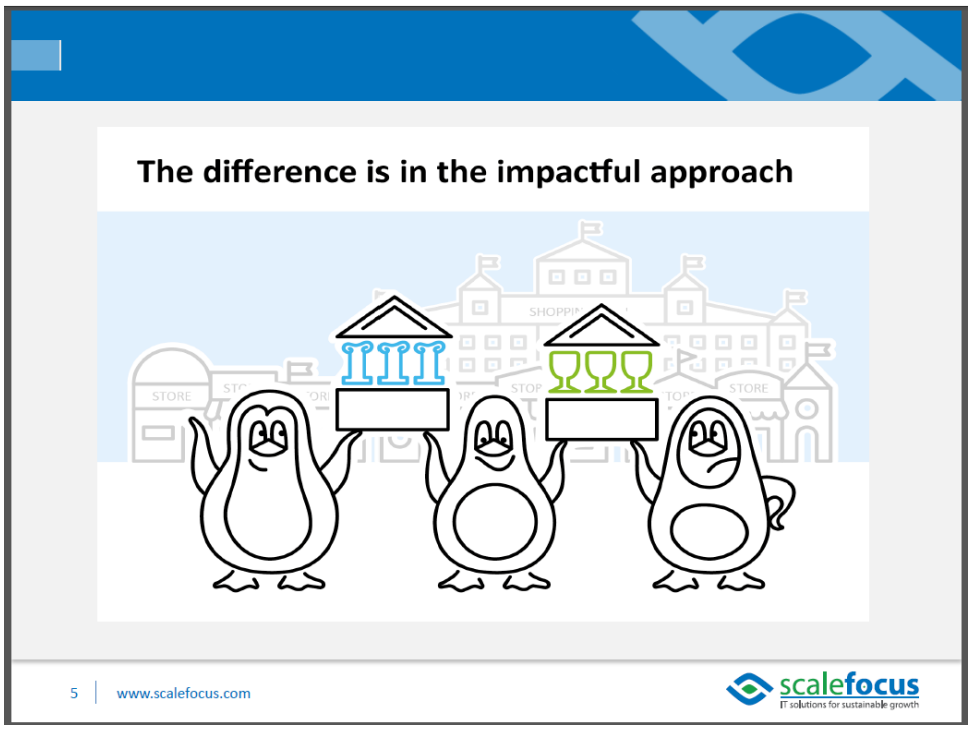
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KEYNOTE SPEECH 2

RENTAL RELATIONS IN SIE

Grigori Borta, Serghei Ohrimenco,

ASEM, Chisinau, R. Moldova

Rental Relationships in Shadow Information Economics

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Abstract: The paper analyzes rent in the context of shadow information economics. Rent types and foundations are analyzed in depth.

Keywords: Shadow information economics, information security, rent.

1. Introduction

Rent is a category related to the nature of income and the character of economical behavior. Complex socio-economic relations are hidden behind this phenomenon. The notion of rent is widely used in economic theory and applies to many production factors: labor, land, capital. Today information is the leading production factor in all its manifestations and it complements the sphere of scientific interests hugely. The formation of rent is related to rare and universal resource ownership, which in this case are information and its use.

The basis of general rent theory was laid by the classicists of political economy (e.g. A. Smith, K. Marx, D. Ricardo, etc.). They recognized several rent types in their works. They particularly underlined rent of rare resources (natural), absolute and differential land rent. Neoclassicists in their turn broadened the notion of rent, viewing it as income from any production factor, not just land.

Historically the category of rent appeared in terms of land and agricultural rent, but gradually received wide acclaim and spread in economics – from traditional production to modern intangible assets, and even reached into social and political domains.

2. Forms of Rent

Most modern rent researchers adhere to two main postulates. First one is superprofit – a special kind of income related to the use of an exclusive, limited or temporarily rare good. Second, the rent is appropriated by the good owner. Rent is a fundamental notion of economic science that represents immense scientific interest. The interest is defined by the existence of multiple facets of possible use of the rent theory in certain management conditions outlined by spatial outlines (local, national, global). Modern rent theory is very often defined by its different forms: intellectual, financial, informational, social, scientific, worldwide, comprador, etc. Multiple authors consequently analyze different rent types: natural, monopolistic, politic, administrative, transitional, intermediate and final, natural and artificial. At the same time different typology of rent-oriented behavior is proposed: rent searching, rent struggle, rent acquisition, rent creation (expansion, broadening the possibilities for the rent that already exists). It should be noted that shadow information economics along with rental relationships encompasses the following occupation types: activity on the fringe of legality, illegal activity, that does not threaten human health or lives, and illegal activity that does.

In terms of modern economics it is crucially important to outline the problem of intellectual rent as a source of public wealth growth based on restructing and increasing economy competitiveness. Despite a lot of attention brought to rent theory research in economic literature, intellectual rent has little to none attention drawn towards it by economic researchers, research dedicated to intellectual rent is almost inexistent. This is likely to be one of the reasons why the notion is partial and shallow. Many intellectual rent aspects are still debatable.

It is important to note that economic characteristics of rent as an important resource should be considered the following [2]:

1. Possession of certain social assets.
2. Privileged market position compared to other economic agents due to monopolization process.
3. Use of state resources for personal benefits due to industrialization processes.
4. Active parasitizing on the intellectual component of labor.
5. Informational nature of rent.

The main features of economic rent acquisition are the following [3]:

1. Rare or demanded resource acquisition by a small group of proprietors is the condition of rent creation.
2. Rent creation may be performed without any capital investment.
3. Rent creation may be performed bypassing any normal practices and mechanisms of income building.
4. Rent appropriation is very often followed by antirent generation for the society as a whole.
5. Rent production mechanism is heavily influenced by specifics of market price forming.
6. Both rent and antirent are the result of an established personal expense level and their correlation to the expenses required by society.

All the above mentioned clauses are partially related to rent extracted in terms of shadow information economics.

Let's analyze the main rent types common to shadow information economics.

The major criterion of classification should in our opinion be the source of rent production. In its turn, the main source of rent production is the ownership of special resource types.

The researchers of **economic rent** outline two main rent features:

1. A special kind of superprofit related to a rare, limited, exceptional good or resource use.
2. The subject of rare good appropriation.

Social rent – is a regularly acquired profit that does not require entrepreneurship and requires legalization. In other words, social rent is appropriation of another person's labor, social parasitizing, when this possibility is granted by a state approved status. Social parasitizing in the domain of information technologies is granted a special status while a certain attitude to this kind of labor causes a shift towards neglecting production labor.

Rent-oriented behavior on different levels of socio-economical system has acquired wide spread in the world. Search for rent is characteristic to economic agents of all the countries, but in shadow information economics it was blown out of proportion, casting influence on all the different domains of human activities. According to many researchers in

the nineties a specific "rent economics" was formed defining many peculiarities of many economic process flows.

Monopolistic rent – in a broad sense is the result of any artificial activity limitation of potential competition that allows increasing the wealth of a protected company. Compared to profit-seeking rents, artificial rents usually seek to struggle against market forces aimed improving efficiency, and can even lower the price factors in resource management. Moreover, economic agents usually tend to spend resources in order to create and acquire this kind of rents which means poor resource management during the rent seeking process. In other words profit seeking is aimed among others at creating and acquiring "good" rents, while rent seeking at creating and acquiring "bad" rents.

Rent seeking behavior describes the ability to acquire profits without producing any goods or even without any production effort at all. Thus rent seeking is opposed to profit seeking. As professor Latkov mentions in [4] "Very often rent seekers are a symptom of "ill" economics". In [5] Latkov proposes the following definition: "Rent is an agent's profit stipulated by his or her position in socio-economic space".

Intellectual rent appears due to special intellectual abilities, talents or scientific, inventor, engineering initiative that develops new highly technological ideas. Thus, while developing and implementing a series of software abuses, a new negative term may be used: antirent. A major specific of this kind of rent is its temporary yet repeating character.

Scientific rent is the result of scientific-educational or scientific-educational activity. First, the difference in scientific and education employee qualification insures them higher incomes. Second, the use of scientific achievements in production activity allows them to get unique production with unique qualities, while privileged ownership rights limit access to its use and grant long-term income in case of strict rights for novelties and inventions are differentiated. The latter circumstance does not only concern processes of information technology creation, it covers all the shadow goods and services in the domain of information economics. Scientific rent (in its shadow context) that is created as a result of scientific-innovative activity unites all the developers' and intermediaries' income that is formed during the process of the full cycle of work related to intellectual property subjects. In this case rent creation is stipulated by research and development results commercialization.

The differences of scientific rent compared to other rent income types are related to the resource forming the rent (scientific knowledge) being an intangible asset. First of all, in theory, all rent incomes are explained by objective need to gradually involve less and less effective production factors and their combinations into production process. In the scientific and innovation domains the rent-forming resource itself can change its qualitative characteristics which in turn stipulate rent income forming. Second, historically, the first rent forming resources to ever exist are not freely reproducible manufacturing conditions, which act as a natural limiter for their supply. For scientific knowledge which in the case of information economics can easily be copied, a certain set of artificial limitations for their use is required. Third, rent income from scientific-educational and scientific-innovational activity creates stimuli for economic agents to act in these domains, thus ensuring reproduction of the rent forming resource. This is why the existence of scientific rent exerts positive influence on economic development of society, determining the necessity to create conditions and mechanisms of its creation and appropriation.

When speaking of shadow information economics the following quasi-rent categories can be outlined:

Technological quasi-rent which appears with "entrepreneurs" and "researchers" who were the first to master highly efficient "inventions", carried out basic or improving

"innovations", supplied the market with "new" product, implemented brand "new" highly efficient technologies.

Organizational and economic quasi-rent is the result of mastering much more "effective" methods and forms of organization, specialization, cooperation, concentration, diversifying production, granting increase in production "efficiency" and other forms of temporary superprofit acquisition, e.g. new money laundering techniques, etc.

Managerial quasi-rent is related to the use of "more efficient" methods and means of managing production and marketing of goods, scientific-technical and innovative activity, applying secure forecasting and prediction methods, allowing for much more efficient planning, programming, management, etc.

Financial, credit, and monetary quasi-rent appears when highly efficient methods of financing, crediting, assurance activity, new types of securities issue, novelty money flowing methods (e.g. cryptocurrencies) are used in the process of superprofit acquisition.

Trade quasi-rent is formed on the basis of putting new commodity turnover forms into practice.

Informational quasi-rent. The developers, producers and suppliers of an information resource, web-site, software product, TV or radio broadcast are its proprietors.

Intellectual quasi-rent is the addition profit acquired by the "inventors".

The probability of rent acquisition may be formally represented by the following function:

$$\pi_i(x_1, x_2, \dots, x_n) = \frac{f_i(x_i)}{\sum f_i(x_i)} \quad (1)$$

where

- n – number of rent searchers
- x_i – investment into agent i rent search
- F_i – the individual function of rent searchers' expenses

Let's discuss the possibilities of rent acquisition during the stages of vulnerability's life cycle. The probability of rent apparition may be noted at the stage of research, in other words, during the stage when software is analyzed for bugs and vulnerabilities. A newly found vulnerability may be passed on to the developers for them to fix it, depriving the researcher from the possibility of rent acquisition. Sale of the vulnerability to the hacker community might be considered another option, which will grant certain remuneration as well as rental payments. It is possible to assume that the longer vulnerability's life cycle is, the bigger rent rate is going to be. It is important to note that the most typical examples of this kind of actions are bot-nets and their rent under different conditions. Different variations of rent relationships are noted in the black market, which should be a subject for additional studies.

Rental resource acquisition in form of a bot-net for example may vary in time but fixed surplus income is always the result.

3. Conclusion

Generalizing the above it is safe to assume that a number of factors form the basis of rental nature of shadow information economics. For example, stable discrepancy of certain spheres of economic activity with law and moral institutes. This state of affairs is based upon yearning for acquiring surplus profit hidden from taxation as well as the desire to damage state and corporate structures and society as a whole. This profit is seen as shadow rent being a free use of economic space which belongs solely to the state.

Rental character of modern shadow economics brings ambiguous influence on economic, politic, scientific-technical and other domains of everyday life. Further studies are required in order to define the system of factors stipulating the character of rent-oriented behavior of "shadow" market for goods and services, to estimate the consequences, to define the most important ways, methods and tools of shadow processes limitation.

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Assessing Patient Safety Culture from Nurses' Viewpoints of a Teaching Hospital in Taiwan

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Abstract. The new Chinese version of safety attitudes questionnaire (SAQ) was developed with eight dimensions and then applied to assess the patient safety culture of healthcare organizations in Taiwan since 2014. The new questionnaire removes the dimensions of hospital management support for patient safety, teamwork across hospital units, and hospital handoffs and transitions and then adds two dimensions of resilience and burnout. It would be of interest to observe the nurses' attitudes toward the patient safety culture when the new version of SAQ becomes effective. Independent sample t-test for mean differences and one-way analysis of variance are applied to observe how different demographic variables impact eight dimensions of patient safety culture. The results show that age, experience in organization, and experience in position have significant influences on at least five out of eight dimensions statistically. Further analyses and implications for hospital management are provided in this study.

Keywords. Patient safety culture, safety attitudes questionnaire, independent sample t-test for mean difference, analysis of variance, demographic variable.

1. Introduction

A positive patient safety culture allows healthcare staffs to reduce medical errors, learn from failures, and commit to safer care [1]. Wagner et al. [2] stated that an organization's safety culture is a fundamental factor to influence system safety. Besides, Lee et al. [3] and Allen et al. [4] pointed out that reviewing and improving safety culture relentlessly in healthcare organizations is a key strategy to improve patient safety. Safety attitudes questionnaire (SAQ) developed by Sexton et al. [5] has been widely applied to measure patient safety culture [6]-[8]. In Taiwan, the Chinese version of SAQ developed by Taiwan Joint Commission on Hospital Accreditation is the questionnaire for hospitals to evaluate patient safety culture in a yearly basis [1], [9]. Through the Chinese version, the hospital management can assess staffs' attitudes toward patient safety culture in Taiwan.

The staffs in hospitals typically include physicians, nurses, technicians, pharmacists, medical administrators, respiratory therapists, and others. Lee et al. [10] summarized that the core staffs are physicians and nurses. AbuAlrub and Alhijaa [11] further emphasized that nurses are the biggest workforce in healthcare organizations and can possess enough power to move the underlying organizational culture to a patient safety culture. Under such circumstances, it would be of interest to observe the nurses' attitudes toward patient safety culture. That is, this research intends to study how different nurses' demographic variables impact patient safety culture. Therefore, this study applies analysis of variance to observe how different demographic variables affect patient safety culture based on the Chinese version of SAQ survey results.

2. Safety Attitudes Questionnaire

Safety attitudes questionnaire developed by Sexton et al. [5] has six dimensions and thirty questions. The descriptions of six dimensions are below. Teamwork climate is the perceived quality of collaboration between personnel. Safety climate is the perceptions of a strong and proactive organizational commitment to safety. Perception of management is the approval of managerial actions. Job satisfaction is the positivity about the work experience. Stress recognition measures how performance is impacted by stressors. Finally, working condition is the perceived quality of the work environment and logistical support such as staffing and equipment.

In 2008, Taiwan Joint Commission on Hospital Accreditation developed the Chinese version of safety attitudes questionnaire based on the short form of SAQ [10]. In 2014, the Chinese version of SAQ has been modified by removing three hospital-level aspects of safety culture from Agency for Healthcare Research and Quality and by adding resilience and burnout dimensions into the modified Chinese version of SAQ. That is, the questionnaire becomes eight dimensions and forty six questions as shown in Table 1.

Table 1 The Updated Chinese Version of Safety Attitudes Questionnaire in Taiwan

Dimension	Question
Teamwork climate	1. Nurse input is well received in this clinical area. 2. In this clinical area, it is difficult to speak up if I perceive a problem with patient care. 3. Disagreements in this clinical area are resolved appropriately (i.e., not who is right, but what is best for the patient). 4. I have the support I need from other personnel to care for patients. 5. It is easy for personnel here to ask questions when there is something that they do not understand. 6. The physicians and nurses here work together as a well-coordinated team.
Safety climate	7. I would feel safe being treated here as a patient. 8. Medical errors are handled appropriately in this clinical area. 9. I know the proper channels to direct questions regarding patient safety in this clinical area. 10. I receive appropriate feedback about my performance. 11. In this clinical area, it is difficult to discuss errors. 12. I am encouraged by my colleagues to report any patient safety concerns I may have. 13. The culture in this clinical area makes it easy to learn from the errors of others.
Job satisfaction	14. I like my job. 15. Working here is like being part of a large family. 16. This is a good place to work. 17. I am proud to work in this clinical area.

	18. Morale in this clinical area is high.
Stress recognition	19. When my workload becomes excessive, my performance is impaired. 21. I am less effective at work when fatigued. 25. I am more likely to make errors in tense or hostile situations. 26. Fatigue impairs my performance during emergency situations (e.g. emergency resuscitation, seizure).
Perception of management	27. Management supports my daily efforts. 28. Management doesn't knowingly compromise patient safety. 29. I get adequate, timely information about events that might affect my work. 30. The levels of staffing in this clinical area are sufficient to handle the number of patients.
Working condition	31. Problem personnel are dealt with constructively by our unit. 32. This hospital does a good job of training new personnel. 33. All the necessary information for diagnostic and therapeutic decisions is routinely available to me. 34. Trainees in my discipline are adequately supervised.
Resilience	20. I feel like I'm at the end of my rope. 22. I feel burned out from my work. 23. I feel frustrated by my job. 24. I feel I'm working too hard on my job. 35. I feel emotionally drained from my work. 36. I feel used up at the end of the workday. 37. I feel fatigued when I get up in the morning and have to face another day on the job. 38. Working with people all day is really a strain for me. 39. Working with people directly puts too much stress on me.
Burnout	40. Missed meals. 41. A hasty meal. 42. All-day work without any rest. 43. Individual or family plan change due to work factors. 44. Poor sleep. 45. Less than five-hour sleep at night. 46. Late work.

The questions use five-point Likert scales ranging from strongly agree to strongly disagree or frequency such as never, rarely, sometimes, most of the time, and always [3], [12]. However, the questions in burnout dimension only use four scales to measure the frequency, such as less than 1 day, 1-2 days, 3-4 days, and 5-7 days per week. In addition, question items 2, 11, 20, 22, 23, 24, 35, 36, 37, 38, and 39 are reversed questions such that each respondent's answer needs to be adjusted.

3. Research Method

The study intends to observe how different nurses' demographic variables influence patient safety culture from a regional teaching hospital in Taiwan based on the Chinese version of SAQ survey results in 2014. By removing incomplete questionnaires, the number of effective questionnaires is 389. The demographic information in terms of gender, age, job status, experience in organization, and experience in position is depicted in Table 2.

To analyze how different nurses' demographic variables impact patient safety culture from an overall viewpoint, independent sample t-test for mean differences and one-way analysis of variance with $\alpha = 0.05$ are applied to eight dimensions of safety attitudes questionnaire. The total score for each dimension is to sum up the scores from the questions of that particular dimension. That is, the higher score the dimension is, the more satisfied the

nurses are. If the p-value is less than $\alpha = 0.05$, Bonferroni method is chosen to perform post hoc analysis except for gender with only two levels because Bonferroni method outperforms Scheffe method in reducing the probability of a Type I error [13].

Table 2 Demographic Information of Nurses in this Case Study

Demographic Variable		Frequency	Percentage
Gender	1. Male	12	3.1
	2. Female	377	96.9
Age	1. Less than 20 years old	9	2.3
	2. 21-30 years old	167	42.9
	3. 31-40 years old	149	38.3
	4. 41-50 years old	55	14.1
	5. 51-60 years old	9	2.3
	6. 61 years old and above	0	0.0
Job status	1. Full time	342	87.9
	2. Part Time	20	5.1
	3. Agency	7	1.8
	4. Contract	20	5.1
Experience in organization	1. Less than 6 months	45	11.6
	2. 6 to 11 months	16	4.1
	3. 1 to 2 years	67	17.2
	4. 3 to 4 years	63	16.2
	5. 5 to 10 years	91	23.4
	6. 11 to 20 years	96	24.7
	7. 21 years or more	11	2.8
Experience in position	1. Less than 6 months	59	15.2
	2. 6 to 11 months	18	4.6
	3. 1 to 2 years	70	18.0
	4. 3 to 4 years	67	17.2
	5. 5 to 10 years	101	26.0
	6. 11 to 20 years	71	18.3
	7. 21 years or more	3	0.8

4. Research Results

Independent sample t-test for mean differences is used to test if different genders perceive differently. From Table 3, different genders do not perceive different satisfaction statistically. Different age groups perceive differently depicted in Table 4 in teamwork climate, safety climate, job satisfaction, perception of management, and working condition by analysis of variance. Specifically, nurses with the age of less than 20 years old have significantly higher satisfaction than nurses with the ages of 21-30 and 31-40 years old in safety climate, job satisfaction, perception of management, and working condition. In addition, nurses with the age of 51-60 years old are more satisfied than nurses with the ages of 21-30 and 31-40 years old in job satisfaction. Moreover, nurses with the age of less than 20 years old have higher satisfaction than nurses with the age of 41-50 years old statistically in working condition. Finally, nurses with the age of less than 20 years old are more satisfied in teamwork climate than nurses with the age of 31-40 years old.

Table 3 Mean Differences on Eight Dimensions for Genders

Dimension	Assumption	t	Sig.	Post Hoc
Teamwork Climate	Equal variance	-.014	.989	
	Unequal variance	-.014	.989	
Safety Climate	Equal variance	.198	.843	
	Unequal variance	.215	.834	
Job Satisfaction	Equal variance	.108	.914	
	Unequal variance	.097	.924	
Stress Recognition	Equal variance	1.145	.253	
	Unequal variance	1.228	.243	
Perception of Management	Equal variance	.026	.979	
	Unequal variance	.025	.980	
Working Condition	Equal variance	.590	.555	
	Unequal variance	.785	.447	
Resilience	Equal variance	-.863	.389	
	Unequal variance	-.961	.356	
Burnout	Equal variance	.081	.935	
	Unequal variance	.070	.945	

Table 4 ANOVA Results of Age on Eight Dimensions

Dimension	F	Sig.	Bonferroni
Teamwork climate	4.375	.002	1 > 3
Safety climate	4.635	.001	1 > 2, 1 > 3
Job satisfaction	6.306	.000	1 > 2, 1 > 3, 5 > 2, 5 > 3
Stress recognition	1.480	.207	
Perception of management	5.953	.000	1 > 2, 1 > 3
Working condition	5.347	.000	1 > 2, 1 > 3, 1 > 4
Resilience	1.108	.352	
Burnout	1.328	.259	

From Table 5, job status does not influence any dimension statistically. In contrast, experience in organization has impacts significantly on six out of eight dimensions except for stress recognition and resilience as shown in Table 6. From the overall viewpoints, nurses with less than 6 months in experience in organization are more satisfied statistically than nurses with 1 to 2, 3 to 4, and 5 to 10 years in teamwork climate, safety climate, job satisfaction, perception of management, and working condition. Besides, nurses with more than 20 years in experience in organization perceive significantly higher satisfaction than nurses with 3 to 4 and 5 to 10 years in teamwork climate, safety climate, job satisfaction, perception of management, and working condition. For burnout, nurses with 3 to 4 and 5 to 10 years in experience in organization have better satisfaction statistically than nurses with less than 6 months.

Experience in position has influences on six of eight dimensions except for stress recognition and resilience depicted in Table 7. Generally, nurses with less than 6 months in experience in position have higher perceptions statistically than nurses with 3 to 4 years in teamwork climate, safety climate, perception of management, and working condition and nurses with 5 to 10 years in teamwork climate, safety climate, job satisfaction, and perception of management. For working condition, nurses with more than 20 years perceive higher satisfaction statistically than nurses with 1 to 2, 3 to 4, 5 to 10, and 11 to 20 years. For

burnout, nurses with 5 to 10 years have higher satisfaction than nurses with less than 6 months statistically.

Table 5 ANOVA Results of Job Status on Eight Dimensions

Dimension	F	Sig.	Bonferroni
Teamwork climate	.671	.570	
Safety climate	.357	.784	
Job satisfaction	.604	.613	
Stress recognition	2.264	.081	
Perception of management	1.571	.196	
Working condition	1.065	.364	
Resilience	1.044	.373	
Burnout	1.415	.238	

Table 6 ANOVA Results of Experience in Organization on Eight Dimensions

Dimension	F	Sig.	Bonferroni
Teamwork climate	8.951	.000	1 > 3, 1 > 4, 1 > 5, 1 > 6, 7 > 4, 7 > 5, 7 > 6
Safety climate	8.955	.000	1 > 3, 1 > 4, 1 > 5, 6 > 4, 6 > 5, 7 > 3, 7 > 4, 7 > 5
Job satisfaction	6.963	.000	1 > 3, 1 > 4, 1 > 5, 7 > 3, 7 > 4, 7 > 5
Stress recognition	.488	.817	
Perception of management	12.737	.000	1 > 3, 1 > 4, 1 > 5, 1 > 6, 6 > 4, 7 > 3, 7 > 4, 7 > 5
Working condition	6.663	.000	1 > 3, 1 > 4, 1 > 5, 7 > 3, 7 > 4, 7 > 5, 7 > 6
Resilience	1.224	.293	
Burnout	4.433	.000	4 > 1, 5 > 1

Table 7 ANOVA Results of Experience in Position on Eight Dimensions

Dimension	F	Sig.	Bonferroni
Teamwork climate	4.968	.000	1 > 4, 1 > 5
Safety climate	4.054	.001	1 > 4, 1 > 5
Job satisfaction	2.929	.008	1 > 5
Stress recognition	.462	.836	
Perception of management	7.008	.000	1 > 3, 1 > 4, 1 > 5, 1 > 6
Working condition	3.675	.001	1 > 4, 7 > 3, 7 > 4, 7 > 5, 7 > 6
Resilience	.960	.452	
Burnout	2.828	.010	5 > 1

5. Conclusions

Nurses are the biggest workforce in healthcare organizations and can possess enough power to impact patient safety culture [11]. Thus, it is of interest to observe how nurses with different demographic information perceive patient safety culture. The Chinese version of SAQ survey results in 2014 from a case regional teaching hospital in Taichung, Taiwan is analyzed by independent sample t test for mean differences and analysis of variance. The

results show that age, experience in organization, and experience in position have significant influences on at least five of eight dimensions statistically. In general, nurses with less than 20 years old perceive high satisfaction in five dimensions. Nurses with less than 6 months in both experience in organization and experience in position also perceive higher satisfaction in teamwork climate, safety climate, job satisfaction, perception of management, and working condition. However, it is worth to note that nurses with less than 6 months in both experience in organization and experience in position perceive relatively lower in burnout. Therefore, the hospital management needs to pay much attention to these three demographic variables and more specific details in order to improve the patient safety culture in this case hospital.

Acknowledgement

This study was partially supported by Ministry of Science and Technology in Taiwan with the grant number of MOST 104-2221-E-018-024.

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What We Need to Know for Patient Safety: The Viewpoints of Physicians and Registered Nurses in a Case Hospital

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Abstract: In recent years, patient safety culture in healthcare organizations have been considered as a critical issue for improving the quality of healthcare. The current study attempts to examine the perceptions of patient safety from physicians and registered nurses in a case hospital by conducting the Chinese Safety Attitude Questionnaire (CSAQ), developed from the Taiwan Joint Commission on Hospital Accreditation. Confirmatory factor analysis (CFA) and Pearson correlation analysis are used to assess the data. The findings highlight that safety climate is highly significant to teamwork climate and perceptions of management whereas stress recognition is negatively related to resilience.

Keywords: Patient safety culture, exploratory factor analysis, confirmatory factor analysis, Pearson correlation test, Chinese safety attitude questionnaire.

1. Introduction

Nowadays, the health care business becomes more and more competitive, every advantage is very important to the business strategy for future sustainable development. It has also proven that patient safety culture is a significant key influencing factor of improving physician-patient relationship and the service quality that patients receive [1][2]. A positive safety culture allows Healthcare employees to reduce medical errors or adverse events and learn from those failures [3]-[5]. Safety attitudes questionnaire (SAQ) developed by Sexton et al. [6] has been widely adopted to assess patient safety culture for healthcare organizations [8]-[7]-[9]. In Taiwan, the Chinese Safety attitudes questionnaire (CSAQ) developed by Taiwan Joint Commission on Hospital Accreditation is the questionnaire for hospitals to evaluate patient safety culture [10]-[12]. Hospital managers can understand the perceptions of staff toward patient safety and further develop any scheme to achieve a superior physician-patient relationship in a competitive healthcare-based industry by conducting the questionnaire.

Hospital staffs are on the front line of efforts to satisfy patients, Lee et al. [13] particularly emphasized that the core staffs are physicians and nurses. Thus, it is critically important to understand opinions and attitudes from physicians and nurses toward patient safety. The confirmatory factor analysis (CFA), and Pearson's correlation analysis is subsequently conducted to demonstrate the relationships among patient safety culture dimensions. Following this introduction, the second section of this paper presents a review of the literature on patient safety culture. The third section then illustrates details of the methods used in the empirical study. Finally, the results are discussed.

2. Patient Safety Culture

Patient safety culture in healthcare organizations has received increasing attention. Management's comment to patient safety can be realized through evaluating the attitudes of healthcare staff and patients on a regularly basis [14][15]. In general, the SAQ (Safety Attitude Questionnaire) originally developed by Sexton et al. [6], is widely used for measuring patient safety attitudes in healthcare organizations. The questionnaire contains 30 items, grounded into six dimensions: teamwork climate, safety climate, job satisfaction, stress recognition, perceptions of management, and working conditions. Based on the Sexton et al. (2006)'s SAQ, the Taiwan Joint Commission on Hospital Accreditation developed the Safety Attitude Questionnaire (CASQ) using forward and backward translation to verify the Chinese safety culture survey instrument. In 2014, the Taiwan Joint Commission on Hospital Accreditation modified the CASQ, two dimensions (resilience and burnout) were integrated into the questionnaire, as shown in Table 1.

Table 1 The Chinese Safety Attitude Questionnaire

Teamwork Climate
(1) Nurse input is well received in this clinical area
(2) In this clinical area, it is difficult to speak up if I perceive a problem with patient care
(3) Disagreements in this clinical area are resolved appropriately (i.e. not who is right, but what is best for the patient)
(4) I have the support I need from other personnel to care for patients
(5) It is easy for personnel here to ask questions when there is something that they do not understand
(6) The physicians and nurses here work together as a well-coordinated team
Safety Climate
(7) I would feel safe being treated here as a patient
(8) Medical errors are handled appropriately in this clinical area
(9) I know the proper channels to direct questions regarding patient safety in this clinical area
(10) I receive appropriate feedback about my performance
(11) In this clinical area, it is difficult to discuss errors
(12) I am encouraged by my colleagues to report any patient safety concerns I may have
(13) The culture in this clinical area makes it easy to learn from the errors of others
Job satisfaction
(14) I like my job
(15) Working here is like being part of a large family
(16) This is a good place to work
(17) I am proud to work in this clinical area

(18) Morale in this clinical area is high
Stress Recognition
(19) When my workload becomes excessive, my performance is impaired
(20) I am less effective at work when fatigued
(21) I am more likely to make errors in tense or hostile situations (e.g. emergency resuscitation, seizure)
(22) Fatigue impairs my performance during emergency situations
Perceptions of management
(23) Managers supports my daily efforts
(24) Managers do not knowingly compromise patient safety
(25) I am provided with adequate, timely information about events that might affect my work
(26) Staffing in this clinical area are sufficient to handle total patients
Working conditions
(27) Problem personnel are dealt with constructively
(28) This hospital does a good job of training new personnel
(29) All the necessary information for diagnostic and therapeutic decisions is routinely available to me
(30) Trainees in my discipline are adequately supervised
Resilience
(31) I feel like I'm at the end of my rope
(32) I feel burned out from my work
(33) I feel frustrated by my job
(34) I feel I'm working too hard on my job
(35) I feel emotionally drained from my work
(36) I feel used up at the end of the workday
(37) I feel fatigued when I get up in the morning and have to face another day on the job
(38) Working with people all day is really a strain for me
(39) Working with people directly puts too much stress on me
Burnout
(40) Missed meals
(41) A hasty meal.
(42) All-day work without any rest.
(43) Individual or family plan change due to work factors
(44) Poor sleep.
(45) Less than five-hour sleep at night
(46) Late work

3. Methodology

The Chinese Safety Attitude Questionnaire (CSAQ) developed by the Taiwan Joint Commission on Hospital Accreditation was used to assess the perceptions about patient safety in the case hospital. An intra-organizational online survey was conducted at case hospital, Taichung City, Taiwan in 2014 and along with 405 valid questionnaires were collected. In the current study seven dimension with 39 items were used exception burnout since its scales were designed using frequency. Physicians and nurses were asked to evaluate each question using five-point Likert-type scale, where 1 and 5 represent strongly disagree and strongly agree, respectively. In addition, resilience were measured using reversed questions such that each respondent's answer is adjusted. Examination of the sample profile

shows that most respondents are female (86.7 percent), age ranged from 21 to 50 years (93.6 percent), and education of the bachelor's level (92.1 percent). Additionally, over one-half of respondents with relevant working experiences for more than five years in organization.

Confirmatory Factor Analysis (CFA) is first used to verify the scale of Chinese version of patient safety [16]. In this stage, a model re-specification was applied by confirming measurement items [17]. Items with a weak factor loading (< 0.70) will be removed from the original scale due to the elevated measurement error [17][18]. After validating the scale, Pearson's Correlation Analysis is conducted to examine the strength and direction of the relationships between dimensions [19].

4. Research Results

Seven dimensions with 39 items are assessed to confirm the dimensionality of the scale. The CFA results demonstrate that seven items were removed since the estimated loadings were lower than 0.7 [20]. As presented in Table 2, 32 items measuring seven factors were identified. Furthermore, the fit indices meet satisfactory levels of overall goodness of fit. For example, most of the values of the absolute (GFI and RMSEA), incremental (NFI, CFI and TLI), and parsimonious fit indices (PNFI and PGFI) are also higher than their threshold values [20][21], as presented in Table 3. Consequently, all fit indices' values are within their threshold values, indicating a satisfactory goodness of fit for the measurement model to the data.

Table 2 The Rectified Chinese Safety Attitude Questionnaire

Teamwork Climate
(1) Nurse input is well received in this clinical area
(2) Disagreements in this clinical area are resolved appropriately (i.e. not who is right, but what is best for the patient)
(3) I have the support I need from other personnel to care for patients
(4) It is easy for personnel here to ask questions when there is something that they do not understand
(5) The physicians and nurses here work together as a well-coordinated team
Safety Climate
(6) I would feel safe being treated here as a patient
(7) Medical errors are handled appropriately in this clinical area
(8) I know the proper channels to direct questions regarding patient safety in this clinical area
(9) I receive appropriate feedback about my performance
(10) I am encouraged by my colleagues to report any patient safety concerns I may have
Job Satisfaction
(11) I like my job
(12) Working here is like being part of a large family
(13) This is a good place to work
(14) I am proud to work in this clinical area
(15) Morale in this clinical area is high
Stress Recognition
(16) When my workload becomes excessive, my performance is impaired
(17) I am more likely to make errors in tense or hostile situations (e.g. emergency resuscitation, seizure)
(18) Fatigue impairs my performance during emergency situations

Perceptions of Management
(19) Managers supports my daily efforts
(20) Managers do not knowingly compromise patient safety
(21) I am provided with adequate, timely information about events that might affect my work
(22) Staffing in this clinical area are sufficient to handle total patients
Working conditions
(23) Problem personnel are dealt with constructively
(24) This hospital does a good job of training new personnel
(25) All the necessary information for diagnostic and therapeutic decisions is routinely available to me
Resilience
(26) I feel like I'm at the end of my rope
(27) I feel burned out from my work
(28) I feel frustrated by my job
(29) I feel I'm working too hard on my job
(30) I feel emotionally drained from my work
(31) I feel used up at the end of the workday
(32) I feel fatigued when I get up in the morning and have to face another day on the job

Table 3 CFA Results for Seven Dimensions of Patient Safety

Research constructs	**Cronbach's α**	**CR**	**AVE**	**Items**
1. Teamwork Climate	.88	.89	.61	5
2. Safety Climate	.89	.90	.65	5
3. Job Satisfaction	.94	.94	.77	5
4. Stress Recognition	.92	.91	.71	3
5. Perceptions of Management	.88	.90	.75	4
6. Working Conditions	.91	.91	.72	3
7. Resilience	.92	.92	.67	7
Fit statistics				
χ^2-value of 1022.959 (*df* = 463, χ^2/df = 2.346), GFI = .90, RMSEA = .05, NFI = .92, CFI = .95, TLI = .92, PNFI = .85, PGFI = .76				

Table 4 The results of Pearson's Correlation Analysis

	1	2	3	4	5	6	7
1.Teamwork Climate							
2.Safety Climate	.824**						
3.Job Satisfaction	.704**	.770**					
4.Stress Recognition	.220**	.193**	.153**				
5.Perceptions of Management	.738**	.815**	.768**	.290**			
6.Working Conditions	.714**	.792**	.726**	.220**	.818**		
7.Resilience	.240**	.300**	.389**	-.223**	.261**	.304**	

Additionally, we conducted a Pearson's Correlation Analysis to realize the relationships among seven dimensions of patient safety. The results of Pearson's Correlation Analysis demonstrate that safety climate is highly significant to teamwork climate and perceptions of management. Perceptions of management is also significantly related to working conditions. On the other hand, stress recognition is negatively related to resilience.

5. Discussion

The current study aims to realize the perceptions of patient safety from physicians and registered nurses to create a superior patient safety culture for healthcare organizations. The following are the discussions of this study. First, CFA results show that 32 items were constructed seven dimensions, including teamwork climate, safety climate, job satisfaction, stress recognition, perceptions of management, working conditions, and resilience.

Second, Pearson correlations analysis results are consistent with those of Pinheiro and Uva [22], and Abdou and Saber [23], who suggested that an increase in the degree of safety climate improves teamwork climate and perceptions of management. Additionally, as the resilience faced by the physicians and registered nurses increase, a decline in stress recognition decline is presented. Physician and nurse working environments are normally under a wide range of potential stressors and challenges [24][25], and thus an appropriate management is needed to relieve the pressures. Consequently, this research suggests that more attention to teamwork climate, safety climate, perceptions of management, and working conditions should be focused on the development of patient safety culture.

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User Satisfaction after Ward Cleaning Logistics System Implementation in a Hospital

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Abstract: The case hospital has implemented a ward cleaning logistics system to reduce the nurses' workloads. This study adopts the information system success model proposed by DeLone and McLean [4] to develop the questionnaire with six dimensions and thirty questions along with six demographic variables. The results show that gender has significant impacts on five dimensions statistically. Experience of the new system implementation also has significant influences on system quality, information quality, intention to use, and net benefits, while education has the influence on information quality. From the post hoc analyses, male employees are more satisfied than female employees in five out of six dimensions. Employees with the new system implementation experience have higher satisfaction in system quality, information quality, intention to use, and net benefits. Finally, Employees with university degree are more satisfied than those with junior high school and below in information quality.

Keywords: Information system success model, ward cleaning logistics system, user satisfaction.

1. Introduction

Shanafelt et al. [6] stated that health professionals with overwork, stress, and fatigue would result in medical errors. Cimiotti et al. [1] pointed out that job-related burnout has been linked to medical care and patient satisfaction. Moreover, hospital nurses with heavy workload might have job dissatisfaction and poor quality of patient care. If the health organization can reduce nurse burnout, the quality of patient care can be improved. Improving health care facilities can be a means of alleviating job-related burnout in nurses [1].

Due to the manpower shortage in nurses in Taiwan, the introduction of a logistics-based clean-bed system can improve the workload for nurses. The ward cleaning logistics system has been implemented in Singapore for many years, and the case hospital is the first hospital to introduce the system in Taiwan. Through the implementation, the process and efficiency of ward cleaning can be enhanced to shorten the patients' waiting time.

This study intends to conduct a survey from the system's users to collect the needed data mainly based on the information systems proposed by DeLone and McLean [4]. Through the study, the users' satisfaction and difficulties can be identified to further improve the efficiency of this ward cleaning logistics system and enhance better patient care.

2. Information System Success Model

In 1992, DeLone and McLean [2] have proposed a framework to measure the success or effectiveness of information systems (IS) in order to understand the value and efficacy of IS management actions and investments. The IS Success Model consists of six dimensions, including system quality, information quality, use, user satisfaction, individual impact, and organizational impact. A created information system can be first characterized by system quality and information quality. Later, the experience of using these IS features from users and managers can be either satisfied or dissatisfied. That is, the use of the IS and its information products influences the individual users and these individual impacts would have collective results in organizational impacts [3]. Specifically, system quality and information quality measure technical success and semantic success, respectively. Use, user satisfaction, individual impacts, and organizational impacts measure the success or effectiveness of the system [4].

In 2003, DeLone and McLean [4] provided an updated IS Success Model with the following six dimensions, such as information quality, system quality, service quality, intention to use or use, user satisfaction, and net benefits. In this model, quality is composed of information quality, system quality, and service quality. In addition, the quality of the system affects use and user satisfaction. The difference between intention to use and use is that the former is an attitude, while the latter is a behavior. Finally, net benefits can be either positive or negative depending upon the results of use and user satisfaction. DeLone and McLean [4] provided metrics to measure the e-commerce success. Specifically, system quality can be measured by adaptability, availability, reliability, response time, and usability. Information quality can be measured by completeness, ease of understanding, personalization, relevance, and security. Service quality can be characterized by assurance, empathy, and responsiveness. Use can be evaluated through nature of use, navigation patterns, number of site visits, and number of transactions executed. User satisfaction may consist of repeat purchase, repeat visits, and user surveys. Finally, net benefits may comprise cost savings, expanded markets, incremental additional sales, reduced search costs, and time savings.

3. A Case Study

The questionnaire was developed based on the Model proposed by DeLone and McLean [4] and the needs of this case hospital. There were thirty questions, where the numbers of the questions in system quality, information quality, service quality, intention to use, user satisfaction, and net benefits were six, six, five, two, three, and eight, respectively. The detailed questions are depicted in Table 1. A five-point Likert scale was used for each question, where five and one represented very satisfactory and very dissatisfactory, respectively. In addition to the questions, six questions were included in the demographic information, including gender, age, education, position, experience in this case hospital, and experience of the new system implementation.

This study surveyed the employees who have the experience in Ward Cleaning Logistics System in this case hospital. One hundred and forty surveys were issued from April 1, 2015 to April 20, 2015, but only one hundred and thirty five surveys were valid, representing a 96.43% return rate. The detailed demographic information is provided in Table 2. The majority of respondents were female with 97.8%. The age was in 30-39 years old with 29.6%, and the education was university with 40.7%. The positions of interviewees were nurses and sanitation members with 38.5% apiece. The experience in this case hospital

fell in 1 to 5 years with 38.5%. Finally, most interviewees did not have the experience in the new system implementation with 60.1%.

Table 1 Detailed Questions in this Case Hospital

Dimension	Question
System Quality	1. Ward Cleaning Logistics System is easy to operate and use
	2. Ward Cleaning Logistics System provides useful functions
	3. Information provided by Ward Cleaning Logistics System is reliable
	4. The response time for performing Ward Cleaning Logistics System is fast
	5. Ward Cleaning Logistics System integrates well with the case hospital's existing system
	6. Functions and documents provided by Ward Cleaning Logistics System are easy to learn
Information Quality	1. Ward Cleaning Logistics System provides information content integrity
	2. The query information of Ward Cleaning Logistics System is timeliness
	3. The user interface of Ward Cleaning Logistics System is easy to be understood
	4. The information provided by Ward Cleaning Logistics System meets the needs
	5. The information provided by Ward Cleaning Logistics System is highly correlated to the work
	6. The accuracy of Ward Cleaning Logistics System is satisfactory
Service Quality	1. The question can be quickly responded by IT vendors
	2. IT vendors are willing to understand and solve the problems
	3. IT vendors have the sufficient knowledge and technology
	4. Service staff of IT vendors is polite
	5. Interaction with IT vendors are comfortable and trustworthy
Intention to Use	1. I think I am willing to use Ward Cleaning Logistics System
	2. I think I am interested in using Ward Cleaning Logistics System
User Satisfaction	1. The output of the system is satisfactory
	2. That the work requirement and system message achieve the same goal is satisfactory
	3. Overall, the system is satisfactory
Net Benefits	1. Ward Cleaning Logistics Systems enhances the effective use of beds
	2. The system saves time
	3. The system enhances employees' productivity
	4. The system improves patient satisfaction
	5. The system improves the overall image of this hospital
	6. The system improves the communication effectiveness of this hospital
	7. The system reduces ineffective work
	8. The system improves the overall operating performance of this hospital

Table 2 Demographic Information in this Study

Demographic Information		Frequency	Percentage
Gender	Male	3	2.2
	Female	132	97.8
Age	Less than 30 years old	28	20.7
	30-39 years old	40	29.6
	40-49 years old	24	17.8
	50-59 years old	27	20.0
	60 years old and above	18	11.9
Education	Junior high school and below	42	31.1
	Senior high school	15	11.1
	College	18	13.3
	University	55	40.7
	Graduate school	5	3.7
Position	Nursing supervisor	4	3.0
	Nurse	52	38.5
	Administrative	10	7.4
	Sanitation	52	38.5
	Secretary	9	6.7
	Assistant	8	5.9
Experience in this case hospital	Less than 1 year	9	6.7
	1-5 years	52	38.5
	6-10 years	34	25.2
	11-15 years	14	10.4
	More than 15 years	26	19.3
Experience in the new system implementation	Yes	53	39.9
	No	82	60.1

The reliability of the questionnaire was measured by Cronbach's α. The Cronbach's α values of system quality, information quality, service quality, intention to use, user satisfaction, and net benefits were 0.910, 0.924, 0.940, 0.874, 0.923, and 0.956, respectively. In addition, the overall Cronbach's α value was 0.978. Therefore, the reliability of the questionnaire was excellent [5]. The contents of the questionnaire were based on the study of DeLone and McLean [4], and two experts who were in nursing and logistics were invited during the questionnaire development. That is, the questionnaire has content validity. With the Kaiser-Meyer-Olkin measure of sampling adequacy value of 0.913 and significant Bartlett's test of sphericity (p-value = 0.000), factor analysis was performed. All of the factor loading values were greater than 0.50, showing the questionnaire has construct validity [7].

Independent sample t-test for mean difference and one-way analysis of variance were applied to observe if different demographic variables perceive differently in terms of dimensions. For each dimension, the score was summed up by the scores from the questions. For instance, there were six questions in system quality, and the score for each question ranged from 1 to 5. Thus, the overall score in system quality would be from six to thirty. Scheffe's method was used for post hoc analysis.

Table 3 showed that gender has significant impacts on five out of six dimensions statistically. Specifically, males have better perception than females in system quality, information quality, service quality, intention to use, and user satisfaction, while there is no significant difference between males and females in net benefits.

Table 3 Independent Sample t-Test for Mean Difference on Gender

Independent variable (Dimension)	Frequency	Mean	Standard deviation	t	*p*	Scheffs' test
Gender (System quality)				2.760	0.007*	
1. Male	3	28.00	1.00			1 > 2
2. Female	132	21.99	3.76			
Gender (Information quality)				2.824	0.005*	1 > 2
1. Male	3	28.33	1.53			
2. Female	132	22.01	3.85			
Gender (Service quality)				2.183	0.031*	
1. Male	3	21.67	1.53			1 > 2
2. Female	132	17.16	3.21			
Gender (Intention to use)				2.239	0.027*	
1. Male	3	9.33	1.16			1 > 2
2. Female	132	7.35	1.52			
Gender (User satisfaction)				2.462	0.015*	1 > 2
1. Male	3	14.00	1.00			
2. Female	132	10.79	2.25			
Gender (Net benefits)				0.958	0.341	
1. Male	3	36.00	4.36			
2. Female	132	29.25	5.48			

Age, position, and experience have no significant differences in six dimensions. However, different education perceives differently in information quality. Table 4 shows that employees with university degree perceive better than employees with junior high school and below significantly. On the other hand, no significant differences in education are existed in system quality, service quality, intention to use, user satisfaction, and net benefits.

Table 4 ANOVA Results on Education

Independent variable (Dimension)	Freq.	Mean	Standard deviation	F	*p*	Scheffs' test
Education (System quality)				2.409	0.053	
1. Junior high school and below	42	20.91	3.96			
2. Senior high school	15	21.27	3.06			
3. College	18	22.56	4.09			
4. University	55	22.98	3.66			
5. Graduate school	5	24.00	3.08			
Education (Information quality)				2.898	0.025*	4 > 1
1. Junior high school and below	42	20.81	3.96			
2. Senior high school	15	21.60	3.33			
3. College	18	21.83	3.73			
4. University	55	23.22	3.98			
5. Graduate school	5	24.40	2.07			
Education (Service quality)				1.082	0.368	
1. Junior high school and below	42	17.41	3.28			
2. Senior high school	15	16.53	2.03			
3. College	18	17.83	3.00			
4. University	55	18.04	3.56			
5. Graduate school	5	19.40	1.95			
Education (Intention to use)				1.537	0.195	
1. Junior high school and below	42	7.10	1.32			

2. Senior high school	15	7.00	1.65			
3. College	18	7.39	1.85			
4. University	55	7.64	1.57			
5. Graduate school	5	8.40	0.89			
Education (User satisfaction)				1.378	0.245	
1. Junior high school and below	42	10.45	2.07			
2. Senior high school	15	10.33	2.32			
3. College	18	10.72	2.63			
4. University	55	11.24	2.33			
5. Graduate school	5	12.20	0.84			
Education (Net benefits)				1.863	0.121	
1. Junior high school and below	42	28.21	5.41			
2. Senior high school	15	29.27	4.65			
3. College	18	27.72	7.58			
4. University	55	30.75	5.05			
5. Graduate school	5	31.00	2.35			

Experience in the new system implementation also perceives differently on four out of six dimensions. Employees with the experience in the new system implementation have better perceptions in system quality, information quality, intention to use, and net benefits. In contrast, no significant differences are found in service quality and user satisfaction.

Table 5 Independent Sample t-Test for Mean Difference on the New System Implementation

Independent variable	Frequency	Mean	Standard deviation	t	*p*	Scheffs' test
New system implementation (System quality)				2.215	0.028*	1 > 2
1. Yes	53	23.02	3.93			
2. No	28	21.55	3.66			
New system implementation (Information quality)				2.615	0.010*	1 > 2
1. Yes	53	23.23	4.00			
2. No	28	21.45	3.76			
New system implementation (Service quality)				1.485	0.140	
1. Yes	53	18.21	3.51			
2. No	28	17.37	3.01			
New system implementation (Intention to use)				2.107	0.037*	1 > 2
1. Yes	53	7.74	1.55			
2. No	28	7.17	1.49			
New system implementation (User satisfaction)				1.435	0.154	
1. Yes	53	11.21	2.66			
2. No	28	10.63	2.26			
New system implementation (Net benefits)				2.090	0.038*	1 > 2
1. Yes	53	30.62	4.96			
2. No	28	28.61	5.76			

4. Conclusion

In order to improve nurses' workload and nurse burnout, the case hospital has implemented a ward cleaning logistics system. This study develops the questionnaire based on the information system success model proposed by DeLone and McLean [4] with six dimensions and thirty questions along with six demographic variables to analyze employees' satisfaction. The results show that gender has significant impacts on system quality, information quality, service quality, intention to use, and user satisfaction. Employees with the experience of the new system implementation have significantly better perceptions in information quality, system quality, intention to use, and net benefits. Moreover, employees with university degree are more satisfied than those with junior high school and below in information quality.

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Application of SEM on Re-developing Employee Satisfaction Scale for Healthcare Organizations in Taiwan

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Abstract: The aim of this research is to redevelop the employee satisfaction scale for healthcare organizations. 150 valid questionnaires are retrieved to implement item analysis and EFA (Exploratory factor analysis) for pretest, and 524 valid questionnaires (excluding the 250 selected pretest samples) are used for CFA (confirmatory factor analysis). There are 34 items with 7 dimensions remaining after a series of critical tests for validation and reliabilities. The results indicate that this scale measure employee satisfaction effectively, especially for those in healthcare organizations.

Keywords: Employee satisfaction scale, structural equation model, healthcare organization, Taiwan

1. Introduction

Employee satisfaction has been playing a critical position in the field of human resource management. Nowadays, healthcare system has been changed from short-term treatment to long-term treatment due to the improvement of medical technology. However, the shortage of healthcare labor force keeps increasing because of high turnover rate. Ghiselli et al. [1] and Mrayyan [2] indicated that higher employee satisfaction will lead to lower turnover rate. Therefore, it is very important for every healthcare organization to focus on increasing their employee satisfaction in a more effective way. Most employee satisfaction scales were developed for long time and have not been modified over time. Furthermore, the diversity between industries always cause ineffectiveness of the measurement. Therefore, this research re-structures the employee satisfaction measurement and develops an effective scale especially for healthcare organizations.

2. Employee Satisfaction

There are 40 journals selected with 5-year impact factor greater than 3 in Management field based on SSCI (social science citation index). A total of 26 studies including 13 journals ae selected with key words either job satisfaction or employee satisfaction. There are total seven dimensions, including 1) salary and benefits [3]-[6], 2) employee education training and development [7], promotion and appraisal system [8]-[9], colleagues [10]-[11], supervisors [12]-[13], employee autonomy and empowerment [14], and work itself [9]-[10], [15], to construct the scale of employee satisfaction.

3. Analysis and results

There are five experts invited to review the protocol and the results of S-CVI are all more than 0.92 (S-CVI/Ave 0.98) which meet the criterion of 0.8 [16]-[17]. After the expert examination, a pre-test is conducted to examine the employee satisfaction scale with 150 sample employee in a Taiwanese regional teaching hospital by adopting item analysis and EFA (exploratory factor analysis).

Pre-test

This study first used item analysis to delete pretest items, and 7 indices as the judgment standards, including missing value examination (<5%), mean (less than the whole scale with 1.5 standard deviation), standard deviation (>0.75), skewed (absolute value less than one), extreme value test (T-test with $p<0.05$), Corrected Item-Total Correlation (>0.3), and factor loadings (>0.3). The results of item analysis indicate that, only 6 items failed to meet the standard (>0.75), while the remaining 6 indices all met the standard; therefore, all 35 items were retained.

Afterwards, this study used EFA, Principal component analysis, and eigenvalues of more than one to determine the number of factors. In addition, this study decides whether factor loading is greater than 0.5, communalities are higher than 0.5, and the items can be used inter-dimensionally as the judgment standard [18]. According to the result of factor analysis, 7 major factors were extracted from 35 items. During this stage, this study deleted 1 item, as it included inter-dimension. This study repeated factor analysis on other 34 items, and the result of second factor analysis showed that, similarly, 7 main factors were extracted, and 80.94% of the variation was explained. No item was deleted, for a total of 34 items. Moreover, in order to test whether there is internal consistency among the items, this study performed reliability analysis. The overall Cronbach's α of the scale on employee satisfaction was 0.960, and Cronbach's α of the various dimensions was 0.869~0.964, suggesting that reliability was high [19].

After completion of the pretest, during the formal test, as the number of research samples was the same as that of population of the pretest (1,156), the sample size for the EFA and CFA should be different; this study excluded 250 pretest samples before the sampling. A total of 906 formal questionnaires were distributed, and 524 valid questionnaires were returned, for a valid return rate of 57.84%.

Multivariate Normality Test

Given that non-normal data may affect the underlying factor structure and results of data analysis, the examination of normality is required [20]. To check the normality of the seven first-order factors measuring employee satisfaction, Mardia's coefficients of skewness and kurtosis was examined [21]. Non-normal distribution will be achieved if the modulus of skewness is greater than three, and the modulus of kurtosis is greater than ten [22]. Multivariate normality distribution will be demonstrated if Mardia's coefficients is lower

than p(p+2), where p is the number of observed variables [23]. The results of multivariate normality testing indicate that the modulus of skewness was between.391 to 1.514, and the modulus kurtosis was between.005 and.694, respectively. The normalized estimate of Mardia's coefficient was 629.291, and p (p+2) was 1224, which satisfies the assumption of multivariate normality for our data distribution.

To test the proposed Employee Satisfaction Scale, CFA (confirmatory factor analysis) was used. This study first examined the offending estimates to depict the structure of data. The common forms of offending estimates that appear in measurements are negative error variance, standardized loading of the manifest variables exceeding one, and high standard errors for the estimate coefficients [24]. These offending estimates are suggested to be accessed before evaluating the measurement model [25]. The test of offending estimates was conducted for both the seven first-order factors and second-order factors.

4. Conclusion

This study developed a valid and reliable instrument for measuring employee satisfaction, especially in medical organizations. Item analysis, EFA, and CFA were adopted to critically verify the scale. The results showed that, the employee satisfaction scale must be reconstructed with the changing industrial phenomenon over time. However, this case data was derived from a regional hospital, which may vary from other types of hospitals and even different other industries. Therefore, future research is encouraged to adopt this scale for further examination.

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Digital Tools as Support for Collaborative Activities in Higher Education

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Abstract: This study, analyze the attitudes in a group of students in higher education applying the use of digital tools as support of collaborative activities. In this sense, this paper examines the educational experience Telecommunications Principles pertaining to recent education program in Faculty of Statistics and Informatic. To this end, the use of software (test tone generator and oscilloscope) were used. Data collection was applied to a group of 28 students through a survey of mixed type, who completed the course. Finally, the results indicate that the group exists in acceptance favorable towards the use of digital tools for collaborative activities as an integral part of their training.

Keywords: Collaborative work, higher education, communications, digital tools.

1. Introduction

This study, analyze the attitudes in a group of students in higher education applying the use of digital tools as support of collaborative activities. In this sense, this paper examines the educational experience Telecommunications Principles pertaining to recent education program in Faculty of Staticals and Informatic. In this course, basic concepts about the workings of generic components for this type of communication systems are studied: a) transmitters, b) and receivers c) medium transportation. Also, the physical principles discussed in the propagation of electromagnetic waves for communications and converting analog to digital signals.

2. Approach to collaborative activities at the university

Various investigations are conducted around collective work at the university and that support the collaborative work approach mediated by Information and Communication Technology (ICT), is a teaching strategy that lies in the social, where the formation of the learner interacting with others as a result socialization and communication with the group (Guerra, 2008; Romero and Guitert, 2012; Webber and Webber, 2012). This encourages teamwork skills so it is consistent with prevailing educational use current technologies and design mechanisms for evaluation. In this vein, Calzadilla (2008) DT suggests that represent benefits for collaborative activities, because they stimulate interpersonal communication to facilitate the exchange of information and dialogue between the parties involved in the process.

Also, this approach favors the contributions of the learning community which is part of the subject and acquire new skills. Therefore, if the above conditions are met, networks

working for the collective construction of knowledge are formed. This requires that the skills required in the process of creating learning communities are promoted.

3. Digital tools used

The computer applications that can be used in academic work and some authors have called digital tools (DT) (Basilotta y Herrada, 2013). Also, the possibilities offered by DT can play roll for education that have been treated for various investigations (Cabero, 2007; Casanova, Álvarez y Gómez 2009; Macías, 2009 y Villalustre y Del Moral, 2010). For the academic development of the educational experience Principles of Telecommunications, two digital tools were used. First the program is test tones generator (TTG), that lets you use the computer for sound output in different frequencies, either in a constant tone or waveforms (synod , square and triangular) see figure 1. This software is installed locally on a computer. In addition, it emits a sound wave and is transmitted by the audio card on your computer (Esser, 2014). It also allows, program tones at different frequencies ranging in the range of 40 to 15,000 cycles per second.

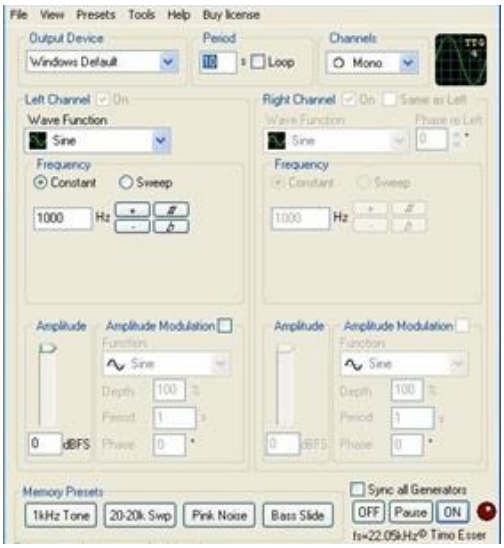

Fig. 1. Screen test tone generator.

The selection of the amplitude of the wave can be of three types: synodal, quadratic and triangular. It is noteworthy that this program enables different scenarios and can be used for practical demonstration of the behavior of waves depending on their frequency and amplitude. However, for the assessment of the waves, it is necessary to have a scope which is an instrument for measuring electrical signals and voltage variation in time; displays the values obtained in the form of coordinates, where the "X" axis represents time and the "Y" axis represents the voltages (Amalfa, 2006). To meet the practical purposes of the educational experience related to the measurement signal. It was decided to use a software-based oscilloscope, to be installed locally on the computer and allow obtaining the signals by the sound card in the same. That decision, settled mainly in the economy of using an oscilloscope for each of the students, this due to the high cost of measuring instruments of this type are marketed.

Another computer program used is PC Oscilloscope (PCO), this software allows the analysis of the electrical signals using electronic audio interface and a computer that also has 3.5 mm input jack for connecting a microphone Zeldovich (2006). Thus, the sound card is used as an analog-digital converter, once the PCO program runs (see figure 2), oscilloscope graphic environment where signals are analyzed by the coordinate axes are displayed. Also, the controls are displayed, you can adjust the time to plot the oscillations of the sound spectrum by fast Fourier transform (FFT).

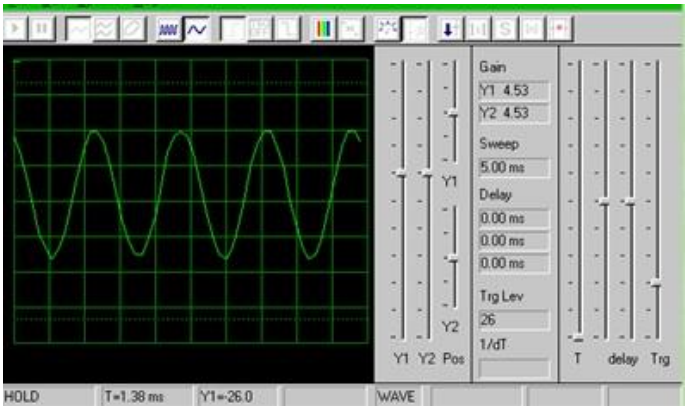

Fig. 2. Screen of Oscilloscope software.

4. Methodology

The sample of this exploratory study was non-probabilistic and intentional kind, since subjects were selected by accessibility of research and study to achieve the objective of the implementation of collaborative activities in small groups. The inclusion of participants was based on the following criteria: **a)** students enrolled in the February-July 2015 semester, **b)** college students of Computer and Networks Services **c)** students in the assignment of Principles of Telecommunications. From the above, the sample was composed of a group of 28 subjects of which 25% are women and 75% are male, the average age is between 18 and 21 years old. As for the evaluation of the subject, it was weighted as follows: 30% tests, 30% practices and 40% integrating projects. The academic performance of students comprised the following step:

First step, was based on both individual and collaborative activities type (Units 1 and 4), the debate led students in the virtual classroom topics related to the history of telecommunications, spectrum covered by different signals RF and the elements of a communication system.

Second step, consisted of the insertion of the joint collaborative activities (and virtual) where students performed different practices related to the behavior of signals in a medium, for that digital tools were used: **a)** tone generation and **b)** PC Oscilloscope.

Third step, finally the integration project was the development of a document whose contents reflected the generation and reception of sound signals in a wireless communication medium, as well as their respective forms of modulation (synod, square and triangular) in different frequencies.

Data were collected using a questionnaire called mixed type "ColabUV" designed ad-hoc, which was formed by two dimensions: **a)** perception towards collaboration and **b)** attitudes about collaboration. This instrument was formed by four items of personal

identification and 16 items distributed to each of the indicators. Most of the questions were answered in a Likert scale of four values: critical, significant, bit and void. The instrument was designed using the "Forms" Google-Drive application and was conveyed through the virtual classroom. Once you stored the data were processed using the SPSS statistical software.

5. Results

At the beginning of the course were 28 students questioned whether they had previous experience in such collaborative activities 69% claimed to have experience against 31% who said yes. Following this the results are presented on the methodology of collaborative work, with respect to the first dimension in relation to the perception and in accordance with the means obtained, highlights the contributions of the other partners, as well as the respect for diversity. In this vein, the students performed and accepts constructive criticism from different points of view of others, just as they have a positive perception regarding responsibility through commitment to the objectives of the task and the agreements reached in consensus with the group.

First, they were questioning the students if they consider it appropriate to use digital tools as support to improve their academic performance. As shown in table 1, 17.9% said it is "unfavorable", the term "quite favorable" was the highest with 42.9% and the remaining 39.3% it seems "favorable" to use digital tools.

Table 1. Consider that the use of digital tools help you improve your academic performance

Answer	Frecuency	Percentage	Cumulative percentage
Unfavorable	5	17.9	17.9
Favorable	11	39.3	57.1
Quite favorable	12	42.9	100.0
Total	28	100.0	

In addition, they were asked about how they are easier to learn through practical exercises, the answers were "nothing" 3.6%, while "favorable", were "quite favorable" response answers 39.3% and 32.1% respectively; while 25% think it is "unfavorable". This means that if the practical exercises are implemented other approaches should be included and mediate learning with practice (see table 2).

Table 2. How it makes you learn what the teacher tells you through practical exercises

Answer	Frecuency	Percentage	Cumulative percentage
Nothing	1	3.6	3.6
Unfavorable	7	25.0	28.6
Favorable	11	39.3	67.9
Quite favorable	9	32.1	100.0
Total	28	100.0	

Finally, they questioned whether they believed students being satisfied with what they learned to perform collaborative activities using digital tools 60.7% responses were considered "favorable" than collaborative activities and the use of technology can help in the development of their learning, while 21.4% believe that if is "quite favorable"; while 17.4% considered "unfavorable", this shows an acceptance by the use of digital tools through collaborative activities (see table 3).

Table 3. Consider collaborative activities using digital tools provide support in your learning

Answer	Frecuency	Percentage	Cumulative percentage
Unfavorable	5	17.9	17.9
Favorable	17	60.7	78.6
Quite favorable	6	21.4	100.0
Total	28	100.0	

With respect to the attitudes about collaboration results obtained averages include a positive attitude to the use of digital tools, since they influence as a complementary part in their education. This is reflected in their answers, as they understand the focus of the collaborative activities as a dynamic that allows them to share ideas, opinions and knowledge about a certain topic. Likewise, the motivation for collaborative activities is appreciated, understanding that the basis of the organization corresponds to individual responsibility and group tracks the success of the shared task.

6. Conclusion

The discussion of this document focuses in the inclusion of digital tools as support for collaborative activities in university students, located in a learning environment of mixed type, focusing the spotlight on the perceptions and attitudes of students regarding types of collaborative activities. A key aspect lies in mediating between theory and practice which reinforces the learning of students.

Finally, it notes that the perception and attitude towards use of digital tools by students was positive. Practices undertaken in the TTG and the PCO tool, participants interacted collegially and each was changing the role between the transmitter and receiver signals thereof. This enabled to confirm the theoretical aspects regarding the modulation signals in a communication channel. As an end we live in an era of constant technological changes which society is increasingly interconnected (Carvajal, 2015). Therefore, should guide the teaching so that teachers adopt and adapt the use of technology in the classroom interventions. Finally, it is required that students be prepared with both the theoretical underpinnings and the practical, the latter must be addressed by collaboration skills demanded by employers.

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Proposal of Teaching Strategy for Research Competencies Development in Higher Education

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Abstract: Research is a substantial activity of universities. Research competencies should be developed gradually and systematically across the curriculum, for which it is necessary to design learning experiences which implement processes involved in the formal investigation. Since modern research can hardly be understood without the use of internet, skills for managing information from internet are essential. In this paper, a teaching strategy of project-based learning articulated with digital curation activities is proposed in an attempt to integrate a comprehensive set of research tasks, conforming rich and meaningful active learning experiences for students.

Keywords: Teaching methods, research competencies, digital curation, project-based learning, higher education.

1. Introduction

Research is one of the most important quality characteristics of modern universities. When we talk about research in higher education institutions we mean not only doing research but to use it appropriately in teaching and preparing students to understand and do research [1].

Even if research is not a substantive activity of the future professional work of students, with research training, they develop skills applicable to any sphere of life that will allow them to question, investigate, observe, look for information from various sources, critically analyze the information, tie loose ends, make diagnoses, generate substantiated conclusions and propose solutions to problems. Therefore, development of research competencies is an essential aspect of a comprehensive higher education.

The development of research competencies along the career would have to ensure that upon its completion, the student is ready to make a solid and rigorous thesis, although other degree options exist. This is not the purpose of the training but only an evidence of performance. At this point, the students must demonstrate not only what they learned in the courses of research methodology, they should articulate all the baggage of knowledge, skills and attitudes at their disposal to successfully carry out a research project.

In order to reach this level of expertise, students need to develop gradually a set of competencies for research through educational strategies such as project-based learning (PBL) focused on research. Incorporate learning activities in the form of small research projects makes students simultaneously develop the ability to understand and apply knowledge to new situations of concern in its immediate context.

Given the importance that has taken the internet as a source of information and the difficulties of a space where true and false information converge in huge amounts,

management information from websites is a major task that involves certain competencies. To develop competencies in recent years teaching strategies based on digital curation have been proposed. Digital curation is an activity that involves the search, selection, analysis, use and sharing of internet information. The proposal of this paper is to articulate the PBL with digital curation, forming active learning experiences for the development of research competencies. We start with a review of different views and experiences regarding research training, PBL and the educational use of digital curation tools.

2. Research Competencies Development in Higher Education

When students reach the higher level of education, it is expected that they have a minimum level of mastery of a set of competencies. Cardenas [2] warns that it should not be assumed that students have what she calls "minimum platform of skills", but, on the contrary, it is the bounden of duty of higher education to identify and address the deficiencies in new students. The author questions the way in which the students are introduced to research, noting that it has installed an instrumental conception of this activity through methodology courses where it is common to use the protocol format to guide the research process, which it is obviously a mistake.

Competencies are integrated actions facing activities and problems of context, suitability with ethical commitment, integrating, knowing and doing with a perspective of continuous improvement [3]. The competencies are built gradually and systematically. In the case of research competencies, one can start with the establishment of conditions for the curiosity, methodical doubt, reading, critical analysis, teamwork, writing and discussion [4].

The path that is drawn to develop research competencies in students throughout the curriculum is called formative research. It involves training in and for research, located in the field of teaching strategies focused on the learner [5]. In other words, formative research is the joint construction of knowledge processes that keep procedural analogies with research in the strict sense, but do not produce knowledge admitted as new and valid [5,6,7].

There are different positions about which competencies are required for research. Muñoz, Quintero and Munévar [8] divide the research competencies in the following categories:

Competencies for asking: Questioning and investigation come from the natural human curiosity, but not every question triggers an investigative process. That is why the skills to ask, particularly in the higher education level, should become raised under the logic of verification or discovery.

Observational competencies: Observation is a key element of research, particularly qualitative research. The researcher observes and records what others say and do, including not only the words but also the expressions, gestures and attitudes, in as much detail as possible.

Analytical competencies: They are related to the systematic and thoughtful handling of collected information, in order to identify trends, typologies or patterns to discover, assimilate and make sense of the information.

Scriptural competencies: The scriptural competencies will be reflected in the order, logic and style of the research report.

On the other hand, Tejada, Tejeda and Villabona [9] establish a classification of the research competencies into three levels:

Basic: Includes the ability to identify and formulate problems; the ability to formulate questions; the ability to structure research projects; teamwork and collaboration and communication skills (speaking, reading and writing).

Complementary: Ability to relate the knowledge and skills acquired in different areas of knowledge with research; and ability to relate skills, abilities, attitudes and skills with research activity.

Advanced: Ability to experience; analytical skills; to solve problems; and to interpret results and draw conclusions.

According to Parra [7], the articulation between research and training should not be viewed in terms of content, but in the way of delivering content. On that subject, some authors agree in suggesting PBL as a strategy for the development of investigative skills since it promotes active and independent work, critical thinking skills and collaborative work [5,10,11].

Some studies on the development of investigative skills have agreed to apply PBL because it is a learning model that involves planning, implementing and evaluating projects with application in the real world and is intended to bring solutions to complex problems or address difficult issues [10,11]. The results showed positive effects on the promotion of research competencies, due to a dynamic and interactive learning process.

3. Digital Curation Tools

Far from lack of information, the student is currently facing the phenomenon of *infoxication* which occurs when the amount of information we receive exceeds our ability to treat it. This makes necessary the development of skills to manage the abundance of information published on websites. A proposal to address this challenge is the implementation of *WebQuests*, characterized by a previous collection of resources made by the teacher, with the intention that the student focus on the use of information and not in the search. However, this teaching strategy, successful for some purposes, eliminates the possibility of developing autonomy in students in locating and selection of resources.

Digital curation has its origin in the field of marketing, given the need to frequently feed websites with content to capture the interest of specific sectors of the target population not only for information but also for advertising that accompanies information. It is a technique that essentially is to recover, select and share quality information posted on the internet on an issue, respecting its ownership and forming a collection of online content, taking new meaning and value. The term "curation" is a comparison with the museum activity consisting in selecting, organizing, preserving and forming collections of artwork.

Antonio Martin & Stagg [12] conceived the digital curation as an active process by which contents are selected by a critical evaluation using additional instruments such as social networks, so that other users can comment or suggest other content. The authors believe that the digital web tools for curation can be classified according to their main functions in four areas, namely, blogs and microblogs; social bookmarking; images and videos sharing; and digital curation exclusively.

For example, *Scoop.it* has the sole function of digital curation, *Pearltrees* is a social bookmarking system, *Pinterest* is a social network for sharing images and *Storify* also functions as a blog to build digital storytelling. There are more tools of digital curation with its own peculiarities, as *Paper.li*, *StumbleUpon*, *Scoopinion*, *LikeHack*, *Ensemba*, *Learnist*, among many others.

Digital curation tools have in common that they have the ability to conduct automated searches by generating results that are considered reliable, although it is the user who decides, according to its own criteria of validity and relevance, what resources will add in a collection. By adding a resource in the wall or custom page, the user writes a comment or description of the information. Another feature of these tools is that they have ways to

socialize and disseminate publications through the site itself or connect with social networks as facebook or twitter.

The curation process is not unique; there are several proposals and variants. Albion [13] identifies three key stages: 1) Search: select the best quality content considering its relevance to the topic under investigation. 2) Making sense: add a self-description and comments that add value to content. 3) Share: post, generating interest in other people interested in the subject, may establish communication with them.

4. Proposal of Teaching Strategy

PBL is a model that organizes learning around projects that consist of a series of tasks based on challenging questions or problems that involve students in the design, problem-solving, decision making or investigative activities [14]. Under a research approach, PBL is oriented to action in order to engage students in investigation of real problems of their context.

Learner & Mergendoller [15] consider seven essential elements of meaningful projects:

1. A need to know. This need can be suggested by the teacher with an "entry event" to trigger an exchange of ideas, brainstorm or discussion in the group. The trigger element can be a video, a talk by a guest, an excursion, or any activity that generates in students a genuine interest in knowing.

2. A driving question. This question captures the essence of the project; it must be clear, interesting, complex, challenging and linked to the learning objectives. The guiding question is what gives meaning to the project and gives students a sense of purpose and challenge.

3. Student voice and choice. The more the student is involved in decisions about the project, the better. They can decide how to design, create and present the products, either from a set of options presented by the teacher or propose their own products and tools to produce them.

4. 21st Century Skills. The project should encourage the development of skills such as collaboration, communication, critical thinking and the use of technology.

5. Inquiry and innovation. Students conduct a real investigation, which means that the search for information does not involve copying and pasting but follow a path that starts with their own questions, continues the search for resources and the discovery of responses, which can lead to generate new questions, test ideas and draw their own conclusions.

6. Feedback and revision. It is a process that must be formalized, highlighting the generation of quality products. It is important that students learn that to achieve quality work, review and improvement are required.

7. A publicly presented product. When students know they will present their work to a real audience, they care more about its quality. The audience may be integrated by the group or even people outside the school context, which will make the challenge more interesting.

These seven elements have been considered in the design of the proposed teaching strategy for the development of research competencies. In general terms, the use of information and communication technologies (TIC) in PBL may enhance the learning experience in several research tasks. Particularly, searching for information on internet is addressed through digital curation activities.

The phases of a teaching strategy of PBL with digital curation activities are shown in Figure 1. Whereas it is a student-centered strategy under the logic of “learning by doing”, the activities are performed by the student with the support and guidance of the teacher.

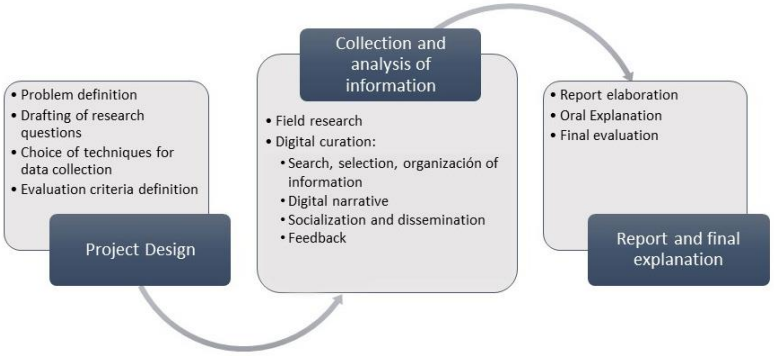

Fig. 1. Phases of a teaching strategy of PBL with digital curation activities

Phase 1: Project Design

- Problem definition: Agreement between students and teacher about the problem to investigate. The problem must be linked to the contents and the context of the student in order to be meaningful for them.
- Drafting of research questions: Having defined the problem to be addressed, the question or questions that will guide the project are written. These questions must be drawn up under the logic of verification or discovery, in order to drive a research process.
- Choice of techniques and data collection instruments: Depending on the problem of research, data collection may or may not include field research. This is defined in this first phase. At this time the digital curation tool to be used is also selected.
- Consensus on products, delivery times and evaluation criteria: It is highly recommended that the assessment includes student performance throughout the process of the project and not only the final products.

Phase 2: Collection and analysis of information

- Design and implementation of instruments for field research: If the project includes field research, the instruments to be used are designed, considering a basic level of complexity according to students and the objectives of the project.
- Analysis of the information collected in the field: The information collected in the field is analyzed. The findings will be integrated later with the findings of the documentary research on the internet through digital curation activities.
- Digital curation:
    - Search, selection and collection of quality web resources that are relevant to the investigation, adding their own texts.
    - Organize information forming a digital narrative which integrates the field. It is therefore advisable to select one of the tools of digital curation that allow to add texts in order to form a digital story, like *Scoop.it* or *Storify*.
    - Socialization and dissemination of publications. : Linking the digital curation tool with social networks in order to disseminate, share and receive feedback about publications.
    - Feedback: Users of social networks can leave comments or additional information which may cause a correction or modification of publications

and even lead to new quests to complement the information presented, forming a cycle of digital curation.

Phase 3: Report and final explanation

- The report can be made in the digital curation tool or written. It must integrate the findings of field research with the documentary information.
- Explanation in the classroom on the findings, the proposed solution to the problem and the experience of the research process.

Finally, it is suggested that teachers use rubrics to assess, given the performance demonstrated in both, processes and products.

5. Conclusion

The research training affects not only the future generation of knowledge through formal investigative work, but also improves the performance on professionals, and even personal challenges of future graduates. However, training for research is not easy and cannot be rushed. It is necessary to implement teaching strategies for a gradual construction of investigative competencies in students from the first semester of the degree program. A good way is to confront students with real-world challenges related to their context. Such experiences can be developed by PBL, which has already proved its efficiency.

The proposal presented in this document is to articulate the PBL with digital curation activities in order to develop skills related to the management of information located on websites in addition to other research competencies. This articulation is justified considering that in the dynamics of current research, internet plays a critical role.

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Perception of Mexican Teenagers about Their Level of Competencies in the Use of ICT in Research

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Abstract: Information and Communication Technology (ICT) and Information Literacy (IL) has been recognized as a key competencies by international organizations such UNESCO. Computer tools for research has become a daily activity realized by teenagers students that helps them to do their homework. The paper reviews preliminary results of the perception of Students about their level of competencies in ICT in research in public secondary schools in Veracruz, Mexico. It was a quantitative study using a survey applied to 979 students from two schools. Preliminary results show an average above 60% proficiency using ICT in research. However, one cannot assume that just because students feel a high degree of confidence in the pursuit of information are really sophisticated users of search strategies and collection of information sources. Deeper research must be performed.

Keywords: Information literacy, teenagers, use of ICT in research, secondary school, Mexico.

1. Introduction

The incorporation of information and communications technology (ICT) in educational spaces is no longer an option. Countries, regions and schools are compelled to develop new initiatives to consider incorporating these tools in teaching and learning so that education systems achieve connect the new demands of the knowledge society, with new features apprentices who are part of them.

Today education systems around the world face the challenge of using information and communications technology to provide its students with the tools and knowledge required in the XXI century (Gomez & Macedo, 2010).

Some educational systems in Latin America have relatively solved the problem of access to education and are now facing the demand for equitable quality improvement; others still have great challenges of inclusion to include all children in the learning process, and other radicals require wagering strategy to build, from education systems and institutions extremely fragile, new solutions that support its students. In any of these educational contexts, we are convinced that ICT, properly implemented, offer alternative access and use can have an impact on student learning (Severin, 2010).

Nowadays, information literacy is strongly related with ICT due to the expansion of Internet around the world. In this sense, learning basic computer skills became a necessity, which included managing word processors, spreadsheets, image editors, databases, and other applications. These skills turn out to be increasingly important in the workplace and also in the ordinary life. So, the tendency related to computing is the concept of network literacy,

which focuses on finding, accessing and using information in a networked environment (Savolainen 2002).

Farmer and Henri (2008) defines information literacy as "*a set of abilities requiring individuals to recognize when information is needed and have the ability to locate, evaluate, manage, and use effectively the needed information*".

ICT literacy education aiming to build up information technology literacy and develop its skills has therefore become the object of the attention of a number of conceptual and programme documents and also lifelong learning system domains (Anderson, 2008; European Commission, 2006; ITU, 2012). From the viewpoint of the access to and effective use of technologies, including the use of their educational potential in lifelong learning, society can become more and more differentiated. It is therefore important to perceive information literacy as a factor which can separate those who are educated in informatics and who know how and when to use these technologies from those who are not able to use informatics technologies and who have then a rather limited access to knowledge resources (Norris, 2001).

In this sense, is relevant for this study to analyze the perception of Students about their level of competencies in ICT in research in secondary school level. According to Gurstein (2003) the future success of the individual can depend to a certain extent on the level of their information technology skill, ICT and the opportunity to learn how to use them. It could be a big mistake to assume that ours teenagers know how to use it just because they are digital natives. Anyway teenagers require attention and training.

In order to meet this aim, it is necessary training and develop the competency in the use of ICT in research and not to cling to acquiring concrete knowledge and skills linked to the platform or application without the capability of their transfer and use in other environments or conditions (Educational Testing Service, 2002).

2. Methodology

The origin of this report came from a research project between two Mexican universities: Technological Institute of Sonora (ITSON) and Veracruzana University (UV) in order to make comparative analysis between the perceptions of students at the secondary level. For this reason was considered secondary schools in Sonora and Veracruz.

In Table 1 shows detail information about the sample of 979 students. The quantitative instrument was composed by 178 items. However, in this document we will show the preliminary results of just 6 items of the secondary schools in Veracruz City.

Table 1. Statistic by gender

Name of institution	**Gender**		**Total**
	Male	***Female***	
Industrial Technical School # 1 (ITS #1)	264	323	587
Secondary General Miguel Alemán #5	188	204	392
Total	452	527	979

In this document we present the results of one dimension: Use of ICT in research. The results were obtained using the statistical program SPSS 21. The analytic strategy used was

to show the descriptive statistics of the overall results with respect to the frequencies in selected dimensions.

3. Results

For their study, the dimension is divided into the following six items: (1) Use digital information of Internet; (2) Use search engines as Google, Yahoo, Bing, and others to search for valid and reliable information; (3) Use electronic databases and resources for finding information; (4) Select digital information sources to perform tasks; (5) Search information in online libraries; and (6) Using information search strategies on the Internet.

The dimension of use to ICT in the research is aimed at those elements search and collection of information sources to perform various tasks. Table 2 shows the result of the perception of the students regarding the level of ICT skills: frequency, percentage and some statistics (Chi square, significance value and asymptotic significance).

Table 2. Use of ICT in research

Items	Not Competent		Competent		Chi square of Pearson*	Expected minimum frequency	Bilateral asymptotic significance
	F	%	F	%			
Use digital information of Internet.	371	37.9	608	62.1	7.689[a]	32.83	.262
Use search engines as Google, Yahoo, Bing, and others to search for valid and reliable information.	187	19.1	792	80.9	7.554[a]	20.42	.273
Use electronic databases and resources for finding information.	357	36.5	622	63.5	17.748[a]	35.24	.007
Select digital information sources to perform tasks.	317	32.4	662	67.6	11.342[a]	34.44	.078
Search information in online libraries.	385	39.3	594	60.7	5.467[a]	48.05	.486
Using information search strategies on the Internet.	320	32.7	659	67.3	5.301[a]	34.84	.506
General dimension	**Not Competent**		**Competent**		**Chi square of Pearson***	**Expected minimum frequency**	**Bilateral asymptotic significance**
	F	**%**	**F**	**%**			
ICT in research	937	33	3937	67	43.692[b]	1.60	.177

[a] Applying a degree of freedom of 6,0 boxes (.0%) have an expected frequency less than 5
[b] Applying a degree of freedom of 36, 14 boxes (18.9%) have an expected frequency less than 5.

The first item of the dimension ICT in Research related with the *Use digital information of internet*, the 37.9 of students evaluated themselves as not competent and its counterpart the results show that 62.1% of students considered competent.

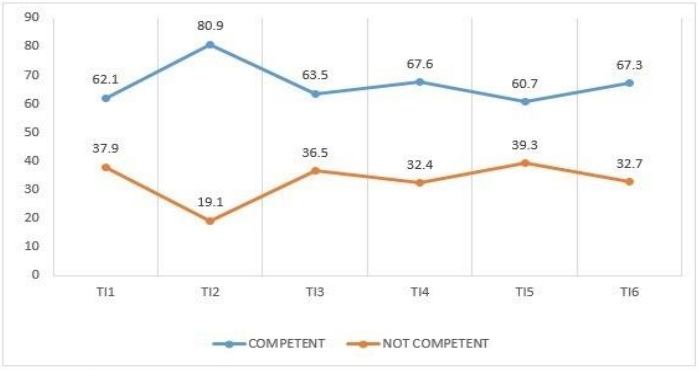
Continuing with the item *Use search engines as Google, Yahoo, Bing, and others to search for valid and reliable information*, the results showed that 19.1% of students were considered as not competent, however, showing the biggest difference is displayed in dimension 80.9% of surveyed students determined to be competent.

In item *Use electronic databases and resources for finding information*, 36.5% of students mentioned that not competent and 63.5% of them is consider themselves as competent

Meanwhile for the item *Select digital information sources to perform tasks*, 32.4% of respondents declared themselves not competent and 67.6% rated competent in the use of ICT.

As regard, *search information in online libraries*, as in the previous item, show it a big difference in the results, the students who are considered competent are 60.7% against 39.3% who are considered as not competent.

Finally for item *Using information search strategies on the Internet* the trend was the 67.3% of students who opted to be considered competent and only 32.7% of students surveyed were deemed competent.



TI1	Use digital information of Internet.
TI2	Use search engines as Google, Yahoo, Bing, and others to search for valid and reliable information.
TI3	Use electronic databases and resources for finding information.
TI4	Select digital information sources to perform tasks.
TI5	Search information in online libraries
TI6	Using information search strategies on the Internet.

Fig. 1. ICT in research: measures percentage competency

In general, the results show a competent perception through the use of ICT in research (Figure 1). The items with the highest percentage were: *Use search engines as Google, Yahoo, Bing, and others to search for valid and reliable information* (TI2) with 80.9%, *Select digital information sources to perform tasks* (TI4) with 67.6% and *Using information search strategies on the Internet* (TI6) with 67.3%.

One thing to note is that the item marked as TI2 had the highest percentage value in this dimension (80.9%) as other statistics returned values between 60% and 70%. One possible explanation about the high results in the item the Use search engines as Google, Yahoo, Bing, and others to search for valid and reliable information (T12) is because teachers request to the students conducting research checking different sources.

Presumably not only because the students have a high degree of confidence in the pursuit of information means users are really sophisticated using search strategies and collection of information sources. The power of the Internet is that everyone can find something about anything. But because of the apparent ease and availability of information that exists on the network, is very important to focus on teaching students how to evaluate such information, and how to collect it efficiently in order to get quality information and to be able to answer relevant questions. In turn, they need to learn about the ethical use of information and its role in our society (Rodriguez, 2011).

In order to check the items in this dimension, the corresponding null hypothesis (H0) and alternative hypothesis (H1) was developed: H0: There is significant difference on perception in students of the Industrial Technical High School # 1 (ESTI) and the General Secondary Miguel Aleman # 5 on the level of competition concerning the use of ICT in research. Logically alternative hypothesis (H1) is when there is no significant difference.

According to Table 2 results obtained by the application of the chi-square test, the alternative hypothesis (H1) is accepted: There is NO significant difference on perception in students of the Industrial Technical High School # 1 (ESTI) and the General Secondary Miguel Aleman # 5 on the level of competition concerning the use of ICT in research.

4. Conclusion

The perception of students on their proficiency level towards the use of ICT in research is higher in areas related to the level of skills to handle technological tools. However, it remains to improve the management aspects of the quality of the information expressed in the consultation of quality information sources such as databases, articles in scientific journals, among others.

In this sense, Williams and Rowlands (2007: 8-11) found that young people have a poor understanding of their information needs and thus find it difficult to develop effective search strategies. Also, Internet research shows that the speed of young people's web searching means that little time is spent in evaluating information, either for relevance, accuracy or authority.

OECD (2015) reports that the impact of technology on education delivery remains sub-optimal, because we may overestimate the digital skills of both teachers and students, because of naïve policy design and implementation strategies, because of a poor understanding of pedagogy, or because of the generally poor quality of educational software and courseware.

So the final recommendation is to develop strategies in order to increase the skills in teachers and students in order to be prepared for a long life learning.

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Parent Perception towards ICT in Secondary Education

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Abstract: Family interaction and the use of Information Technology and Communication in the student basic education is a recent field of study, contrasted with other research themes in Mexico. Hence the purpose of this study is to determine the perception of the parent in the use of technologies in high school students by a quantitative study. The results show a significant void in varying sociodemographic marital status. However, have a computer and Internet at home shown significant to the supervision of the parent in the student's home.

Keywords: Parents, technology, students, basic education in Mexico.

1. Introduction

Learning throughout life is a priority for education in the twenty-first century citizens, given the omnipresence of the new Information and Communication Technology (ICT) in all spheres of society, today it is necessary to integrate new technologies such as computer, mobile phone, Internet, surf the web, use technology programs, among others, because they are an inescapable part of the family, and ignore its impact could have repercussions, it is as influencing society from schools, workplaces and even in homes (Ochoa, 2010).

Pablo, Mañas and Cuadrado (2006) establish that the interaction between ICT and the family is relevant, since on the one hand social behavior and consumption patterns are modified by the new technological possibilities; but then, these are also driven by the needs of families and their children as students.

Two aspects in the process of introducing into the homes of a new technology is the speed and the scheme with which this way it will evolve digitization households spreads essentially depends largely on the willingness of families to introduction of innovations (Pablo, Mañas & Cuadrado, 2006).

Buxarrais et al. (2011) the study suggests that regularly conducts the National Institute of Communication Technologies (NICT) in Barcelona, shows the level of trust that is generated in households regarding the use of ICT and security measures that are taken in students.

On the other hand in Mexico studies by the National Institute of Statistics and Geography ([INEGI], 2012); Mexican Internet Association ([AMIPCI], 2015) concerning statistics on the availability and use of ICT indicate that the access site are home to 84% and how to access them is through Wi-Fi 80%. The review of the literature indicates that studies on access to and use of ICT in secondary education pupils they have focused in terms of infrastructure, frequency and methods of use without considering the interactions that occur between children and parents. Hence the importance of investigating the perception of parents regarding the use to give their children the ICT in their education in secondary level.

2. Family Participation. An approach to its definition

The actors of the training process are formed by the teacher, student, school and parents, where they themselves contribute to these major changes in the time to learn and are an essential part of the training process of education. Studying family involvement in education is the result of the influence they exert in the learning process of children.

Family involvement in education is variously defined, as the involvement with these in various activities such as attending meetings of parents in school, helping children with homework at home, all those activities that parents and mothers do with their children, the school and the community to improve student academic achievement, as this participation is a predictor of student performance (Valdés, Martín and Sánchez, 2009; Valdés, Carlos and Arreola, 2013; Bazán, Sánchez, and Castañeda, 2007).

3. Evidence of Family Involvement through the Use of ICT

Internationally there have been studies regarding the involvement of families making use of ICT in the education of their children, with reference to various studies conducted in the United States, Spain, Colombia and Mexico.

Olmstead (2013) it reveals that both teachers and parents place a high value on proactive parental involvement and that technology can be used to keep parents involved in the academic life of their children.

Segura and Martínez (2011), in order to identify the views of parents of students to the use of ICT in the tutorial with families revealed that closely involve if they carry out this type of activity, that is, making use of technology to be active participation in the education of their children.

Aguilar and Leiva (2012), in order to reflect on the needs of ICT not only as curricular environment but also as a way to involve the family, school and other school environment evidenced that recent decades show the difficulties and limited participation families in school, despite attempts by the administration to establish laws that encourage such participation. However, as can be seen in the innovative experiences of some centers, to encourage family participation in school, they start from an awareness of a joint effort between teachers and families, creating learning communities.

And finally, the study of Little et al. (2011), in order to identify the social, technological and educational context surrounding parents from countries such as Mexico and Colombia, to establish the basis for a better understanding of the factors that influence their attitude towards the use of ICT in the education of their children found that many parents are digital immigrants or settlers since, although some digital still illiterate.

4. Method

A descriptive cross-sectional quantitative study was conducted. To collect data the consent of school authorities was requested. Also voluntary cooperation was asked parents to reply to the questionnaire.

The population is made up of parents of students in public secondary schools in a city in the south of Sonora in Mexico. They were not randomly selected 379 parents form, the average age of them was 38 years (SD = 7.18) with a minimum age of 23 and a maximum of 73 years.

5. Results

To determine whether there are significant differences between marital status of the parents and the dimensions academic activities and search for information for academic purposes, it made a comparison of means by Student's *t* test for independent samples:Table 1.

Table 1. *Results of Student's t test "Marital Status".*

	Single		Married		t	gl	p	Cohen's d
	M	DS	M	DS				
Academic activities	2.55	1.40	2.39	1.09	1.157	377	.248	0.11
Search information for academic purposes	4.26	2.03	4.24	1.69	.115	377	.909	0.01

P ≤ .05

This shows that there are no significant differences in the marital status of parents and their perception to use their children as students have of ICT. The statistical power of this difference is smaller as it meets the minimum criteria for determining that a difference between the means is established and is supported by evidence of Cohen's *d*.

On the other side to see if there are significant differences in the general data to have computer and internet at home parents and dimensions academic activities and search for information for academic purposes, a comparison of means was performed using a Student's *t* test for independent samples (see Table 2 and 3).

Table 2. Results of Student's t test "Having a computer at home."

	Yes		Not		t	gl	p	Cohen's d
	M	DS	M	DS				
Academic activities	2.66	1.17	1.88	.98	-6.139	377	.000	-0.63
Search information for academic purposes	4.71	1.55	3.15	1.81	-8.514	377	.000	-0.87

P ≤ .05

It was found that there are significant differences in having a computer at home by parents and their perception to use their children as students have of ICT. The statistical power of these differences is greater as it meets the minimum criteria for determining that a difference between the means is established and is supported by evidence of Cohen's d.

Table 3. Results of Student's t test "Having internet at home."

	Yes		Not		t	gl	p	Cohen's d
	M	DS	M	DS				
Academic activities	2.75	1.14	2.00	1.08	-6.382	377	.000	-0.65
Search information for academic purposes	4.94	1.49	3.36	1.73	-9.485	377	.000	-0.97

P ≤ .05

It was found that there are significant differences in having internet at home by parents and their perception to use their children as students have of ICT. The statistical power of these differences is greater as it meets the minimum criteria for determining that a difference between the means is established and is supported by evidence of Cohen's d.

6. Conclusion

The process of comprehensive training of Mexican youth requires the active participation of parents in supervision and monitoring of the use of ICT in the teaching-learning process. In this regard, the review of sociodemographic variables marital status shows that regardless of whether the parent is single or married no significant change to the perception on the use of their children and students have towards ICT.

It should be noted that according to data provided by the AMIPCI (2015), 26% of Mexican adolescents between 12 and 15 years old make use of technology. In addition, 78% of students who use these tools from home focus on finding information.

In relation to the variable having the Internet at home for academic activities and search for information for academic purposes it was found that there are significant differences, which is indicative of the lack of knowledge among parents about the proper way exploitation of technological resources to support the teaching-learning process.

Based on preliminary results, the need for the issue of educational policies at the national level shaping generating indoctrination campaigns aimed at parents in relation to the work of training, supervision, monitoring towards the use of ICT from their children.

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Improving E-Assessment and E-Learning in Language Learning and Teaching Using Information Technology

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Abstract. The advent of computer and ICT thereafter has introduced many irrevocable changes in learning and teaching. There is substantially growing need for the use of IT and ICT in language learning and teaching. In other words, the integration of Information Technology (IT) into online teaching is of vital importance for education and assessment. Considering the fact that the image of education is undergone drastic changes by the advent of technology, education systems and teachers move beyond the walls of traditional classes and methods in order to join with other educational centers to revitalize education. Given the advent of distance learning, online courses and virtual universities, e-assessment has taken a prominent place in effective teaching and meeting the learners' educational needs. The purpose of this paper is twofold: first, scrutinizing e-learning, it discusses how and why e-assessment is becoming widely used by educationalists and administrators worldwide. As a second purpose, a couple of effective strategies for online assessment will be enumerated.

Keywords: ICT, e-learning, e-assessment, online assessment.

1. Introduction

The new innovations in the area of communication and technology, more particularly. Information Technology and ICT have made remarkably changes and improvemnts in every aspect of life. The third millennium witnessed a revolution in education thanks to the advent of IT and ICT. Accordingly, web-based learning will continue to expand and provide one of the chief resources for language learning in this century and assigns new challenges and duties on the modern teachers; in fact, the tradition of English teaching has been markedly changed with the remarkable entry of technology. Moreover, technology provides so many options as making teaching interesting and also making teaching more productive in terms of improvements. As Cummings and Dawkins (1998) put, information technologies help in promoting opportunities of knowledge sharing throughout the world and can help the teachers and students having up-to-date information and knowledge since accurate and right information is essential for effective teaching and learning. The new era is the age of globalization; thus, the growth of ELT through technology is of great importance to grasp on various foreign languages particularly English language. English Language Teaching has been with us for many years and its significance continues to grow by IT. With the integration of IT with e-learning, e-assessment lies at the heart of education and it becomes the most enterprise in any educational systems in such a way that it is impossible to work in either field without being concerned with the other one. E-assessment can take different forms including the use of e-testing, e-portfolios, social software (such as wikis and blogs) and other approaches. As the findings manifest, there are many benefits to using e-assessment that will be discussed in present paper.

2. The Internet and Language Learning

The Internet offers the best way to learn language other than immersion in an English speaking milieu. The advantages of online learning, can be summarized under the following headings:

1) Access – the internet offers the possibility to experience English without the need of travel. Even without the need of leaving home or bedroom.

2) Flexibility – the internet allows for users to learn language when they want, where they want.

3) Response – the internet offers the possibility of instant feedback to learners. This greatly enhances the learning experience.

4) Repeatability – the learner can encounter the language in a repetitive fashion until mastery is achieved.

5) Durability – the internet is 24/7. It never tires. It does not take coffee breaks.

6) Modality – the internet is a multimodal learning tool. It stimulates in a rich sensory and cognitive and thus fertilizes language acquisition successfully.

7) Specificity – the internet allows the language learner choice and variety in both what and with who will be learned. Learning can be tailored to the language learner s precise makeup and needs.

8) Cost – the internet is a business model which due to economies of scale, can offer services for pennies. It also offers to widen access through a pay as you can dynamic.

The internet-mediated communication allows users to share not only brief messages, but also create lengthy documents - thus facilitating collaborative writing (learning). Furthermore, learners can share graphics, sounds and video. Thus, the internet helps create an environment where authentic and creative communication is integrated into all aspects of the course.

4. The application of ICT in foreign language teaching

The integration of information and communications technology in teaching and learning is considered as a medium in which a variety of approaches and pedagogical philosophies may be implemented.

However, ICT as a teaching aid is more complicated in that it demands more specific skills from the teachers. The development of ICT – electronic mail, internet, multimedia, possibilities to use collaborative platforms, undoubtedly, influences the process of using them in everyday classroom teaching and learning. ICT no longer serves to be a simple additional means but ICT is an indispensable part of the modern and contemporary learning environment.

The application of ICT gives more opportunities for communication between peer learners: they can exchange information in real time, they can participate in blog discussions, work in teams on different projects, exchange emails, search for information, etc. By using the authentic material provided by the Internet, we will have a better insight into the culture of the country and people whose language we study [12,15].

There is significant evidence of the benefits and advantages that the use of ICT can have on learners. The effective use of ICT impacts on learners and various aspects of the learning process can be summarized as follows [4]:

- ICT increases learners' motivation and thus enhances personal commitment and engagement;
- ICT improves independent learning;
- Learners' collaboration and communication are more important;
- Learners' attainment and outcomes are improved.

As for the learners perceptions of ICT, students work independently with technologies with the goal of arriving at a specified level of mastery of a given knowledge set. At the same time, it provides flexibility to learners which are a must for mastery of learning and quality of learning. The use of ICT in language learning not only involves pedagogical changes for teachers but also involves environmental and pedagogical changes for learners who are traditionally used to face-to-face teaching in classrooms. Although an increasing number of learners have access to online technologies and use
ICT for personal interactions, they find it challenging to use ICT in an educational context.

3. IT in Language Teaching

According to Daintith (2009), Information technology (IT) is defined as the use of computers and telecommunications equipment to store, retrieve, transmit and manipulate data and it is used as a tool to facilitate Interactive Learning. As Hussain (2005) notes, IT can be used in classrooms in presentation and practice phases as the following ways:

- *Audio-Visuals and Animations***:** Audiovisuals, video conferencing, short animations, virtual reality, etc can be used in teaching learning process to present or recycle new language to learners.
- *Multimedia:* Development in computers, communication, electronics and other Multimedia tools provide a wide range of sensory stimuli.
- *Community resources:* An electronic community allows students to engage in dialogue with each other, their teacher, experts and teachers in different parts of the country or the world.
- *Individualized instruction:* Technology can be used for individualized instruction in order to bridge the gaps between the teaching styles and the learning styles.
- *Digital devices:* The digital devices like cameras, scanners can be used for instruction.
- *Online materials:* The online materials used in the educational setting.
- *Teacher-parent interactions and Teacher- teacher interactions*
- *Online testing:* The teacher may prepare a question bank or an objective type test and place it on the network. The students answer and submit the test. The immediate feedback and scores can be obtained by the student. The evaluation can be done by means of assignments in the form of presentations, documents, and audio visuals, drill and practice, online quiz in various subjects, etc.

From above it is quite obvious that the benefits and influence of IT in education in the classrooms cannot be underestimated; therefore, as an effective and successful teacher, we should be able to find suitable ways and means to improve teaching techniques by using IT.

- Students use information technologies to:

1. Participate in a media revolution, profoundly affecting the way they think about and use information technologies.
2. Improve the ways of learning in new learning fashions
3. Extend the ability and skills of applying their learning in real situation.
4. Working in groups for cooperative and collaborative learning
5. Developing self-learning habits at their own pace and time.
6. Learn with the teacher rather by the teacher.
7. Develop inquiry-learning habits.
8. Use right information at right time to achieve right objective.
9. Review and explore qualitative data.
10. Exchange learning experiences and information with others students and teachers living anywhere in the world.

- Teachers use the information technologies to:
  1. Present the material in more interesting and attractive way.
  2. Guide and help students in searching the qualitative material.
  3. Make best use of time.
  4. Coach the students.
  5. Provide individualized instruction.
  6. Direct the students toward cooperative as well as collaborative learning activities.
  7. Prepare learning material for students, rather teaching in conventional situations.
  8. Diagnose the learning problem of students and help them to overcome.

4. E-Learning

According to Tavangarian, Leypold, Nölting and Röser (2004), E-learning or web-learning is currently huge buzzword in education includes all forms of electronically supported learning and teaching, including educational technology . Abbreviations like CBT (Computer-Based Training), IBT (Internet-Based Training) or WBT (Web-Based Training) have been used as synonyms to e-learning. In fact, E-learning allows us to be educated on any subject at any time in many different locations and it brings new dimensions in the world of education. It is commonly thought that new technologies can make a big discrepancy in distance learning .For instance, learners specially children can interact with new media, and develop their skills, knowledge, and perception of the world. Many proponents of e-learning believe that everyone must be equipped with basic and rudimentary knowledge in technology, as well as use it as a medium to reach a particular goal. Some of the advantages of the use of e-learning are indisputable and obvious. They stem from the opportunities offered by this type of systems. In fact, for those who have yet to experience the e-learning revolution, there is a treasure trove of rich benefits and exciting advances just waiting to be discovered, but some believe that there are also major pitfalls that must be carefully avoided.

Here are the advantages of e-learning for foreign language training that can be considered in several aspects (Burbles, 2004):

• Student can study anywhere as long as there is access to a computer with internet connection (education for all).
• They can work at own pace;
• User can accommodate different learning styles through different activities;
• Flexibility to join discussions any hour of the day;
• E-learning is cost effective.
• E-learning also offers individualized instruction, which print media, cannot provide, and instructor-led courses allow clumsily and at great cost.
• E-learning can target specific needs.
• Online instruction knows no geographic boundaries. Online courses link students from all over the world. •Students can share ideas in a culturally diverse setting with people from different social, economic, and experiential backgrounds.

Disadvantages of e-learning: The research findings indicate that there are some possible barriers and enablers to e-learning use as below (Burbles, 2004):

• Lack of personal community and connection (not for blended learning)
• Tech, toys, and teaching over learning
• Focus on memorization over learning core competencies
• Underutilized talents and facilities
• Learners with low motivation or bad study habits may fall behind.
• Without the routine structures of a traditional class, students may get lost o r confused about course activities and deadlines.

- Students may feel isolated from the instructor and classmates
- Instructor may not always be available when students are studying or need help.
- Slow Internet connections or older computers may make accessing course materials frustrating.
- Managing computer files and online learning software can sometimes seem complex for students with beginner-level computer skills.

All in all, e-learning advantages and disadvantages are important to consider when organizations and individuals are making learning decisions, but what is universally agreed is that e-learning, whether offered as a stand-alone approach or mixed or blended with other training, is difficult to implement.

5. E-assessment

According to Gomersall (2005), e-Assessment in present decade has played a pivotal role in people's lives and has been one of the key factors behind the success of people in education. The term e-assessment is a broadly-based one, covering a range of activities in which digital technologies are used in assessment. Such activities include the designing and delivery of assessments, marking – by computers, or humans assisted by scanners and online tools – and all processes of reporting, storing and transferring of data associated with assessments. In fact, e-Assessment is an alternative to testing since using only tests as a basis for assessment has obvious drawbacks. Some form of e-assessment at which a learner's attainment and progress come under review are as below:

- Formative assessment or diagnostic testing is a range of formal and informal assessment procedures employed by teachers during the learning process in order to modify teaching and learning activities to improve student attainment. It typically involves qualitative feedback (rather than scores) for both student and teacher that focuses on the details of content and performance (Crooks, 2001).
- Summative is the final assessment of a learner's achievement, usually leading to a formal qualification or certification of a skill. Summative assessment is also referred to as assessment of learning (Crooks, 2001).

Advantages of E assessment:

Gomersall (2005) enumerates the advantages of e-assessment as follows:

- Greater flexibility in when and where assessment can be taken
- Increased motivation for candidates through the use of media-rich elements in assessment
- Support for preferences in different learning styles and assessment approaches
- Immediate feedback to candidates (depending on the e-assessment type)
- Time savings for assessors through automatic marking (depending on the assessment instrument)
- Assessment management is easier and quicker
- Support for candidates who use assistive technologies in assessment
- Cost savings, quality assurance gains and improved administration through easy access and transfer of electronic evidence
- Assessing metacognition
- Knowing how to use knowledge
- Better exemplification for students and teachers
- Increased flexibility Assessments can be provided at a greater range of locations and times.

• More efficient and environmentally friendly administration that is, e-assessment, and the associated e-administration of candidates, reduces the administration burden on centers.

Generally, e-assessment may be best used to free staff for tasks that humans do best. Administrative functions performed by the computer – scoring, recording, and transfer of data – will ensure greater accuracy and objectivity than is achieved by humans. However, a uniquely valuable attribute that e-assessment can offer to learners and practitioners is an authentic assessment experience. Computer-based assessments can be taken in the workplace, acquiring an immediate relevance. They may also replicate an authentic context through simulations, virtual worlds or use of audio or image files, so that the activity seems more real and purposeful for the candidate. The use of gaming software as a preparation for, or as part of, a summative assessment, increases the stakes in this respect, and, where development funding is available, has the potential to revolutionize assessment practice .

The use of online techniques in language teaching

Leask (1999) lists the techniques based on ICT as follows:

- Electronic submission of written assignments
- Parallel print and on-line assessment options where students are given the choice of whether and how they use on-line tools in assessment tasks
- Publication of documents on the web
- Labeling of on-line diagrams
- Manipulation of on-line graphs
- Completion of on-line quizzes
- Completion of short-answer and multiple choice questions
- On-line exams with monitored and controlled start and stop times
- Any formative or summative task carried out in a web-based environment.

6. Conclusion

Although, there are some disadvantages to use e-learning as well as e-assessment, students will get tremendous satisfaction from it. According to student surveys, e-learning has had a broadly positive pedagogical impact on students. What is of great importance is that e-learning and classroom learning can not be separated by teachers, but classroom learning can be enhanced by adding e-learning .For example, a discussion to continue dialogue after session can be fruitful for learners to improve their speaking. In fact, the focus is now how to make e-learning and e-assessment more effective and useful both for teachers and learners. E-assessment is not just about multiple choice objective testing; technology can be used to provide assessment opportunities not possible with pencil and paper. In brief, learning English is a lifelong process that preparing learners to learn online is the greatest skill that teachers can offer since learn how to use some skills in order to acquire knowledge play a vital role in success. Given that e-learning and e-assessment are novel activities so there is much more to be done by researchers in this field to get a clear understanding for the future.

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A Cubic Relationship between Institutional Ownership and Capital Structure

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Abstract: Using a panel data including 237 the main market Malaysian firms, the results of this study show that there is a non-linear relationship between institutional ownership and capital structure. Our results reveal a cubic relationship between institutional ownership and capital structure but pressure-sensitive institutions have positive, negative and again positive influence and inversely pressure-insensitive institutions have a negative, positive and again negative impact on debt ratio.

Keywords: Capital structure, institutional investors, nonlinear relationship, cubic relationship

1. Introduction

Institutions are arguably the most important and powerful class of investors. Their average equity ownership in U.S. firms has increased eight-fold over the past thirty years, and by the end of 2009 they held 70% of the aggregate U.S. market cap. For both large and small firms, institutions are now, more often than not, the majority investor group(Michaely & Vincent, 2012). Generally, it is supposed that the availability of the institutional investors may lead to the change of the company behavior. It origins from the controlling actions that these investors do and these controlling institutional owners is not usually clear. Theoretically, the institutions may have motivations for active controlling on management, but still there are lots of scientists which believe that institutions do not control the company effectively, because they do not have enough experience or they may behave conservatively with managers (Almazan, Hartzell, & Starks, 2005; Ashrafi & Muhammad, 2014a; Salehi, Hematfar, & Heydari, 2011). In this paper we examine how institutional investors affect firms' capital structure. Capital structure theories imply that through the effect of institutional holdings on the fundamental frictions underlying these models – conflicts of interest between managers and equity holders, asymmetric information, and taxes – institutional holdings may affect capital structure decisions (Elyasiani, Jia, & Mao, 2010; Michaely & Vincent, 2012). However, there is conflicting empirical evidence on the role that institutional investors play in monitoring corporate managers. The efficient monitoring hypothesis predicts a positive relation whereas the conflict-of-interest and strategic alignment hypotheses assume a negative relation between institutional ownership and corporate leverage. Thus, a non-linear relationship is possible between institutional ownership and capital structure. Therefore, the main objective of this study is to examine the non-linear relationship between institutional ownership and capital structure. Our results do not indicate a cubic relationship between total institutional ownership and debt ratio. However, another concern is whether all institutional investors have incentives for actively monitoring management. To consider this, we divide institutional investors into pressure-sensitive and pressure-insensitive institutions and find a significant and strong cubic relation.

An interesting finding is that there is inverse trend in the relationship between two types of institutions and capital structure as pressure-sensitive investors have a positive, negative and positive relation and inversely, pressure-insensitive institutions have a negative, positive and negative relation in the different levels of their ownership.

2. Institutional Investors and Capital Structure

According to the theories of capital structure, the existence of agency costs(Elyasiani et al., 2010; Jensen & Meckling, 1976; Michaely & Vincent, 2012) and information asymmetry(Elyasiani et al., 2010; K. Li, Yue, & Zhao, 2009; Michaely & Vincent, 2012) are the most determinant factors of firms' capital structure. As regards to agency problem, some scholars such as Firth (1995); Harris and Raviv (1990); Jensen (1986), believe that mangers are worried about bankruptcy risk because they may lose their jobs, and this concern may push them to use less debt. Shleifer and Vishny (1986) state that institutional investors have higher incentives to decrease agency costs because they can have larger benefits through monitoring. They also will have larger voting powers that will enable them to take corrective actions when it is necessary (active monitoring hypothesis). Brailsford et al. (2002); Brickley et al. (1988); Elyasiani et al. (2010) consistent with the active monitoring hypothesis, find that it is more possible that institutional investors vote against the harmful changes which will decrease shareholders' wealth. Therefore, they will not allow mangers to use less debt than the level that is needed for value maximization. Conversely, some other researchers believe that institutional ownership and debt can be substituted. Al-Najjar and Taylor (2008); Crutchley, Jensen, Jahera Jr, and Raymond (1999); Michaely and Vincent (2012) state that institutional investors have sufficient resources and incentives to mitigate the agency conflicts between shareholders and managers within a firm. Accordingly, to solve these conflicts, institutional monitoring can be considered as a substitute bonding mechanism to debt. Consequently, firms with a high institutional ownership need less debt in their capital structure for mitigating the agency conflicts between mangers and shareholders.

As regard to asymmetric information problem, institutional investors are professional groups and they make decisions based on scientific and fundamental analysis. They are large stockholders, and large shareholders can obtain private and better quality information from firm's managers and convey them to other owners (Bartov, Radhakrishnan, & Krinsky, 2000; Elyasiani et al., 2010;Michaely & Vincent, 2012). Allen, Bernardo, and Welch (2000) also note that by making prudent investments institutional investors lower their risk of being sued, incentivizing them to collect information about the firms they invest in. This process leads them to be more informed than other types of investors, but also decreases the information gap between outside and inside shareholders, because at least a portion of the information they collect is reflected in their trading patterns In addition, institutional investors, by forcing managers to increase information disclosure, are able to mitigate information asymmetry. As a result, the adverse selection costs of equity financing will be decreased and firms can finance by the issuance of new equity instead of debt financing Conversely, Michaely and Vincent (2012) state that firms have to issue stock optimally when asymmetric information problem is low to avoid underinvestment in projects with positive NPV in future. However, the future equity financing dilutive costs could be decreased by reducing the information gap between (potential) shareholders and managers. Therefore, if institutional investors, by mitigating asymmetric information, allow companies to relinquish issuing equity today, there is a complementary relationship between leverage and institutional ownership. Therefore, it is acceptable to believe a positive relationship between institutional investors and leverage. The results of the empirical studies on the relationship between institutional ownership and capital structure, in line with theoretical discussion are

different and some studies show a positive relationship (e.g., Brailsford et al., 2002; Firth, 1995) and some other studies reveal a negative relationship between institutional ownership and capital structure (e.g., Al-Najjar & Taylor, 2008; Crutchley et al., 1999; Michaely & Vincent, 2012). Consequently, in this study in order to test the relationship between institutional ownership and firm capital structure we estimate a cubic model. At low levels of ownership we expect the alignment effect to be prevalent while at higher levels we expect the entrenchment effect to be the more predominant one. The cubic specification also allows the possibility that the relationship will become negative again at very high levels of institutional ownership. This may be due to the fact that when the degree of ownership concentration in the institutions' hands is so elevated, the institutions effectively become the institution-owner (López-de-Foronda, 2012). Moreover,to consider heterogeneity of institutional investors, we divide institutional investors into pressure-sensitive and pressure-insensitive institutions.

3. Sample Selection, Data and Methodology

This paper uses the main market listed companies of Malaysia as sample for the period between 2002 and 2011. We exclude financial firms, firms with incomplete data and firms with negative assets. To choose our sample, we select one of every two firms in the population using a systematic random sampling method. The final sample includes 237 main market firms. Thus, we have 2,370observations in our sample. Table 1 gives the definition of each variable.

Table 4: Variables definition

Variable	Symbol	Measurement
Debt ratio	DR	Total debt to total book assets
Institutional investors	IO	Institutional ownership to total shares outstanding
Pressure-sensitive institutional investors	PSO	Pressure-sensitive Institutional ownership to total shares outstanding
Pressure-insensitive institutional investors	PIO	Pressure-insensitive Institutional ownership to total shares outstanding
Profitability	PROF	EBITD to total book assets
Firm size	SIZE	Natural logarithm of total book assets
Tangibility	TANG	Total net fixed assets to total book assets
Growth opportunities	GO	Market-to-book value
Non-debt tax shield	NDTS	Depreciation expenses to total book assets
Market timing	MT	The stock price at time t to the price at time t-1
Dividend	DIV	Cash dividend payment to total book assets

We estimate the multivariate regressions using panel data methodology in which the debt ratio in each year is a function of various financial and ownership variables. Our particular focus is the influence of institutional ownership on capital structure. However, the relationship between institutional ownership and capital structure is subject to a potential simultaneity bias and consequently, endogeneity problem. Therefore, we employ GMM estimator to solve this problem. There are two types of GMM estimator: Difference GMM and System GMM. Because of the difference GMM drawbacks the main estimator in this study is System GMM.

4. Results and Discussion

Table 5: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
DR	2370	0.2074	0.1657	0	0.9574
IO	2370	0.1667	0.1887	0	0.9203
PIO	2370	0.1358	0.1776	0	0.9102
PSO	2370	0.0309	0.0617	0	0.8043
PROF	2370	0.0801	0.1062	-1.341	0.9496
SIZE	2370	12.97	1.437	5.419	18.45
GO	2370	1.002	1.336	-22.2	30.07
MT	2370	1.124	0.5947	0.141	6.948
TANG	2370	0.3941	0.2009	0	0.9549
NDTS	2370	0.0264	0.0213	0	0.1646
DIV	2370	0.0172	0.0381	0	0.6842

Table 3: Debt ratio trend in different leveles of institutional ownership

	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
IO	0.2060	0.2024	0.2492	0.1888	0.1904
PSO	0.2129	0.1828	0.1824	0.2013	0.2358
PIO	0.2056	0.2285	0.2344	0.1811	0.1910

Table 4: Total institutional ownership and debt ratio, a cubic relationship test

	Dependent variable: total debt ratio				
Independent variables	Pooled OLS	Random effects	Fixed effects	Difference GMM	System GMM
IO	-0.3228*** (0.0967)	-0.3270*** (0.0860)	-0.2966*** (0.0886)	-0.1956* (0.1087)	-0.2191** (0.1065)
IO^2	0.7907** (0.3337)	0.8678*** (0.2943)	0.8074*** (0.3013)	0.3384 (0.3556)	0.4428 (0.3470)
IO^3	-0.6623** (0.3022)	-0.7814*** (0.2636)	-0.7426*** (0.2703)	-0.2410 (0.3035)	-0.3323 (0.2986)
PROF	-0.2745*** (0.0562)	-0.2005*** (0.0219)	-0.1893*** (0.0219)	-0.1851*** (0.0390)	-0.1905*** (0.0382)
SIZE	0.0341*** (0.0024)	0.0500*** (0.0035)	0.0612*** (0.0042)	0.0413*** (0.0105)	0.0401*** (0.0082)
GO	0.0180*** (0.0040)	0.0097*** (0.0017)	0.0091*** (0.0017)	0.0059*** (0.0015)	0.0053*** (0.0014)
MT	-0.0123** (0.0051)	-0.0090*** (0.0033)	-0.0084** (0.0032)	-0.0095*** (0.0030)	-0.0079*** (0.0027)
TANG	0.0403** (0.0193)	0.1776*** 0.0180	0.2057*** (0.0189)	0.1822*** (0.0308)	0.1690*** (0.0296)
NDTS	0.6133*** (0.1704)	-0.3477* (0 .1894)	-0.5344*** (0.2050)	-1.688*** (0.3178)	-1.671*** (0.2959)
DIV	-0.9568*** (0.2201)	-0.2774*** (0.0723)	-0.1997*** (0.0733)	0.1707 *** (0.0584)	0.1815*** (0.0605)
Adj R-squared	0.1568	0.1998	0.2032		
Sragan test	---	---	---	38.72 (0.3053)	42.88 (0.4764)
AR(1)	---	---	---	0.0000	0.0000
AR(2)	---	---	---	0.7526	0.7758

Notes: ***, **, and * represent statistical significance at the 1%, 5%, and 10% level, respectively. AR(1) andAR(2) are tests of first- and second-order serial correlation. Figures reported in parentheses are standard errors.

Table 3 shows debt ratio trend in the different levels of institutional ownership.

Table 3 suggests that firms with low total institutional ownership have low debt ratio, but when firms have middle institutional ownership debt ratio increases and again at high level of institutional ownership it decreases. Moreover, the results show that there is inverse trend in debt ratio for different level of pressure-sensitive and pressure-insensitive ownership. Thus, we check for a cubic relationship. Tables 4 and 5 show the results of cubic relationship for total and different types of institutional investors.

Table 5: PSO, PIO and debt ratio, a cubic relationship test

	Dependent variable: total debt ratio				
Independent variables	Pooled OLS	Random effects	Fixed effects	Difference GMM	System GMM
PSO	-0.0040 (0.1397)	-0.0908 (0.1280)	-0.1006 (0.1299)	0.2614* (0.1457)	0.2371* (0.1352)
PSO^2	1.406** (0.7030)	-0.0436 (0.6323)	-0.1588 (0.6384)	-2.165*** (0.7248)	-2.139*** (0.6722)
PSO^3	-2.136*** (0.7842)	-0.0277 (0.6786)	0.1369 (0.6811)	2.888*** (0.7143)	3.050*** (0.6903)
PIO	-0.4813*** (0.0953)	-0.3827*** (0.0913)	-0.3284*** (0.0948)	-0.3325*** (0.1119)	-0.3458*** (0.1096)
PIO^2	1.338*** (0.3460)	1.245*** (0.3312)	1.148*** (0.3420)	0.9134** (0.3922)	0.9631** (0.3871)
PIO^3	-1.162*** (0.3242)	-1.229*** (0.3070)	-1.179*** (0.3176)	-0.7882** (0.3638)	-0.8101** (0.3529)
PROF	-0.2717*** (0.0556)	-0.2002*** (0.0220)	-0.1883*** (0.0219)	-0.1855*** (0.0391)	-0.1927*** (0.0380)
SIZE	0.0341*** (0.0025)	0.0495*** (0.0035)	0.0607*** (0.0042)	0.0406*** (0.0104)	0.0395*** (0.0084)
GO	0.0178*** (0.0039)	0.0097*** (0.0017)	0.0091*** (0.0017)	0.0060*** (0.0015)	0.0055*** (0.0013)
MT	-0.0136*** (0.0050)	-0.0091*** (0.0033)	-0.0083** (0.0032)	-0.0095*** (0.0030)	-0.0081*** (0.0028)
TANG	0.0422** (0.0191)	0.1799*** (0.0180)	0.2091*** (0.0189)	0.1815*** (0.0310)	0.1735*** (0.0299)
NDTS	0.6601*** (0.1706)	-0.3592* (0.1893)	-0.5548*** (0.2053)	-1.700*** (0.3139)	-1.676*** (0.2924)
DIV	-0.9421*** (0.2193)	-0.2824*** (0.0723)	-0.1998*** (0.0732)	0.1770*** (0.0585)	0.1872 (0.0595)
Adj R-squared	0.1702	0.2022	0.2061	----	-----
Sragan test	---	---	---	39.03 (0.2932)	42.69 (0.4842)
AR(1)	---	---	---	0.0000	0.0000
AR(2)	---	---	---	0.7817	0.8131

Notes: ***, **, and * represent statistical significance at the 1%, 5%, and 10% level, respectively. AR(1) and AR(2) are tests of first- and second-order serial correlation. Figures reported in parentheses are standard errors.

The results of Table 3 show that there is a cubic relationship between total institutional ownership and debt ratio in Pooled OLS, Random effects and Fixed effects models. In the low level of institutional ownership the relation is negative, when the institutional shareholding is in the middle the relation becomes positive and again in the high level of institutional ownership the relation turns to negative. This suggests, although institutional investors initially decrease the debt ratio of firm, once they reach an ownership threshold, they find incentives to entrench themselves and to pursue their own interest even to the detriment of the other shareholders. However, this cubic relationship is not significant in the difference and system GMM estimate.

Our findings in Table 4 support the cubic relationship between different types of institutional ownership and firm capital structure but there is an inverse association.Pressure-sensitive institutional investors positively impact on firms' debt ratio for low levels of their ownership. This influence turns negative once a certain threshold of their ownership is reached and again in high level of their ownership, they have positive influence on debt ratio. It may suggest that, pressure-sensitive institutional investors may both collude with and contest the power of the dominant shareholders. Our results also support this two-faceted relation. At low levels of ownership, institutional stakes are positively related to firm capital structure. The possible reason is that when pressure-sensitive institutions do not have enough power they use debt financing as an internal controlling mechanism to monitor management; once these investors achieve sufficient power to contest or challenge the control of the largest shareholder, they effectively engage in the governance of the firms and decrease debt ratio.Jara-Bertin et al. (2012) also find that when the level of institutional ownership becomes high enough, institutional investors achieve the power to contest the control of other large shareholders and, therefore, to engage in activities that improve the firm's performance. However, at very high level of ownership they may push the firm to have more debt financing for increasing their profitability. This is because banks are classified in this group and since in such level of ownership they are actually the owners of the firm and at the same time the creditor, they are not worried about default risk.

In contrast, consistent with the alignment hypothesis, pressure-insensitive institutional investors negatively impact on firms' debt ratio for low levels of their ownership. Their influence turns positive once a certain threshold of their ownership is reached and again in high level of their ownership, they have negative influence on debt ratio. These results suggest a convergence/entrenchment relation between institutional ownership and capital structure. At low levels of ownership, an increase in their stake implies more engagement in the control of managers and reduces the debt ratio of the firm. At moderate levels of institutional ownership, investors achieve excessive power to pursue personal objectives, expropriation of shareholders, and entrenchment.As such, institutional investors can act in ways that harm the interests of other shareholders and lead to an increase in the firm's debt ratio.Maury and Pajuste (2005) state that by colluding, the blockholders form controlling coalitions and share the diverted profits among themselves. This view is consistent with Zwiebel (1995) who argues that many investors choose to hold less than majority blocks of equity because such blocks are generally considered necessary for active participation in controlling coalitions. By monitoring, the diverted profits can be returned to the firm and shared among shareholders on a pro-rata basis. Again at very high level of ownership, they have negative effect on debt ratio. This may be because of the reason that institutions actually become the owners of the firm and they do not want to put their firm at risk. An alternative view that leads to the same conclusion is that there is an optimal level of internal control mechanisms required within a firm. Corporate debt itself is an internal control mechanism that can reduce agency conflicts (Grossman & Hart, 1982). Specifically, the obligations associated with debt reduce management's discretionary control over the firm's cash flow and their incentives to engage in non-optimal activities. At high levels of institutional ownership, the alignments of interests between managers and shareholders may be so strong that there exist few agency-related benefits to be obtained from the increased use of debt. This result is in line with Magalhaes, Gutiérrez Urtiaga, and Tribó (2010) who find cubic relationship between ownership concentration and bank performance. De Cesari et al. (2009) also show that when institutional ownership is low, an increase in this variable is related to a rise in a firm's tendency to time the market when repurchasing stock. When institutional ownership is high, an increase in this variable reduces a firm's ability to time repurchases.

5. Conclusion

This paper studies the relationship between institutional ownership and capital structure using an original panel data set of 237 Malaysian listed non-financial firms for the period 2002-2011.There is confusing theoretical explanation about the relation between institutional ownership and corporate leverage.While the efficient monitoring hypothesis assumes a positive relation, the conflict-of-interest and strategic alignment hypotheses predict a negative relationship. Consistent with theoretical text, almost all of the previous studies show a significant relationship between institutional ownership and capital structure but some of them find a positive relation and some others a negative relation,thus, a non-linear relationship is possible. Consequently, the main objective of this study is to examine the non-linear relationship between institutional ownership and capital structure. Although there was a significant cubic association in pooled OLS, Fixed effects and Random effects models, we could not find strong evidence for a cubic relationship between total institutional ownership and capital structure. The reason may be inverse influence of different types of institutions. The results of study showed that pressure-sensitive institutions positively affect on debt ratio when they have low level of ownership. This influence turns negative once a certain threshold of their ownership is reached and again in high level of their ownership, they have positive influence on debt ratio. In contrast, consistent with the alignment hypothesis, pressure-insensitive institutional investors negatively impact on firms' debt ratio for low levels of their ownership. Their influence turns positive once a certain threshold of their ownership is reached and again in high level of their ownership, they have negative influence on debt ratio. The results have considerable implications for the capital structure debate. By arguing for a link between institutional ownership and capital structure and through empirical support, this paper adds to an understanding of cross-sectional, and possibly time-series, variation in capital structure. The practical import is that ownership structure is related to the financial efficiency of a firm and hence decisions regarding the issue of equity need to consider a range of implications.

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Information System Design for Eco-Economic Monitoring

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Abstract: The paper is devoted to experience in the field of eco-economic monitoring. It includes the description of the methodology, design and implementation of eco-monitoring systems in Ukraine on the basis of the current situation. From the other side paper provides MATLAB based information system of monitoring activities using economic indicators and possible ways to calculate the necessary monitoring indexes in the form of analytics.

Keywords: sustainable development, eco-economic, monitoring, MATLAB, framework, GUI, information system, algorithm

1. Introduction

Over the last decades, economic growth has been actively implemented in developing countries. For these countries it is very important to provide the projects in economic systems that refer to the problems of the valuable estimation of eco-economic functions in environmental economics. These functions do not have physical forms, so they can not be taken into account in pricing forecast process. Such an aspect predetermines the necessity of the construction the methods of pricing including the ecological constituent [1]. There is a huge amount of literature on economic development and environmental sustainability. The literature concerns problems of measuring and implementation of it in eco-economic and environmental policies. Thus there is now widespread interest in the use of Multi-Regional Input-Output Analysis for understanding global environmental problems [2, 3]. Previous international studies which have estimated final demand induced carbon emissions using IO tables include Cumberland (1966), Ayres and Kneese (1969), Bullard and Herendeen (1975), and Griffin (1976) [4-7]. A number of national statistical agencies and other official bodies in Europe including Carlsson, A. et al. (2006), Francis (2004), Rormose et al. (2009), Rormose (2010) and Federal Statistical Office of Germany (2011) and also Canada such as Gaston (2011) have produced data for consumption based emissions using IO model [8-12].

But complexity and diversity of the eco-economic systems and sustainable development require further investigation with the aim of construction new methods (or perfection the existing ones) of the solving socioeconomic tasks and saving natural-resources potential with comprehensive consideration of eco-economic factors in pricing. Therefore the aim of the article is construction models of eco-economic monitoring and providing informational tool for its computing.

Designing the new modern information system for eco-economic monitoring will enable to operate more complete information about costs and production in environmentally sustainable economy. From the other side it must meet the following requirements:

- user-friendly user interface;
- extended help system;

- maximum consideration of eco-economic models in environmentally sustainable economy;
- providing calculations with matrices of large dimensions;
- numerical differentiation;
- solving systems of linear and nonlinear algebraic equations;
- charting;
- high speed calculations;
- efficiency and reliability.

2. Eco-economic environmental input-output model

As in [13] in this paper we consider the problem of the prognostication of balanced prices in environmental economics on the basis of Leontief-Ford model [14] that generalize Leontief's classical input-output model [14]. Leontief-Ford reflects the simultaneous operation of two kinds of activities: main (the branches of material production) and secondary (the industry of destruction of pollutants).

One of the variants of the direct Leontief-Ford model can be written as follows:

$$\begin{cases} x^{(1)} = A_{11}x^{(1)} + A_{12}x^{(2)} + y^{(1)} \\ x^{(2)} = A_{11}x^{(1)} + A_{12}x^{(2)} - y^{(2)}, \end{cases} \quad (1)$$

where $x^{(1)} \in \mathbb{R}^{n}_{+}$ – vector of total output of main production ($\mathbb{R}^{n}_{+}$ – positive orthant of *n*-dimensional vector space); $x^{(2)} \in \mathbb{R}^{m}_{+}$ – vector of total destroyed industrial contaminant (that total output vector of support sector); $y^{(1)} \in \mathbb{R}^{n}_{+}$ – vector of final output; $y^{(2)} \in \mathbb{R}^{m}_{+}$ – vector of undestroyed industrial contaminant; $A_{11} = \left(a_{ij}^{(11)}\right)_{i,j=1}^{n}$ – the square matrix of spending of the good *i* for producing the good *j* in number $x_j^{(1)}$; $A_{12} = \left(a_{is}^{(12)}\right)_{i,s=1}^{n,m}$ – the rectangular matrix of spending of the good *i* for destroying the contaminant *s* in number $x_s^{(2)}$; $A_{21} = \left(a_{lj}^{(21)}\right)_{l,j=1}^{m,n}$ – the rectangular matrix of production of the contaminant *l* during the production process of the good $x_j^{(1)}$ in number *j*; $A_{22} = \left(a_{ls}^{(22)}\right)_{l,s=1}^{m}$ – the square matrix of production of the contaminant *l* during the destroying process of the contaminant *s*.

The components of above vectors and matrixes are positive because it reflects the real economic sense. The meaning of model (1) is obvious: the first equality – it is good's distribution of material production on the spending in the main and secondary activities and final output; the second equality – it is balanced interrelation that concerns pollutants and means that the amount of destroyed contaminants equals the difference between the amount of the all produced pollutants and undestroyed ones.

Similarly with the classical input-output model the formula (1) can be constructed on the base of appropriate scheme by "rows". The formula (1) is well investigated on the problem of existence of positive solution (so called problem of productivity) and its practical usage. In our case it is interesting to consider the double natured variant of (1) that can be used for the prognostication of the prices.

As for [1] and [13] after some mathematical transformation we will get the system that can be used for the forecasting price indexes in environmental economics:

$$\begin{cases} \tilde{x}_j^{(1)}\pi_j^{(1)} = \sum_{i=1}^{n}\tilde{x}_{ij}^{(11)}\pi_i^{(1)} + \sum_{l=1}^{m}\tilde{x}_{lj}^{(21)}\pi_l^{(2)} + \sum_{r=1}^{R}\tilde{\upsilon}_{rj}^{(1)}\pi_j^{(1)}, \ j=\overline{1,\ n} \\ \tilde{x}_s^{(2)}\pi_s^{(2)} = \sum_{i=1}^{n}\tilde{x}_{is}^{(12)}\pi_i^{(1)} + \sum_{l=1}^{m}\tilde{x}_{ls}^{(22)}\pi_l^{(2)} + \sum_{q=1}^{Q}\tilde{\upsilon}_{qs}^{(2)}\pi_s^{(2)}, \ s=\overline{1,\ m} \end{cases}, \quad (2)$$

where $\tilde{x}_j^{(1)}$ – the cost of main good from sector *j*; $\tilde{z}_j^{(1)}$ – the cost of net output from the main sector *j*; $\tilde{x}_s^{(2)}$ – the cost of the destroyed contaminant *s*; $\tilde{z}_s^{(2)}$ – the cost of net output from the support sector *s*; $\tilde{x}_{ij}^{(11)}$, $\tilde{x}_{il}^{(12)}$, $\tilde{x}_{lj}^{(21)}$, $\tilde{x}_{ls}^{(22)}$ – appropriate valuable analogues of the above costs $A_{11}=\left(a_{ij}^{(11)}\right)_{i,\,j=1}^{n}$, $A_{12}=\left(a_{il}^{(12)}\right)_{i,l=1}^{n,m}$ and outputs $A_{21}=\left(a_{lj}^{(21)}\right)_{l,\,j=1}^{m,n}$, $A_{22}=\left(a_{ls}^{(22)}\right)_{l,s=1}^{m}$; $\tilde{\upsilon}_{rj}^{(1)}$ – the cost of net output with type *r* from sector *j* of main industry; $\upsilon_{rj}^{(1)}$ – the amount of net output with type *r* from sector *j* of main industry in kind; $\tilde{\upsilon}_{qs}^{(2)}$ – the cost of net output with type *q* from sector *s* of support industry; $\upsilon_{qs}^{(2)}$ – the cost of net output with type *q* from sector *s* of support industry in kind; $\pi^{(1)}=\left(\pi_1^{(1)},...,\pi_n^{(1)}\right)^T\in\mathbb{R}_+^n$, $\pi^{(2)}=\left(\pi_1^{(2)},...,\pi_m^{(2)}\right)^T\in\mathbb{R}_+^m$ – appropriate vectors of price indexes for the next time of period $[t,\ t+1]$ in the comparison of previous time of period $[t-1,\ t]$.

3. Information System of Eco-Economic Monitoring

Choosing Matlab to design the information system of pricing in environmentally sustainable economy associated with the key features of the system, namely cross-platform programming language focused on the matrix calculations and algorithms.

The information system pricing in environmentally sustainable economy has the structure shown on Fig. 1.

The core of information system of eco-economic monitoring is based on Math and optimization tool. Extension Math provides a large number of functions for data analysis, which include almost all branches of mathematics, including matrix and linear algebra; polynomials and interpolation; mathematical statistics and data analysis; differential equations etc.

Graphical user interface of information system had been built as a multi-window interface that allows working with different subtasks separately placing intermediate calculations in separate structures.

Graphical user interface of information system of eco-economic monitoring include:

- set of visual tools for empirical testing of economic models described in the second section;
- decision-making support in a given subject area;
- administrative subsystem;
- navigation between blocks of the system;
- modern tools of visualization;
- user-friendly technology of the data input;
- help system;
- procedures and documentation.

Entering input data to perform calculations realized through ActiveX-technology Simple Grid Control, which allows item-entering data, connecting and implementing objects in other documents, which increases the efficiency and accuracy of subsequent calculations.

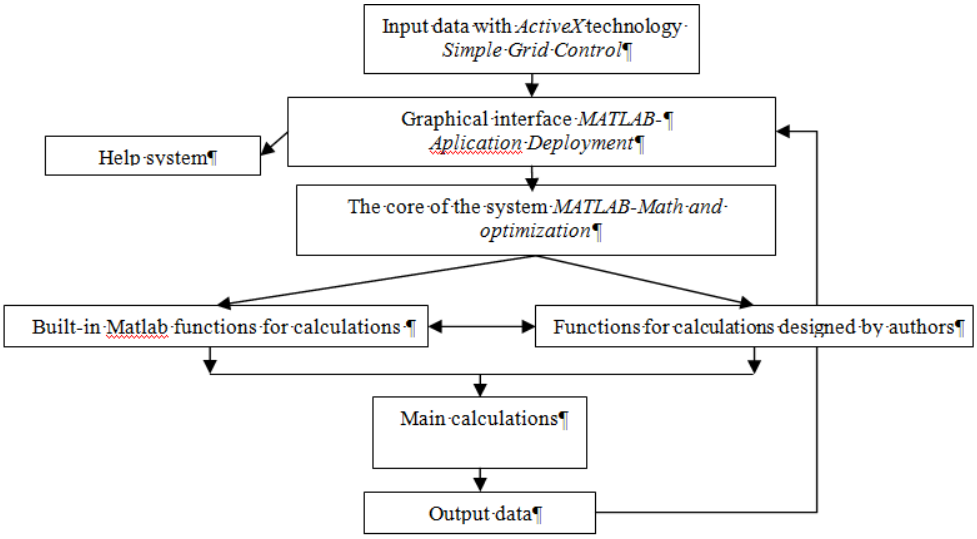

Fig. 1. The structure of information system of eco-economic monitoring

4. Conclusion

The designed information system provides solving pricing tasks in the ecologically balanced economy and contains the kit of visual resources for empirical analysis of developed economic-mathematical models and its usage in experimental researches and monitoring tasks.

Designing the new modern information system for eco-economic monitoring will enable to operate by more complete information about costs and production in environmentally sustainable economy.

It has been considered the problem of the prognostication of balanced prices in environmental economics on the basis of Leontief-Ford model that generalize Leontief's classical input-output model. Leontief-Ford reflects the simultaneous operation of two kinds of activities: main (the branches of material production) and secondary (the industry of destruction of pollutants). From other side we have provided the system that can be used for the forecasting price indexes in environmental economics

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Cognitive Approach to Adaptation of User Interaction with Computerized System

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Abstract: The problem of high levels of information load on the users of modern automated systems is considered and an approach to solve this problem by user's process of interaction with the information adaptation with taking into account his cognitive properties is proposed. Parameters of the process of interaction with information and opportunities to influence them are analyzed. The architecture of software to adapt the information flows to the peculiarities of perception and processing of information by the system's user is proposed.

Keywords: Information overload, information flow, cognitive style, human agent, information processing.

The intensive use of information technologies in the developed world confronts researchers and practitioners the problem to avoid information overload. The essence of information overload is that the amount of information exceeds its objective possibilities of human perception. It was established experimentally that the human brain is able to accurately perceive and process information at speeds of up to 25 bits per second. On the other hand, one of the consequences of overloading and information noise is the phenomenon of "permanent partial attention" (or incomplete attention). By this we mean mode of operation, in which a person gets used not to focus on anything for a long time, performing several cases, while constantly "scanning" the surrounding for "new opportunities", which are not to be missed. [1] Thus, it is necessary to influence the flow of information addressed to the person having specific or limited possibilities of perception and transformation of information.

Two types of information exist in technical systems - well-structured information in systems of organizational management and poorly structured information in training systems . It is the second type of information that leads information explosion, user's information overload be it decision maker (DM) or students. It means that the ergonomical methods of information flow management is insufficient to provide effective procedures for user's data perception. It is necessary to affect not only the procedures of perception, but also the structure of the content. In the field of automated training systems (ALS) content control is the traditional task. In organizational management the relevance of adaptive control of the content addressed to the user is connected to the explosion of information. For example, the effectiveness of the decision-making process suffers from informational overload and noise while managing economic objects.

ALS and information systems for the collection of information for decision-making (Decision Support System - DSS) can be viewed from the same position on the requirements to adapt the flow of information for the following reasons.

ALS are intended to provide educational information to the user, who uses it to manage the "internal environment" of the "user-ALS" supersystem, i.e., to control changes in the state of knowledge on the teached subject.

DSS are intended to provide users with software-technical means of collecting information from various sources. First stages of solutions-forming also provide management of "internal environment" of the system "user-DSS," changing the state of knowledge on the problems to be solved (with regard to the DSS domain).

The above data on threats to information overload relate, therefore, to the users of the ALS and the DSS, that is, of systems of mass use. Power of information flow, which users receive as part of the professional activity, is the highest for the information systems of this type, and the effectiveness of the perception of these flows affects the efficiency of business and educational activities for significant number of users.

In recent years, there have been changes with respect to the design of software systems. Interest in the field of System Studies became apparent not only from the IT experts, but also from ergonomists, psychologists, sociologists, linguists, reflecting the complexity of the interface design problem and the need for implementation of results of the studies in different scientific disciplines. Increasing the comfort of user interaction with computer is focused on information presentation. One of the strategies lies in adaptation – comparing the system's interactive behavior to the individual needs of users, i.e. adapting the interface. In the latter case the criterion of adaptation is a model of the user - a description of his basic socio-demographic, psycho-physiological and professional characteristics. The features of the adaptive interface are: the selection of the human-computer interaction dialog structure has to be carried out in the context of the domain; interface refinement comes from prior communications with the user; user model serves as the basis of knowledge and interaction with the user updates the database. [2, 3]

Processes of information perception and processing by intelligent agents can be represented by the diagram in Fig. 1.

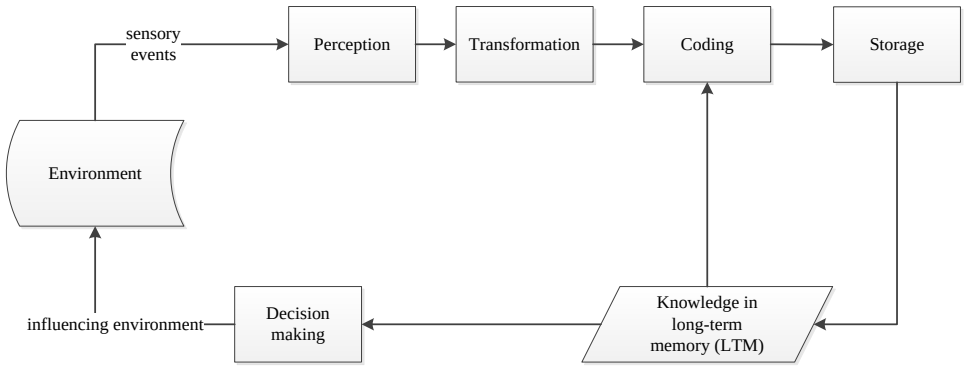

Fig. 1 – Cognitive processes of perception

Among the most formalized and adequate models of the interaction of the user with the information it is necessary to use those that are able to provide an assessment or determination of the variables that may be applied to the construction of algorithms to adapt the flow of information to the individual preferences of the user.

Fig. 2. shows the generalized schemes and the impact of exogenous variables (tempo, level of difficulty, shape) on the processing of information.

Conceptual of expression of the main hypotheses of the study is shown in Fig. 3.

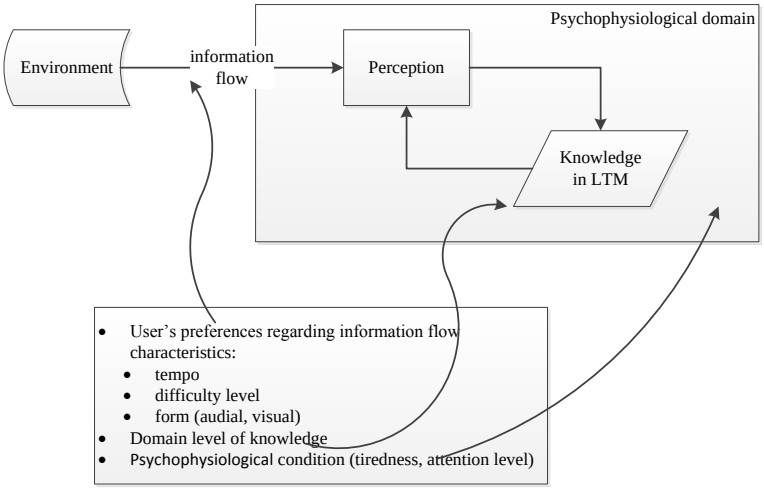

Fig. 2. The exogenous variables describe the cognitive state of the user

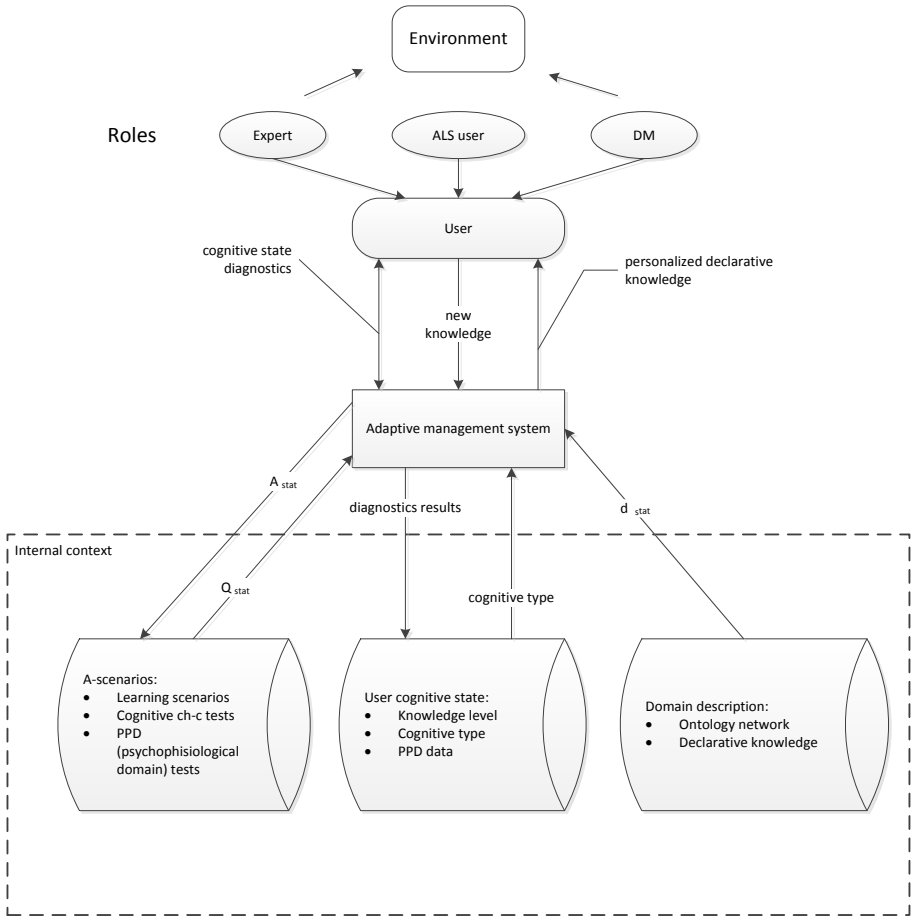

Fig. 3. Basic hypotheses of the study conceptual mapping

The information processes of assimilation of new knowledge involves almost all physiological processes. They can be grouped in different ways, for example, their importance for the perception, storage, reproduction, use and transfer of acquired knowledge. This principle of grouping comes from the sequence of phases, typical for the process of mastering the information. Another grouping is a classic triad: thinking, feeling and will. In this case, different cognitive (intellectual, rational), physiological (emotional, affective), and incentives (volitional) components of educational activity are studied separately.

Education is seen by psychologists as the activity of the individual, and the activity can be successful and unsuccessful. In [4] the success of training is presented as a factor in the process of assimilation of information. In turn, the factors affecting the success of learning are as follows: intellectual ability (type of intelligence, attention, memory, mindset, observation, etc.); style of learning activities (regular classes, methods of preliminary preparation for future lectures and others.); motivation training activities.

Specific features of strategies of information processing, assignment, structuring, organizing and updating the acquired material cause individual differences in learning, because thanks to this process occurs the acquisition of knowledge, the establishment of semantic relationships between them and their meaningful replay when needed [5]. Individual differences in learning can be partially reduced to the students' preference for certain perceptual and cognitive strategies. In this case, they are a manifestation of cognitive styles.

Cognitive style is a construct to show ways of perceiving, thinking and action, which are mainly used by a person. There is a variety of cognitive styles and their settings depending on whether as a basis for the typology are taken peculiarities of perception, concept formation, classification, decision-making or problem-thinking. Currently, more than 30 cognitive styles are defined. However, the study of cognitive styles and abilities indicate that the majority of stylistic parameters are associated with the traditional performance test of intellectual abilities. Research [6] shows that all the known cognitive styles are located in the abstract space of two dimensions "wholist – analytic" and "verbaliser – imager".

Cognitive-oriented approach emphasizes the stable cognitive style influence on the organization and presentation of information in the process of thinking and learning. It is essential for the perception of knowledge. When a certain style coincides with the content and presentation of the material to be studied, the individual recognizes the task easier than when the style and way of teaching do not match. In the case where there is a discrepancy, the individual can make things easier by developing learning strategies for working with the material, which at first was incompatible with his style.

To build and maintain an up-to-date cognitive model of human (human-agent), which is part of a hybrid information systems (HIS), the individual characteristics of human cognitive processes are diagnosed. Solution of the problem of psycho-diagnostics for the construction of the cognitive model of human-agent solution requires the following three subtasks: 1) identification of target characteristics, i.e. the original features that will classify subjects into internally homogenous group; 2) the selection of diagnostic characteristics used for the diagnosis of class belonging; 3) finding the rules to refer the DM to a particular class by the values of diagnostic parameters.

When approaching the perception of information as the management process one can control the efficiency of the process and the method of fixing and transmitting information on a computer display device. [7] We assume that the information materials transmitted to users are a sequence of messages. Messages formal characteristics are content, form and pace and rhythm of the flow of information (the intervals between the individual messages).

The experimental results indicate that among five main components of the process of information processing stage of representation of the initial situation has a special place. Distribution of these components in the amount of time spent on them: 54% are coding (i.e. the construction of a mental representation of the external action); 12% - conclusion; 10% - comparison; 7% - checking; 17% - response message.

Intellectual form of representation is individualized because of uniqueness of the cognitive structure and the construction of individual intellectual reflection space (it can be a picture, a spatial diagram, hierarchical categorical description, semantic structures, etc.).

Thus, the presentation of information can be seen as a way to control human agent cognitive activity in the composition of the HIS, because it is a significant factor that contributes to the perception, understanding and assimilation of the material being studied. It is known that, mastering the material, while studying people selectively refer to its content and form.

When designing the presentation form of the information it is necessary to enable the presentation of content in various forms. Options should be provided, which create the possibility of perceiving the same content using various forms of its presentation (verbal description, visual drawing, schematic images, tables).

Individual features of the DSS user must also be taken into account when choosing the pace and complexity of the presentation of the material, as these characteristics influence the efficiency of information and the quality of learning [8].

Table 1 provides a list of suggested cognitive types. The numbers on the right side indicate the extent of the preference from 1 to 3.

Table 1. Users' data form priorities for the four cognitive styles

Theme	The form of presentation of information			
	Drawing	**Schema**	**Voice data**	**Textual information**
Integrally-verbal	1	3	1	2
Analytically-verbal	3	2	2	1
Analytically-visual	2	1	3	2
Integrally-visual	1	2	2	3

When learning under the guidance of a personalized adaptive tutor it is necessary to provide aspects of transmitted knowledge representation management. Learning episodes presentation form corresponding to the agents' (students) preferences of perceiving information improves performance and reduces the traffic load on the human nervous system. Fig. 4 shows a personalized and adaptive tutor architectures [9], which provides:

- determining the characteristics of the user (student);
- building his cognitive profile;
- defining the cognitive type;
- adapting the educational information to the user's cognitive profile.

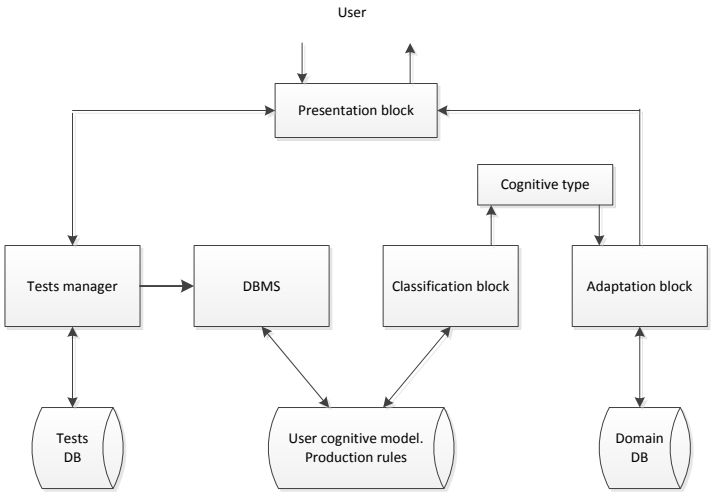

Fig. 4 - Personalized adaptive tutor architecture

Conclusion

The proposed scheme of the cognitive process and architecture provides the foundation for creating software means for complex adaptation of the process of automated system user interaction with the information in the system taking into account peculiarities of information processing by the user and thus reducing his level of information load. Such software can work both independently and as part of existing and future automated systems for management, decision support, learning and design.

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Use of Information Technology in Public Administration and in the Business of the Republic of Belarus

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Abstract: Here we observe the role of information technology in the economy of the country. According to this we analyze the indices and list the results of the use of IT in public administration and in the business of the Republic of Belarus

Keywords: Information technology, public administration, business, marketing

1. Introduction

Modern information technology (IT) now plays an important role in relations with the state and in the communication of companies with each other. The basis for their use in these areas is the level of development of the IT industry in Belarus, which is currently characterized by the following indicators. The share of gross value added of the domestic sector of information and communication technologies (ICT) in gross value added in the economy in general by the end of 2014 was 3.5% [1]. However, this figure is steadily declining: in 2012 it was 3.8% and in 2013 - 3.7%. The share of expenditure at public organizations and ICT in GDP increased over the last 4 years from 2.1% of GDP in 2012 to 2.4% in 2014. At the same time, the share of investment in the ICT sector in the country has decreased from 1% of GDP to 0.7%, and the total investment in fixed assets - from 3 to 2.3%. The proportion of companies in this sector in the total number of commercial organizations increased over 4 years from 3.6 to 3.7%, and its staff in the payroll number of employees - from 3 to 3.2%. But the share of exports of services in the ICT sector in total exports of services increased over the last 4 years from 9 to 12.6%, while imports - fell from 6.3 to 4.9%.

As the development of the economy of the Republic of Belarus is being formed under the influence of the dynamics of the global economy, strengthening of the geopolitical tensions in the region, the slow recovery of world oil prices, the weak dynamics of key trading partners, under these circumstances the government funding of the National Program for Accelerating development services in the field of information and communication technologies for 2011-2015 is being reduced. This is provided for by governmental resolution from 12.06.2015 № 492 [2]. Nevertheless, it is relevant to consider and analyze the use of information technology in public administration and in business, obtained results and occurred problems.

2. Use of IT in Public Administration

Among the projects implemented in the National program of accelerated development of services in the field of information and communication technologies in 2011-2015 there is a sub-program "Electronic government". Within its framework, in particular, the infrastructure is being formed and a single center for the national automated information

system (UAIS) has appeared, which is to integrate information resources through which the economic entities and individuals will be able to use e-government services [3].

The results of its operation are characterized by the following indicators. The proportion of documents sent (received) in electronic form in the total document management of state agencies has increased from 37.7% in 2011 to 40.6% in 2014., and sent (received) in electronic form in the interaction with government agencies and organizations - from 21.4 to 33.6%. [1]. Share of organizations that use the Internet to obtain information from state bodies and to provide them with it is 90.6%, while 4 years ago, it was 76.5%. Considering the active introduction of electronic declaration service (by the state) in foreign trade enterprises, it can be assumed that these figures will continue to grow.

The share of government agencies engaged in the provision of electronic services through UAIS in the total number of government agencies has increased from 13.6% in 2013 to 16.9% in 2014, while by means of UAIS 43 electronic services are provided.

The concept of using information technology (IT) in public administration emerging now in the country is based on the creation of a single data center, timely accounting and control of interactions between citizens and public authorities on the basis of the management information system. On this basis it is possible to implement relationship marketing which represents the identification of needs of the population and their satisfaction by the means of timely reaction of authorities to citizens' needs.

Fast, reasonable, and timely resolution of the problems that the population turns to the authorities with will be promoted by the establishment and operation of a single information center, which is a call-center and Internet portal to provide public services.

With such a structure a citizen can:

- Familiarize themselves with the necessary information on issues related to the application to the state institutions through a special website;
- Find information about the activities of government agencies;
- Leave the complaint about dissatisfaction with the services of private or public organizations;
- To get other advice.

On the basis of electronic request of a citizen, decision-making and a response to it in electronic form within a specified time a rating of a particular official and an appropriate official agency can be calculated using the developed algorithm evaluation of each participant in the chain of appropriate levels of request consideration.

Features and benefits of the use of IT in the public administration are the following:

- Determination of the spectrum of issues in each region, etc. (citizens choose from a list of problems cited);
- Rating the quality of work of the authorities with the population (local, provincial, regional);
- Improvement of public services (timeliness and objectivity);
- The fight against corruption at the expense of the automated control over the process of solving the problems of each individual citizen;
- Conditionality of salaries of officials by their rating;
- Implementation of efficient control and timely decisions making based on the information and ratings of a single information center;
- Availability of data for the top officials of each civil servant, government bodies, statistical information at the request of citizens, quantities of responses, failures, etc. at any given time;
- Completeness and relevance of the information due to the constant automatic updates.

The use of IT in public administration reveals various controversial issues, and helps to solve them on the basis of the automated control of the relationship between a citizen and a public servant, it also saves time of problem solving and favours the dynamic development of the state.

3. The Use of IT in Business

Information technologies are increasingly used in corporate relations. Share of organizations that use them in their activities in the total number of legal entities is presented in Table [1].

Table 1. Share of organizations that use IT technology (% of total number of organizations)

Indicators	**2011**	**2014**
Using a system of electronic document management	14,7	21,1
Using the Internet to receive orders	30,8	41,6
Using the Internet to place orders	39,5	56,4
Providing employees with technical means for mobile Internet access	26,4	34,6
Using the digital signature	87,9	96,5
A website availability	50,2	62,2
Internet connection ,%	94,6	97,3

At the same time the development of Internet commerce remains quite modest. Share of retail turnover through e-shops in 2014 only was 1.3% of the total retail turnover of the Belarusian trade. Returning to the level in 2012. Meanwhile, in 2013 this showing was 1.5%. In addition the number of e-stores has grown over the last 4 years from 1253 to 3072. 1824 of them (59.3%) are located in the capital (Minsk). [1]

Constant expansion of the Internet audience and the emergence of new, effective media lead to an increase in the online advertising market. Advertising on the Internet is a form of online advertising that uses this resource as a channel of transmission of information, in order to attract customers. This peculiarity of the Internet is its extra-informativeness, which has high efficiency of communication process that allows the interaction between market participants on a completely new quality level. Visitors are attracted to the site to review the promotional offers, place them and search of product consumers.

An independent activity that relates to an electronic business is internet marketing. Its popularity is growing not only among companies but also among ordinary users who want to promote their websites, blogs. Belarusian Internet audience in 2014 compering to the one in 2011 has expanded by more than 42%. The number of mobile Internet users has increased as well. In the structure of revenues from telecommunications services in the country the share of funds from the provision of up-mortar internet is growing. In 2014 there were more of them by 27.5% compared to 2013, which formed 11.3% of total revenues from telecommunications services. [4] It was noted that Internet users have higher level of education and financial well-being compared to consumers of traditional forms of advertising.

A manufacturer starting advertising campaign conducts audience research to identify the most effective channels for dissemination, which are most suitable for target consumers. At the same time an advertiser is interested in the degree of influence of a promotional tool for users as well as its possibility to be achieved. These data allow us to more effectively

plan and allocate investments in advertising. According to the Ministry of Trade, Belarusian producers began to spend more on advertising their products, which led to the vital development of this market. Over the past year the rate of growth of advertising budgets in the field of food production was 147%, footwear - 132%, wholesale and retail trade - 133% and 151% respectively [5].

According to consulting company "Media Audit", the volume of the advertising market by major media (radio, the press, TV, outdoor advertising, the Internet) in the first half of 2014 was $ 67 million. Compared to the same period in 2013 the increase in advertising budget is observed in the last three resources. According business estimate, the advertising market in Belarus in 2014 grew by about 20% and amounted about 123 million dollars. The highest rates observed in the field of Internet advertising - by 22% [8]. But despite this the most important segment is television, its share in the first half was 49% [5].

The market volume of media advertising on the Internet in 2014 is $ 12.872 million which is by 22% higher than in the previous year. With regard to 2015, experts agree that it will not be easy. The current economic crisis, entailing the reduce in advertising budgets, will make adjustments: the market growth dynamics of Internet Advertising will slow down and it will grow by 5-10% [5]. According to the agency Zenith Optimedia, the cost of advertising in the world will be reduced from 4.9% to 4.4% compared with the previous period and will be 544 billion dollars. At the same time the Internet Advertising will continue to grow in crisis and will increase by 5%. The main reason for the positive dynamics will be the expansion of the share of contextual advertising. As for the distribution of existing advertising budgets between the different media, the television will continue to lead and make 39% of all money spent on advertising last year. In general, the Internet in 2014-2017 will grow by 14% per year, the main reason for this will be the increase in the online video segment, which will add an average of 29% per year. Consequently, its volume in two years will reach 23.3 billion dollars. [6].

Thus according to experts the Internet this year will be number 2 in terms of the cost of advertising after TV because:

- The number of Internet users and so the traffic volume and speed of access to the network in 2015 in the country will increase;
- There will be new advertisers, and the existing will start to spend more for the Internet. Many agencies will increasingly offer online resources as the key media to their customers.
- After that the technologies that let analyze and estimate online advertising campaigns will develop.

All this will lead to the expansion of advertising opportunities, the emergence of platforms and competition between them. For mass brands that are still advertised on television, video advertising on the Internet allows optimize costs to achieve high coverage of the target audience due to the fact that some part of target audience doesn't watch TV and advertising message can be shown only on the web [7].

One of the main factors restraining the growth of Internet advertising market is the lack of knowledge in this field in our country, ignorance of the Belarusian advertisers in the possibilities of using the Web for marketing purposes. In order to achieve maximum impact, the marketing program should include a set of measures on construction and the continuous development of the field of communication - a combination of ways to influence consumers, which includes:

- Sites of the company, created to promote individual products and brands, provide information to users, etc .;
- The use of domain names used to identify a site in the Internet space;
- Contextual advertising, offering placing in the first lines of search systems and

electronic directories [7].

This allows the user to request using keywords to see a hyperlink to the network resource of companies, placing information on the websites of the parties, their companies or partners (through payment or on mutually beneficial terms). As external sites the following means can serve: the specialized portals, business-to-business (b2b), professionally oriented social network resources with a high degree of visiting by certain users, forums, e-mailing and targeted spam, banner placement, coverage of online activity in traditional media; informing the audience about the specific additional benefits using the Internet.

4. Conclusions

IT can help realize marketing at the state level, taking into account the problems of each individual as much as possible. Besides it objectively reveals rating of issues, which plays an important role in evaluating the activities of local authorities, objective assessment of the positive and negative trends which are formed in a given region. This assessment may differ from the information provided by the authorities. This helps the country's leadership to more effectively monitor all processes and to prevent unfavourable events timely.

Advertising on the Internet has rapidly developed over the past decade. Being one of the youngest branches in the Republic of Belarus, it is the most effective means of marketing com-munications. Due to its use the capabilities of the enterprise in terms of the internal and external communication with target groups, commission sales, optimization of business processes and the interaction of business-to-business are significantly extended is being extended.

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Improving the Capacity of the State Statistical Office of Republic of Macedonia in Compliance with the EU Statistical Standards

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Abstract: Daily progress of IT and its influence in every pore of life initiates a chain of requests to all state institutions which affect the growing need to monitor changes. This is especially important in complex public institutions such as the State Statistical Office (SSO). The rush of change has led to a growing need for modernization. The improvements to the IT structure of the SSO are made with a joint EU statistics twinning project between EU members and SSO in Macedonia. Very significant results were achieved in improvement of data collection, the data collection speed and in virtualization of equipment.

Keywords: State Statistical Office (SSO), SAS Data warehouse, SAS data integration studio, twinning projects.

1. Introduction

SSO is an institution that is in charge of statistics of all relevant information in the country. Due to the above, we can say that it is the institution with the most serious and most comprehensive approach to the collection, purification, analysis and storage of information needs of statistical processes in Macedonia. Therefore it can be assumed that, for such serious task that is assigned to, this institution needs to use professional software tools for data warehouses. For this purpose, sophisticated software tools are used (SAS DW, SAS Data integration studio, SAS Import utility, SAS Data Integration services, SAS Reporting services) [1]. But the above mentioned tools are intended for one of the later stages of working with the collected data obtained from various sources under different platforms and stored across heterogeneous databases.

The data processed in the repository for SSO are taken from different administrative resources [2], areas which are obtained by various statistical studies of the SSO and the statistical register in the SSO.

The administrative data sources are: the Central Register (final users' accounts from General ledger), the Public Revenue (tax-information base), the Public revenue office of Ministry of Finance (public revenues and expenditures - treasury bills), the National Bank of RM (Monetary statistics), the Health Insurance Fund (health insurance contributions) and the Pension and Disability Insurance. Since 2005 it is becoming popular to collect data for agricultural statistics needed for specific databases and new ways of obtaining them.

Statistical surveys are carried out in the fields of foreign trade, internal trade, industry, construction and hospitality, agriculture, surveys on household consumption, statistics of prices and the labor force survey (Figure 1).There is also need for statistical data on agriculture in Macedonia that ought to show the development of this sector. As a source of

statistical registers, SSO uses the Registry of business entities, which are used in the phases of preparation of repository data loading. For agricultural statistics, it was necessary to create a new database and to collect all existing data on agricultural entities in the country as well as to detect the attributes which have to be the subject of statistical processing. Growing needs for obtaining accurate statistics on persons, households and artisans contributed SSO to design a project of creating a software tool that will help define the data by setting a framework for defining their metadata.

The improvements to the IT structure of the SSO are made with a joint EU statistics twinning project between EU members (State extras Germany [3,7]) and SSO of the Republic Macedonia [5] which processes have started in 2006 and are still ongoing.

Fig. 1. Data Sources from which SSO repository is loading

2. The Situation before the Start of the Project and Defining the Problem

SSO owns the largest data warehouse in Macedonia where all statistical indicators are calculated and the loading and maintenance is a responsibility of many employees. Therefore, it is the largest and most important institution in the country, responsible for the collection and storage of relevant data statistics and shows the condition of the Macedonian economy.

Data collection is actually the most difficult part of the job because the data sources are constantly changing their formats (Figure 2).

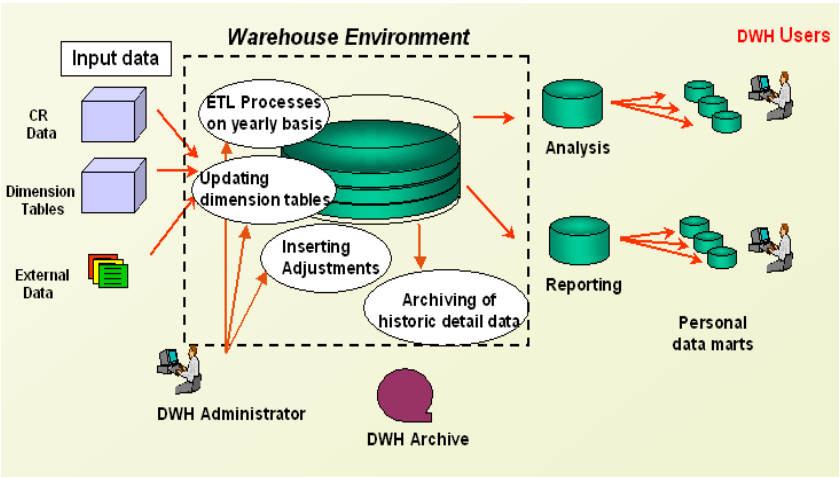

Fig. 2. Logical model of SSO Data warehouse

It was therefore necessary to devise an innovative strategy for overcoming this problem. Besides the problem of software tools for data collection, we had to consider the problem of decentralized information that was prevalent on many of SSO computers and disc drives. Business processes collected data were redefined (Figure 3) and according to them physically gathered data on some of the memory locations (drives), and then transmitted to the required locations after they have been reviewed and verified by the staff of the National Accounts team. Common logic of processing was placed in the file Kategorii.xls under which all the necessary calculations are made. SAS Integration studio is the tool that finally integrates the data structure in SAS DW (Figure 4). Their treatment is divided into 3 phases: First Run, Second Run and Final Run that required aggregations calculated according to the Eurostat standards for transparency of information.

The dissemination of data is done through a web site, made by Microsoft ASP.NET platform, with content that is constantly updated and which contains a range of information that can be obtained with a choice of multiple attributes - parameters for statistical analysis. The tool is offered for special formats compatible with all European statistics and applied for the dissemination of the data is PC-AXIS for Windows. With easy user interface is enabled to receive different combinations of data. Visual display of the selected data is included (Figure 5).

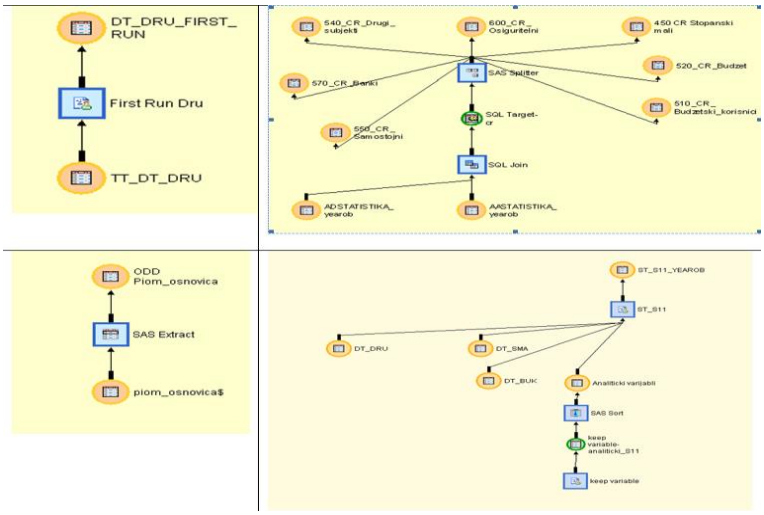

Fig. 3. Models of software business processes which transform data and load into SAS DW

But continuing growth and development of new information systems, replacement of existing and the IT development in general, and the requirements of Eurostat, require a proactive role of the SSO as in the processes of collection and data dissemination. The range of responsibilities assigned to the SSO is really wide - it touches all entities in Macedonia, government and non-governmental institutions, citizens of Macedonia, the business sector, individuals and households, farmers and artisans, students. Therefore, it is inevitable to have a cost-effective IT tools of the class that they will be able to collect, integrate them into their bases and then prepare them for filling in the repository.

The complexity of the problem requires high technological level of hardware support as well as sophisticated tools for data collection via Internet tools that have the ability to model metadata for the data required to be collected and which will enable a high interoperability with many different platforms and databases data.

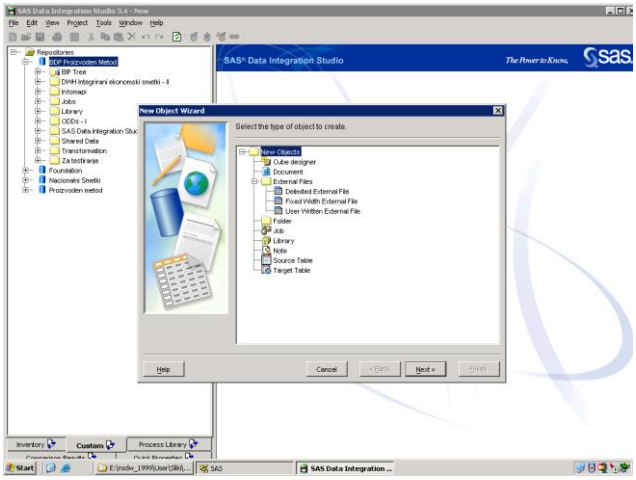

Fig. 4. SAS Data integration studio – tools for data loading in the DW

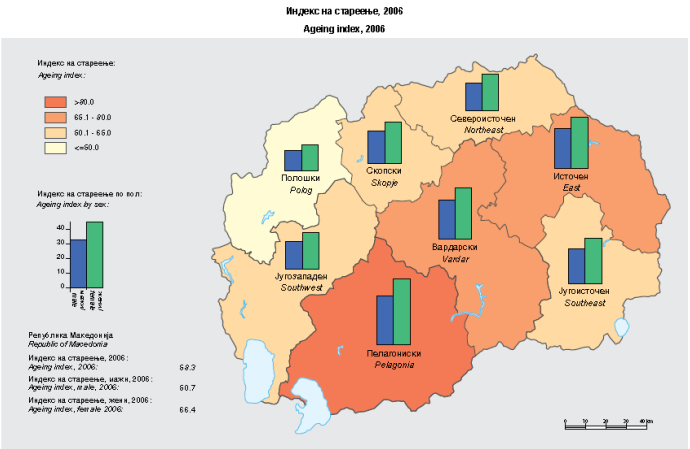

Fig. 5. Example of data visualization from data extracted from SAS DW made with PC Axes

These requirements also assume implementation of quality control system for received data, data protection system for collected data and application of the latest standards of Eurostat in security preferences in practice. Without the help of professionals, dedicated team and project implementation assistance, such projects would be doomed to failure.

3. Focus on Project Activities and Achieved Results

When we take in consideration state institutions and improving their capacities, it is necessary to emphasize that they take place under the strict supervision of the European institutions and often initiated by EU projects [4, 5, 7]. With the support of EU funds in order to implement NACE Rev.2 for the national accounts, to improve the methodology and the indicators on them and support calculation of indicators of sustainable development and the code of the European Statistics, the EU supported the twinning project State Statistical Office of Macedonia and the Federal Statistical Office of Germany under the title "Support to the SSO for capacity building and improving compliance statistics with EU standards"

which started in 2006. In addition to the above assumptions, the project made pilot research areas of transport statistics, organic farming and environmental protection. In parallel with this project, there were some projects from the IPA 2009 national program that worked in symbiosis with the aforementioned twinning project.

The twinning project is very complex and includes many participants covering professional parts of the project which are guided by the Code of the European Statistics. 61 experts were included from nine EU countries and 676 employees in SSO [6]. The main objectives of the project were improving certain processes of statistical business process model in accordance with European standards for quality control, defining the strategy for electronic data collection and strategy for data management, automating the process of making backup and archiving, monitoring the quality of work performed in parallel project metadata - supported data collection via Internet, preparation of technical specification for upgrading infrastructure of "centralized backup and disaster recovery."

Measurable goals with tangible outcomes were defined in process of designing the project [6]: applied adapted European self-assessment questionnaire for managers of statistical research (DESAP), in compliance with the procedural model of the SSO; enabling access to protected microdata for the scientific research community, with security protection; recovery of IT infrastructure SSO benefits related to balancing the load on the servers in virtual environment and energy saving, centralized data storage with increased levels of data security and convenience for creating backup; improving the system for collecting data over the Internet with their effective, timely loading and reducing the burden on data providers.

SSO project activities supported by the two projects of program IPA 2009 were related to: Creating a system for metadata preparation - supported process of electronic data collection via the Internet; and parallel project to purchase and restore the hardware and software infrastructure of the SSO. For the first project, experts from the Danish Institute of Statistics were continuously involved in the evaluation of quality software tools developed by the software company that implemented the project, as outsourcing solution [5]. For the second project, the technical specifications of the software and hardware needs arise from the activities of the twinning project.

In addition, with the twinning project detailed assessment of the current situation, needs and possible risks was made. According to this analysis, a strategy was developed to manage data with predicted possible automation in all areas of extraction, transformation and loading data and creation of automated backup procedures. The result of the joint work of the implementation team and software contracting company under the control of the Danish experts software were made called eStat which is an interactive generator of metadata frameworks for collecting data over the Internet, which enables all reporting units to get a tool that will be well accepted. This tool is the result of long-term and coordinated work of the team, software developers and adviser who together developed the specification of information needs of SSO (which is made in the period 2011-mid-2012), followed by the announcement of a tender for the project, selection of outsource for the software solution and a detailed specification and system analysis of “to be" system. By created design, for the needs of the institution, working documentation was provided under which the software developers have created application. This completes the 3-year process witch results in creation of a software tool that enables efficient charging based metadata processes, defined by administrators, according to the respondents. All previous procedures defined by previous software processes need to be processed and define new models for metadata. Help is obtained from the institutions by filling out the form eStat [8]. The login system is carried from the site of the SSO - Figure 6.

The processes for making "skeleton" of the new data structure for data collection are assigned to reporting units, which in the first phase focused on business entities. Staff is

focused on the part of the collection of the data and defining meta-structures for them. The project which has to include individuals, households and craftsmen is still not ongoing but it will probably have to make a new project that will analyze the specifics of the data and their collection.

Although still using the same platform and existing applications for processing, quality of the data is constantly improving and storehouses for national accounts quickly receive the data is significant measurable result that has improved.

The repository of basic statistics pertaining to agriculture is called Estaf. Still sampling data, but fully defined, these data allow agricultural statistics, data for IPA funds and allow a register for farming industry.

The application provides data collection and structural surveys of agricultural holdings, current states, e-commerce and the use of ICT technology as recommended by Eurostat. Commissioning of the application was planned to be by the end of 2014 despite the complexity of the processes with the project. Outputs from the processing are turning to SAS DW and thus allow the use of SAS software for data processing and preparation for their dissemination through web tools SSO.

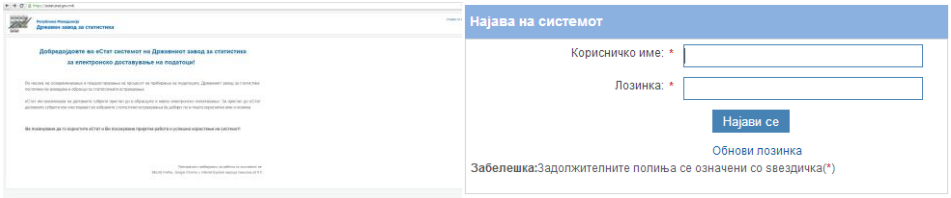

Fig. 6 a, b. HCI for selection of screen and account and password verification as input in eStat

The results achieved in the twinning project are measurable and impressive, presented in February 2014 year to partner institutions and the Chamber of Commerce. It is still necessary to work on their implementation in reality in order to achieve sustainability of the project. During the implementation, it is necessary to incorporate the recommendations of the experts as expert assistance was involved in a twinning project and the shared experiences of European statistics. As for the dissemination of data through web-based techniques, the project objectives are achieved by improving done in cartographic outputs and visualization of statistical data in the GIS environment. The application implemented for the preparation of thematic maps in ArcGIS environment is Open Source tool. The project defined aspects of GIS functionalities and possible solutions which have to be developed for the project.

4. Future Plans - Draft CFCA to Fully Integrate the Acquisition of National Accounts data

Centralize Financing & Contracting Authority (CFCA) as an institution linked to the Ministry of Finance as the next project will support the project for the complete integration of the acquisition of national accounts data. For this purpose it is necessary to prepare a detailed analysis of system requirements that require enormous energy and great effort by the team. Therefore, it is recommended to hire an external expert team would work on the project specification according to which the necessary design software tool will be made where you need to specify information requirements and to automate the collection of

relevant data on subjects that support the process of collecting data and then the extraction, transformation and load.

Quality control preparation for the project as the hardware and software maintenance of the implementation of the second parallel project with the twinning project is done. Actually, complete centralization of servers with their virtualization and virtualization of storage space used and hardware resources is made through the introduction of virtual systems management users and resources in the Office. Efforts have been made for providing quality hardware structure (servers and storage units) and security control by setting the security protection through ISA server, application encryption operations and preparation of security procedures that are applied according to the recommendations of Eurostat and recommendations for dealing with informational Security in R. of Macedonia. Although the institution is not yet certified for ISO 27001 (ISMS), they are working on the introduction of high-level security protection recommendations.

The expectation from the project is to make specification and to develop software tool for collecting data on national accounts. This activity is to take place in three phases: The first should create a detailed specification of information requirements. The second one is to find a contractor who will work according to the specifications. The final phase is the processing of legacy procedures aimed at creating a virtual structure for automated data collection for national accounts through the new software that will deliver outputs according to the analysis of the everyday growing needs of Eurostat and other state, local and government requirements.

Fig. 7. Visual online displays from www.stat.gov.mk web site

5. Conclusion

As the institution responsible for the collection, processing and dissemination of relevant statistics that should show the entire condition of Macedonian economy, SSO owns the largest data warehouse in RM. It is created with SAS DW Tool and supporting tools that enable all the necessary Statistics after data loading and processing in the SAS DW. However, the data collection was followed by intensive waste of human resources in the SSO. With the growing IT complexity that modern times has brought, the issue of effective collecting of relevant data is becoming more obvious. This complex system clearly requires improvement. A solution to the problem was found by implementing automation of business processes. The aid obtained by the twinning projects in cooperation with the German Institute for Statistics. These two projects of IPA 2009 funds are performed in parallel and together, they gave symbiosis in the realization with high degree of automation in processes in SSO. The benefits from the implementation of the project of virtualization is equipping SSO with a new hardware and software tools, improving the way of data collection, and

approaching EU standards on statistics. Another huge benefit is acquiring software tool for defining metadata schemes to automate the process of data collection.

Future improvements plan should lead to better data integration and further expanding of the scope of collected data. Besides data on national accounts, it has to collect data on individual households, farmers and other stakeholders in Macedonian statistics data. Tools for visualization of SAS as BI tools for data analysis and visualization and using data mining tools are desirably considered by IT sector [9]. However, the purchase of licenses for this software and some additional modules of SAS tools, although it requires additional investment, can greatly improve system integration and contribute to the further exploration of the data.

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Power Systems Reliability and Development Improvement during Post Crisis-Chaos Period (Approaches and Methods)

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Abstract: The paper is an original research article with the aim of encourage works that support innovations, debates and collaborations within the energy community. The existing situation in the former USSR republics, in the former Eastern Socialist Republics and in some nearby countries Electrical Power Energy systems (EPE) especially in the Russian Federation allows confirming: the firm development warranty – really none, the reliable execution function - truly none, the consolidation effort on these problems decision – actually none. Their energy strategy to 2030 is already collapsed. The forecasted growing of the load in 2008-2010 yeas was broken by the incomprehensibly whence financial crisis, fell all general schemes of the EPE system development, all are moldered, the countries ware left approximately on the consumption of 1990. They have no any generalized theories, non post crisis-chaos development conceptual forecast models (however new predictable crisis is coming), but there are some fragments only. Know-how of the work is concluded in that, it suppose to use here the elements of the system realized management, too.

Key words: Electrical power energy systems, post crisis-chaos development, conceptual forecast model, technological, produce-deliver and social-technical systems, chaos, ordering, setting.

Introduction (The Situations and Problems)

The existing situation in the former USSR republics and in Russian Electrical Power Energy system (EPE system) is the following: none any firm development warranty, none any reliable execution function, none any consolidation effort on decision of these problems. Just it goes the production and distribution complex process of its energy according to the general conception which answers new realities.

The appropriate count-calculate list of EPE conceptions:

- designing's and programming's (or planning's),
- developments and their managements,
- EPE systems reliability and accuracy and other in the accordance with these main.

The great number the conception's Russian [1 - 5] and foreign specialists [6 - 33] in the different fields are concerned with this problem as theoretically, so practically. However, to fill these notions by contents and to reveal them in the sufficient practical use volume is always remains actual.

But it is important to note here, that it was created during the former USSR disintegrations some determined methodical breakup between the technical system approach and the former USSR power systems monumental governing approach. Both approaches are intended the presentation of the EPE system as the management object, - *operationally open system*, - where there are unambiguous of the «inputs/outputs» relationships and the EPE

system management problems are reduced only to its modeling and study.

The first turned out problems are to be insolvent the EPE system management in the market relations conditions, because they are intended for an «*integer*» achievement in the «*determined the known*» external environments. The second, - it is became «*lead*» in the condition, where due to the reliability of the external ambience change is disappeared, i.e. what has noted by P.Druker – «*has approached the era of the absence of the regularities*». The attempt to «*suture*» this breakup is undertaken with one or another degree of the success, insofar manages to select «*operated organization*».

1. PART 1. The Offered Methodological Approach

As the methodologies foundations are used the system approach and the functional representation of the world EPE activity, based on which the stated below conceptions are deduced.

1.1 The EPE system is the social-technical system

• During the period of its development in twentieth age the EPE passed the way from a technological subsystem (the industrial enterprise block-station) up to the power production system (EPE system), but at the beginning of 21 age it was transformed into *social-technical system* (refer to Fig. 1).

1.1.1. The EPE *is the production system*

• The EPE main purposes are to perform the territory electrification works, i.e. to increase the electricity use in lieu of other type of energy.

• The change of this production system is totally complied with the purposes to increase the EPE system production potential, which was the part of the former USSR monolithic economic potential.

With the diminished economic potential of the country, the USSR production potential grows (the Integrated Power System) was stopped at beginning 90th years, which have brought about crisis in the countries and in the EPE system branches.

• The temporary consumption decline in the EPE system has allowed to put and solve the branches reorganization problem, i.e. it was defined by new organizing forms and the EPE system exchange terminate around 2008 year.

• Main result made due to these changes was possibility to consider the EPE system transition from production into *social-technical system*, oriented on the self-organization and, consequently, on the development possibility.

1.1.2. EPE system is the social-technical system

The EPE system is the operating vital economy and the people life saving foundation which allows considering the EPE system as the social-technical system. The later implies that in the EPE system (refer to Fig. 1) is possible to find also:

-the technical-technological subsystem (the power electrical network system),
-the organizing-economic subsystem (the economic relations between subjects and so on),
-the social-psychological subsystem.

1.2. System reliability

According to the EPE system status change it is also transformed into the reliability interpretation: from the product and subject reliably up to the system reliability.

In the social-technical system can be shown three reliability levels, which can be solved only in the cooperation the EPE system reliability problems:

I.The Technique-Technological (T T) reliability – degree of the electric power supply and production performing.

1. The TT-system is realizing the prevention and reduction of all negative effects from the technical damages and technological breaks.
2. The TT-reliability is the characteristic of the system production and the other EPE system property objects, bound by the production and transmission electric energy combined processes. They should be curry in the operative conditions of the EPE system electric power production and delivery dispatcher control. It must be done in the consumers agreed volume and required quality under the determined operational condition.
3. The provision ways: technological regulations, control modes and diagnostics.
4. The characteristics: the frequency, volume and time of the introduced restrictions.

II.The Organizing-Economic (OE) reliability – distribution risks between the EPE system *subject and the* EPE system *consumers*

1. There are realized distribution resources, reserves and spare between subjects, providing reliability of the unite EPE system.
2. The OE-reliability is the system characteristic shows the relations among the EPE system inter-coupling subjects and consumers, which allowing to provide the balance the economic interest of the observance on ecological restrictions and the EPE system technological safety.
3. The ways of the OE-reliability provision determine the economical work mechanism and orders.
4. The characteristics verify reserves and spares amounts.

III.The Social-psychological (SP) reliability is the EPE system *prestige and confidence*

1. The *SP* -system is forming the relations in-between the EPE system subjects common reliability provision.
2. The *SP* -reliability is the characteristic of the image and feature system, which is allowing create and support attractive image EPE, i.e. the certain attitude to the EPE system in the society, let provide the arrival resource, which necessary for the EPE system operations and developments.
3. The main ways of the provision SP-reliability are their openness, transparency and publicity.
4. The main SP-reliability characteristics are the safety, their professional prestige, investment attractiveness and innovational convenience.

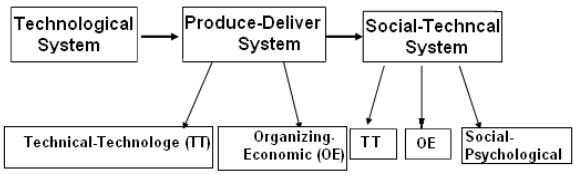

Fig. 1. The EPE system development stages.

1.3 The EPE system is the potentially self-organizing system

It is coming from the main the EPE system denotation purpose, histories of its development, which provides the EPE system life nature. So it is possible to assume and concerns the EPE system as a self-organizing class of systems.

1.4. The development conceptual model

The development is not simple change. It essentially presents itself as the self-organizing and runs in the systems, which are having the development potentials.

The typical characteristics of such systems are:

1. The **Directivity** – it is the mastering the «potential of the development», which possesses as the self-organizing system.
2. The **Irreversibility** – it is due to the dissipative forces presence, - the «impossibility» backtrack position.
3. The **Regularity** - it means that the system entropy is not growing evolutionally.

As an effect of these characteristics, the development is natural or naturalized for social-technical systems processes, which are running like a crisis or evolutionarily.

The development can be presented by three sub-runs:

The **Chaotic** - means the system expansion definition as the space configuration, which conditioned by transition to a new structure – an attractor with the several relations. This process raises the system's sophistication, increases its possibility for step by step adaptation and changes of its relation structures.

The **Arranging** – means the new relationships determination, order in the EPE system on base of the established relations structures. This process leads to the growing categorizing and the new function's possibilities execution.

The **Stabilization** – means an increasing degree of the created relationships use within the framework of the established relations and relationship structures. This process leads to growing number of loading elements, relationships, growing of the man-made product volume.

The development structure presented here is generalized and do not conflict with the common and known determinations.

In the biology this process is corresponded to the morphogenesis processes, differentiations and growing, alongside ***Darwin*** – selections, variability's, inheritances. In economy they are crises, competitions, capitalizations. In the production system they are reorganizations, re-structurizations, efficiency rises. The knowledge's development process consists of such three sub-runs: **thesis-antithesis-syntheses**.

The revising results study of the notion «*development*» is offered as result of its conceptual model (refer to Fig. 2).

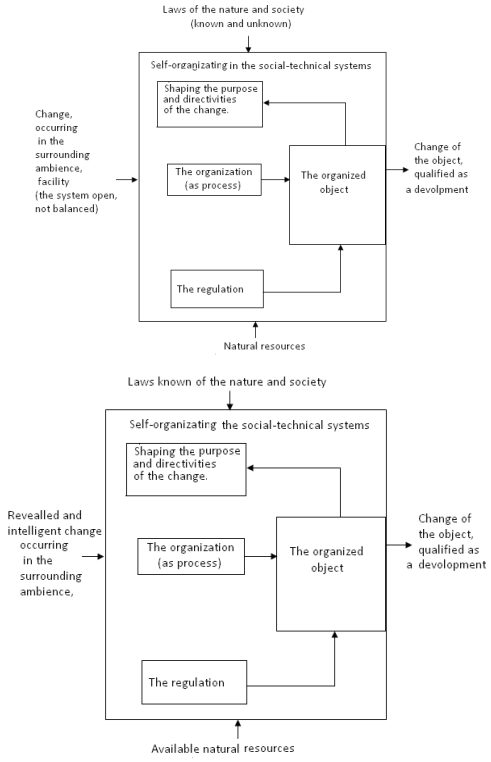

*Fig. 2. The «development» conceptual model of the **not balanced and** the **naturalized** development open systems.*

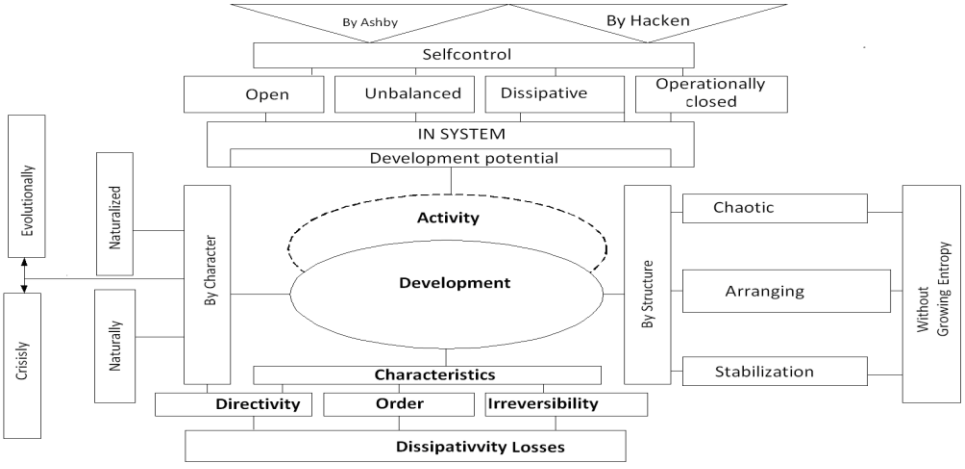

Fig.3. The functioning mechanism of the self-organizing naturally development systems.

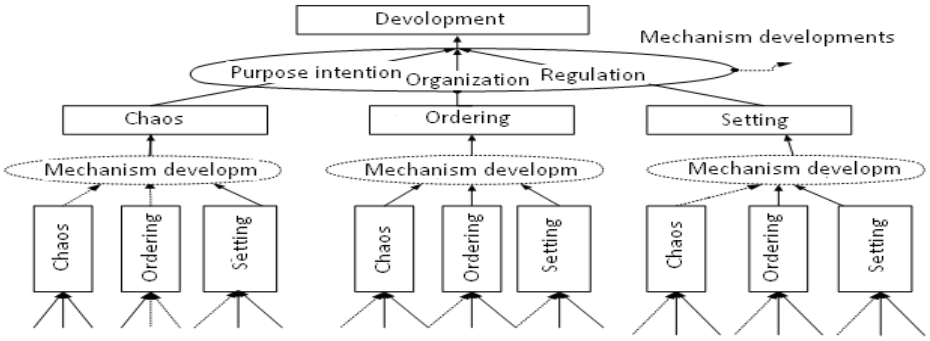

Fig.4. The general structure of the processes and of the development mechanism.

1.5. The PES development mechanism control

Based on the «mechanism» notion study, the development's presentations as self-organizing systems, the considered above development conceptual model, and using ***A.A. Bogdanov's*** idea («tectologia») it was designed the development mechanism's structural scheme. This scheme is presented on Fig. 3 for self-organizing **naturally developing** object.

On the mechanism «entry» - input, presenting itself «got to know organization» (A. Bogdanov), the «entry» changes occurring in surrounding ambience facilities (the system open, not balanced) and also the nature and society laws; but on output – changes of the object, - that is qualified as the development (Fig.3.).

The artificially developing system's mechanisms (including a human bin person) differ by the following: they use at the input only well known laws of the nature and society, make intelligent changes in the surrounding ambience. The available to use facility and the direction shaping's blocks are transforming into the change block (Fig.2).

The main function of the proposed block is the maintenance and the deduction in the determined frames of the chaos sub-run, to support the organization sub-run block (the ordering and regulation) and of the stabilization sub-run block.

Each of these sub-run processes in turn must have its own development mechanism, which are also should be designed. The general scheme of all mechanisms and processes is submitted in Fig.4. The crisis-less development is possible only under determined harmonious running of all sub-runs, which allows telling about the firm development.

Under the «developments» is considered the understandings, which come up from the questions:

1. what is the development possibility control, if system operationally closed?

2. what the method can be realized for this management, if the development laws and the development mechanisms unknown ?

There are following answers can be offered for these questions:

The management development is possible to realize through the external ambience changes, which mainly define the changes in the «potential of the development», which grows by the public «consumption» potential.

The management development appears at that time, when come out the specific subject – «Management». It intends to use the self-organizing system in the determined purpose and for this it begins to enter into the development affairs as such system.

Under the determined conditions it is possible to obtain the operated developments for the management interest. For this it is necessary to recognize all necessary conditions of the functioning (working) development mechanism. They are an attraction and mobilization

from the external ambience, which is determined as – an *investor, guarantor, innovator, organizer and consumer*.

Here the selected terms (*investor, guarantor, organizer, innovator, and consumer*) have much more broad and generalizing importance, than that importance's, in which they are generally used.

Under the investor is understood the temporarily free resource presence (financial, trained, material, energy, etc.) and possibility to direct them into the operated development.

The **guarantor** means the authorities and power presence (the laws, knowledge's, authority and other) and possibility to provide the privileges (the advantage, priorities, and benefits) of the operated development.

The **innovator** means the presence of new valuables (the life quality, the civilization and miscellaneous level) and possibility to add them in the determined form, type, as the operated development results.

The **organizer** means the funds and programming availability (planning, designing, construction and mixed) and possibility to form the new orders of the operated development results salvaging.

The **consumer** means the ability presence to use the results of the operated development and also the possibility to restore, to fulfill, to substitute, to change the used facilities.

The dialect about of the Management interest, it is important to note that the development management must be realized in the purposes of the *safety*, *usefulness* and *accessibility* increasing as the result of the systems development.

2. PART 2. Designing of the Reliable Power Electrical Systems

2.1. The EPE system designing and programming (planning),
2.2. The Mechanisms of the country energy development,
2.3. The Structure and work on the EPE system development,
2.4. The EPE system «Developments» forecast,
2.5. The EPE system reliability Provision.

2.1. Designing and programming (planning)

The term «designing» occurring from Latin word, which means « thrown onward», but it today has a very broad interpretation: from the concept, preliminary text of some document up to technical documentation (the drawings, calculations, modeling and etc.) and newly - creating buildings, machine systems buildings, instruments and etc.

The project is executed (is booked) by determined subject for its problems solutions and also achievements of its purposes, etc. On the growing amount and measure of the designed objects, periods of their realizations, there is need for the facilities sharing and the separate works performing periods i.e. is appeared the organizing-management problem.

For its solution can be used once again the design approach to execute the organization project for the realization of the project. So, it is appeared the object project gathering program and its ways of realizations.

However in the more detailed type program and brainwashing it might be shown its real meaning. Therefore it is appeared need to confirm the projects change and their realization ways for several subjects, which are participating into creation something new.

The program is the interpretation of the main aims, tasks, ways and methods of their achievements and decisions.

In the former Soviet Unions the considered plan was made only by one subject – the state. So, the state was executed projects of the energy development (the schemes, technical–

economical reports and etc.) within the framework of the socialism and communism construction programs, accepted by the USSR Communist Party.

At present in Russian Federation (and in some former Soviet republics) projects can be carried out only by independent energy subjects (local committees, power system enterprises and etc.). Under their co-ordination all these projects must be organized, balanced and executed the energy development program.

The main purpose of this paper is the determining main conditions and forming decisions and tasks for all these subjects' co-ordination and decisions taken by them.

With these position the Russian United Power System (RUPS) and Russian United Electrical Networks (RUEN) cannot be an objects of the designing since they are not subjects, but their change («development») is formed by realization of the separate subjects development projects (or power system enterprises), and is result of their power development programs realization. In ditto time RUPS and RUEN can be the objects of the designing their managerial system which, unfortunately, presently is not done.

2.2. The Power System development mechanisms and its functioning structure

The designed general mechanisms were applied to the power system, which was considered as social-technical system with three sub-systems: the technician-technological (TT), the organizing-economical (OE) and the social-psychological (SP).

These subsystems are under determined condition and can play the role the organizations and purpose-suppose mechanism blocks (according to regulations) of this system development.

Three subsystems are run in each of three processes. So we deal with nine mechanisms. Each mechanism is solved three type tasks (the purpose-suppose, the organization and the regulation). Altogether they solve 27 tasks. In general event of severe tasks it is possible to continue the task.

It is designed and presented as the development's mechanism elements (the blocks) in power system with presentation as the social-technical system, consisting of SP-, OE- and TT- subsystems.

There are these blocks tasks description, which must challenge and perform, which coming from accepted in this country organizing structure for present-days. In the **Attachment** tables 1-3 blocks are brought for all subsystems and presented their tasks and mechanisms. The implemented power systems «developments» studies have allowed to disclose condition of the firm (evolutionary) development of:

- the chaos in social-psychological subsystem,
- the ordering in organizing-economical subsystem and
- the stabilization in technician-technological subsystem.

The maintenance and the termination chaos sub-run of the social-psychological (SP) subsystem for firm development may be the start most difficulty to be presented. The more formal is the problem of the ensuring- ordering in the organizing-economical subsystem (OE) and stabilizations in (TT), but moreover the efforts have turned on their decision. However the solutions of these problems require the new methods and ways development and establishment, too.

Initially they must contain the motivated decisions on the PES development. As it follows from the methods scheme, these decisions must be disagree with the nature and society laws and to be with them in consent. In other words, these laws appear in the manner of some restrictions at the decisions creation of the EPE system development and will assign in the certain frames.

2.3. The structure of the work on the EPE system development

All the PES restrictions are subdivided on four groups:

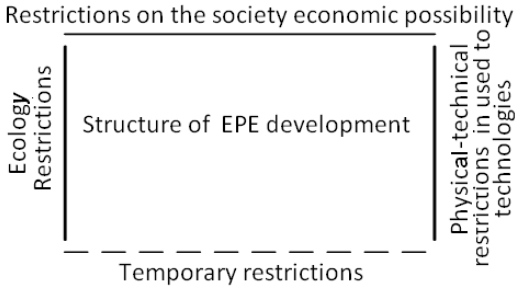

Fig. 6. Restrictions resulting from the nature-society laws.

Schematically all these EPE system development condition restrictions were submitted on Fig.6:

1. the society economic possibilities restrictions,
2. the used technique and technologies physical-technical restrictions,
3. the ecology restrictions,
4. some temporary restrictions.

The Russian Federation accepted law «about power system» is fixed for all this organization to install the list of those works, which must be performed with the motivated decisions on the EPE system development (see Fig. 7).

The PES more distant prospective development work decisions can be carried out, but the more significant role will play the economic factors. On the contrary, for the closer considered time, the more significant role play the reliability factors.

The presented working scheme on the power system development, prepared by Russian Federation law «about power system», allows formulating the following:

« the EPE system object accommodation general scheme » and « the power system perspective development programs» challenge the EPE system development economic tasks with the reliability provision. But in the «actions on the technological schemes and the development program of the Russian UEPS» challenge of the power system development on the conditions reliability provision tasks. On the Fig. 7 is presented the functioning structure, resulting from the Russian Federation law «about PES » and based on the EPE system previous development designing experience.

On herewith the unreserved lines are specified in law as the functioning straight line marked, but dotted lines are specified as logical ones, resulting from the design functioning past hierarchy experience of the. However, not dependent from nature of the market relations, forming in branches, the state role in regulation of the main requirements of these relations will remain in the responsibility UEPS (United Electrical Power System) for the system reliability provision.

2.4. The RPES development forecast

The social-psychological plan «development EPE system » is defined by of the available energy resources policy used in the country and nature of the ambience, i.e. abilities of the investing, innovation, as well as the warranty and organize capability as the forming public needs potential.

The investing is mainly defined by the electrical energy pricing liberty degree of the country. Due to some reasons do not expect the high degree of pricing liberty, that can be predetermined here as the fading investment activity. Only certain activity is possible in the electric networks development, when this system is introducing.

From the big EPE system innovation aspect is hardly follows to expect the new high effective technologies appearances. A certain small activity is possible in the field of controllability of the EPE system electric networks as a whole by increasing of their «intellectuality» level.

It can be expected only some increasing innovations in the fields of the renewable energy and in the distributed generation.

In the consumers aspects the electric powers potentials are also not particularly great since there are the higher efficient facilities of the transition also on the energy-saving technologies.

Under these conditions it is possible to expect that investments to energy will not appear soon and that will bring about stabilizations of the property. It is because the entering powers will be realized due to generating and network companies incomes, due to investments of the incomes controlled block shares holders, and in their interest.

The first symptoms of this situation have already begun to expose it. Practically all the generating and network companies new owners reduce their activities interest on execution of their own obligations on the new powers entering (in accordance with program «UEPS) Russia»).

As the result of this it follows to expect the rate reduction of the new powers growth entering, which is oppose to the existing requirements upon their increase.

The reality shows that on the appearing power shortage the electric networks reception capacity is compulsory deficit too. On the different estimations today already the demand for connection is dissatisfied by the electrical networks for the new users' connection up to 10% of the EPE system. The connections cost on some EPE system territories reaches 50,000 rubles/кwt, which is commensurable to construction cost-performance of a new power energy source. This is not «bad», but will not bring to the new owners appearance, who have their own interests which colliding with interest existing.

In the expectation of such prospects many of the large owners build their activity and first of all the state itself. For the current moment, the state controls more than third of the whole generating powers of the country (the atomic stations and hydropower station), completely checks the trans systems relationship, controls the system operator and thereby checks the process of the transmission and the electric power market. That it is enough for the covering public-home and other social significant loads, which allows the state to protect

the population interests in the provision comfort and safety of the state vital activity.

The large companies (aluminum industry, gas, coal and others) check the generating powers in the amount sufficient for their own interest satisfaction, and their participation in the EPE system will be lower their necessity.

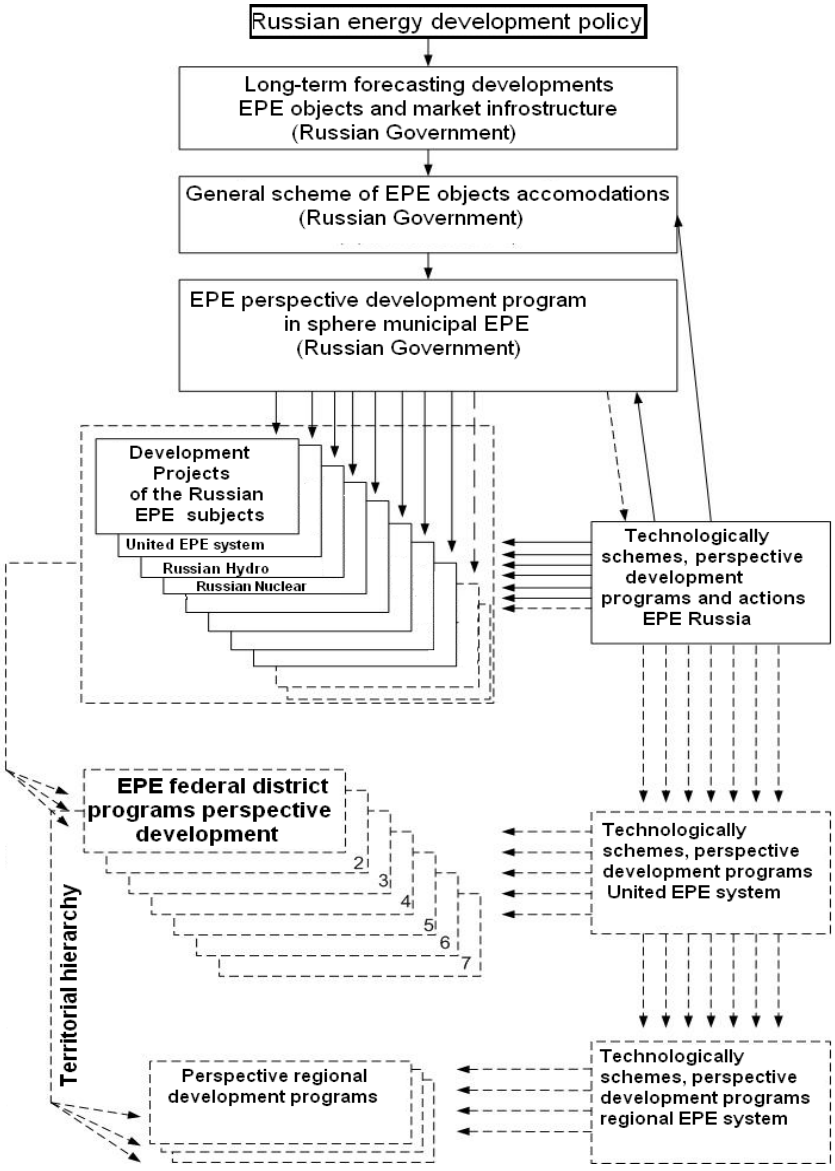

Fig. 7. The work structure of the Electrical Power Energy system (EPE system) development

Remain small and average enterprises, whose interests practically are not protected in the property structure, their needs are mainly not satisfied. But in the market conditions are always appear some subjects, which will solve their problems themselves. Therefore with full confidence it allows to forecast the small power sources appearance on the territories, where is formed and grows the demand for electric power.

It is possible to build or within the framework of UEPS, or decentralized the small traditional and renewable energy sources. Probable, the second variant is more real than the first one.

It means that ripens the chaos subsystem in that part, which more exactly satisfies of the small and average electric powers business interests in the networks energy distribution consumers companies. The process will begin if the state, as one of the owner in the power system will develop the maintenance and growing small and average power business program, including the available electric power provision to them.

However, the most progressive and natural is to expect the effective energy saving policy. The energy consumption reduction will be due to the product energy consumption reduction particularly in the metallurgy, chemistry and machinery building etc, stimulated from the state site and other large power energy owners. The modern technologies application will remove the electric power deficit problem and will allow them to make the modernization and reconstruction in their power energy networks and that is very important for every stabile development. It will be shown by their «organization» and «technologies» applied program blocks.

From the organizing-economic aspects presently there are the most actively run two processes in the power energy: the chaos and the ordering. The chaos process was delayed basically firstly because of this subsystem significant enclose reason, secondly due to the weak innovation investment knowledge and moreover its relationship with the ambience. The pricing system conceptual organization is not determined. The services and goods compositions are constantly changed on the electric powers market. Up till now the UEPS reliability status is not determined: they are the services or goods, the functioning or goods characteristics (quality), the electric energy or power?

It is possible to expect that in the nearest decennial event the chaos active phase will be terminate here and then the ordering process will slowly dominate due to the new relationships determinations and the existing reinforcement, where this can be made. Obviously, first of all that will be reveal itself in the electric power and energy market organizations and the system services. This will find its reflection during co-ordinations of the branches rules and standards, in the investment activity, as well as throughout the new generating powers entering and the high voltage lines management. That can exclude the situation, when new power stations will be built, but corresponding networks is weak to transmit out their powers.

The main problem will be remaining: the scientific studies direction structures are very important for the power system research politics and corresponding programs, which are necessary for all subjects' general establishments.

However, there is most sharp problem in the modern conditions of preparation skilled and competent specialist for all branch enterprises. Since practically everywhere is sharply felt specialists needs, who are possessing deep and fundamental knowledge and mastering. Who knows the enterprises development potential and can apply to them modern analysis methods and who is capable to organize and control them. The engineer's preparation modern teaching process and the retraining courses on the «power engineering» special courses need for the cardinal changes. The teaching processes and subjects programs

organization will require the experienced power engineer's participations moreover their co-ordinations.

The process of the chaos will increase in technical-technological (TT) aspect, too and it is connected with the growing power supply deficit and the TT-reliability reduction. Here the main problem is to avoid the crisis and cataclysm. Due the fact that power production potential may be at the moment practically exhausted, it comes the tasks of the modern diagnostics systems introduction under the production technical condition: the EPS control in normal and emergency mode, mastering their modern control technical facilities, methods and technologies of the planning mode.

Important is certainly remains the problem of the rational funds draw, directed on the capital and operating repairs, which must restore the working resources and provide the acceptable reliability levels of the power equipment operations.

From the positions of the cost-performance maintenance condition, the chaos in «technologies» provides the new technology applications and high capital productivity, since the power productions are fully loaded. This requires appropriate «organizations», but allows raising the EPE system investment attractively, which will provide the EPE system innovation activity.

The development processes analysis and its prospective are possible to continue hereinafter. It is possible to get the certain presentation process about organizations in the EPE system about possible scenario of the developments. These will be the further studies subject within the proposed approaches framework to the EPE system development.

2.5. The power system reliability provision

The reliability must be provided in all subsystems of the PES social-technical structures. The social-psychological determination tasks are:

1 the reliability status determination (goods, services, work, goods characteristics, energy or/and power);

2 determining the criteria (the standards) of the rational reliability and safety;

3 the developments of the necessary methodical Instructions, recommendation, specifications, standards, regulations and other normative documents must be done.

Decision levels: Ministers Council, Legislative Organs.

The solving problems in the organizing-economic subsystem are the attractions and optimum use of all reliability facilities provided (the power reserves, spare of the network reception capacity, different resources, repair influences and other potentially possible system services).

Decisions levels: with, arc, Market Advice Committee.

The tasks of the technical-technological subsystem are the working systems regimes calculations and their realization taking into account of the reliability requirements and available facilities.

The reliability level of the decision is the power systems subjects.

For solution above presented tasks in the accordance to section 2.2 must be executed functioning «of the UEPS Russia program development ». This functioning forms are the purposes and tasks to guarantee the EPE system reliable development.

All these solve the searching questions of the development projects compromises and co-ordinations of the different subjects based on the taken criteria and standards.

Conclusion

1. The country power electrical system is passed the way from the technological (electrical power productions and transport) and production (territory electrification) up to social-technical system (life-supporting).

2. The changes in the EPE system are result as in the technical-social system development.

3. The attitude to the EPE system, as to self-organizing system, which inherent development, allows revealing the natural directivity, regularity and non irreversibility its changes.

4. The active approach allows define the development mechanism as three processes system – «chaos», « ordering » and «stabilizations». The studies have allowed revealing the condition of the firm development, which are reduced to the maintenance: «chaos» in SP (socio-psychological), ordering in OE (organizing-economical) and «stabilizations» in TT (technological-technical) subsystems.

5. Due to the potentially self-organizing and socio-technical EPE system nature, the need for electricity in the modern market condition will be always satisfied, but possible with some crisis.

6. The EPE system potentials and development directivities analysis allows to reveal the tendencies:

a) the distributed generation appearances in the manner of small energy sources,

b) the Nuclear and Hydro Power Stations adduction to the self life-supported ones according to requirements (like civil, social infrastructure, transport and etc.),

c) the orientation on the forced and adaptive load flow in the networks.

7. The development regularity will require from EPE system:

a) to go from the fulfillment demand to its arrangement, which will allow to realize the public well-being growing, become to form fuel-energy clusters, as new type of the organizations,

b) to raise the consensus degree energy subjects interests, the project co-ordination the scientific education and other institutions interactions.

8. The developments irreversibility can be shown in:

a) the increasing efficiency in the production processes, transport, distribution and the electric power consumptions,

b) the modern transition facilities, the objects control ways and the EPE system regimes parameters,

c) the specific materials consumption reduction and the equipment modularity growing, that will bring to innovations in EPE system.

9. The specified trends will find their reflection in EPE system, when will be performed the requirements to system reliability, that must become the branch subjects development programs for the all hierarchical level, as the EPE system unite subjects developments project characteristics.

10. The EPE system design will require the transition from the differential to integral method of the regimes description modes, stability estimations, the spare and reserve of the power and power resources.

11. The increased trained personal problem will require the changes into process of the specialist preparation for EPE system, directed on the personnel shaping, capable to work

out and realize effectively as their own, so and outside new ideas and projects. The modern educational-research process organization becomes the priority task on the increasing innovation potential of the EPE system.

12. The priorities will be given to the modern systems study and application of the control and management technological process, of the electric power production and transmission. All these will allow to raise the reliability and efficiency of the Russian EPE system functioning. The important here is the problem of the recovering funds rational use, which will provide run of the heavy repairs and the main fund technical maintenances.

Table 1 Social-psychological subsystem, as block « purpose-suppose » mechanism of the PES

Entry	Problems	Performers	Result
CHAOS Backlog of the country power energy from world investment attractiveness factors	1.1.1. Provision level of the country power energy by machinery, economy and society 1.1.2. The co-ordination strategy of resources use. 1.1.3. Restriction on the own attractive resource facilities and possibilities	Science, scientific debates in the Energy Ministry conferences	Energy policy and strategy
ORDERING Inconsistency of the conditions and orders of the country power energy provision to economy needs, and society	1.2.1. The standards of comfort life's and level of the country power energy machinery. 1.2.2. Openness to public, transparency of the relations in main subject branches 1.2.3. The organization and the co-ordination interests of the society and subjects of the country power energy	Committees of the government Russian Parliament, Energy Ministry, scientific and practical conferences in Energy Ministry	Russian Federation laws resolutions, government program of the development of electro-energetic
STABILIZATION Discrepancy of the country energy efficiency to the world factor	1.3.1. Growing level of the country energy machinery 1.3.2. Programs of the development power electro energy of territories and regions 1.3.3. Scientific and Technical achievements in the energy saving field	Shareholders meetings, board of Scientific and Technical Council (STC) directors of the subjects branches	Technical politicians and strategies enterprise

Table 2. The organizing-economic subsystem; the EPS development «organization» mechanism block.

Entry	Problems	Performers	Result
CHAOS Non-execution of the correlation rate of growth energy and rate of growth of the economy	2.1.1. ensuring the balance of the supply and demand 2.1.2. territorial programs of the development electric power system 2.1.3.investment attractiveness	regional administrations AFBPES (agency on forecasting of the balances in EPE system)	general scheme of the accommodation object of electric power system

ORDERING Strong funds ware out and deficit of the possibilities upon their repair and change	2.2.1. structure market, protection of the property, privileges	Market advisers	investment program
	2.2.2. rules market, sale, nomenclature of the product, organization of the competition		
	2.2.3. efficiency criteria		
STABILIZATION Low beralization degree of markets	2.3.1. growing of capitalization and investment attractiveness	Market tariffs advisers	tariffs on power and electric energy
	2.3.2. order of the pricing		
	2.3.3. tariffs optimization		

Table 3. The technical-technological subsystem; the EPS development «regulation» mechanism block

Entry	Problems	Performers	Result
CHAOS risks unjustified or insufficient entering object beside subject of the branches	1.1.1. reliability of the balances	System operator of the united energy system	scheme of the development of the Russia United Power System
	3.1.2. optimization reserve, spare		
	3.1.3. investment restrictions		
ORDERING presence of the network restrictions both on issue and on consumption of the electric powers	3.2.1. optimization of the schemes, mode	System operator of the united energy system	scheme of the development United Power System
	3.2.2. projects, methods, specifications		
	3.2.3. restrictions on possibility of the entering the new powers		
STABILIZATION break of stability mode and defect of the controlling possibilities	3.3.1. provision of reliability, controllability	System operator of the united energy system	systems automatic and automatic management and regulations
	3.3.2. improvement of the managerial systems and regulations mode		
	3.3.3. criteria, standards, requirements		

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Economic Reforms in Post-Soviet Georgia: Analysis and Forecasts

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Keywords: Stages of reforms, SWOT-analysis, external and internal factors, strong and weak sides of reforms, challenges, employment, GEL exchange rate, prognosis, recommendations.

1. Introduction

Purpose of present research is diagnosis-evaluation of strong and weak sides of economical reforms implemented and provided in post-soviet Georgia on the basis of SWOT-analysis, as well as sectoral evaluation of main economical challenges, processing prognosis scenario and recommendations in direction to the preventing and softening economical and financial risks (The Research is based on the official statistic data of National Service of Statistics of Georgia, and ministries and agencies of Georgia).

Reforms provided in Post-Soviet Georgia and, relatively, economical transformations implemented in the economy of the country, may be divided into four stages with the criteria of changes of managing government.

The first stage includes the period after restoration of state independence and before adoption of the Constitution (1991-1995). With the influence of internal armed conflict, weak governmental management, inexperience and other unfavorable objective and subjective factors currently taking place in the country, deep economical crisis has been commenced. Industrial manufacturing was significantly fallen. The volume of Gross Domestic Product was decreased 70 percents, and export for 90%. Multiple field of economy in fact stopped existence; large factories and plants were closed, industrial and transport infrastructure was destructed. We may say that during this period the country was leaving without budget, incomes covered only 17 percents of expenses. Subsidies on bread, natural air, electricity and transport made more than half of the budgetary expenses. The government used to borrow from national and commercial banks, giving significant rise to the internal debt of the country and created the problem of insolvency. Transitive national currency – the coupon soon lost trust among population and for this reason, trade-economical transactions were provided in US Dollars or Russian Rubles. The Country was sunk into the inflation, which transferred into hyperinflation. Rapid devaluation of the new currency (coupon) impoverished people. In 1994, volume of the Gross Domestic Product of the country fell in 70% compared with the level of 1970 [see details: 1, 2, 3, 4, 5, 6].

Coming out of the created hard economical crisis required rapid and clever actions of the Government. At the end of 1994, the Government, with the help of International Monetary Fund (IMF), effected numbers of activities in direction of economical recovery of the Country [5]. Bodies of local governments were prohibited to raise loans of any kind from the banks. National Bank started monitoring of banking system of the country and

established supervision on it. State budgetary resources were accumulated in National Bank. Administration of regulated prices was strengthened; electricity tariff was essentially increased; free privatization of residential houses and agricultural lands was started. Notwithstanding this, we may say, that this stage of reforms appeared to be unsuccessful.

At the second stage of reforms (1995-2003) they started the process of taking the country out of the economical crisis. With the help of the credits of International Monetary Fund and the World Bank, economical situation was gradually stabilized in the Country; hyperinflation was reduced; new monetary item (Lari) was established, more comprehended and scientifically argued macro-economical policy was adopted [3]. National Bank became independent from the Government; governmental expenses were significantly reduced; tax system became simpler; numbers of restrictions on inflow of foreign investments and foreign commercial operations were removed; prices on grains and bread and flour products were released; agreement was signed on construction of oil-pipeline passing the territory of Georgia; law was adopted on commercial banks, taxation and land; the process of privatization of small and middle enterprises was accelerated; trading became more liberalized; the reforms of other social-economical nature were implemented, with the help of which the process of gradual economical growth and taking the Country out of the crisis situation was started. According to the official statistic data, in 1996 economical growth reached peak index and, compared to the previous years, it made 11.2%, and in 1997 – 10.2%. For this period, incomes, salaries, pension of population was increased, compared with the data of previous years; small and middle business was gradually activated; the level of unemployment was insignificantly reduced.

Though, from 1998 rate of economical growth started decreasing, which was significantly influenced by the currency crisis taking place in Russia and Turkey. Only from 2001, the economy started gradual growth, which was assisted by the inflow of direct foreign investment to the territory of the Country, related with the construction of main transit pipeline. Foreign financial assistance was also increased related with construction of Baku-Supsa and Baku-Jeihan pipelines.

Weak side of the second stage of economical reforms shall be considered pursuing inconsistent macro economical policy, incompleteness of structural reforms and lack of transparency of the financial system of the country. These gave rise to the corruption at every level of management. The Government was unable to provide economy with the required financial resources. During entire period, the Country was under budgetary crisis; the level of "Dollarization" of economy was being increased; energy crisis could not be overcome; the volume of nonpayment of salaries and pensions was being increased. Implemented reforms could not provide growth of employment and essential raise of living standards of population [3, 4, 7, 8, 9].

Third stage of economical reforms includes 2004-2012, when the Country was governed by the Government of Rose Revolution. New Government provided numbers of effective reforms in many fields of economy with the assistance of international financial and economical organization and foreign partner states. Only in 2004-2006, the volume of foreign assistance was more than 1 billion US Dollars, and in 2008, for alleviation of damage inflicted with the Global Economical Crisis and Russian-Georgian War, Government of Georgia received 4.5 billion US Dollars from the Commonwealth States and international organization. The assistance included 2.5 billion US Dollars of low-interest loan and 2 billion US Dollars in the form of the Grant. Economical reforms implemented in the years 2004-2012 in Georgia became the subject of discussions of public and researchers, which is being continued till today [10, 11, 12, 13, 14, 15, 16, 17]. Evaluations of the implemented

reforms are inhomogeneous and in many cases, they are essentially different [18, 19, 20, 21]. Outcomes of economical reforms implemented at the said stage, age given in the Table 1 below.

Table 1:The Dynamics of Principle Macro-Economical Data of Georgia (the Years 2004-2012)

	2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
GDP current price (billion US Dollars)	9,9	11,6	13,7	16,9	19,1	17,9	20,7	24,3	26,1
GDP real growth (%)	5,9	9,6	9,4	12,3	2,3	-3,8	6,3	7,2	6,1
GDP per capita (GEL)	1187,6	1483,5	1763,6	3866,9	4352,9	4101,3	4675,3	5447,1	5811,7
Inflation (%)	103,6	110,6	114,5	109,2	109,2	110,0	107,1	108,5	99,1
Direct foreign investments (million US Dollars)	499,1	449,8	1190,4	2014,8	1564,0	658,4	814,5	1117,2	912,2
The level of unemployment (%)	12,6	13,8	13,6	13,3	16,5	16,9	16,3	15,1	15,0

On the basis of SWOT-analyze of activities implemented at the third stage of economical reforms we may distinguish following strong and weak lines:

Strong sides of the economical reforms implemented at this stage are: structural and public transformation of government (reducing amount of ministries and halving the number of the employed); increasing salaries of public officials; reducing corruption in lower and middle ranges; implementing wide-scaled, aggressive privatization; reducing taxes from 22 to 7; reducing tax rate; improvement of tax administration; privatization of agricultural lands being under the ownership of the government; minimizing licenses and permissions and simplifying the process of their obtaining; involving liberal labor code; recovery of the state budget (improvement of tax administration); admission of foreigners to the real estate market; increasing direct foreign investment; liberalization of financial and banking sector; state support of tourism (tax and infrastructural preferences); rehabilitation and construction of infrastructure; liberalization of foreign trade; signing free trade agreement with some foreign countries; improvement of energy management and minimization of energy crisis.

Weak sides of this stage of economical reforms are: violation of human rights and private ownership rights (illegal seizure of private ownership); spontaneity and inconsistency of reforms (absence of long-term strategy of the country development); ignoring real sector, destruction of processing industry; negligence of agricultural field by the government; construction of large expensive non-economical; increasing foreign debt and dependence of the Country on foreign financing (grants, humanitarian aid, preferential credits); allowing monopolization of market (canceling anti-monopoly law); transactions with “malinvestors”; wasteful disposal of state resources and neglecting financial monitoring; increasing elite corruption; selective assistance of business on party basis; implementing ineffective programs of assistance of entrepreneurship and employment; development of unsymmetrical market sector (dictatorship of banking sector on the economy); increasing negative balance

of foreign trade; deepening misbalance of regional development; social tension and political instability; deepening polarization of public incomes.

The most important positive outcome of the third stage of economical reforms was growth with high rates of economy and healing state budget. However, besides this, similarly rapid growth of living conditions of population was not achieved. This was conditioned with incorrect distribution of incomes and wasting financial resources on non-priority projects. With final accounts, at this stage of reforms such important challenges, as low level of employment, poverty and social inconformity remained to be important issues of the agenda. Great negative impact of economical reforms implemented during this period was performed by illegal restriction of ownership and human rights, which became main reason for coming of opposition coalition to the head of the government at following elections. After restoration of state independence of Georgia, every change of government was attended by the attempts of recovering economical reforms, new methods and methods of approaches of economical regulation. The government of Georgian Dream came with quite ambitious political program, economical part of which was directed towards assistance of business and development of real sector; as well as recovery of illegalities made by previous government in relations of private ownership. Practical realization of these complex and multi-profile, and overly optimistic promises was time-consuming and requiring deliberate method of approach. However, expectation of the society appeared to be unexpected and immediate that right after coming of the new Government there appeared categorical demand for immediate fulfillment of pre-election promises. Former managing political group moving to the opposition used this moment for getting political grades. Clear examples of this is artificial strikes, manifestations and other civil activities, which took place in almost every field and sector of economy, requiring from new government immediate recovery of legality and rapid improvement of social conditions [25].

2. Political-Economical Preconditions of Current Reforms

Georgian economy was being based on the ideology of managing national government during nine years, expressed in illegal encroachment of human rights and private property. This accumulated negative charge in public and gave rise to their replacement with coalition government by means of the elections. Created situation required from the new government moving of the established practice of managing with sole dictation to the democratic rails, which, in its turn, needed legislative changes, improvement of personnel policy and implementing other multiple activities of methodology-organizational nature. However, due to the legislative defects, duality of power took place in the Country, which lasted more than a year and this time was completely dedicated to the opposition of new and old governments. Political opposition harmful to the country was not balanced neither after presidential, nor – local elections. Revenge policy of opposition, which often went beyond good faith; blaming of with the mistakes made in the past and making inert, and often unbalanced and analytical-prognostic grounds, are important inhibiting factor of present economical reforms.

At current stage, economical reforms, generally, are of passive nature, which is conditioned by multiple subjective and objective factors, among which following shall be noted: the economy turned into the object of acute party opposition and political cohabitation; inexperienced government could not express respective braveness and promptness, could not form new reformist-innovative visions; social-economical development strategy of the country – Georgia-2020 – was not fallowed by processing of

respective particular action plan, due to which numbers of economical decisions are detached from reality; declared pseudo-cohabitation gave rise to nihilism in public and weakened entrepreneurial activity; no healthy, working and transparence coordination could be established between different branches of government, and moreover, covered and open opposition took place between them, which scared domestic and foreign investors; pre-term leaving of the position by the Prime Minister, influenced negatively upon the economy, as it extended expectation regime to the entrepreneurs; military opposition of the Ukraine and Russia gave negative impact upon business, as the Ukraine occupies the third, and Russia – the fourth place of trade partners of Georgia. The Government had no respective skill and experience of making rapid decision. Due to timely nonperformance of numbers of components, decreased the quality of public trust in the government.

The opposition, towards which the most part of the society had negative attitude, gradually became stronger and widened operation area. They, standing behind governmental-national interests, using different information facilities conveniently, create public opinion about spinelessness and incompetence of current government. For this purpose, they use widely international meetings and forums, organizational provisions of which are provided by large lobbyist organizations financed by them earlier. Current government, towards which the critics of the opposition is often fair, often is to require excuses and pedaling defaults of previous government, which is negatively reflected on their ratings. The Opposition uses in its favor the environment of democracy and freedom of speech created by new government. By using electronic and printing media, which is free from state intervention, there take place discussions among political parties not based on democratic basis, but cruel and merciless battle, contentiousness, defamation, ambush and revenge for realization of personal interests of the Parties. It is yet very difficult to proof it, but we may assume that supporting devaluation of Georgian currency with the actions or omission of opposition team left in the monetary government, significantly lowered rating of the Government and undermined faith towards economical reforms in the society. It shall also be noted that the fact that the leaders of National Movement being in opposition today are appointed on the high governmental positions in the Ukraine, in the first place is disrespect of the friend state to the current government of Georgia and, on the other hand, such approach looses the faith among greater part of the Society in implementing reforms in Georgia and the Ukraine.

Present government of Georgia can not bring information to the public clearly and confidently regarding implemented economical reforms and objective challenged created in this direction. The Opposition being experience in PR campaigns uses this fact in its own favor effectively. Created political uncertainty and deepening opposition prevent provision of economical reforms, especially disturbing local and foreign investors.

As seen from the last activities of the Government, it gained special experience of management, which is confirmed with the fact of activation of their attempts in direction of the reforms and making relatively positive decisions. Though the opposition responds to this with creative approaches and activation of forces and transfers battle field to different regions, where population is less informed regarding implemented reforms and those to be implemented in the future. Such political polarization is probably to be more deepened until new parliament elections, which will be serious disturbing reason phenomenon on the way of economical development of the Country.

Today scientific research of economical reforms implemented during last 2 years is provided as in the context of previous reforms [22, 23], so – from the point of evaluation of the first economical outcomes of the said reforms [24, 25, 26, 27, 28].

3. First Outcomes of Current Economical Reforms

Current stages of reforms in their length are so short that they give no opportunity for elimination of expressed regularities and trends, though it is possible to make particular evaluations and conclusions.

Outcomes of economical reforms are measured with the totality of economical indicators, with which economical challenges facing the country are evaluated. Under current conditions of Georgia, such indicators include the rates of economical growth, foreign trade relations, direct foreign investment, employment, state budget, stability of national currency and, the main thing is, characteristic of the living conditions of people. Find quantitative characteristics of the said above, are given in the Table 2 below.

Table 2: Principle Macro Economical Indexes of Georgia in the Years 2012-2014

	2012	**2013**	**2014**
Real growth of GDP (%)	6,4	3,3	4,8
Average annual of inflation (%)	-0,9	-0,5	3,1
Level of unemployment (%)	15,0	14,6	12,4
Direct foreign investments (million US Dollars)	911,6	941,9	1272,5
Foreign trade turnover (million US Dollars)	10425	10934	11457
Export of goods (million US Dollars)	2375	2908	2861
Import of goods (million US Dollars)	8048	8026	8596
Incomes of state budget (million Georgian Lari)	7058,2	6839,5	7377,2
Exchange rate (million US Dollars/Georgian Lari) at the end of year	1,66	1,73	1,86
Money supply (M3) (million Georgian Lari)	7903,7	9855,3	11189,8
Average monthly incomes per capita (Georgian Lari)	218,4	246,6	273,1

Subject to the analyses of official statistics, outcomes of economical reforms implemented during last 2 years in Georgia may be characterized briefly as follows:

- prognosis of economical growth could not be performed, instead of 5%, in 2013 made 3.3%; in 2014 – 4.8% and in the first quarter of 2015 – 3.2%. With these synthetic characteristics, economical reforms yet appeared to be unsuccessful;
- challenges existed in foreign trade could not be overcome. In 2013 situation was improved in export and the growth made 20.1%, In 2014, some negative trends in circulation of foreign trade was maintained and worsened. In the first part of 2015, the trend of reducing foreign-trading circulation was detected;
- In 2013, state budget was not fulfilled. The Plan lacked up to 700 million Georgian Laris. State budget of 2014 was fulfilled, and incomes of state budget of the 1st quarter of 2015 were increased in 14.6%. In the first half of 2015, the plan of budgetary incomes was not endangered;
- In 2013, direct foreign investments were insignificantly (1.1%) increased, in relation with the previous year, and in 2014 the growth made 27.1%;

- Compared with precious year, in 2012 the level of unemployment was reduced in 0.4% and made 14.6%; however, subject to the social studies, more than 60% of work power of the country consider themselves unemployed;
- The highest figure – 9.8% growth was reached in the agriculture and made 10.6% in 3025 in the structure of GDP. Industry was increased in 6.9%. In 2013, appeared to be unsuccessful to the construction, as, compared to the previous year, it was reduced in 10.6%. Almost 30% lacked implementation of construction of projects. It is noteworthy that growth of investments in 2013 was quite high in construction (28%), which should be followed with the important development of this field on the following year. In fact, this took place and in 2014 field of construction was increased together with the agriculture.
- At the end of 2013 and in the 4th quarter of 2014 fall of exchange rate of Georgian currency – Lari was fixed, which is being continued till now. This phenomenon gave essential negative impact upon living conditions of people.

Herewith, economical reforms implemented by the Government of Georgia during last period could not be evaluated unilaterally, as particular fields were successful, and some components of reforms, subject to their economical outcomes, deserve negative evaluation.

4. Strong and Weak Sides of Economical Reforms

At current stage (from the end of 2013 till today) SWOT-analyze of social-economical reforms implemented by the Government identified following strong and weak lines:

Strong sides of current reforms are: releasing of business from party-political pressure; signing association agreement with EU; attempts to protect private property rights; orientation towards inclusive economical growth and social development; universal insurance of public, the program Georgia without C-Hepatitis; strengthening targeted social assistance (increasing pensions and assistance of the vulnerable); increasing salaries of teachers and scientists; providing school children with school manuals free of charge; creation of the Demographic Development Fund and involving levers stimulating births; partial returning of export market of Russia (wine, alcoholic spirits, mineral water, ferroalloys); announcing agriculture for priority and strengthening governmental assistance to it (creation of agricultural development fund, distribution of vouchers, adoption of law on cooperation, three-tier program of preferential agro-credit, subsidies, agro-insurance and etc.); activation of work from the point of energy security (rehabilitation of small energy-plants and orientation towards end constructions), processing the Strategy of Social-Economical Development of the Country – "Georgia-2020"; amendment of Tax Code (reduction of penalties, involving untaxed minimum, undergoing small tax amnesty and etc). Starting local self-government reforms; starting governmental project "Produce in Georgia" (transferring property for GEL 1, state assistance in pledge, financing part of interest on the loans); allocation of incidental assets and etc.

At this stage of reforms, making positive changes in tax legislation shall be considered to be special achievement. In the first place, the improvement of the procedures of administration from the point of protection of ownership shall be noted. Namely, different form the operating regulations, when upon starting tax dispute the government was eligible to transfer the property under its ownership and sell it (which was used effectively by previous government in relation with political opponents and businesses unacceptable to it), changing owner of property with new edition, owner of the property may be changed only by passing all three instances of the court. Besides this, the period of tax limitation shall be

decreased from 6 to 5 years, and in the following years reduction to 3 years is foreseen. We shall consider releasing agriculture from the right of including VAT to be progressive decision, as well as releasing from the income tax of the persons with disabilities having up to 6 thousand Georgian Laris.

Releasing import of book paper from VAT is of great importance from the point of development of publishing industry of the country, as tax code had released only book import, which gave rise to publishing books abroad and than its import. Additional phenomenon also is releasing the sum accepted for medical treatment from charity foundation from income tax. To out mind, business development is definitely assisted with exemption of the tax liability up to almost billion Georgian Laris and this process shall be continued in the future. It would influence positively upon construction business development to determine tax benefits on the constructions commenced several years ago. Besides the said above, it is intended to replace 20% taxation of income made from renting apartment, or selling apartment and car with 5%. New tax initiatives – cancelling profit tax directed to reinvestment, involving tax stimulation for provision of economical and social development in highland region are to be noted as well. The Entrepreneurs starting business in the mountain region will be released from profit and property tax. Among the reforms implemented from taxation point of view, agreements on double taxation concluded with Belarus, Cyprus, Island and Lichtenstein are to be noted. It shall be noted that inadequate recommendation rendered given by the International Monetary Fund, about increasing taxation rates, has not been shared fairly and reasonably by the fiscal government.

To our mind, the project "Produce in Georgia" initiated in 2014 oriented to the economical growth in the close future, which is one of the most important economical reforms, which are together implemented by the Ministry of Economy and the Ministry of Sustainable Development and the Ministry of Agriculture of Georgia, The Program is based on the three principle components: financial availability, availability of infrastructure (real estate) and consulting service.

According to the practice, special interest of entrepreneurs is provoked by the component of financial availability, which was expected due to the fact that today business, and especially trust business suffers financial shortage, which is mostly conditioned with high interest rates on bank loans. Subject to the said practice, the entrepreneur working with industrial profile, in case of taking bank loan, is to pay 1-3% during the first two years, and its greater part (10%) is covered by the government. Farmers in the agriculture received more benefits, as they pay less (1-2%) on the loans. Business sector met transfer of state property to the starting entrepreneurs for GEL 1 with great interest, as well as activation of the project (20 million Georgian Laris) assisting micro and small entrepreneurship, which foresaw issuance of grant in the amount of 5 thousand Georgian Laris on the projects implemented in the villages. The Projects - Preferential Agro-Credit and Co-Financing of Enterprises Processing Agricultural Products shall be considered to be interesting component of the Reform. The Project of preferential agro-credit is implemented by the Agency of management of agricultural projects. 13 banks, 2 micro-finance organizations and 2 leasing companies are included in it. The Project, which initially included 3 components, was increased up to 7 (interest free commodity credit (credit purchase for small farmers; preferential agro credit for middle and large farmers; preferential agro credit citrus exporter and processing companies; preferential agro credit for the enterprises processing agricultural products financed with the concurring grants). Financial provision of the Project is provided by the Agency of Agricultural Development, which, in its turn, is financed by the legal entities – International Charity Foundation of Agricultural Development and international

charity fund Kartu. Above projects are accompanied with the defects (capriciousness of banking sector, privileges of relatives and persons related with the government and etc), and for this small farmers and agricultural workers express fair dissatisfaction.

Weak sides of current reforms are: weakness of legislation in recovery of property rights impaired illegally by previous government; non-coordinated activity of the branches of government; weakness of economical analyze and prognoses; ineffectiveness, prompt regulations (changing in regulation of visa regime, rapid adoption of moratorium on selling land to foreigners); revision of large infrastructure projects and procrastination of construction (Karsi-Akhalkalaki railway, Tbilisi bypass road)l low competitiveness of private sector (non-development of small and middle business); non-implementation of structural reforms; weakening activities in direction of privatization; procrastination of creation of anti-monopoly service and its inactivity (maintenance of monopolies in oil, medication and other fields); non-regulation of the problem of unemployment and passiveness in this direction; instability of monetary environment (deflation, inflation, high level of "dollarization", uncertainty in creation of state bank); deepening regional distinction of the level of living, increasing inequality of incomes between city and village; deficit of state budget, abundance of funds, lack of control f expenditures, targeted performance of budget; willful legalization of the system of premiums and salary additives in governmental structures; uncertainty in creation of different investment funds; maintenance of stagnation and inertia in development of education and science; retardation in realization of infrastructure construction projects; reduction of the volume of export of goods and money transfers; significant fall of exchange rate of Georgian Laris; slowing rates of development of tourist business; weak communication with public.

Such grouping of strong and weak sides of reforms are approximate and disputed, but until their final economical outcomes of their practical implementation occur. Though, there is doubtless fact that at this stage the government shall refuse PR-economy established during previous period and took course to the economy, which come into opposition to the principles of economy. Of course, maintenance of human life and its provision at minimal material level is the first task of the country, but it is required to have particular moderation and foreseeing long-term perspective. Universal state social assistance is purposeful in terms of critical, force-majeure situating, when natural disasters and other objective circumstances beyond human control, which touches upon every layer of population. As for the public social assistance to the vulnerable people and those with disabilities – this is accepted in every democratic country. But purchasing agricultural instruments, organization plowing and seeding and annual rendering of services of other kind, notwithstanding social conditions of beneficiary, are ineffective and lost. It, in the one hand, is heavy burden to the public budget, large part of which is filled with foreign and domestic loans, and, on the other hand, permanent assistance gives rise to relaxation of entrepreneurial stimulation, moving it to the regime of expectation of systemic assistance from the site of the government. To our mind, at the initial stage, such social preferences may be justified, though maintenance for long period of time is not purposeful and the government shall change economical policy in this direction. It is required to find golden mean between social conformity and market principles, to build economy in the way the government could maximally manage the attempts for regulation of long-term challenges and at the same time to provide satisfaction of the people with low-incomes and of living requirements of the socially vulnerable groups.

5. Main Economical Challenges

At every stage of economical reforms in Georgia, the Problem No. 1 is employment of working force and it remains to be main challenge. Today, majority of Georgian population (subject to the different sociology researches) considers unemployment to be main problem. In 2013, compared with previous year, the level of unemployment was reduced in 0.4%, which was provoked by reduction of the amount of economically active population 1.2 and the level of activity in 0.7 percent points and by creating up to 30 thousand work places in business sector. In fact, the level of employment was not increased, but it was reduced in 0.2 percents. According to the National Service of Statistics of Georgia, in 2013, compared to previous year, reduction of the levels of activity of population and their employment was provoked in the settlements of municipal type by reducing of these indexes, and the level of activity of population of villages remained unchanged and level of unemployment was increased. During last 8-years of retrospective period, the trend of growth of the level of activity and employment of Georgian population was identified; exception was the period from 2008 and 2013 subject to the official statistics. Level of unemployment in Georgia in 2014, compared with 2103, was reduced in 2.2 percents and made 12.4 percents. During 11 years, this index reached the lowest marking. The statistics of economically active population (work power) is unreal, due to the fact that the number of population, on the basis of which this index is determined, is inaccurate (Preliminary data of Census of Population of 2014 published by National Service of Statistics of Georgia, amount of population is 3.729 million persons, which is less than the Census of 2002 for 14.7%. Subject to this, official statistic data published till now do not reflect real situation and it becomes necessary to reconsideration and processing of program documents based on official statistics, as well as analyze-research materials, plans, concepts, prognosis and etc.). On the other hand, for determination of the amount of unemployment, they use international organization of labor and UN recommendations, which are inadequate for the reality of Georgia and it doesn't reflect real image. Therefore, distinction between real and official statistics of unemployment is 4-5 times more. This is the reason for the distrust of public to the state statistics. Subject to the provided studies of 2015 conducted by the Institute of National Democracy No.1, 66% of the population of Georgia is worried of unemployment [29]. To our mind, to decrease the level of unemployment in 2014 was mostly conditioned by following factors: Census of Population and election of local self-government took place in this year, which gave rise to the temporarily employed persons. Beside this, the amount of persons employed in public structures was increased; and finally, the government could partially activate the programs of business assistance, which also provoked growth of employment. In the following 2015, first two of these factor will not operate, which doubt the fact of maintenance of achieved results, if no additional effective activities are carried out by the government in this regard.

At current stage, among main economical challenges of Georgia, devaluation of exchange rate of national currency – Lari shall be noted. At the end of 2013, exchange rate of Georgian Lari against US Dollars was reduced from 1.65 to 1.75. The process of devaluation of Georgian Lari was completed in January of 2014. This was preceded with the selling of about 400 million US Dollars from the international reserves by the National Bank. After finding new balance by Georgian currency, in December 2014, the process of its devaluation was started and the fall was continued in higher rate including April of 2015. Its rate against US Dollars fell in 32%. Opinions of the government, and Georgian and foreign experts and scientific economists about main reason provoking devaluation of Georgian Lari during last

period are inhomogeneous. They basically name following factors and conditions: foreign factors (strengthening US Dollars, falling prices on oil, Russian-Ukraine war, devaluation of national currency of foreign countries); low rate of economical growth; restriction of alienation of land to foreigners by the Government; making migration law stricter; pursuing inadequate monetary policy by national bank; uneconomical wasting of budgetary resources and wasting costs at the end of the year; worsening investment environment; reduction of the volume of money transfers from foreign countries; reduction of net income from foreign tourism; reduction of incomes from international transportation; low rate of privatization of governmental property; secret transaction of national bank and government on devaluation of Georgian Lari for the purpose of planned index of inflation and prognosis of budgetary incomes; illegal outflow of capital out of the country; banking speculations, panic and commotions ().

Quantitative determination of the share of each actor influencing upon exchange rate of Georgian Lari is, in fact, impossible. This process is not subject to mathematical modeling, as cause-and-effect relation are not formalized. Statistic and logic analyze of the set versions shows that following factors and conditions participate in the fall of exchange rate of Georgian Lari:

1. Appreciation of US dollar. During last period the US dollar was appreciated against every national currency of European and other countries of the Region (commercial partner of Georgia). This was provided high rate of economical development compared with other developed countries. It is evident that national currencies of the developed countries, as well as Euro and national currencies of the largest commercial partner countries of Georgia (Ruble, Hryvnia, Dram, Manat, Lira and etc) were significantly devaluated against US Dollars by influence of global objective factors. This is the fact the Georgian currency is not the exception.

2. Reduction of export and increasing import. According to the data of GeoStat, negative balance of foreign trade turnover in 2014 (11218 million US Dollars) in relation with 201 3 (1140 million US Dollars), was increased in 6.8%. On the same year, export was increased in 3.2% and import – in 13.2%. In turnover of foreign trade, compared with the previous years, no essential changes were made. For example, in 2012, compared to 2011, deficit of foreign trade turnover was increased in 22.5%. On the same year, export was increased in 15.2%, and import – in 20.3%. Consequently, to out mind, it is not correct to recognize reduction of export to be main factor of devaluation of Georgian Lari in 2014. Of course, more rapid growth of import in comparison with the export increased demand on US Dollars, though, this factor influenced upon devaluation of the exchange rate of GEL only partially. This is confirmed with the fact that in the first part of 2015 decreasing of the foreign-trade turnover was not followed by appreciation of GEL.

3. Reduction of money transfers. According to the data of the national Bank of Georgia, money transfers from abroad to Georgia in 2014 was reduced in 2.45% (compared with 2013) and it made 1.44 billion US Dollars, which is less than 8.7% of GDP of the Country. Reduction was provided by reduction of money transfers from Russia in 11.5%. Share of Russia made almost half of money transfers to Georgia. In 2014, money transfers were reduced from Ukraine. On the same year, growth in 3.4% of money transfer from Greece was identified (compared with the previous year). Greece is the second largest source. Accrual of money from Italy was increased in 121.4 million US Dollars (growth in 10.2%); from the USA – 82 million US Dollars (growth in 9.6%); from Turkey – 64.3 million US Dollars (growth in 54.1%). Reduction of money transfers from Russia and the Ukraine is continued in 2015. In March of 2015, the volume of money transfers enters to

Georgia made 91.2 US Dollars, which is less in 30.8% compared with the similar data of March of 2014. We may say that reduction of the money transfers, under the conditions of reduction of other foreign currency incomes, influences negatively upon fall of exchange rate of Georgian Laris.

4. Reduction of the volume of foreign loans and grants. New government could not foresee in its pre-election program necessity of inflow of foreign currency for appreciation of national currency and refused growth of foreign loans, which gave negative impact at the modern stage. It is noteworthy that main factor of appreciation of exchange rate f Georgian Lari from 2009 through 2012 was allocation of 4.5 billion US Dollars by Commonwealth Countries of the world in 2008 for alleviation of the damage inflicted by Global Crisis and Russia-Georgian War; it included gift in the amount of 2 billion US Dollars and long-term preferential credit in the amount of 2.5 billion US Dollars. In 2013 the inflow of the currency in this channel was stopped.

5. Outflow of the capital from the country. Coming of new government created expectation of danger to illegal capital, which accelerated its secret outflow from the country. This was added with the immigration of public officials being suspected in different illegal actions, who are probable to take great amount of foreign currency with them through close banking and other channels.

6. Malfunction of monetary policy. National Bank could not use financial instruments at its hands for regulation of exchange rate of Georgian Laris. According to the President of National Bank of Georgia, "our task is not monitoring of exchange rate. Out task is monitoring pries and maintaining inflation. Fluctuation of exchange rate is an ordinary phenomenon and, based on the sufficient reserves, Georgian economy and national currency are not under threat" [30]. However, it is widely spread that changing of the exchange rate is in direct relation with inflation processes. Such risk is much higher to the countries depending on import, such as Georgia. One of the tasks of the National Bank is prognosis of expected risks and providing preventive actions in direction of its leveling. National Bank new that stability of exchange rate of Georgian Lai in the past was conditioned by "Assistance of Brushless", received by the country in tranches during multiple years (another case is how and what it was spent for). At the same time, it could not address respective volume of US Dollar in timely and proper manner and removal of access GEL from circulation, required for maintenance of stability of exchange rate. It is enough to note that, subject to the official statistics, National Bank removed (purchased) 550 million US Dollars from circulation and sold only 200 millions in 2014.

Economical wasting of international reserves by the National Bank, on the one hand, is welcomed, though, on the other hand, one of the function international reserve is provision of stability of currency, parallel to the maintenance of international reserves, at the critical moment National Bank should strengthen monetary-credit policy, even temporarily; it should increase basic rate, and interest rate of refinancing and to remove access mass of Georgian Lari from the monetary market, which would stop fall of the exchange rate of Georgian Lari in the period following operation of fundamental factors. It is evident that neither National Bank, nor – Government could provide preparation of the economy for softening of potential internal and external shocks. According to the final report, these shocks were expropriated by the exchange rate, for which entire burden was distributed upon population, especially its part, which took loan in US Dollars or they are to perform other transactions in US Dollars. As for the devaluation of Georgian Lari in the period following leveling of the fundamental factors, and appreciation of exchange rate of Georgian Laris after strengthening of the parliamentary and public criticism of monetary policy of National Bank, these gives birth to

the hypothesis in two directions: one is that important role in devaluation of Georgian Lari in February of 2015 was played by deepening of commotions and speculation and, on the other hand, by speculative transactions of commercial banks, which take place very often in multiple countries of the world and this factor may not be ignored in Georgia as well. Recently, 5 largest banks (JPMorgan, Citigroup, Barclays, Royal Bank of Scotland, UBS) were charged in 5.7 billion US Dollars for manipulation of interest rates at the monetary market [31].

Out of the multiple versions of devaluation of Georgian Lari, which gave rise to the fierce discussions during last period, following may be excluded with simple logic analyze. For example, at the current stage in Georgia no direct foreign investments may be named for one of the factors of devaluation of Georgian Lari, as, according to the official statistics, no reduction is confirmed compared with previous years according to the official statistics. In 2014, direct foreign investments made 1273 thousand US Dollars, while their annual volume in 2012 and 2013 respectively made 911.2 and 941.9 thousand US Dollars. Herewith, statistical analyzes show that in 2014, no negative fiscal pressure over exchange rate of Georgian Lari took place. On the contrary, spending sources from the budget was provided more consistently, than during last years, and at the end of the year insufficient growth of expenditures, due to objective reasons, always took place and it will take place in the future. The versions about stability of exchange rate of Georgian Lari regarding procedures of alienation of land and important influence of strengthening migration law is unreasoned. During previous years, in terms of existence of more liberal regulations, amount of alienated lands and incomes made from it was insignificant and it had minor influence over the volume of foreign currency brought to the Country. As for the changes made in regulations of migration, it didn't give rise to the reduction of net income from tourism. According to the official data, in 2014, amount of visitors entering the Country was increased in 1%, compared with the previous year. Herewith, net income made from tourism was also increased from 1.425 million US Dollars to 1.489 million US Dollars. Distributed opinion regarding the fact that during last two years amount of visitors was decreased in Georgia is incorrect. Amount of visitors was not reduced, but, in fact, increased, though not in the similarly high rates, as in previous years. In fact, growth of visitors during last four years averaged 20-25% and it is clear that during last 2 years no serious growth has been detected in this regard. We shall not exclude the fact that the achieved level will be maintained for long period of time (temporary peak) and in the close future, no sharp rise of the amount of visitor will take place in the close future in Georgia.

Herewith, we may assume that devaluation of the National Currency was influenced by the complex of factors, including external factors – appreciation of US Dollars, difficulties created in global economy and the war between main commercial partners of Georgia (Russia and the Ukraine). Out of the domestic factors following shall be noted: weakening attempts of the government in direction of inflow of sufficient amount of foreign currency, involving new regulations on management of land and migration, which scared foreign investors and tourists though insignificantly; herewith, confusion, omission and delays of the National Bank. Specially negative role was played by extended political opposition, fluctuating international image of the Country and scared foreign and local investors.

For the purpose of appreciation of Georgian Lari, Government of Georgia determined the activities to be provided in the first place: accelerated realization of privatization objects, promotion of tourist business, activation of attempts in attraction of additional direct foreign investment, reduction of administrative expenditures, implementation of large infrastructure

projects, searching for the alternate trade ties, implementation of tax and other legislative changes stimulating business. We may say that activation of the governmental activities in this direction is evident, making grounds to optimism in the close future.

6. Hypothesis and prognosis of economical development

Subject to the short-term inertial prognosis of economical development of Georgia, no essential positive changes are expected in the economy of the Country in the close future. Achievement of little – 5-percent growth planned for current and future years, will be related in multiple difficulties. Though, in case of continuance of the process of devaluation of exchange rate of Georgian Lari or maintenance of current rate, it is not strange to achieve planned indexes of economical growth, budgetary incomes and inflation, which, of course, doesn't speak of successful economical development. At the same time, to our mind, 5% growth of GDP in 2015 will become problematic, if no stabilization of global political environment takes place and if not finding compromise in oppositions arising at the international level; also if not providing radical operations for attraction of foreign currency in Georgia. According to the inertial prognosis, GDP will be increased in 3.0-3.5% in 2015 and according to the actual prognosis – there will be the growth of 4.0-4.5%. Prognosis of the international financial institutions, as always, is contradictory, fluctuating and unreal, having its objective reasons.

There is the probability of escalating domestic political confrontations in Georgia, which will definitely have essential factor delaying economical growth in the future, similar to the previous years. Enclosure of pre-election period may escalate domestic political balance of the Country, due to which no essential growth of direct foreign investments is expected in the close future, though the Government has quite optimistic prognosis in this regard. At the background of expected pre-election political confrontation, the vector of foreign investments may transfer to another direction, and local investments will avoid placement of resources into business and they will be transferred to the banking sector form making relatively less, but guaranteed profit.

In the close future, no growth will take place in foreign trade, which, on the one hand, will be considered with the expected stagnation or crisis of economical status of foreign commercial partner countries (especially the Ukraine and Russia), and, on the other hand, resource (especially financial) growth of the volume of manufacturing export products inside the country. The problems will be maintained in this regard in the future and there are the grounds of confrontation in the future. They expect reduction of export in Russia and the Ukraine due to confrontation of the monetary and economical crisis (Russia-Ukrainian is probable to be extended in time). Due to membership of Armenia in the Eurasian Customs Union and, respectively, amendment of customs regulation, no foreign commercial turnover will be increased with this country. Export to the EU countries will be increased insignificantly, which will be assisted with the signature of agreement about association, though, due to the height of dents on the standards of products, activation of this agreement in full regard will require time.

Bank sector will maintain prevailing condition, though its growth is not expected in today high rates. Exchange rate of Georgian Lari will be expressed in turbulent trajectory, though, in the close future it will find new balance 1:2.2 – 1:2.3 closeness, which will be temporary, if no leveling of principle factors of negative influence takes place.

Energy, construction and agricultural sectors are expected to be developed in high rates, compared with the real sector, and growth of tourism will be reduced in the close future.

It is easy to forecast that devaluation of Georgian Lari in import-depending Georgia will definitely be followed with inflation expectation, rising prices (inflation) on goods and services. According to the logic prognosis, in fact, we shall not expect for strong inflation explosion, taking into account two principle factors. In the first place, using financial instrument at its hands, National Bank of Georgia will try not to allow growth of prices above planned 5-percent index. And second, devaluation of national currency also took place in principle commercial partner countries of Georgia, for the reason of which the price of export goods are reduced in US Dollars. Briefly saying, universal process of appreciation of US dollar will be the factor restricting important growth of prices on the imported goods. However, subject to the complex political and economical processes taking place in the world, we shall not exclude the prognosis of cheapening US Dollar and making price on oil higher.

In the close future and even perspective, non-suspension of devaluation process of Georgian Lari will make undesired effect upon social=economical status of the country and living conditions of population. Under such conditions, present level of dollarization in the economy of the country (about 70%) will be increased. Consequently, due to the reduction of trust in GEL, the population prefers saving of US Dollar. The volume of deposits in US Dollars will be increased, reaching 70% today. In case of non-appreciation of Georgian Laris, raising credits in US Dollars, will be insignificantly reduced. The volume of foreign debt will be significantly increased in relation with the Gross Domestic Products, as it is nominated in US Dollars.

In the close 2-3 years we shall not expect economical profit of essential nature from the Associated Agreement signed with European Union. Full activation of the agreement of deep and comprehensive free trade, manufacturing competitive products of high standards for reaching 500-million markets of the Europe required time and investments. Consequently, in the close future foreign trade orienteer with the European Union will be mostly directed to the markets of CIS and neighboring countries.

Subject to the above, to our mind, it is necessary to pursue following activities in the close future: 1. harmonic and balanced work of every branch of government, including elimination of existed open and covered contradiction; 2. further liberalization of economy, taking into account prognosis of expected outcomes in perspective; 3. minimization of administrate expenditures from state budget; 4. stronger purposeful governmental support of business (taken direction is promising, notwithstanding particular defects); 5. creation of maximally advantageous political, economical, social and infrastructural environment for attraction of foreign direct investments (orientation towards fair investors); 6. meeting principles of moderations in social orientation of state budget; 7. rapidness and promptness in making governmental decisions but also their practical realization; 8. meeting the principle of teamwork in governmental operation and making implemented projects and those to be implemented in the future understandable to public; 9. certification of current and expected economical threads of the country and processing governmental programs of their overcoming; 10. amendment of organic law about National Bank to allow provision of stability of exchange rate of Georgian Lari to become its direct competence, as well as practical implementation of legal regime for only means of paying Georgian Lari for the purpose of dedollarization of economy; 11. strict monitoring of principle directions of monetary-credit policy of National Bank by the Parliament of Georgia and providing strict

supervision of its implementation; 12. creation of analytical-prognostic and scientific-research standing center staffed with high-qualified experts and scientific economists, to inspect, evaluate and predict expected social-economical risks and prepare particular offers and recommendations for the government to make respective decisions; 13. achievement of political balance, positioning state interests above party interests, requiring high political culture.

In the future, challenges of every kind existed in the country will be deepened and more complex new problems will appear if not reaching internal political stability, for which, in the first place, it is necessary to eliminate open or covered confrontation existed between branches of the government, as well as positioning governmental interests above personal and party interest of political forces of different ideologies.

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Essence of the «Educational Tourism» Category

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Abstract. The article defines the essence of the category of "educational tourism" based on the most common approaches and its correlation in the context of educational tourism development in Ukraine and suggests the classification of varieties of tourist services identifying the place of educational tourism in a wide range of modern tourist services**.**

Keywords: Educational tourism, tourist service, foreign students, higher education.

1. Introduction

The role of higher education as a champion of economic development is becoming more and more actual today. Educational services attract increasing attention of both the public and scientists; geographical and spatial characteristics play all the smaller role, education is becoming without borders. Educational services are increasingly correlated with the tourist ones; travellers increasingly aim at obtaining new knowledge and skills. Educational tourism is a relatively new category so the idea of academic discourse on its essence is not coordinated and largely represented by foreign research works.

The terminology of such variety of travel services as educational tourism has not been studied enough. Dualistic nature of educational tourism makes it impossible to identify the essence without studying two key categories: "education", "tourism". Another issue that has not yet been solved at this stage of the study of the phenomenon of educational tourism in Ukraine is the correlation of the concepts of "educational tourism" and "educational migration."

2. Approaches to Definition of Educational Tourism

The issue of educational tourism is increasingly the subject of studies at both the international and national levels and in the works of native scientists. The works of A. Nikolaev [1], M. Pevzner [2], A. Lebedev [3] and B. Ritchie [4] will be the theoretical basis for the research that illustrates the nature and peculiarities of educational tourism. However, the existing definitions of educational tourism are not able to fully ensure the definition of all aspects of its manifestation.

Educational tourism, in a global sense, correlates with all variety of travels which purpose is cognitive activity. In the context of tourist services it is associated with the tourist trip to combine leisure and learning outside the permanent location for a particular purpose within the period from one day to six months [1, p.162].

Educational tourism is the modern trend of tourism. Its development and formation are taking place here and today, that is why it is quite natural that there is mismatch of views as to the content and specification of the category. The definition of the nature of the

category of educational tourism should be started with approaches to the interpretation of the nature of the phenomenon. In the study of the existing theoretical apparatus, we can conditionally distinguish the following most common approaches to determining the definition of "educational tourism":

- global [1, p.162],
- managerial [2, p.61],
- economic [3, p.5],
- dualistic (segmental) [4, p.10].

3. Existing Definitions of the Category of "Educational Tourism"

The group of scientists in their work "From Educational Management to Management of Educational Tourism" summarizes the category and defines it as a type of tourism that covers various types of training and education which are implemented outside the permanent residence, as a rule in the form of tourist trips for a period from 24 hours to 6 months without being engaged in activities related to the receipt of income from various sources in the country (place) of temporary stay [2].

Considering educational tourism as an economic category, A. Lebedev gives the following definition: "educational tourism is the system of relations connected with production, distribution, exchange and consumption of educational tourist product as part of national and world economy». By tourist product, the author means tangible and intangible benefits that a tourist requires in the process of acquiring new knowledge, skills and habits during irregular movements between permanent residence and place of studies [3].

The view of foreign researchers is conditionally agreed, world practice associates educational tourism in the broad sense focusing on dualistic character of the category. Integrating the characteristic features of the category of "education" and "tourism" educational tourism has a definite place both in the educational process and in the tourist industry.

Given this fact, B. Ritchie from Great Britain, the author of many books on management theory and tourism, in 2003 developed the conception which is based on comparison of two approaches to understanding of the conception of educational tourism: "tourism in the first place" or " education in the first place» taking into account all environmental factors that affect the formation of supply and demand for educational tourism [4].

The study «School Excursion Tourism and Attraction Management» treats educational tourism as a tourist activity that is carried out in the long term (from day) by tourists inclusive, which main goal is to travel for the purpose of education and training [4].

Viewing the component of " tourism in the first place" the author of the conception implies a product that incorporates some forms of education or training which often act as motivation when choosing a tour. This is, for example, cultural or informative tourism.

The structural model of the approach to the definition of the category of educational tourism, based on previous research of B. Ritchie, is presented in the research of Lithuanian professors D. Prekapin and L.Oblerkayte based on inseparability of educational tourism from the influence of environmental factors, namely: political, economic, social, ecological, technological and legal ones, organizational bases of the development of educational tourism are under the influence of the processes of globalization and changes in the environment [5].

Tourism in the context of research of the formula of educational tourism (education + tourism) is an aggregated category for the range of tourist services associated with cognitive purpose is steadily developing each year.

4. The Place of Educational Tourism in the Classification of Educational services

The key to the definition of "tourist service" is its ability to meet the needs of tourists. Thus, the purpose of the visit of a tourist, that is what motivates people to travel, is reasonable to use as the first criterion, which can classify the variety of tourist services. State Statistics Service in its surveys divides the entry of foreign nationals according to the purpose into seven parts. According to another classification, the division of tourists attended to by travel agents and tour operators is divided according to the purpose of travel based on five components (Table 1).

Table 1: Division of tourists by the purpose of the trip according to the methodology of State Statistics Service of Ukraine

Source	
The State Statistics Service of Ukraine [6]	Statistical bulletin of the State Statistics Service of Ukraine « Tourist activity in Ukraine» [7]
Purpose of travel	
- official, business, diplomatic	- official, business, training
- tourism	- leisure, rest
- private	- therapy
- training	- sport tourism
- employment	- specific
- immigration	- other
- cultural and sport exchange, religious	

The Law of Ukraine "On Tourism" includes the generalized characteristic depending on the categories of persons on tourist travels (trips, visits), their purposes, objects used or visited or other characteristics [8]. All in all there are 15 characteristics. Although this division is popular enough because it takes into account a number of criteria, educational tourism is not separated, we assume that it is considered to be a component or a sub-type of one of the above mentioned forms or types that further actualizes the problem as to the positioning of educational tourism and defining of its role in the classification of tourist services.

This picture, in the absence of a common vision of the purpose of a tourist, encourages the study of various classifications with the purpose of their generalization and systematization. The tree-like system of data structuring is the most successful in attempts to summarize the most common classifications and determine the place of education services within tourist ones, choosing the purpose of the visit as a key importance (Figure 1).

The common features that separate educational services in tourism from other objectives pursued by the traveller are as follows:

- the desire to obtain not only knowledge in this or that area, as, for example, in cultural and educational objective but also a certain profession (diploma, certificate etc.),

- a foreign student having a goal to get higher education in Ukraine requires certain legal and physical conditions of existing in another country, given a long, unlike other purposes, period of stay,

- along with other students, a foreign student needs comfortable living conditions. From this perspective, all non-residents need accommodation, there is also the need for certain infrastructure, whether the opportunity to freely and promptly receive a bank transfer from abroad or qualified medical care etc.

- the host country of such a tourist must propagate tolerance to bearers of other cultures, religions, world outlook because educational services are impossible without interaction with the team where a traveller studies, with the staff of institutions of learning etc.,

- systematic and close monitoring of the educational process by the state - the guarantee of quality and correspondence of educational standards of the country to world standards,

- strategic vision of such a kind of tourist services in the context of foreign trade policy of the state.

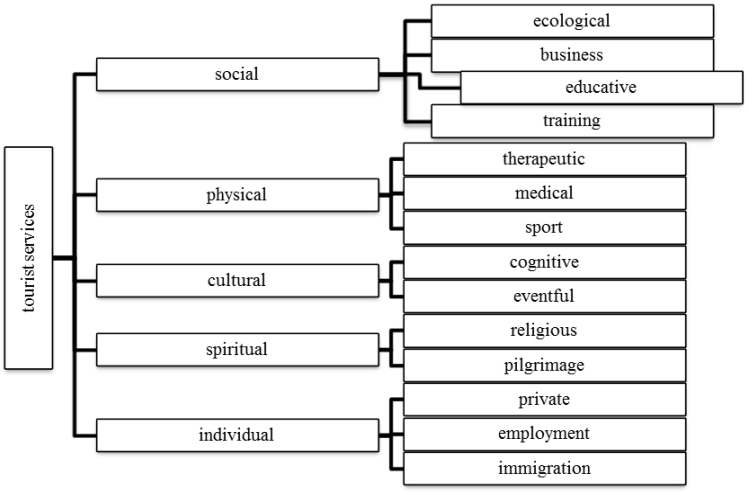

Fig. 1. The classification of tourist services by the purpose (systematized based on [6], [7], [8])

Specificity of educational tourism services lies primarily in the specification of the consumer because young people are mostly the consumers of educational tourism services. Educational tourism in the broadest sense by its organizational form has international character and has seasonality associated with the educational process. The funds of individuals, with some exception, are inherent sources of financing of educational tourism services.

To some extent, the educational tourism services are highly specialized educational tourism, which at the same time has a number of risks for the producers of educational services for tourists and certain positive features related to the concentration on a particular audience of consumers and adaptation directly for their needs.

5. Conclusion

Thus, the essence of the category of "educational tourism" reflects the following definitions: educational tourism - a voluntary change of the place of residence to obtain educational services and unrelated to the obtaining of revenues for a period depending on the desired level of education, which is to be acquired.

According to the proposed classification of educational services, educational services are those that are social in their character. The social effect is stipulated by the inability for a foreign student to stay out of the social environment of the country to which he arrived.

The lack of holistic scientific understanding of relations of the categories of "educational tourism" and "educational migration" creates further research activities. Further specification and theoretical content of educational tourism is essential for obtaining qualitative practical results. In practice, the analysis of the key indicators of educational tourism is accompanied by the recognition of the necessity of its strategic development.

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Morphological Analysis of the Concept of Financial Security of Entity

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Abstract: The essence of financial security of an enterprise and a bank is determined. The key characteristics are marked out. The differences between these notions are considered. The similarity measure of determination of elements of financial security of entity is estimated.

Key words: Financial security of entity, morphological analysis, management of cash-flows in banks.

1. Introduction

In modern conditions of political and economic crises and worldwide economic globalization, the issue of national security becomes vital. As the financial system is the basis for the functioning of any field of national economy, its stability is a fundamental factor.

Nowadays about 95% of all assets of financial market in Ukraine belong to the banking system. It is proved by the fact that banking institutions and their stability play the most crucial role in ensuring national security. Therefore, the issue of financial security of the banking system in Ukraine is relevant today. The aim of the article is to determine the nature of a definition "financial security of banks".

2. Approaches to concepts of financial securities of an enterprise and of a bank

Many domestic and foreign scientists devoted their scientific research to the issue of financial security of the banking system. Among them are Baranovskyi O.I. [2], Holoborodko Iu.O. [6], Kovalenko V.V. [14], Korystin O.Ie. [15], Mikulina M.O. [18], Snishchenko R.G. [26] and others. To clarify the essence of this concept there used morphological analysis proposed by F. Zwicky [28].

According to the results of the morphologic analysis of 27 interpretations of the concept "financial security of entity" (7 out of 27 are connected directly to banks) there were marked out 2 groups of the key characteristics, that are adduced in Table 1.

The most authors (17 is the common number of these authors) believe that counteraction to threads is the principal characteristic of financial security of entity. Nine authors pay their attention to protection of interests and resources as a characteristic of financial security of entity.

Based on determined variants of key characteristics of concepts "financial security of an enterprise" and "financial security of a bank", we marked out the main and specific features of financial security of a bank.

Firstly, authors interpret these concepts from the points of the same approaches: financial security as a state and as a protection. Nevertheless, the certain group of scientists pays their attention to specifying financial security of an enterprise (as an ability of an enterprise to function effectively) and of a bank (as an ability to effectively manage cash flows). According to the author of the article, financial security of a bank has to represent the financial aspects of achieving conditions of continuous and durable activity of banks. As these entities have specific features, their activity is connected exceptionally with monetary resources, and the concept "financial security" has to represent the process of management of the main banking resources, i.e. monetary resources. Therefore, the author believes that the base of the financial security of a bank is the process of management of cash-flows.

Secondly, scientists consider that financial security of an enterprise and of a bank always have to provide financial stability, effective development and opportunity of counteraction to threads. It is clear, because the state, when entities are able to counteract to risks, is the guarantee of stable activity and provides opportunities to increase efficiency.

Specific features are optimal level of the mobilized resources, balance between the society and state interests, protection of financial resources.

Based on morphologic analysis, there were marked out essential characteristics: counteraction to threads, protection of interest and resources, optimal level of the mobilized resources, financial stability and normal functioning.

Table 1. Evaluation of morphological parameters of the concept of "financial security of enterprises"

Groups of key features	Key features	Number of authors mentioning the features	Resource	Groups of key features	Key features	Number of authors mentioning the features	Resource
Properties	Balance	2	[9, 17]	Properties	Paying capacity	1	[25]
	Financial stability	7	[2, 7, 9, 12, 17, 20, 22, 27]		Financial independence	1	[16]
	Effective development	9	[1, 2, 9, 12, 17, 20, 22, 27]		Interests realization	1	[24]
	Normal functioning	7	[1, 2, 4, 8, 9, 14, 15, 23, 27]		Development of employees	1	[17]
	Optimal level of the mobilized resources	2	[2, 6]		Earning capacity	1	[20]
	Increase of share capital	1	[5]		Profitability	2	[4,27]
	Maintenance of financial and wealth values	1	[5]		The high market value of securities	1	[20]
	Balance between the society and state interests	2	[2, 19]		Efficient use resources	3	[10, 24, 25]
	Protection of interests and resources	9	[2, 3, 4, 5, 11, 17, 22, 24]	Approaches	As a state	16	[2, 3, 4, 6, 7, 9, 11, 12, 13, 16, 17, 19, 20, 21, 22]
	Protection of financial resources	1	[24]		As a protection	7	[1, 2, 5, 15, 18, 25, 26]
	Counteraction to threads	17	[1, 2, 3, 4, 6, 7, 9, 11, 14, 15, 16, 17, 18, 21, 23, 24, 26, 27]		As an ability of an enterprise to function effectively	4	[8, 10, 23, 27]
	Liquidity	2	[5, 13]		As an ability to effectively manage cash flows	1	[14]

3. Calculation of similarity and inclusion of the concepts "financial security of an enterprise" and "financial security of a bank"

Let us analyze the morphological parameters what will allow to define the key characteristics of the essence of financial security of a bank. The results of the analysis are presented in a matrix of the key characteristics patterns. Each element of the matrix indicates the existence or absence of the variant of the significant sign (j) in particular author`s identification. If a j-feature is present in i-definition then the cell at the intersection of the appropriate row and column is assigned a value of 1. Is a j-feature is absent in i-definition then the cell is assigned a value of 0.

Based on the matrix we can calculate the similarity of each two definitions of the formula 1:

$$C(i_1, i_2) = \frac{\sum_{j=1}^{n} xi1 * xi2}{\sum_{j=1}^{n} xi1j + \sum_{j=1}^{n} xi2j} \quad (1)$$

where i_1, i_2 – the numbers of two definitions checked for similarity;

x_{i1j}, x_{i2j} – the value of the matrix elements of the key characteristics patterns for two definitions of financial security of enterprises;

j – a number of a significant feature.

According to the similarity analysis and morphological analysis, it is possible to conclude that the definition of the concept by different authors is quite different as each scientist defines his own significant features of the financial security of a bank. The biggest similarity measure (0,50) is provided by Holoborodko Iu.O. [6], Korystin O.Ie. [15], Liashenko O.M. [16], Mikulina M.O. [18], and Snishchenko R.G. [26]. It is interesting that the authors who consider the financial security of an enterprise and a bank have a considerable measure of similarity.

Let us create the refined concept of "financial security of a bank" by analyzing the feasibility of the features introduction. To do this, use the formula 2 of determination of the inclusion of one concept to another (w_{i1i2}).

$$w_{i1i2}(i_1, i_2) = \frac{\sum_{j=1}^{n} xi1j * xi2j}{\sum_{j=1}^{n} xi2j} \quad (2)$$

The analysis of the matrix of the inclusion shows that 3 authors picked up the most quantity (13 is the common number of these values) of maximum values (1,00 is the maximal volume for these values): Holoborodko Iu.O. [6], Hrytsenko R.A. [7], Snishchenko R. H. [26] (exactly the authors, who consider financial security of a bank). According to their papers, financial security is a state, which is characterized by optimal level of the mobilized resources by minimizing threads, represents ability to the development, increasing the efficiency and competitiveness and a state, when financial stability cannot be undermined by activities of the certain group of people or organizations and financial situation inside or outside of the entity [6, 7, 26].

4. Conclusion

The aspects of financial security are vital in nowadays. According to the morphologic analysis, there was defined, that the concepts "financial security of an enterprise" and

"financial security of a bank" are similar, but the measure of inclusion of one concept to another shows that the last one is wider. Therefore, financial security of a bank has some specific features, which are not typical to enterprises. The concept "financial security of a bank" has to represent the process of management of the main resources of bank, i.e. cash-flows.

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Estimation and Analysis Models of GDP Dispersion

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Abstract. The paper is dedicated to the problem of regional disproportions and its impact on the level of socio-economic development of the separate countries and EU as a whole. The set of models is suggested to support the following tasks: analysis and estimation of dispersions trends; forecast of the dispersion level; assessment of the causal relationships between dispersion and socio- economic safety factors; determining the optimal level of disproportions between elements that provides adequate level of socio- economic safety of the system as a whole.

Keywords. Dispersion of GDP, socio-economic level, estimation and analysis models, trend, resource costs.

1. Introduction

Today gross domestic product (GDP) is one the major indicators of sustainable socio-economic development of countries and regions. But unfortunately it does not take into account the disproportions that exist among certain regions within the country. These disproportions may be studied with dispersion of GDP.

2. Research set up

According to the methodology [1], dispersion of GDP is estimated as weighted sum of the absolute differences between regional and national GDP. The resulting indicator is expressed in percent of the national GDP:

$$D = \frac{\sum_{i=1}^{n} \frac{|y_i - Y| * p_i}{P}}{Y}, \qquad (1)$$

$\dot{x} = f(x,t)$ y_i is GDP of the i-th element of the economic system,

Y is GDP of the economic system,

p_i is a population of the i-th element of the economic system,

i is a number of elements of the economic system.

To analyze the disproportions within EU we suggest appropriate set of models, which give the solutions for the following tasks:

- analysis and evaluation of disproportion trends of certain countries and the EU as a whole;
- disproportions forecast;
- assessment of the causal relationships between dispersion and socio- economic safety factors;

– determining the optimal level of disproportions between elements that provides adequate (or minimal) level of socio-economic safety of the system as a whole.

The solution of each of these tasks must be supported with appropriate set of models.

The general model for the first problem is:

$$D = d(a, t), \quad (2)$$

D - dispersion of GDP,

t - time,

a - vector of the model parameters.

We need to obtain adequate models (2) to be able to forecast the level of the dispersion.

To solve the third problem the following set of models are suggested:

$$S = S(D, X_1, \ldots, X_n) \to \min \quad (3)$$

$$g_i(D, X_1, \ldots, X_n) \geq h_i, \quad i = [1, m], \quad (4)$$

S - socio-economic safety indicator,

D - dispersion of GDP,

$X_1, \ldots, X_n$ - exogenous factors that affect socio- economic safety,

g_i, $i = [1, m]$ - model constraints.

Functions g_i may describe causal relationships between exogenous factors of the model. For example, the dispersion of GDP may be connected with some of these factors. This paper is devoted to analysis of causal relationships between the level of GDP dispersion and resource costs:

$$D = D(r_1, \ldots, r_k), \quad (5)$$

r_i - costs level of the i-th resource, $i = [1, k]$, k - number of resources.

As the result the list of resources that have the most essential impact on the dispersion must be formed.

3. Calculation

Let us review the results of parameters estimation for model (2).

According to the formula (1), two time series were calculated (y_i - GDP of the i-th EU country, Y - GDP of the EU):

D_{EU28} - dispersion of GDP for EU28,

D_{EU18} - dispersion of GDP for EU18.

According to the calculations the dispersion values for EU18 always are much less than appropriate values for EU28. D_{EU28} and D_{EU18} are characterized with the opposite tendencies. Let us discuss D_{EU28}. There was upward trends during 1995-2007 and 2010-2011, slight decline in 2008-2009 and 2012-2013. The dispersion for EU18 decreased permanently during 1995-2003, and then it began to rise.

The following models were obtained:

$$D_{EU18} = 18{,}35 - 0{,}85t + 0{,}05t^2,$$

$$D_{EU28} = 37{,}59 - 0{,}90t - 0{,}03t^2.$$

We have obtained two parabolas with the oppositely directed branches. This confirms synchronized but contradictory tendencies of development for EU18 and EU28. General situation for EU18 tends to worsen along with general improvement for EU28. This means that newcomers tend to improve their economic situation despite of elder members of EU.

Let us review the results of analysis for different EU members according to the model (2).

Only eight countries have demonstrated the growth of the total GDP dispersion rating during the analyzed retrospective period (Table 1- Table 2). Table 1 presents the countries that have the declining linear trend of the GDP dispersion.

Table 1

Linear trends

Country	Model	Rating	The absolute change in the rating ("+" - up; "-" - down)
Austria	$D = 26{,}58 - 0{,}40t$	7	+5
Belgium	$D = 28{,}85 - 0{,}20t$	11	+5
Germany	$D = 31{,}37 - 0{,}29t$	16	+3

Table 2 presents the countries that demonstrate non-linear trend of the GDP dispersion.

Table 2

Non-linear trends

Country	Model	Rating	The absolute change in the rating ("+" - up; "-" - down)
Spain	$D = 21{,}74 - 0{,}82t + 0{,}05t^2$	5	+1
Italy	$D = 26{,}39 - 0{,}53t + 0{,}04t^2$	10	+1
Latvia	$D = 39{,}21 + 2{,}91t - 0{,}25t^2$	24	+2
Former Yugoslav Republic of Macedonia	$D = 39{,}20 + 1{,}49t - 0{,}17t^2$	17	+6
Finland	$D = 21{,}72 - 0{,}50t^2 + + 0{,}09t^3 - 0{,}004t^4$	4	+3

Only four countries from the top ten of the rating have improved their position (Finland, Austria, Italy, and Spain).

The rest of the countries have demonstrated the decline of the total rating during the analyzed retrospective period.

For the following countries, the GDP dispersion is described with linear model: Slovenia, Czech Republic, Greece, Poland, Croatia, Slovakia, Romania, Hungary, and Bulgaria. Such countries as Sweden, Denmark, France, Portugal, United Kingdom, Ireland, Estonia, Malta, the Netherlands, and Lithuania have non-linear trends.

All trend models were applied for short time predicting of the dispersion.

The top ten list of countries has remained stable at the forecast period, but the positions of some countries within the rating have changed.

Malta remains on the top of rating –it's dispersion of GDP equals 3,54. Bulgaria and Hungary are the outsiders. Their dispersion levels at the forecast period equal 50,67 and 44,39 appropriately.

The decrease of the dispersion is demonstrated by Germany (-0,26), Estonia (-1,9), Latvia (-1,52), Malta (-0,76), Netherlands (-1,04), Austria (-0,05), Portugal (-0,54) and Finland (-2,51).

Finland has the maximum value of dispersion decline among those countries. It is the permanent member of the top five countries and it continues to decrease the level of GDP dispersion. Bulgaria has achieved the most level of increase. It's dispersion indicator has risen by 5,17.

The results of forecasting were applied to form three scenarios of development: pessimistic, basic and optimistic. The basic scenario is grounded on the point forecasts, pessimistic and optimistic scenarios use the lower and the upper boundaries of interval forecast.

Let us review the results of analysis for EU28 and EU18 according to the model (5):

$$D = D(K, L, E),$$

K - capital costs,

L - labor costs,

E - energy costs.

The following models were estimated and compared:

- $D = a_0 + a_1 K + a_2 L + a_3 E$,
- $D = a_0 + K^{a_1} + L^{a_2} + E^{a_3}$,
- $D = a_0 K^{a_1} L^{a_2} E^{a_3}$,
- $D = \exp(a_0 + a_1 K + a_2 L + a_3 E)$,
- $D = \log(a_0 + a_1 K + a_2 L + a_3 E)$.

The final models are:

for EU28 - $D = 171{,}92 - 23{,}96\log_{10} K + 14{,}46\log_{10} L + 0{,}02\log_{10} E$,

for EU18 - $D = 22{,}61 - 0{,}004K + 0{,}47L + 0{,}043E$.

For both models, labor costs and energy costs are the most important predictors according to the standardized regression coefficients.

4. Conclusion

Significant imbalances in the level of the development have been investigated within EU as a whole and within its separate members. Only eight countries among EU28 such as Belgium, Germany, Spain, Italy, Austria, Finland, Latvia and Former Yugoslav Republic of Macedonia were able to decrease the level of GDP dispersion compared with the base year. Only Germany, Latvia, Austria, and Finland have extended that tendency into the forecast period. Therefore, those countries may be used as examples or standards of how to make a scenario of disproportions decrease for the rest of EU members.

Upward linear trend was determined in the GDP dispersion time series for a large number of countries. It means that the situation tends to worsen constantly. Another group of countries is described with different non-linear models, mostly polynomial. The forecast

results for such models cannot be interpreted correctly. In this case, the model (5) which determines the relationships between the level of GDP dispersion and costs of different resources should be applied to obtain an adequate forecast results.

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Management of the Insiders in Corporate Security

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Abstract. The article is devoted to theoretical, methodological, and practical elements of security personnel in enterprises of different ownership. The theoretical and practical guidance on the implementation of individual elements, and personnel security in general as one of the functional components of the economic security companies.

Keywords: Personnel security, economic security, recruitment, selection, training, fraud, fraud prevention methods

1. Introduction

In a transitional economy one of the priorities for economic entities raises questions of personnel management from the standpoint of economic security. Today the most important issue is to develop a new personnel policy that focuses on the organization of social control, the priority of social values and social policy.

Modern HR policy begins to cover areas not previously considered in personnel policy. This is the sphere of labor disputes and relations with the administration of the new civil society organizations in the process of solving production problems, the role of social programs implemented by the organization in an increasingly competitive and others. Personnel safety is the most important factor for the security of all areas of the business entity, ignoring that not only can cause considerable damage, but also to destroy it.

Personnel security is a process to prevent adverse impacts on the economic security of the enterprise by the risks and threats associated with personnel, its intellectual potential and labor relations in general. Thus for events neutralization, minimization, avoidance and prevention of threats to security personnel should consider the tasks that the system must perform personnel security. Only by carrying out a clear, balanced and holistic approach to defining problems of security personnel to the specifics and typology of threats that affect it can get effective results of these measures.

The main prerogative of this approach is the presumption of dominant position security personnel in relation to other elements of economic security, because it works with the staff, personnel, and they are in any of the elements are primary.

The purpose of personnel security specified in the tasks that are defined in the first place, depending on the levels of organization management, and secondly, depending on the types of threats, and thirdly, depending on risk.

2. Methodology

Depending on the level of organization management personnel safety problems associated with the fact that a part of corporate security personnel security implemented initially at the level of strategy, and specified in the programs and techniques. At the strategic level is determined by the personnel policy of the company, is its relationship with the general trend of enterprise development, identifies the main areas of service management personnel. The problem at this stage - identifying problems companies making their decisions, the development of certain rules and regulations, mandatory for all companies that help to ensure personnel safety. Methods of personnel policy should be included in the planning of human resources, information, financial policy, development and evaluation of personnel.

Strategy personnel security personnel policy and overall strategy of the enterprise as a whole should be clear and understandable for officer personnel management. In line with the strategic objectives set out personnel policy Enterprise Service HR forms defined requirements for the quality of the personnel and internal environment. At the operational level management is design principles of enterprise strategy in regulations for service management. They specify clear guidelines regarding matters of personnel security. It is in accordance with these instructions preventive measures, personnel safety.

To determine the safety of personnel problems, depending on the types of threats to consider their classification.

Types of threats must be divided by areas in which they arise. The main threat is related to the economic sphere. This kind of threat to cause the most severe damage to the company. The second area of threats related to information security. The third area - is social. It includes threats related to the human factor and the relationship between individuals and social groups that are characterized by the lack of direct motive of economic gain, this could lead to serious negative consequences for the company.

Determination of such problems must come from the highest parts of the guide that will provide them a clear algorithm execution. The practical implementation of ideas and documents the top levels of management is implemented at the tactical level. At this point, Officer HR Service sells their skills in accordance with the regulations of the company. Tactical level answers the question of how to accomplish what defined at higher levels. Here the task of every employee is to use their abilities for the good of the company.

As in all cases of threats emanating from employees, there is a need of separation of ordinary workers, managers and mid-level management. So approach to security personnel regarding employee belonging to a particular level will be different.

Its problem of security personnel is to conduct activities [13] that are aimed at not permit persons to job positions abusing that they can apply their actions harm the company in accordance with the threats, as well as constant monitoring, aimed at ensuring personnel safety.

In the modern theory of economic security is no single defined system of personnel security, clearly and logically constructed structure and defined mechanism that makes it impossible in practice to effectively utilize available resources and ensure a sufficient level of security personnel through one-sided perception. Most businesses in practice negate measures of economic security and reduce them to only physical. Building a schematic representation of the system to ensure personnel safety may solve part of the problem in terms of its theoretical justification.

When building a model of personnel security business entity should guide optimal cell structure that would ensure its most efficient use, and therefore could give quality to protect all existing facilities while being in the process of continuous growth.

The objects of security personnel stands everything on that directed efforts to ensure safety. Because, in our opinion, are the primary footage for all functional components of the economic security, personnel security to facilities include:

1. Directors, shareholders, partners, staff and freelance staff who possess information not to be disclosed or is a trade secret.
2. Financial resources at the disposal of personnel and subject to the possibility of misappropriation, embezzlement and intentional financial fraud.
3. Hardware and software used by employees in the performance of their official duties, which can be harmed by its own staff intentionally or unintentionally.
4. Objects of copyright, related rights objects, objects of scientific and technical information, industrial property, means of individualization, know-how, which may be subject to misappropriation, embezzlement, fraud, industrial espionage and corporate intelligence, and even destroy their own staff.
5. All the material resources of the entity which is free or restricted access to staff that can do such illegal actions as embezzlement, willful damage to property companies and others.
6. Protected information, information resources and limited use of freely distributed information resources, which is protected against unauthorized removal, collection and transmission of a third interested party, loss, distortion in the interest of the attacker, the disclosure of which entails the detriment of the company.

The subjects of personnel security advocate physical entities, departments, services, institutions, organizations directly involved in system security. It is advisable to divide the subjects into two subgroups:

1. Exterior, which should include public authorities, law enforcement agencies, security services, other business entities, non-governmental structures to ensure the security of the person does not have a business relationship with the company.
2. Internal, which include security service companies, recruitment agencies, legal departments, units, company personnel.

As with any economic system, the personnel security functions within the legal and legislative environment that are essential to its effective operation. Regulatory support system operation personnel safety is the main legislation, legal documents, internal policies and regulations.

3. Results

Information and analytical support for the functioning of the personnel security business entity is to search, selection, processing and protection of information and analytical data necessary for tactical and strategic enterprise management, and aims to search, detection and neutralization of open and latent threats to the smooth functioning personnel safety. It is this type of security is a primary component of most threats faced by system personnel safety.

Formation mechanism of functioning of the security personnel allowed to form its optimal structure, to include those components reflect strategic ties, which in turn made it possible to illustrate an integrated approach to its construction. It is this kind of model can ensure the human resources component of economic security effective operation, without

material and financial losses, thus multiplying the equity and functioning under a single corporate vision.

Like any system, the security personnel consists of several subsystems. For example, a subsystem of security personnel in the selection of personnel subsystem providing security personnel in carrying out fraud employees of firms.

Yes, one of the security personnel subsystem is a subsystem of personnel safety during recruitment. Selection of competent staff capable of productive work in the market, its rational structural and spatial distribution, change management culture of enterprise is the key to success now.

Then we need to develop an algorithm for the selection of personnel in the enterprise (Figure 1).

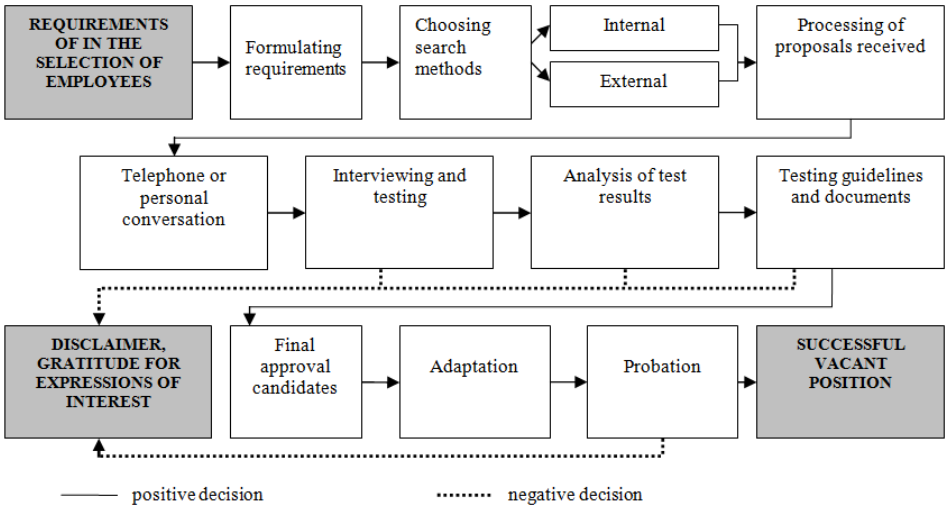

Fig. 1. Algorithm selection process employed staff (compiled by the authors)

According to many surveys and conducted interviews, nowadays many executives leading commercial structures more deeply aware of the role and place their employees in establishing and maintaining the overall system of economic security. This understanding of the problem leads to persistent implementation procedures careful selection and placement of personnel.

Recruitment problem facing the direction of the organization in two major cases: the creation of new units or vacancies. In both cases, you must make demands on the applicant. The more clearly they will be compiled it will be easier selection process. The requirements can be summarized in the form of questionnaires.

Practice showed two main ways to meet the needs of the frame:

1. Through better use of its own personnel capabilities (internal sources).
2. Through the involvement of employees necessary qualification from the environment (external source).

For us, it is obvious that, other things being equal, preference should be given to the involvement of workers required from internal sources.

Internal sources of personnel selection in organizations provide it to better use of their human resources, increase the confidence of their employees in the future, creating

conditions for their career growth. Organizational form of internal staffing source advocates tend talent pool company. Having permanent staff reserve is a sign of stability [1].

Internal method vacancies particularly attractive as seen from the standpoint of personnel safety. First, «its» worker already somewhat familiar to the employer, and secondly, the time the employee was able to form a loyalty to the company, the employer, and therefore more likely that the employee will not resort to such actions may harm the company.

Using internal staff selection method will be much easier when your company personnel policies. Such a program should be developed by management (if any – in conjunction with the service personnel). The essence of this policy includes determining qualification requirements for each position, professional and competent personnel selection, training new staff features work, creating the necessary conditions, the definition criteria of moral and material incentives and incentives to work, care for professional growth and a promising career, creating in the team healthy moral and psychological climate, etc. [3].

A large variety of possibilities personnel selection organization focused on external sources. However, it should be especially careful when taking a large number of new employees to work. A special role in the adoption of new employees to work should the security service in the position of quality checks of applicants. In addition, a large number of newly employees from outside can disrupt the internal balance training organization or cause a chain reaction of increasing salaries and rates of pay. However, on the other hand, new employees can be a source of new ideas and fresh views and creativity.

Among the variety of methods for sampling personnel from external sources, all of them can be divided into two groups: ethical and unethical (Table 1) [3].

Most experts [6, 7] agree that for the successful organization of search candidates should use two main sources: always to search for candidates within the organization and to use at least two methods to attract candidates from outside sources.

Table 1:Methods for selection of personnel from external sources

Group methods of personnel selection	**Methods for selection of personnel**
Ethical methods	Use personal contacts
	Search resumes online
	Placing an ad online media company's website
	Appeal to the NHS
	Appeal to the specialized agencies
	Finding candidates directly at the university
	Participation in job fairs
Unethical methods	Enticement employee of the company-competitor (headhunting)
	- direct poaching
	- poaching by private security
	- poaching by illegal means getting personal database of competitor
	Cooperation with company insiders [12] competitor

Recruitment is the basis for the selection of future employees of the organization. Selection of a further phase of the vacant positions when the pre-selected candidates pick exactly the candidate who best match the position. Contents of this process depends largely on tradition, features the host organization for new employees, as well as the nature of the post to which candidate gets, but in general can be represented by the following scheme (Figure 2).

So, in order to ensure staff safety must be carefully and balanced approach to the process of recruitment. Using multiple methods of personnel selection in their combination will minimize the risk of attracting "exiles" employees and thus saves the organization from further problems and losses.

When legalism and therefore correct formulation of questionnaires and tests used in the selection of personnel is real not violate legal requirements and protect the company from possible threats that could hypothetically suffer enterprise entering into the relationship with a particular employee.

The next subsystem is the subsystem of security personnel in carrying out fraudulent employees. Fraud is a crime: theft of property or rights to acquire it by fraud or breach of trust.

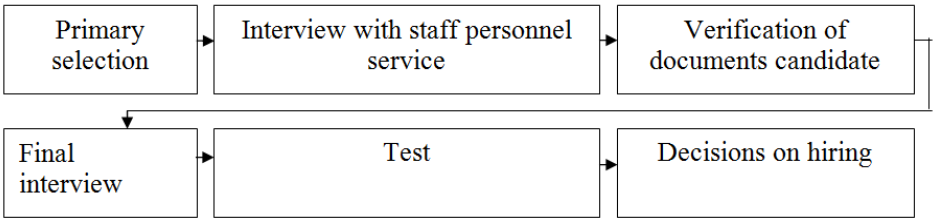

Fig. 2. Stages of the process of recruitment (compiled by the authors)

The basis of fraudulent staff is inadequate individual laws and legal documents, the complexity of the financial and economic ties, incompetence and ignorance of legal, safety and excessive credulity managers, lack of control employees.

Fraud in the enterprise can be internal and external. Internal fraud is a fraud, misappropriation of property or violation of the law, which involved at least one employee organization.

External fraud occurs with the assistance of "third parties", which includes the impact on employees outside of "business partners". Thus, protection against fraud of personnel security as a component of economic security should be implemented in two ways:

1. Prevention of fraud within the company – identifying individuals prone to fraud; eliminate factors that provoke committing malpractice, work organization so that any violations were "in sight".
2. Prevent fraudulent actions of business partners – information-analytical work with external entities, corporate intelligence test partner companies and their representatives, analysis of the proposed options for business relations [11].

Disclosure of fraudulent intent is complicated by the fact that illegal operation virtually indistinguishable from conventional agreements. In addition, fraudsters have specific personal qualities that make them easy to win trust. Justifying their actions and

persuading potential partner to participate in the upcoming fraud, criminals tend to use the following arguments:

1. Extraordinary profitability.
2. Fast overcome temporary financial difficulties in the business.
3. The involvement of high-ranking officials to ensure speedy and "Safe" resolution of the issue.
4. Providing access to sensitive information and offers manipulate it.
5. Withholding information about the financial condition of the company-contractor for large volumes of transactions.
6. Standard solution ("scheme") of complex economic problems.

It featured cheaters are:

1. The desire to get rich quickly without much effort.
2. Visual appeal - respectability or simulated.
3. Openness that sympathy and confidence.
4. Intelligence that allows you to invent 'scheme' unlawful actions influence people to predict their behavior and encourage appropriate action fraudulent intent.
5. A sense of superiority, confidence in success.

Victims of fraud in most cases are employees that differ:

1. Suggestibility, compliance, deference, excessive gullibility.
2. Incompetence in those areas of the company, allows fraudsters.
3. Inability to make decisions, reliance on the views of other people and external circumstances.

Despite the diversity of 'scenarios' can be detected action algorithm, which conducted any fraudulent transaction:

1. Search for information about the company.
2. Develop a plan of fraud ("scheme").
3. Search for accomplices and victims, their involvement in the scam (froud).
4. Commit illegal actions.

As the number of fraudulent transactions leading middle managers and employees, but the most significant damage of causing criminal actions of senior managers. Using his abilities and position, they organize group "trusted" people who commit criminal acts.

Senior managers who initiate fraudulent transactions and sign financial documents of title, and in the case of exposure - reduces as the persons involved, using his official position.

Acting on the formation of social policy such bosses fraudsters develop relevant documents (such as a collective agreement), providing opportunities for all sorts of shenanigans: improper housing, interest-free loans; abuse in health insurance and so on.

The most common types of fraud are:

1. Abuse of power.
2. Collusion with external agents.
3. To influence by external agents or senior officers of the company and involvement in the criminal "scheme" employee who cannot appreciate the scale of the crime (the so-called use of "blind").
4. Fraud, based on imperfect legislation.

The basic form of internal fraud – misappropriation of money: violation of the calculations with various organizations, a greater percentage ("broth") from the sale of unaccounted goods, illegal cancellation, uncontrolled seizure of goods, etc.

To fraud and corruption include when officials – director or employee – are in collusion with outsiders and for a fee provides criminal acts. There are several basic types of

internal corruption, bribery, illegal remuneration, "kickbacks" when calculating, deliberate overpricing etc.

Theft from middle managers and performers also inflicts damage company, albeit a smaller scale. According to research psychologists, about 10% of people will not go to illegal acts under any circumstances, 10% – tend to make them regularly, and 80% – not waive fraud provided apparent impunity.

The manager should be clearly understood that the employee is to steal the presence of two factors: the possibility of uncontrolled access to wealth and acute dissatisfaction with their income. The desire to "make" can be not only an employee who is living with costs "can not afford", but the apparent inadequate accounting system.

Ensuring personnel safety is on the one hand, monitor the work of staff, on the other - to create the conditions under which a person can not or do not want to steal. It is equally important and psychological climate in the team, and sharpness control system (especially the process of contracting, work with contractors, procurement, etc.).

In the internal regulations of the company, approved by the (regulations, guidelines), the system of economic security empowered to control negotiation, communication in business phone, using the Internet, email and more.

One of the most effective measures to prevent fraud and "nesunstvo" in the workplace – active policy of internal corporate control. All employees should be aware that each job can be checked at any time.

4. Conclusion

Admittedly, no company is immune from fraud, but the risk of abuse can and should be minimized. Any offense is easier to prevent than to deal with its consequences.

Varieties of fraud requires the service of economic security (SES) of care and vigilance. But if, in spite of the complex of preventive measures, the crime still occurred, the system of economic security must immediately begin an official investigation: the sooner started the collection and analysis of the relevant material, the more likely to identify suspects and minimize losses.

Any unpleasant incident in the company associated with the theft of material or money, document fraud, deceit, etc. is an emergency that requires an official investigation. Materials that give rise to it, can be obtained:

1. The results of the audit.
2. The results of the inventory.
3. From formal and informal (anonymous) statements of employees.
4. Based on intelligence.

Official investigation conducted staff sat in collaboration with other departments (including - service HR) and persons related to the incident. Objectives official investigation:

1. To find those responsible for the event.
2. Clarify the causes.
3. To assess the damage and find ways to minimize it.
4. To develop proposals to prevent similar occurrences in the future.

Investigations necessarily conducted in accordance with the laws of Ukraine and internal company documents that regulate the policy of economic security.

When deciding on an official investigation into the leadership necessary to conduct a preliminary assessment of the "cost" verification measures. Sometimes consideration and proof of guilt can cost the company far more than the damage incurred.

It can be argued that the personnel security is a process to prevent negative impacts on the economic security of the enterprise by risks and hazards associated with personnel, his intellectual capacity and labor relations in general.

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Some Approaches to Modelling the Threat Estimation of Forming Financial Crises into Corporate Systems

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Abstract. The article is devoted to analysis of some approaches to modeling estimation of the bankruptcy threat of enterprises of corporate type. The analysis of the current condition of Ukraine's economy from the point of view of the dynamics of change of the financial condition of enterprises is done; the significant role of the corporate segment in the domestic economy is proved. The key stages of the modeling process of estimation of the bankruptcy threat of enterprises exactly of corporate systems are examined.

Keywords: analysis, bankruptcy, crisis, estimation, model.

1. Introduction

The phenomenon of financial insolvency is presented in economy of any system of market relations [7, 8, 12]. At the present stage of development of Ukraine regarding to the consequences of global financial and local national crises the determining of failure of any economic subject is of considerable interest. To be able to identify and to note in time unfavorable trends of financial activity of the enterprise, to assess their scope properly for prevention a financial collapse of the organizations is vital to any competent manager nowadays.

Ukraine has quite a large number of enterprises, which are on the brink of solvency and are running at a loss, which can lead to bankruptcy in the future. There are bankrupted companies in every region of Ukraine, both small and large enterprises become bankrupt. Nevertheless, the domestic economy is almost entirely composed of corporate type of companies; moreover, there is a defined trend towards acquisitions of small businesses by large ones that are the part of corporations. Exactly the holdings, financial and industrial groups and other corporations are now the backbone of Ukraine, which is why financial analysis of enterprises in the corporate sector of the economy, estimation of possible threats to the forming of financial crises and a general analysis of the economy, taking into account the dynamics and trends in corporate bankruptcies are of major interest. The problem of bankruptcies of corporate type firms of modern Ukrainian economy is one of the most important.

Moreover, the first step in its solution is the estimation of the propensity of individual enterprise from corporate segment to bankruptcy, is to determine how its threat of bankruptcy affects the financial stability of the whole organization, and based on the analysis of the results of this estimation – to develop the crisis management of subsidiary enterprise and of the corporation.

2. Current Dynamics of Bankrupt Companies

Recently a tendency to increase the number of companies that go to failure and become bankrupt is formed in Ukraine [3]. Thus, the amount of losses of Ukrainian enterprises of all types, including corporate type, has increased five times over the past seven years. Moreover, the sharp jumps of losses were increasing with time of the financial crisis (in 2008 and 2014). The share of profitable companies by industry is presented on Fig. 1 [6].

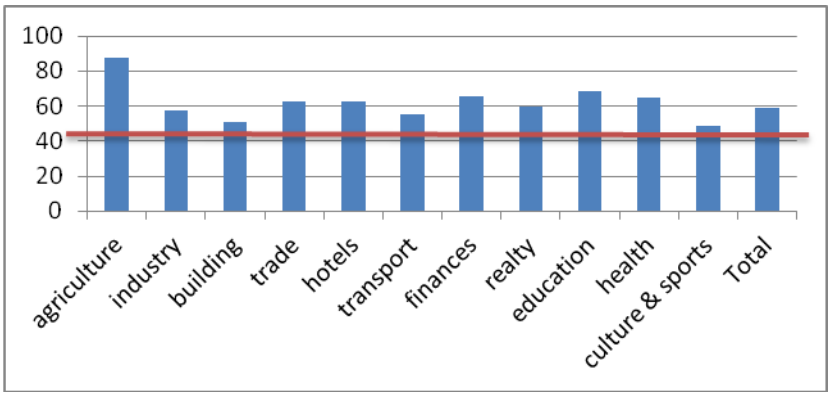

Fig. 1. The shares of profitable enterprises in Ukraine by industries

Almost every second company in Ukraine is unprofitable. Considering the very large number of such companies (40.8%), the number of bankrupt enterprises, and the total number of opened cases on bankruptcy is increasing too.

In 2009-2010 in average eight companies were recognized as bankrupt, three cases of bankruptcy were brought and one company was liquidated. However, in 2014 the number of businesses, which were recognized as bankrupt in Ukraine, was 11 per day. In addition, four cases of bankruptcy were brought, and one company was liquidated [3]. That is obvious that it became much more difficult for domestic enterprises to manage their financial stability, and therefore the problem of early detection and prevention of crisis becomes even more urgent.

Dynamics of the total amount of Ukrainian bankrupt enterprises in the whole in 2010-2015 is shown on Fig. 2 [3].

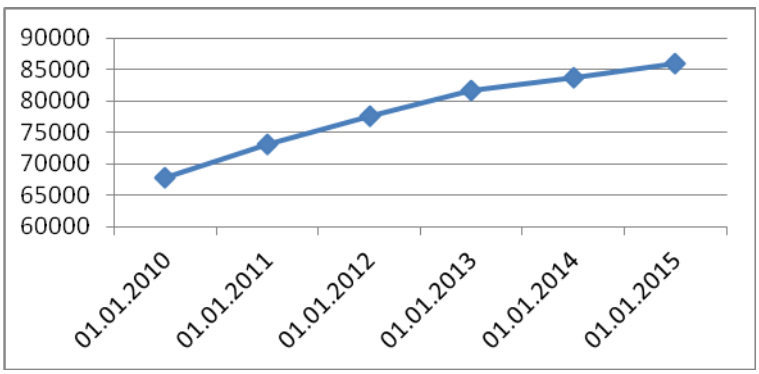

Fig. 2. Dynamics of bankrupt enterprises in Ukraine in 2010-2015

According to Fig. 2, there is a clear linear tendency of increasing the number of bankrupts. By approximately 0.62% of all registered Ukrainian enterprises went bankrupt. Of course, this situation affects on the national economy at whole, it slows the rate of its growth.

3. The Necessity of Estimation the Threat of Corporate Failure

The above analysis highlights that now the problem of bankruptcy for Ukrainian economy is one of the most pressing. Moreover, the possibility of bankruptcy of the enterprises of the corporate type should be assessed as a threat to sustainable economic development, because, despite the fact that the number of small and medium-sized businesses is 99.8% and that the biggest part of bankrupt enterprises consists exactly from these companies, they provide only 15% of GDP. Moreover, with 26% of GDP in the public sector of Ukrainian economy about two thirds of the domestic economy is controlled by large corporate organizations (in the world this figure equals about 55%). So, in Ukraine, nearly the entire economy is controlled by systems of corporate type, by holdings and by financial-industrial groups (FIGs). In addition, among all corporate systems in Ukraine about 62.5% are FIG.

It should be noted that Ukrainian legislation [3] has no interpretations of the bankruptcy of different types of corporations, including financial-industrial groups. However, recently a lot of cases of bankruptcy was brought, where the object of cases were exactly the members of the financial-industrial groups and holding companies, including such large groups in Ukraine as "Private", "Smart Holding", “Sintal’D”, “Rainford” etc., also a catastrophic crisis appeared in the global multibillion-dollar corporations such as "General Motors", "Lehman Brothers" and in many others.

Most corporations are private, non-government, but crashes of private organizations can lead to problems on a national scale too (falling GDP, reduction of the budget, increasing unemployment, psychological effects, etc.) because of the fact that this segment is a rod for the domestic economy. Similarly, the bankruptcy of a small subsidiary could lead to serious consequences for the national economy, if the estimation of the impact of financial crises in subsidiary on the financial condition of the corporation as a whole is not done in time.

Therefore, it is necessary to find and to implement the approaches to financial control of corporations, which are based on modern econometric methods and on modern informational technologies. These approaches should be used for identifying and for determining the factors influencing the threat of bankruptcy of both subsidiaries and of head companies of corporations, and for the forecasting their future values to estimate the financial condition of the company in future periods. This would serve as a signal that can indicate the urgent need to carry out crisis management at the enterprise.

4. Modelling the Threat Estimation of Forming Financial Crises in Corporate Systems

An effective tool for evaluating the threat of bankruptcy is econometric modelling. There is quite a large number of implemented models, which were generally used successfully for some period, among them there are models of Altman [2], Beaver [4], Taffler [1], Fulmer, etc. [7]. However, most of them are unfit to Ukrainian realities [8, 12], moreover, at the moment there are very few of researches about the formation of set of

models about estimation the influence of forming of financial crises in companies that are the parts of corporations, on bankruptcy of corporations as a whole. Usually the objects of research are individual enterprises that are segment of small and medium enterprises or corporate enterprises, but excluding their subsidiaries.

In addition, most existing approaches to assessing the susceptibility of the enterprise into bankruptcy are based on developing the models of "pattern recognition", i.e. those that refer the investigated company to exactly one class of crisis [8, 10, 11]. However, a company often is in transition from one phase of crisis to another, when it is impossible to accurately describe his financial condition. The solution to this problem is to use the models of neural networks and fuzzy logic, which are able to adapt to environmental changes, and the model would be effectively used for a long time [5]. The authors proposed to use the same method of neuro-fuzzy networks in modelling the threat estimation of corporate bankruptcy.

To achieve the aim of a comprehensive substantiated estimation of the threat of forming the financial crises in corporative systems, authors suggest using an approach that consists of the following modules:

1. Financial analysis of the corporation.
2. Models of assessment the impact of financial crises of the subsidiary on financial condition of the whole organization.
3. Models of the threat estimation of bankruptcy of corporation subsidiaries.
4. Models of forecasting the values of the financial performance of the main subsidiaries and of the shell company of the corporation.
5. Models of crisis management at the subsidiaries and at the corporation as a whole.

Here are the contents of the blocks of the proposed approach.

While implementing the first module the economic and political environment around the object, trends, historical features of object are under research. On the base of this data analysis and selection of the type of model of the threat estimation of bankruptcy are provided. Analysis of causal relationships performed based on econometric model, the first stage of construction of which is the justification for a system of indicators, which describes the efficiency of the company in the best way from all aspects. As it has been mentioned above, the authors propose to use neural-fuzzy methods of modelling. Therefore, the realization of the first module will allow estimating the overall financial condition of the corporation, determining the threat of forming a crisis and as a result, identifying the class of crisis. After that, it will be possible to assess the extent and possible consequences of further deepening of the revealed crisis, the likelihood and timing of the appearance of a situation of bankruptcy.

In the second module for the aim of development appropriate measures to prevent the threat of forming of financial crises in the future the main causes and dominant threats of the emergence and deepening crisis are identified. The content of module 2 is a combination of qualitative analysis and econometric modelling. First, it is necessary to analyze the whole nature of the relationship between the parent company and concrete subsidiaries as well as between these companies, to analyze how financial move between all parties of the corporation flows. The results of this analysis will be used in the model during the forming of linguistic terms and of rules of recognition of the strength of influence of subsidiary's financial condition on the threat of forming of financial crises in the entire corporation. After that, by using this model the estimation of a strength of influence will be calculated.

Thus, the implementation of module 2 allows to evaluate the impact of crises in subsidiaries on the threat of bankruptcy of the corporation as a whole and to determine which subsidiaries bear the possible causes of the financial crisis in the corporation. This, in turn,

will make it possible to make better-informed management decisions at the level of the parent company.

Module 3 consists of estimation the threat of the forming of the financial crisis and of identifying its class on subsidiary that have been identified as the dominant threat for the emergence of the crisis in the corporation as a whole at the previous module. The purpose of this module is the timely diagnosis of the forming of the financial crisis in the enterprise, the prevention of deepening and of emergence of the crisis in the corporation as a result of an unsatisfactory financial condition of the company (which is the dominant threat).

In the next module (forecasting) firstly it is necessary to substantiate the specification of predictive models. For different parameters a different type of model can be developed. The authors propose to use a modern method named "caterpillar". This free from the model method is designed to study the structure of time series, it combines the advantages of many other methods, including Fourier analysis and regression analysis [13]. In the process of implementation of the method one-dimensional series are converted into a multi-dimensional by using a procedure of one-parameter shift (hence the name - "caterpillar"), then received multi-dimensional trajectory is investigated by using principal components analysis (singular decomposition) and recovery (approximation) of the series of selected principal components

After receiving qualitative values of forecast in accordance with the relevant criteria of social and economic forecasting [9] predicted factors are substituted into the built in the first and in the second modules models.

Implementation of received predictive values for the parent company allows assessing the threat of the emergence of the financial crisis in the corporation in the coming period. And the use of predictive values for subsidiaries allows assessing and identifying the financial crisis in the future, and on the basis of the results from the module 2 (values of impact on the financial condition of the corporation) to assess the financial condition of the corporation after some time (because appearance of the crisis in the corporation because of the crisis in subsidiary enterprise appears with some lag). Thus, the threat of forming the financial crisis in corporation and, timeliness, of its bankruptcy will be estimated by several aspects.

Then the results of the threat estimation of the bankruptcy are analyzed, and the manager can make a conclusion about the development of crisis management of the investigated object, that is the last block of the suggested approach.

In the fifth module a detailed analysis of the crisis in the enterprise, complex diagnostics of the financial condition are carried out. After that the scheme of implementing the crisis management in the enterprise is developed, such as: a program of exiting out of the crisis, an implementation of program activities, evaluation of the results of anti-crisis measures, adjustment of development strategy, adjusted for the results of programs, and development of the methods for forecasting the future crisis situations.

5. Conclusion

The review clearly shows the necessity of development the methods of estimation the bankruptcy threat of corporations and the issues, which have to be solved in the researches. The proposed in paper approach and built models will allow to analyze the financial condition of both the subsidiary and the entire corporation adequately, to estimate the impact of financial crises in subsidiaries to the threat of bankruptcy of the corporation as a whole, to implement the necessary range of measures for its prevention and thus to improve the efficiency and reliability operation of enterprises of corporate type significantly.

That is why it can be considered as a promising area for future research.

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Perspectives of Ecotourism Development in Ukraine

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Abstract: The paper reviews current research approaches about ecotourism implementation in Ukraine based on world trends. It traces the prerequisites of ecotourism development in Ukrainian regions. To emphasize the perspectives of ecotourism extension one of the main natural resources was analyzed. Different opinions about warning against ecotourism development in the special protected areas were outlined. Many scientific studies about ecotourism potential were depicts in this paper. For this purpose a different evaluation methods were outlined. Special attention was paid to the research of scientists Z. You, W. Chen and L. Song. Promising directions for future research are outlined in this paper.

Keywords. Ecotourism, natural resources, evaluation process, protected areas, ecotourism potential.

1. Introduction

Nowadays we can observe the rapid increase in the tourists' awareness because of the importance of careful attitude to our nature. Because of the fact that understanding of the cultural and natural heritage fragility has become more and more important every year in Ukraine, the ecotourism market has been growing fast, and the question of more responsible travel has become more relevant. The current state of tourism industry in Ukraine clearly focuses on the export of tourism services. Therefore, the problems of increasing the number of importing of tourism services and provide services to the domestic tourists are needed to be solved. The modern situation, which has occurred over the last few years, produces the economic inability of most Ukrainian citizens to travel abroad. The development of socially and environmentally responsible tourism, especially in areas with significant natural resources, can make a great contribution to the competitiveness improvement not only in the domestic but also in the global tourism market. The relevance of the research is stipulated by current state of Ukrainian economy and world tourism trends.

The purpose of this report is to review the perspectives of ecotourism development in Ukraine in order to solve modern problems in national tourism market. The ultimate goal is to find the best approach to conduct a complex assessment of ecotourism potential based on different methods and experience of foreign scientists.

Unfortunately, the problem of analyzing the ecotourism potential are not investigated profoundly yet in Ukraine. However, various approaches to the determination of ecotourism potential were studied by such scientists as J. Reimer, O. Nevin, P. Lindsey, R. Monteros,

S.Spanou, M. Honey, J. Runge, R. Sharpley, You Z., Chen W., Song L. and etc. Despite this fact the issue of ecotourism is very urgent and is needed to be analyzed more accurate.

2. Prerequisites of ecotourism development

According to research which was made by the Association of Travel and Trade, Washington University and consulting firm Xola [1], it was found that in 2012, ecotourists spend approximately 28 billion US dollars. This research was repeated in 2013, and it was found that the growth rate of this sector would increase by 195% within two years [1]. Based on the study, which was conducted under the United Nation Environmental Programme (UNEP) [2], it was found that local enterprises earnings from providing ecotourism services are higher than from providing standard tourism services. Standard travel packages "all inclusive" usually provide only 20% of all income to local businesses, and the remaining 80% of income get airlines, hotels, and large tour operators. In contrast to such situation, ecotourism, can fill up local budgets by 95% more than ordinary mass tourism.

Therefore, relying on the foreign countries experience, which succeeded in ecotourism development. It can be said that the implementation of ecological tourism in Ukraine, can provide the great results in profit increase from tourism sphere. According to recent World Travel & Tourism Council [3] studies from 2005 to 2015, tourism has made about 8% contribution to the total Ukrainian GDP (Fig. 1).

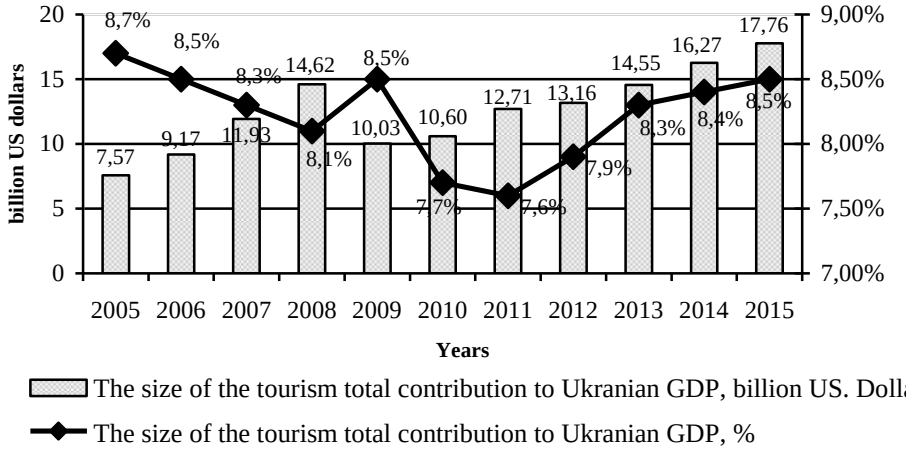

Fig. 1. The tourism contribution to Ukrainian GDP in 2005-2015 years

Note that since 2009 the amount of total contribution into the GDP from tourism has increased from year to year. It is necessary to pay attention to the fact that, despite the positive dynamics of tourism total contribution to GDP in Ukraine, we see that the modern understanding of the importance of implementation alternative types of tourism are still at the stage of inception. Therefore, here comes the need of further evaluation of the ecological tourism potential in Ukraine, because it gives an opportunity to analyze the prospective development not only economic but also social and environmental spheres in our regions.

Ukrainian scientists have developed a “Concept of sustainable development of Ukraine”, according to which the development of environmental protection is important not

only because of purely utilitarian needs of society in a healthy food, clean air, clean water and safe environment, but also because of the fact that nature conservation is a critical factor in the survival of mankind as a biological type [4]. The main aspects of achieving the goals of environmental protection in this concept are shown in Fig. 2.

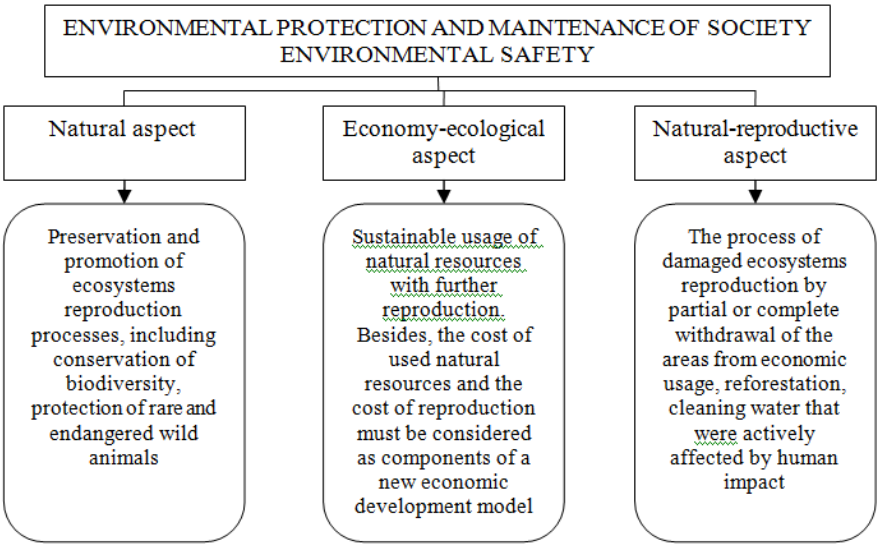

Fig.2. Scheme of logic determining of the main objectives of environmental protection content [4]

As it was mentioned in the "National Strategy of Regional Development for the period until 2020" [5], in period during January-May 2014 socio-economic development of most regions was characterized by such peculiarities as:

- decline in industrial production;
- reduction of investment resources;
- decline of exports;
- significant slowdown in real wages growth.

Consequently, in the "National Strategy of Regional Development for the period until 2020" stated that only by employment stimulating in rural areas, improving the legal framework of tourism and resorts and the creating the high quality tourism product based on sustainable use of tourism resources, we will be able to develop the identification of priority areas for tourism, to improve the current state of economy in Ukraine and to increase its competitiveness.

However, it must be taken into consideration that the events in 2014 actually stopped a number of tourist flows in such region, as the Crimea. Events, which are related to the conduct of anti-terrorist operation in Donetsk and Lugansk regions, and instability which spreads from these regions to other south-eastern region, keep people from traveling. The stabilization of the situation in the Donbass will help to revive the tourism sector.

Timely and adequate response to negative trends in socio-economic development and overcoming potential threats is a necessary condition for the creation of new opportunities for regional development and living standards improvement. Thus, the problem of environmental protection is very urgent in Ukraine. Taking into consideration the fact, that the process of ecotourism development don't need a great amount of investment and tourism market has been developed recently, it should be noted that ecotourism can become the solution to many financial problems. Therefore, it is necessary to overview the main ecotourism natural resource in order to understand the statistical base of the research.

3. Analysis of the ecotourism main natural resource base

One of the main resources for ecotourism development, which is almost impossible to make artificially, and their number is limited, are objects of natural reserve fund. Therefore, it should be clarified the meaning of the nature reserve fund. As scientists O. Kozlovsky and B. Borysiuk [6, p. 80] noted, in order to preserve natural complexes, unique natural objects having special ecological, historical and aesthetic value, some areas were granted the status of protected areas. The presence of a significant number of them in Ukraine is an absolute advantage (Fig. 3).

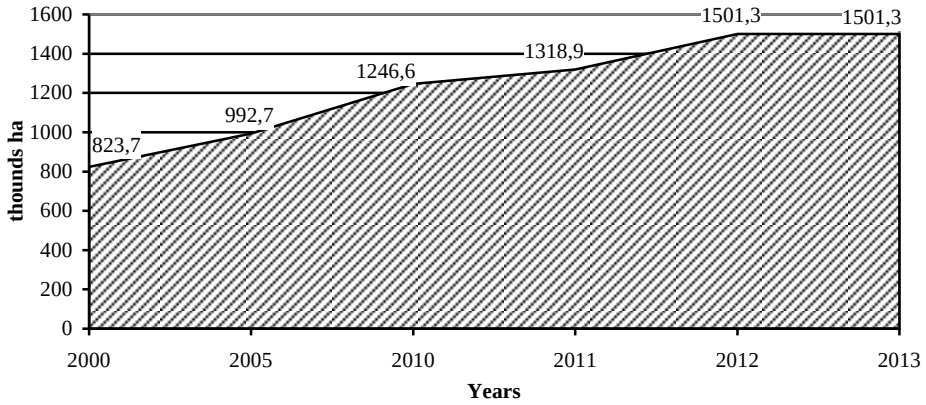

Fig. 3. The land area of protected areas in Ukraine [7, p. 267]

After analyzing the dynamics of changes in land area of the nature reserve fund in Ukraine can be reckon that the ecotourism potential in Ukraine is growing every year because, according to the Statistical Yearbook "Regions of Ukraine" one of the main environmental ecotourism resources has positive dynamics. The abovementioned dynamics play an important role in the current development of Ukrainian economy, so that the ecotourism implementation could become an alternative way to improve the economy of those regions, which are in depressed stage.

However, the scientist V. Boreyko [8, p. 35] warns against the ecotourism development in the protected areas. To emphasize his opinion the scientist refers on the following arguments. Firstly, he believes that local people do not like when tourists visit their territory, because they bring with them heterogeneous invasion. As a result, they may lose their cultural values, their life will become commercialized. The scientist believes that

most of the profits from tourism do not reach the local people, only commercial organizations. However, the authors of this report do not agree with V. Boreyko statements. Scientist identifies the notion of "mass" and "ecological" tourism. He does not take into consideration that all the basic principles of ecotourism, which are directed to nature conservation, environmental education of people, protection of the socio-cultural environment, local people participation in tourism business. That is why it is very important to find the most effective ways to evaluate ecotourism potential in order to find out whether this or that region is the best ecotourism destination.

4. Scientific methods of ecotourism evaluation

Although many ecotourism studies were made in the last years, most of them only try to assess the social benefits or the impacts on rural communities of ecotourism projects [9] or the impacts those projects have on different species [10,11,12]. Very few combine biological, ecological, and cultural data [13], and to achieve the sustainable tourism there is a need to integrate subjects of different disciplines, such as economy, environment, and social area [14, 15]. So, modern scientist use different methodology approaches in ecotourism assessment process, such as: survey, mapping method, integrated assessment and others. The disadvantage of the majority of which are subjective opinion and as the result inadequate information usage.

For example, M. Honey [16] evaluates ecotourism considering the economic and cultural effects of its implementation for local people. The scientist considers initial and final level of local people's income, their cultural identity, etc., and then compares these figures. Public authorities provide the information used in this assessment. The drawback of this assessment is the lack of indicators, which depict the influence of ecotourism implementation. Moreover, in the above assessment there is no educational aspect, which plays an equally important role in the development of ecological tourism.

Another scientist G. Runge [17] used mapping methods to assess the ecotourism potential. They are the method of initial fields by Bartkovskym and bonitet method [17, p.191]. The essence of this assessment is that the first stage of the method is conducted on a topographic map of the region. In the second stage, availability of natural and manufactured social and recreational resources and their concentration in this area are estimated. The indicators, which are used, must be divided into classes, each of which has an equal number of points. In the next step, all values divided into three equal intervals, which identifies ecotourism attractiveness level [20]: low, medium or high. As the result of this assessment the special map with sectors can be made with, which could be identified regions of potential distribution of ecological tourism. We believe that in order to assess the potential of ecotourism the usage of cartographic method could be effective, but most of the information used in the above method, not in the public domain. In addition, the method becomes more complex because of the fact that the result can differ depending on the choice of size, type of map, etc.

Consequently, attempts of most scientists to assess the ecotourism ended only in general measures. Only researches of following scientists helped us to identify the indicators for assessing the ecotourism potential. R. Sharpley [18], for example, estimated the ecotourism potential through socio-survey. After this, the scientist developed a hierarchy of needs, preferred for ecological rest. Although the responders were experts in economics, tourism, environment, etc., subjective assessment should be taken into account.

Another good example is the research of scientists Z. You, W. Chen and L. Song [19, p.235] while studying the world geological park in Xinwen. Their research established evaluation index system according to the sustainable development of ecological tourism evaluation method, and with scientific, integrity, operability, leading, level-oriented, dynamic, stability, and focus for principle. In accordance with the "society – economy - environment" three-component model of sustainable development, the scientists propose three-component framework model for evaluation index system of eco-tourism sustainable development (Fig. 4, Fig. 5).

According to the definition of ecotourism and the evaluation index system of frame model the put forward the sustainable development of ecological tourism evaluation index system; it is 37 indexes including the environmental aspect, economic aspect and social aspect. Based on the judgment of the importance degree of each indicator from experts, we establish the matrix, process comparison and marking hierarchically. Based on the analytic hierarchy process and collecting the judgment of experts, then the 11-judgment matrix is constructed. According to the importance of various factors, they will be divided into five categories: 1, 3,5,7,9. 1 just means two factors are equally important; 3 means one factor is an important than another; 5 means more important, 7 means very important; and 9 means absolutely important.

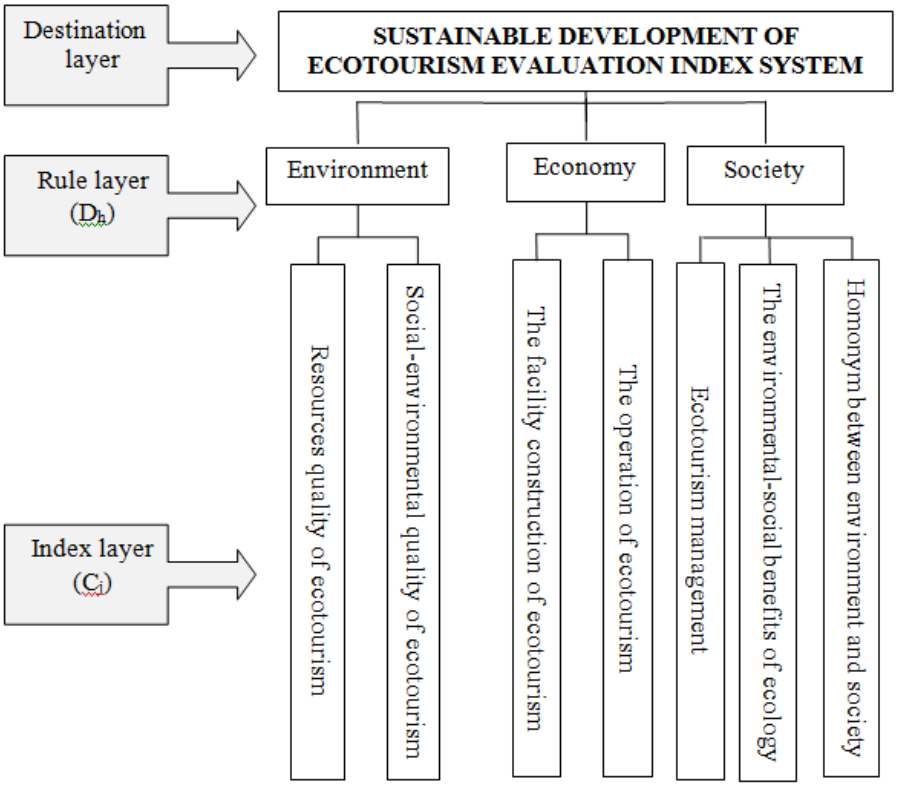

Fig. 4. Sustainable Development of Ecotourism total weight of evaluation index system of order (part 1)

According to the expert advice, each index has selected experts scoring average arithmetic; calculate evaluation score by using multi-objective linear weighted function method.

Adopt multi-objective linear weighted function method to establish ecological tourism sustainable development evaluation model.

$$S = \sum^{p}_{h=1}[\sum^{m}_{j=1}(\sum^{n}_{i=1}A_i * B_i) * C_j] * D_h \quad (1)$$

To sum up, using analytic hierarchy process, expert evaluation method, the multi-objective linear weighted function method and relevant data, establishing the sustainable development of ecological tourism evaluation index system and evaluation model. Then the index system and evaluation model can be used to evaluate the level of the sustainable development of area's ecological tourism in Ukraine, and it belongs to the preparation stage in the sustainable development of ecological tourism.

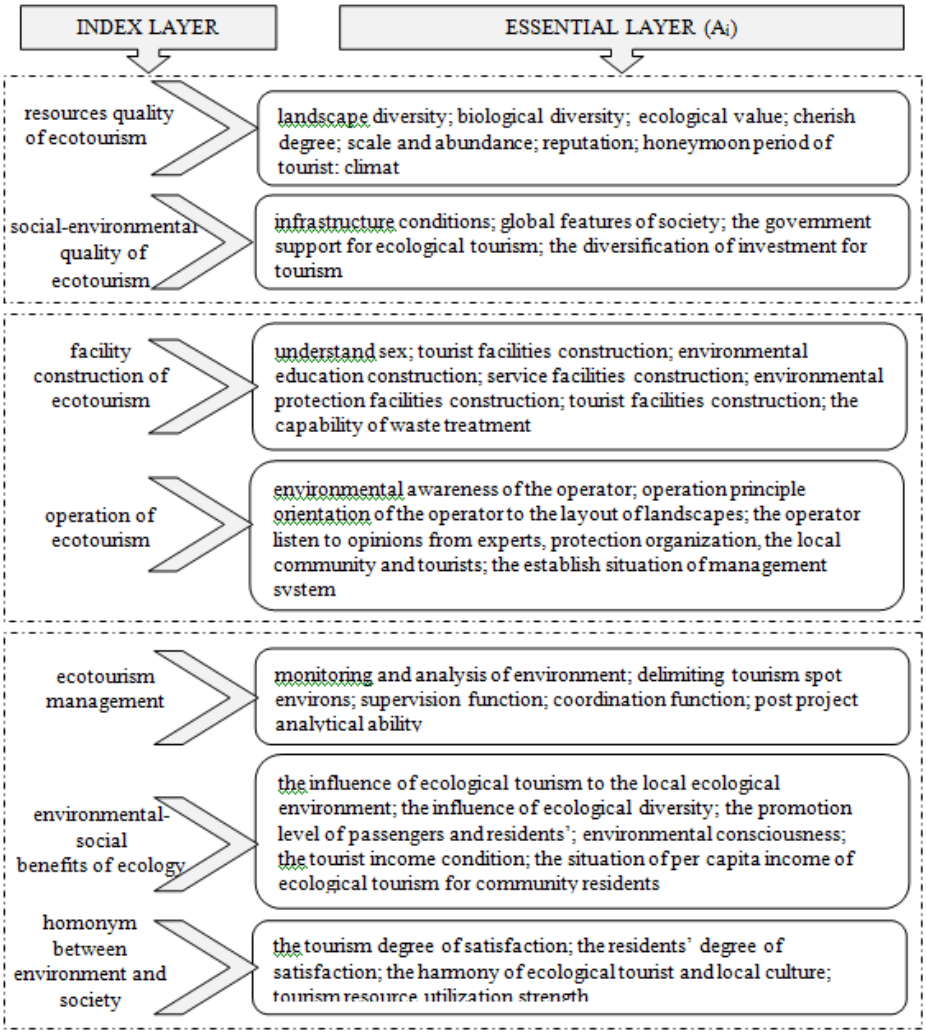

Fig. 4. Sustainable Development of Ecotourism total weight of evaluation index system of order (part 2)

5. Conclusion

Ecological tourism either in theory or in practice is confused. Although the ecological tourism accounts for only a small part of tourism industry, but it is very important especially in the environmentally fragile areas and the culture sensitive areas, and in the ecotourism development process, there is still a degree of unsustainable. So the ecotourism scenic spot to evaluate becomes necessary. Especially this issue is very important in Ukraine, because it has great perspectives to implement ecotourism.

For these reasons the described methods of ecotourism evaluation is a promising area for future research.

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Small and Medium Sized Enterprises Development Strategies in the Context of the Global Financial Crisis

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Abstract: Small and medium sized enterprises (SMEs) has become one of the most important sectors of economy in many countries over the last decades. SMEs are characterized by flexibility, low cost of management, ability to foster scientific and technical progress, innovation, and the social role of this sector. At the same time, SMEs are characterized by weaknesses like excessive dependence on the external environment, lack of resources and difficulties in terms of marketing their production. It is obvious that the global financial crisis that broke out at the end of the first decade of this century, had a negative impact on the situation in the area of entrepreneurship, but particularly affected small business. Hence, the need to address the crisis situation and ability of small business to adapt to it based on international experience.

Keywords: small and medium sized enterprises; sources of finance; financial crisis.

1. Introduction

SMEs sector plays an important role in the development of Moldovan economy. During the period of market relations emergence and development, the role of SMEs was determined not only by the economic structure created, with a significant share of activities, preferred by small businesses but also by availability of labor that was unemployed, unused equipment and secondary raw materials - everything that could be used by small business.

The SME sector in the Republic of Moldova has grown, in terms of both quality and quantity over the 20 years. The global financial and economic crisis has had a negative impact on SMEs. The study of crisis impact on this sector and certain groups of SMEs enables us to consider more specifically, their capabilities and limitations in an extremely hostile environment and argue the need to improve regulatory policies affecting them. In Moldova, SMEs account for a significant share in the total number of economic operators, which provide employment and modest incomes, and saturate the market with goods and participate in the formation of GDP.

2. Current Economic Crisis and Its Impact on SMEs Sector

According to the Encyclopedic Dictionary of Economics and Law, *the financial crisis* (at macro level) is a profound disturbance of a state's financial system, accompanied by inflation, volatility of securities rates, manifested in a sharp discrepancy between budget revenues and expenses, instability and falling exchange rate of the national currency, mutual non-payments by economic entities, inconsistency of money supply in circulation and requirements of the monetary circulation law. Thus, the financial crisis is a rupture in cash flows resulting in a number of problems.

The financial crisis includes the following phenomena:

- collapse in exchange rates;
- a sharp rise in interest rates;
- mass withdrawals by banks of their deposits from other financial institutions, limitation and cessation of cash withdrawal from accounts (banking crisis);
- disruption of normal payments system between companies through financial instruments (payment crisis);
- monetary crisis;
- debt crisis.

Although the crisis has affected businesses of all sizes, this study focuses on small and medium-sized enterprises, which contribute significantly to production and employment in developed and developing countries. The state's ability to limit the scope of the liquidation of these enterprises and making redundant their workers will greatly help restore both global economy and economies of individual countries. Analysis of small business specificity enables to identify the problems of small business, which become more serious during financial and economic crises:

- high degree of instability of the situation on the market and associated increased risk of non-payments due to declining demand for goods and services both by consumers and by counterparties;
- difficulties in borrowing additional funds and obtaining loans as a result of increased cost and reduced lending to the real sector by banks;
- decrease in investment and, consequently, inability to purchase necessary equipment, increase in fixed capital wear;
- lack of working capital for the purchase of raw materials, payroll, etc.;
- payment of taxes becomes problematic, which requires support related to tax relief, including tax incentives, reducing the tax burden, simplifying tax systems;
- payment of interest on loans and refunding loans becomes impossible due to lower demand for products, decrease in profits and profitability of small business;
- increase in the administrative burden on business, increase in the number of inspections by the fire inspection, sanitary-epidemiological service, licensing chamber, tax inspectorate, departments of internal affairs, etc.;
- lack of free access to loans of state and municipal funds to support small businesses due to the small size of their financial assets and limited budgetary financing of these funds.

Lack of financial resources is one of the most important problems of SMEs in times of crisis. In addition, experts say that, in conditions of crisis, only 10-15% of small businesses can obtain bank loans due to excessive demands by creditors to such enterprises. Thus, banks agree to consider the issue of providing a loan only if the small enterprise has at least one year of successful activity (rarely 6 months), does not have any tax debt, has a positive balance and, most importantly, possesses property, which can be used as collateral. Furthermore, banks usually require 100% collateral whereas the assets of most SMEs have significantly depreciated in conditions of crisis. The system of state support in the form of guarantees covering part of the loan is only under discussion and development. Meanwhile, the interest rate stays rather high. Moreover, it is not profitable for banks to give out small loans, which are mainly needed for small enterprises. Costs for analyzing the activity of a potentially large borrower and small business are almost the same, while bank's profit will be significantly different. In addition, measures of financial support to small businesses, which are widely spread abroad, such as microfinance, financial leasing, and credit cooperatives have not been developed in our country.

The state has recently allocated some funds to support small business, but they are generally transferred to banks, foundations, associations, and often simply do not reach small business. Meanwhile, for instance, in countries with developed market economies prevail tendencies such as the gradual transfer of state support and its costs to the regional and local level, reduction in direct financial assistance and the prevalence of so-called "soft" indirect methods of support, including increased use of tax incentives, removing administrative barriers, providing consulting and information services, etc. Some experts, especially in the banking sector, believe that in conditions of crisis it is worthwhile supporting only effectively operating small enterprises. The logic of this approach is that the overall objective of both business and government is to support efficient business that pays taxes, creates jobs, and contributes to the budgets of all levels. Thereby is maintained the principle that effective business will grow while inefficient will die away, irrespective of state support provided.

Foreign experience shows that the approach to support only efficient enterprises is sometimes possible, but only under stably operating economy, which has been stable for a long period of time. In present day conditions in Moldova, supporting only effective SMEs can completely ruin the small business sector.

We have to admit that with the deepening of the global financial crisis there are often discussions about the appropriateness of providing financial support for all small and medium-sized enterprises. Given the experience of industrialized countries, participants in the forum emphasized that they support the entire small businesses in addressing the problems of access to funding sources, making use of different approaches (grants, loans, credits, tax breaks, etc.). In many countries, there are special reserves for investment in fixed assets, allocation of grants to small business or provision of fiscal incentives for investments, soft loans or grants. In some countries (Belgium, France and others) small businesses benefit from risk capital granted in the most favorable terms in times of crisis, in other (United Kingdom, the Netherlands and others), they enjoy guarantees for loans. In addition, in all industrially developed countries providing financial support to small and medium-sized enterprises, when it is not available from other sources, is a key responsibility of organizations engaged in supporting SMEs.

However, it should be noted that the plans developed to support small businesses target the sector as a whole. They do not take into account social and organizational differences across SMEs sector. For instance, the support for enterprises established by representatives of socially vulnerable groups of population (disabled, women, youth), small enterprises exporting their production and innovative businesses has to be more direct and targeted in conditions of crisis. Such enterprises should be granted appropriate tax breaks, or soft loans for investment in fixed assets, modernization of equipment, accelerated depreciation, etc. The development of support measures must take into account the specific features of Moldovan small business, which make it rather different from foreign business. These are several of them:

- combination of several areas of activity by small enterprises in contrast to the narrow specialization of foreign small enterprises;
- combination of employees' significant innovation potential with the general low level of technical equipment and facilities of SMEs in contrast to an opposite picture of foreign firms;
- availability of high levels of general and vocational education and training of small enterprises managers coupled with absence or lack of management and business activity experience under market conditions, and especially in crisis situations;

- prompt adaptability of small enterprises to difficult economic environment in the conditions of disorganized system of government, lack of a permanent, thorough and accurate information on the market state, dynamics and conditions;
- almost complete lack of cooperation with big business, other small and medium-sized enterprises.

3. Conclusion

While all media are full of news on losses and layoffs in big companies, many micro, small and medium-sized enterprises have been severely affected by the global economic recession of 2008-2009 as well. The main difficulties faced by such enterprises are weak demand and tight lending conditions. Measures to stimulate demand can benefit all businesses whereas measures to ensure easier access to finance should target mainly small enterprises. It seems that cooperatives (cooperative enterprises) are the least affected by crisis. Given the current problems of small business development, we can come to the conclusion that further development and improvement of the whole system of state support to small business is becoming a key factor for its successful development.

The importance of small business development involves a comprehensive solution of the following problems:

- activity coordination of all structures of the state support for small business, including at the regional level;
- providing financial support for small business, appropriate to its needs in terms of affordability, volume and timing, which would be achievable by combining efforts of state, banking sector and small businesses alike;
- implementation of a selective approach in provision of state support for small businesses depending on its area of activity by applying appropriate tax, financial measures and public contract system as a priority;
- creation of "growth poles" on the basis of free economic zones, industrial and infrastructure

World experience shows that politically open societies, which respect the rules of law, protect property rights and ensure market allocation of resources, develop faster and are more effective than societies that limit economic and personal freedoms. To protect yourself from the financial crisis, it is necessary first of all to change your mentality and attitude towards money. Since the essence of the financial crisis is that the money leaves some people and comes to others, you just need to do your best in order to join those to whom the money comes. Financial crisis is a kind of turning point, which means that when it arises one should not think in stereotypes. They are useless in this situation. At crucial moments one has to think in new ways, give up traditional solutions and look for original and new ways of solving problems, as the traditional ones are good for nothing. To survive the crisis, everyone needs to break their stereotypes and think in new ways. The financial crisis, by definition, involves change in traditional values, therefore those who will continue to live "as usual" are bound to fail whereas those willing and able to find new, relevant principles of life, on the contrary, will be able to improve their financial condition.

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Improving Information System of the University

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Abstract: This article focuses on the main issues related to the improvement of the University information system, and on those of increasing efficiency due to the creation of the National Federation of identification and authentication for research and educational centers.

Keywords: Information systems, university, NREN, identity federations, services

1. Introduction

International practice shows that the development of information infrastructure communication positively influences the development of modern society, helping to expand opportunities for access to resources for public information in all the areas of human development: e-government, e-business, e-commerce, e-education, e-cultural, e-medicine, etc., as well as employment level by creating new jobs. At present, information and communication technologies (ICTs) have become a dominant factor in social and economic activity. The effective use of information resources of the organization is one of the main success factors.

2. Aspects of Improving Information Systems in the University

The Information System (IS) is in itself a set of interrelated components that collect and process data, store and disseminate information to support the organization's activities. In the same context, what we call using electronic elements and means is the information system itself. It is difficult to distinguish the impact of computerization and academics, is a complex, which is why you humans use the term with a broader meaning of SI.

Modern ISs are characterized by a set of key properties that significantly affect information security and impose additional requirements for information protection system, including:

- a complex system composed of several subsystems, with multiple interdependent multifunctional ramifications, which is in a close relationship with the external environment;
- existence of complex hierarchical organizational and technological structures of management;
- availability of similar units, which have the same functions with a similar organizational structure and a similar closed circuit of documents;
- large number of users and a higher diversity of personnel, simultaneously accessing information resources;

- existence of confidential information system security which is required to be ensured under the legislation. [2]

All the above-mentioned are present within a university SI. To determine what steps may be undertaken to modernize IS, beginning with its information part, it is desirable to understand the existing problems in the IS.

The problems related to IS can be classified considering the components of IS:

- organizational - related to the organization of the institution, including the data on the activity of IS;
- Human resources - the main resource within a university, teaching staff that should be maintained, stimulated and checked to ensure a certain level of work performed;
- Methods and techniques of IS design (including a computer-based component) – ensure the receipt of the IS design that serves as a basis for implementing a performant IS based on technologies and modern principles (current, innovative, etc.).
- software used - program layout (applications, software) used in IS;
- hardware used - technical aspect (hardware) of IS.

Before modernizing IS, it is necessary to carry out the analysis of the current system and the realization of documentation relate to IS modernization design. It is important that the analysis of the current system should not be restricted to a survey of IT components of IS: software and hardware. A wrong analysis, which will be reduced to any IS particular component, will not guarantee an IS improvement, but will only increase costs and add new problems to the existing ones.

Activities related to the creation of IS modernization project should take into account the existing situation in the organization (at all levels), including the creation of a working group that will deal with IS modernization. The existence of an architect in the division of IS design within the organization would ensure stability for the system development and organization. Of course, it is necessary to understand clearly what resources can be used for this upgrade in order to define clearly the goals and tasks related to IS, and determine the issues related to tactics and strategy. In this project, the following are necessary to be analyzed and described:

- Business processes.
- The flow of data within FIS and type (category) of data to be transported.
- To be well-defined the IS topology necessary connections for transporting data (between the customer and data supplier).
- Specifications for transporting data, including protocol and format to be used. In this case, the use of RFC standards and recommendations are welcome.
- Define and implement security policy within the organization (first, the concept, with which it is possible to work and cleared collaborators).
- Define the levels of access to information and roles within the IS, which may be identical or not to the organizational structure. As part of security policy, the role and level of access to data can prevent the emergence of dilemmas related to other levels.
- IS integration with external systems or providing access to some public data that are generated by the IS subsystems.

3. Implementation of Federal Services and Nodernization of the University Information System

We also need to understand the level of IS modernization and take into account

external connections, in case of the flow of data, for example, when implementing federation services in Moldova [1].

- In May 2014, within the National Educational Scientific Network a project was initiated to create the National Federative Resources (RFN), which subsequently to be extended to eduGain [3]. The purpose of federation is the grouping of institutions for facilitating resource sharing. For this a defined certain steps were developed that must be taken [1]:
- Drafting and signing of a cooperation agreement as well as of service performance policies.
- Implementation and testing of the Authentication and Authorization Infrastructure (AAI) within national scientific network.
- Creating and proposing of a set of services; yet, after joining the international resources of those within the eduGain.

The agreement stipulates the contributions of each member to RFN development and membership benefits of the cooperation agreement. To provide clarity in the process of providing RFN services and management certain documents are developed to enforce its policies.

The created infrastructure will consist of two levels: related to local and National Research Education Network (NREN). At the local level, a service and an item of Identity Management (IDM), as well as a nationwide service will be created. In relation to these processes we can distinguish two types of suppliers:

- Identity Provider (IDP) which provides the ability to verify the identity of service providers. Identity providers stay connected with IDM, other national IDP from centers of research and education, as well as Authorized Service Provider.
- Service Provider for IS end-users. In order to be able to interact with the IDP, first they must be authorized.

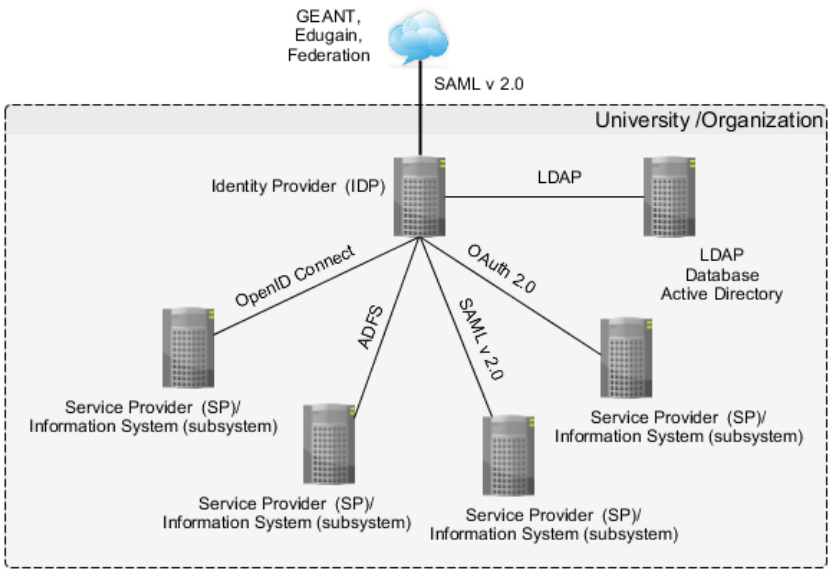

Fig. Protocols used for federative infrastructure. Source: [1]

As the basic protocol within eduGain, SAML2 is used [4], and after a series of tests as application that performs SAML2protocol, the package simplesamlphp was chosen [5].

The figure below shows the schematic principle of interaction of components AAI: IDP and SP and basic protocols that are currently proposed for use.

When using services and federative principles, there are several factors that must be taken into account and creation of the infrastructure is just one of a whole set. We have requirements for standards in this area, and a number of recommendations, which are useful to keep in mind to reduce implementation costs of services for all parties concerned. Access to federation services is not only expansion of services offered within the IS, but also appearance of a series of information security problems and adjustment of the existing legislative framework on data protection and sharing with them. At the same time, some adjustments are necessary not only to information component, but also to the organizational one, the development of a series of guidance and seminars to explain the use of new services offered, and new risks that can occur. There is an increase in the importance of all components adjustment and of the provision verification of the university security policy. There is a need to clarify how and on what basis a University IS interaction is possible, not only for local subsystems and systems but also for third party applications.

4. Conclusion

In modernizing IS we must consider not only its computer side, but also the remaining components, for without teacher training, or without a proper organization of work, it is impossible to achieve such a project. This modernization process should not become chaotic depending on factors or personalities, but well planned and documented. Offering some possibilities of continuous IS evolution with minimum resources, outlining a vision at the strategic and tactical level must become a basic working principle for SI.

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Return on Security Investment: An Effective Way to Eliminate Risks

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Abstract: Technology has become the central nervous system of a business, supporting the flow of information that drives each business process from product development to sales. The role of technology in peoples' personal lives has expanded dramatically, too, and the boundaries between business and personal use of technology are blurring. Many organizations failed to survive the information technology revolution. Many more will not survive the current wave of technology-driven innovation—and the threats and vulnerabilities that come with it.

Keywords. Security, risk, investments, threats, assessment, evaluation, information, security investments.

1. Introduction

Nowadays information technologies are actively reaching all scopes of a person's activity, noticeably simplifying his life. In the meantime, they also bring new threats to information technologies. In order to avoid these threats, a right approach in control risks might help during this informational confrontation.

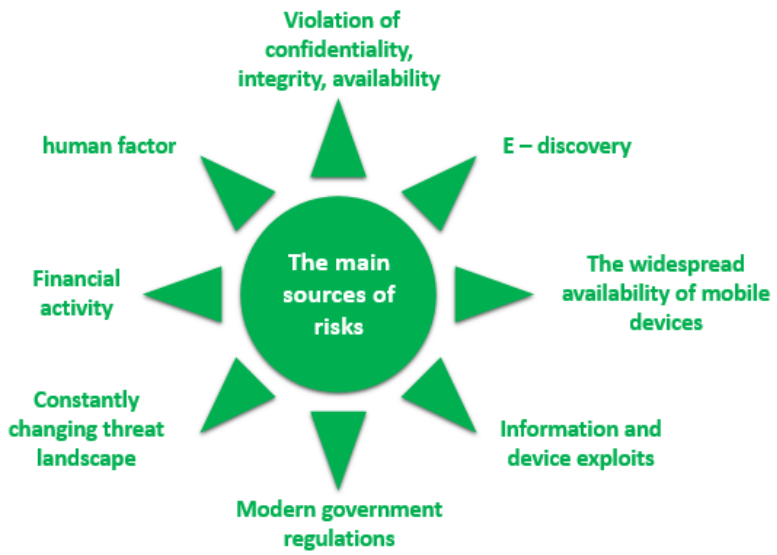

Fig. 1. The main sources of risks [2].

2. Risk Evaluation and Assessment

Quantitative value of risk linked with the accomplishment of specific security threat can be expressed through simple mathematical formula [3]:

$$R = P * L \quad (1)$$

- R – Probability of successful threat realization using organization's vulnerability and creating damage to it;
- P – Probability of threat realization;
- L – In case of threat realization, there is a probability that security would be breached and the organization will sustain a loss.

It has to be taken into consideration that the risk itself represents a combination of a probable negative event, its frequency and consequences (such as material damage, time, and prestige). On the assumption of these data the method "5T's & 5C's" can be used, which suggests ten basic means of managing the information security risks.

Table 1. 5T's & 5C's model

Terminate – elimination of risk. In case of high risk probability and its reduction price.	**Control –** usage of different forms of control in order to eliminate risk
Transfer – transfer of rights to the third party to remove risk	**Contingencies** – formation of reserve data and repositories in case the risk has a big influence, but small probability
Take more – disregarding of risk in order to get a bigger income, resulting in growth of investments related to this risk	**Communicate** – if controls do not let to lower the level of risk to the needed one, then all the personnel has to be warned about such risk and its inevitability
Tolerate – given the low probability of risk and its impact, it can just be ignored and no measures should be taken	**Check compliance** – compatibility risk check and controls applicable to them
Tell someone – when the influence and probability of risk are arguable, then no measures should be taken; hence, delegated to the third parties	**Commission research** – carrying of detailed analysis of existing risks and controls that are necessary to apply

3. Definition of ROI and ROSI

At present, the choice of risk management approaches is limited by existing techniques, which are continuously improving. The main objective of information security

professionals is the development of these techniques, performance indicators and analysis of the investments effectiveness. It is very important to understand the direct relationship between risk management and investment effectiveness. Ignoring this fact leads to undesirable incidents of information security, and as a consequence the loss of material resources and reputation.

Return on investment (**ROI**) is the benefit to the investor resulting from an investment of some resource. A high ROI means the investment gains compare favorably to investment cost. As a performance measure, ROI is used to evaluate the efficiency of an investment or to compare the efficiency of a number of different investments. In purely economic terms, it is one way of considering profits in relation to capital invested.

ROI is frequently used to compare alternative investment strategies. For example, a company might use ROI as a factor when deciding whether to invest in developing a new technology or extend the capabilities of their existing technology.

$$\text{ROI} = \frac{Expected\ Returns - Cost\ of\ Investment}{Cost\ of\ Investment} \quad (2)$$

To calculate ROI, the cost of a purchase is weighed against the expected returns over the life of the item.

An overly simplistic example: if a new production facility will cost $1M and is expected to bring in $5M over the course of three years, the ROI for the three-year period is 400% (4x the initial investment of net earnings). A simple equation for calculating the Return on Investment for a security investment (ROSI) is as follows [6]:

$$\text{ROSI} = \frac{(Risk\ Exposure * \%Risk\ Mitigated) - Solution\ Cost}{Solution\ Cost} \quad (3)$$

4. ROSI Assessment Model

Is there any point to calculating ROSI if the underlying data is inaccurate? Apparently so, since some industries have been successfully using inaccurate ROI metrics for decades. The advertising industry is one such example. Ads are priced based on the number of potential viewers, which is often extrapolated from circulation data and demographics. The ad buyers assume that the true number of ad viewers is directly correlated to the number of potential viewers; if the viewer base doubles, roughly twice as many people will probably see the ad. Therefore, even though they may never know the true number of viewers, ad buyers can nonetheless make informed purchasing decisions based on other more reliable measurements. If the method for determining ROSI produces repeatable and consistent results, ROSI can serve as a useful tool for comparing security solutions based on relative value. In the absence of pure accuracy, an alternate approach is to find consistent measurements for the ROSI factors that return comparably meaningful results. This task is much easier, and breaks through the barrier of accuracy that has kept ROSI in the domain of academic curiosity [6].

It is necessary to analyze the source factors of Return on Security Investment efficiency:

- reducing risks within the framework of the threat model;

- increasing the information security processes efficiency (policy choices, administration).

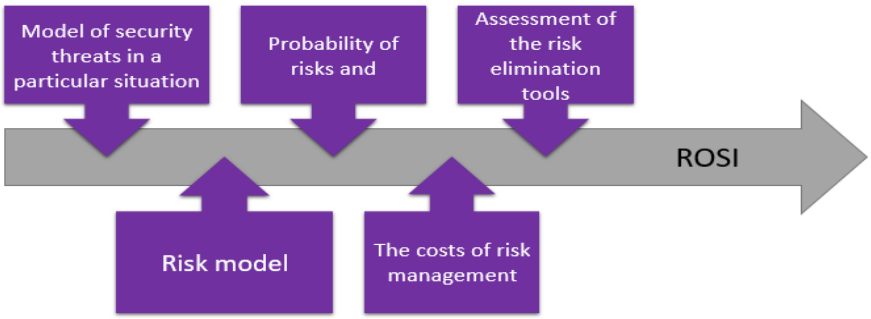

Fig. 2. ROSI assessment model based on threat and risk management Source: http://habrahabr.ru/company/securitycode/blog/136172/

5. Conclusion

Currently, the return on investment calculations in information security sphere became very difficult because of "avalanche-like threats growth, in both quantitative and qualitative terms. Therefore, the process of investment must comply with modern safety standards (ISO / IEC 27000 family, ISO 9000 family, ISO / IEC 24762: 2008, NIST, etc.) and has to be based on the known and available data, especially on threat and vulnerability statistics. ROSI Calculation includes modeling process which requires large amounts of diverse information. This information should be characterized not only by the various activities of the organization itself, but also by the information security system. In addition, it is necessary to introduce a system of independent risk management and ROSI management education system.

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Problems of Complex Software Integration in Existing Informational System

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Abstract: The paper reviews integration problems of complex software in existing informational system before User Acceptance Testing. This complicated process has significant duration that needs involving of financial, technical, time and personal resources. Three types of problems are reviewed: organizational, technical, program.

Keywords: Software integration, user acceptance testing, technical problems, organizational problems, program problems, technical documentation, management of complex software, informational support.

1. Introduction

Development of software products that cover complex business solutions – is a process that need using financial, time and human resources. Necessity of permanent monitoring, regulation of system status and component modification bring to automation of current processes.

For effective building of high-quality informational systems, very often is resorted to the implementation of ready-made software packages. These software solutions systematize and summarize the existing business processes and software used in the current system. Such solution significantly speeds up and simplifies automation of informational processes.

Nowadays the question of testing ready-made software solutions has not been studded carefully and has not been described in the literature, but we consider that this question requires attention. Preparing software for adaptation to a new environment and preparing for testing – is a long-term process and over the period of preparation stage appear a number of different problems:

- Organizational;
- Program;
- Technical.

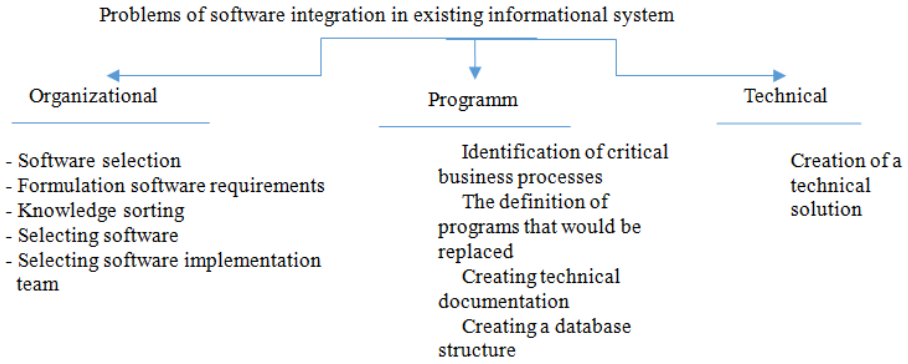
Solving of these problems requires the involvement of software engineers, project managers, business analyst and large-minded testers with depth knowledge about functioning of the current informational system.

On scheme 1 you can see main problems of software integration in existing informational system.

Partially testing of complex software is similar to the process of acceptance testing.

In the book "Software Testing - Basic Course" Svyatoslav Kulikov wrote: "acceptance testing – is a formalized testing, has a special purpose to check the application from the point of view of end-user / customer and to take a decision whether to accept the

application or not". We agree with his point of view, but it means that the end-user team will not have experienced testers who is able to organize the testing process. Based on our practice we can say that test results are accepted by software manufacturer, but for the customer future application using can result many problems.



Scheme 1. "Main problems of software integration in existing informational system"

Due to the fact that the testing phases are not planned and are not defined clear objectives of each testing cycle, users simply use the software product as it will happen in their daily work and they miss errors, which may occur in less standard cases. Also there can be missed some functionalities. Fixing bugs after software implementation is an expensive process. That is why, in order to avoid such problems, we propose to organize and plan acceptance-testing process, but in this case, it takes a completely different form.

The new process becomes complicated, more complex, and thus more expensive, but the price does not exceed the cost of correcting errors after the acceptance tests and completion of the project.

The most specific problems that appears during implementation and testing organization and integration of complex software products are described further in this paper.

2. Organizational Problems

If you have a financial and time resources can solve almost any hardware and software problems, but often the organizational issues can be a major obstacle for introduction of a new software product.

The first problem that appears on customer's way - is the problem of selecting the desired product in the software market. In connection with this, the following questions appear:

- One of the main reasons of problems in the integration of complex programs are organizational defects in determining the requirements for the software product. Errors and defects of this type arise due to the lack of purposes and functions understanding by the team of specialists, as well as due to the lack of a good organization of step-by-step control of crating requirements. These are complemented by the leaders neglect of organizing the whole process and leads to a serious underestimation of the defect complexity and their identification and elimination. To reduce this type of mass errors, there must be leaders - project managers, business-

analysts, quality engineers, capable to control and configure requirements management, to control changes and to control versions development and components of the complex programs.

- Also, it is necessary to order knowledge in the business area that will be automated and decide exactly what functionality should be included in the distributable software product. The solution to this problem in the responsibility of the major business users of the current system. Usually they are - head of the department, and the most active users of the information system. Also, when the integration of a new product is developed, it is important to determine what data will be introduced manually into one system and transported from another. Application can also export data to another connected system. Thereby to the question of ordering knowledge is added the question of data definition for exporting and importing to/from the new system. These requirements must resolved by the new implemented software product.
- Searching on the market of existing software systems that can meet the requirements of the internal system and has ability to cover the maximum amount of current processes. Depending on the complexity of the system to be automated, this problem is solved easier or harder. However, there are not so many complex software products on the market, so the scope is to compare the functionality of the software package found with the functionality of the existing information system.
- The last but not the least – is the selection of the team that can collaborate with internal team of experts involved in the implementation of software. Thus co-operation of the two teams must be most effective. Although many rules of cooperation are mentioned in provisions of the contract, we must not forget about the subjective factors influencing the quality of cooperation. In many cases, the supplier must be searched not only on the local markets, but also on the international. So appears the necessity to find a team with which the customer will "speak the same language". Later, during working process and during solving problems common understanding of the problem is very important in its solution. The slightest difference in understanding can lead to serious disagreements, improper design, and configuration software.

Management of major projects – is a process that involves problem definition, planning, requirements preparation, selection and organization of experts, monitoring and evaluation of the work and control of used resources. This process includes the involvement of professionals-executors of various kinds of activities from different departments, different qualifications, contractors and subcontractors. The problem of organizing their activities in the way when all team is working as a unique mechanism is a project manager's responsibility. This problem is one of the most complex and important. Solving of organizational problem provided the conceptual integrity of the system and the high quality of the decisions of its main functions and objectives.

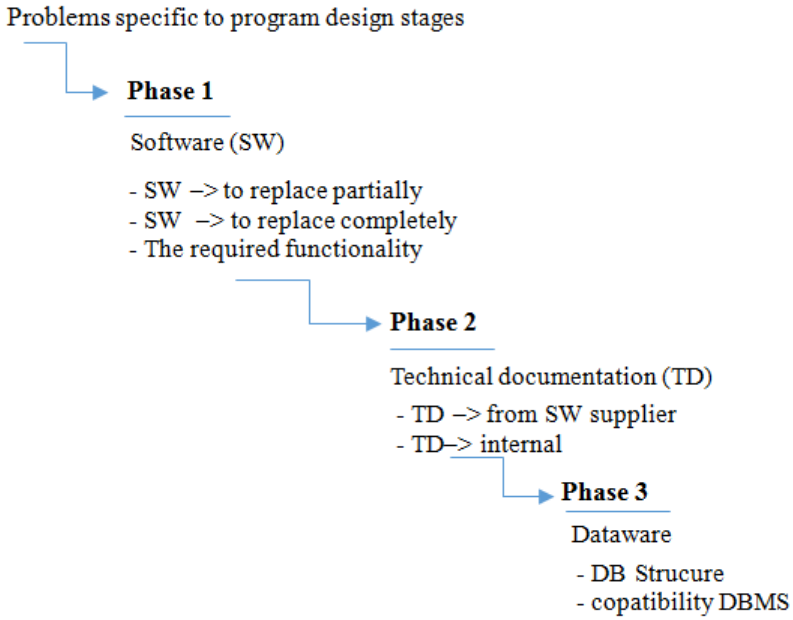
3. Program Problems

During the development and implementation of the complex large software systems, one important question appears - which software will be fully or partially replaced by a new software decision. To answer this question it is necessary to identify critical business processes that must be detailed studied. While combining smaller software in one large complex, it is important to maintain the integrity of data and not to disturb the logic of information system. We can distinguish next stages during development and testing of

complex an integrated system (see scheme 2 "Problems specific to program design stages"):

Phase I – Software

- Must be defined existing software that should be replaced completely;
- Must be defined existing software that should be replaced partially;
- Must be defined functionalities that should enter in new product.



Scheme 2. "Problems specific to program design stages

Phase II – Technical Documentation.

Creating of technical documentation used in the design, development and using of the implemented software. It must be created both internally within the existing system, and by the software vendor. The technical documentation created by the customer, will be the basis of the implementation process. Exactry at this point most problems appear. Usually developers of complex software solutions have created a big number of documents including the technical documentation and technical requirements. From our experience we can say that these requirements are usually common and little adapted for a particular client. As far as during the migration process, client plans to migrate much more data than is necessary for the proper operation of the program, there is a lot of questions about how this additions data affects existing algorithms. It is difficult to imagine how changing of some values that are not mentioned in the technical documentation, affect other values and the program at all. From this follow the basic problems of migration and associated problems of integrity of data and of information system.

Phase III – Dataware

The heart of the automated information system is the database, which is main dataware. The term "database" means not only informational support, but also various forms of documentation, and classifiers. Since the database already exists, special modifications are not required, however, in the process of integration is necessary to ensure the compatibility of the existing database and one that will be integrated. DBMS is a set of language and software designed for the creation, maintenance and use of the database. In the existing system there are already professionals who works with DBMS and who is familiar with it. Retraining takes additional time and financial resources, so that one of the requirements for deploying the products must be to support the existing database.

Another problem associated with informational support – is a lack of documentation describing information architecture, or an overabundance of such information. Information architecture software consists of the following components:

- identification and determination of the content and functionality.
- underlying resource hierarchy structure and nomenclature, which define the relationship between content and functionality.

Usually, when a complex project is developed, a huge amount of documentation is created and it is a part of the information architecture. When designing test cases, quality manager must be familiar with the architecture of the project and is essential that the logic of navigation and the description of the relationship of components have been collected in a single document, and were supported by applications with additional information. In practice, the creation of this single document is moved to the last stage of the project, which complicates the process of preparing the test.

4. Technical problems

For any software solution some certain technical requirements must be met. These requirements are related to the composition of the equipment supporting the product. Technical problems appear from the fact that the current system does not fully meet these requirements. Also, there may be no adequate technical solution – meaning the completeness of performance, productivity, reaction rate, and so on. Thus there is a problem to adapt existing technical solutions to new requirements.

The first step is to study the requirements of the supplier. It takes a lot of time, as these requirements are indicated in the contract and before the start of the design documentation. Next, it I necessary to compare information about the technical part of the current information system. Obviously, the smaller the difference between them, the problem will be less significant. The most important task is selecting necessary technical solutions to replace or supplement the missing components. This problem is solved by IT specialists, but the final decision of the company management, which is usually insists on adapting existing facilities for the new project. Thus, the main problem affecting the technical support is the issue of financial resources.

5. Conclusion

The review clearly shows that during the process of development and implementation appear many different problems. These problems can influent the process of implementation less or more. The most important thing is correct organization and good relationship inside the team and good relationship between the supplier and the client.

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Internal Control in the Planning and Realization of Internet Sales

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Abstract: To ensure steady sales in the crisis conditions, experts recommend focusing on reducing costs and changing approaches of realization of sales. Currently, the most important becomes transfer or opening a business in the virtual space: create website, Internet shop, groups and pages on social networks. E-shop as a tool for online business and has its unique characteristics and its efficient operation affecting by several major factors: technical features of the site, customer service and the quality of work of the sales department. At realization online sales it is essential to have controls and delineation of powers, from the stage of writing technical specifications for the creation of a site before shipment to the customer, or the provision of services to the end user. The activities of any commercial organization assessed by the quality and quantity of goods and services sold, so the sales process must be carefully planned and monitored.

Keywords: Internal control, system of internal control, Internet sales, website, planning of sales.

1. Control in Sales Management

The global economic crisis is very hard on business, so the development of business in crisis conditions - a very current trend for all market participants. One of the key moments in the survival of business is the correct sales management.

The activities of any company evaluated the quality and quantity of goods and services sold. After all, the main source of profit and progress lies in sales, but here are embedded and underlying problems.

Sales – it is a complex and multi-step process, which depends on many factors, having a plurality of parameters. Managing of sales - means to manage vast amounts of information, many people and distribution channels.

Management of the sales process - a time-consuming activity that based on the account of orders, registered clients as well as accounting and control of sales, the ability to analyze the data and take them based on good management decisions.

However, in practice, to obtain the necessary data are not always successful, and sales of goods and services becomes unmanageable, spontaneous, and most importantly - ineffective. This applies not only to offline sales (stores, shopping sites), but also online sales sold via the Internet websites and social networking tools.

2. Tightening of Controls at Realization of Internet Sales

The economic crisis is pushing vendors to develop online trading. Affected by the

high costs of traditional sale because of the high rents, staff costs and other administrative and selling expenses, as well as a change in consumer behavior: more and more people are looking to purchase cheaper goods over the Internet.

Currently, there is a redistribution of demand from offline to online, as it is through the Internet space disseminates information about the price and quality of goods or services. Many companies have decided to move in online space to optimize costs, partly contributed to this growth in Internet penetration, especially mobile. This trend is enhanced and many companies are expanding their presence in the online (online shopping, social networking).

"Online" is defined as sales where the final transaction is made over the internet or at a distance, irrespective of whether the internet has been used for browsing and price comparisons, also taken into account sales made using mobile phones and tablets.

It is undeniable the fact that the market for Internet commerce actively developed and expanded, and the volume "marketable" e-commerce is growing rapidly exponentially. It is clear that those companies that are not yet available, except for certain special or luxury doomed to bankruptcy.

E-commerce is the fastest growing retail market in Europe. Online sales in the such European countries like UK, Germany, France, Sweden, The Netherlands, Italy, Poland and Spain are expected to grow from €156.28 bn in 2014 to €185.39 bn in 2015 (+18.4%), reaching €219.44 bn in 2016. In 2015, overall Ecommerce expected to grow by 18.4% (same as 2014).[2]

Many retailers already report that up to one-half of Internet website browsing occurs through customers using diverse mobile devices, both smartphones and tablets. However, a much small proportion actually uses their mobile device to make the final purchase. In 2014, total online sales via mobiles in Europe was €23.77 bn, which expected to grow by 88.7% to €44.87 bn in 2015.[2]

The growth of online sales at such a rate will inevitably reduce the market for traditional shops. By the time, that online sales represent 5% or more of domestic retailing then the continued growth of online retailers will occur at the expense of conventional stores. In Europe as a whole, online retailers in 2015 are expanding 14.2 times faster than conventional outlets creating major strategic issues for store-based retailers.

At the end of 2014 the market volume e-commerce in Russia increased by 27%. At the same time, it pointed out that the two major players have grown faster than the market: the sale of "Eldorado" in the Internet for the full 2014 increased by 61.6%, and "M Video" - just 90%.[1]

The revolutionary effect of social networks and online marketing cannot ignored. Online sales can increase corporate profits by 20%, depending on the level of penetration of digital technologies. Retailers need to implement various IT innovations - from personalized marketing to take into account the current needs of the customer mobile applications - to keep up with the market.

According to InSales.ru, in 2014 in Russia were about 43 thousand retail online stores, which made orders. Compared with the year 2013 increased significantly the number of online stores closing. This figure obtained based on the analysis of open sources on the number of stores, unloaded on the Russian Internet trade platform, as well as based on the analysis of the number of customers InSales.[1]

Internet - the most profitable channel to increase sales for almost any business. In addition, it is not just the opinion of the majority of Internet users of the space, but a real fact.

The number of websites and online shopping is growing steadily. The greatest increase in the number of stores in 2014 occurred in the categories of goods for the home, materials, equipment and Gifts.

Amid growing volume of online sales and the arrival of new players. In the overall picture looks like this: the big players grow and become multi category (although among the large stores have been eliminated from the market projects), and average stores are trying to grow big and fierce competition, small shops are fighting for survival and growth as well as new players come mainly from offline retailers and suppliers.

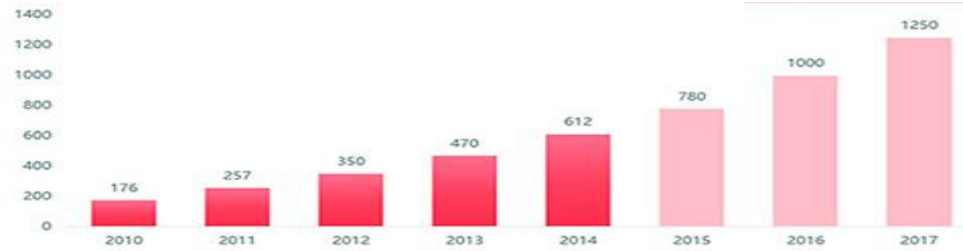

Fig. 1. Volume of the market and forecast for the coming years, in bln. rub.

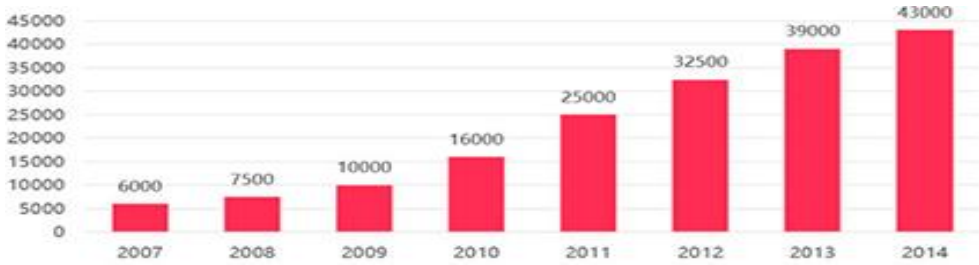

Fig. 2. The number of online stores in RuNet in 2007-2014 years.

According to a study of a large investment trust in real estate "Prologis", projected rapid growth of e-commerce not only in Europe but also around the world in the next five years, and therefore will create 200,000 additional jobs needed to receive and process orders in logistics distribution centers. Accordingly, will change the approach to the organization and control of the Internet sales.

According to the report, "The global market for B2C E Commerce 2015" prepared by Ecommerce Foundation - last year, 2.64% of the world's GDP was spent on buying goods and services online.[3]

Online shopping in Moldova began to develop in 2006, although in 2000 a program was launched "Moldova 2000", whose main goal was to develop e-commerce. Today, online stores are successfully developing in the market there is a lot of competition, as the main market - is Chisinau, although many online retailers carry out the delivery throughout the country.

Speaking of the leading countries in the world of e-commerce, here in the first place China followed by the United States, in third place - United Kingdom. More statistics that is detailed presented below in Fig. 3.

E-commerce gains momentum around the world, showing a steady growth even in developing countries. Fig. 3. It is evident that the estimated share of online goods in total retail of goods are 5.9%.

According to the expert, for a segment of "Clothing and footwear", which is one of the largest in terms of turnover, today characterized sale only through social networks without their own online store. There are many shops, but they not taken into account in the studies, and this trend for the fashion segment will continue. These statistics and experience in Ecommerce show that the growth and development of online sales requires a new approach to their organization and control.

Fig.3. E-commerce Data of Goods and Services at a Glante 2014

Business process of organization and implementation of online sales include:

- Sales planning: the development of the sales strategy, the choice of distribution channels, resource planning (procurement, personnel, finance), logistics planning, budgeting and pricing, forecasting;
- Implementation of sales marketing, customer acquisition, customer base management, channels of contact with the customer reception and order processing, order fulfillment;
- Monitoring and analysis of sales, as well as continuous marketing analysis.

The entire business process of sales management must be accompanies by regulatory and reference documentation: company strategy, organizational structure, job descriptions, organizational and administrative documents, regulatory and reference information.

To implement online sales necessary to use the following tools:

- The site of the company, which provided information about the company offered goods and services, with the possibility of ordering and counseling;
- Groups and pages in social networks (Twitter, Facebook, Instagram, Vkontakte, LinkedIn, Odnoklassniki and others), which publishes information on the activities and achievements of the company (or a specialist in a certain area), information about products and services, reviews and customer testimonials, conduct surveys and contests. This is one of the tools provide feedback with customers and converting them into loyal customers, ensuring customer loyalty, as well as the ability to monitor and analyze the company's image;
- Register and published in the publically available directory and the information society, providing information about the activities and contacts of the company;
- Analysis and active participation in various tender areas;

- Use of specialized outsourcing Call Centers for the realization of "cold calls" the target audience;
- In addition, of course, the various types of advertising: The targeting, banner, publications from bloggers, publishing articles on popular websites and social networks, e-mail and sms sending.

Online sales tools must constantly develop, analyze and range of actions of competitors, run and analyze marketing campaigns.

To use these tools, you must have a whole staff of skilled: IT professionals, marketers, content managers, or to obtain the necessary services as outsourcing. In any case, the work of these specialists needed to be carefully planned and monitored.

Website development for the organization of online sales activity is not simple, and includes the following tasks:

- Select a name - name should be short and memorable. In general, today to find a name for the site more difficult than before, because the most simple and exciting domain names are already taken;
- Web site design - be aware that the appearance of the website must comply with the specialization of the company so the visitor immediately realized what products it sold;
- Filling of the website content - images and texts on the website must be original and not duplicate information of competitors. Today, there many resources available that can help you verify the originality of text. In addition, on the website necessary to place articles and links to external resources related to your specialization. This will attract more customers to you and simplify promotion;
- Choosing a reliable hosting company - the unavailability of the website negatively affects the confidence of customers.

It is important for the organization of online sales of goods or services to provide and monitor:

- Design and development of an attractive website, with the design, selection of domain name, hosting company and selection of online platforms is better to trust the professionals in the IT sector. In the future, you must regularly realize SEO website optimization;
- Advertising strategy to promote the goods and services, after analyzing the activities of competitors;
- Activities of the courier service that will deliver your orders, or own logistics department, if you want to know many interesting about your product from customers;
- The continuous availability of the website, e-shop, social groups - sales tools;
- The relevance of the information on the website, in social groups and online resource: about the company, its contacts, products and services, current actions;
- Performing plans for contacts with customers (the number of calls, sending e-mails, meetings);
- Responsiveness, correctness and quickness on requests from potential clients (calls, e-mails, discus);
- Any feedback about the company, its products and services, personnel, both positive and negative. In case of negative feedback is necessary to organize work with them and bring them under control;

- Control over fulfillment of the sales plan for each category of goods or services in general, and for each manager individually;
- The process of communication between the customer and sales manager should also be monitored at all stages, including:
- Listening to the conversation with the customer, from the greeting, communication, and before the end of the conversation - in order to adjust and correct the employee;
- Analysis of the terms of customer service, tracking of KPI (Key Performance Indicator);
- Timeliness and quality of the logistics channels of delivery of the goods to the customer, as well as the availability of required merchandise (correct planning and forecasting purchases of goods).

Responsible for execution and performance of control of process online sales are the heads of the sales departments, customer service, IT division, as well as the company's management. For those companies that do not have such a post for sales management meets its head.

All controls should be grouped into daily, weekly and monthly.

For Managers online sales very clearly, leaving no room for initiative, prescribes the procedure for their actions, for example, in cases where the contact person of the client does not answer the call as voice greetings and so on. All criteria must be logically clear, physically feasible and their use should be beneficial to the company, as well as respected by the company management as well.

The process of making online purchase order includes the following tasks:

4. Contact with the customer by telephone, e-mail, correspondence in social networks, and so on;
5. Providing the buyer with the necessary information;
6. Check the availability of products in stock;
7. Determination of the conditions of the transaction, including approval of the terms of payment;
8. Registration the order in information system, or reflected in the appropriate catalog, in the absence of Customer Relationship Management;
9. Execution of the contract with the client, if necessary;
10. Ordering of the goods from the warehouse.

The main benefits of online shopping for a long time include a wide range of products and the convenience of the process, but over the last year on the first place was the price. Here, strong competitor online stores are Chinese trading platforms, which are a huge range of wide variety of goods at the lowest prices, so you need carefully approach the selection of the development strategy of its online business.

The main purpose of building management subsystem of online project – is establishing standards for the actions of all sales staff, providing:

- Acceleration and facilitation training of new employees the company with the required quality and efficiency;
- Establishment of clear and transparent rules for all of the control of business processes sales unambiguous quantitative indicators for evaluation;
- Full safety and easy access to all the information related to the work with customers from client card and commit to each customer contact (phone call, e-mail, meeting), including information on the products they have purchased;

- Basic principles of the customer base in the Customer Relationship Management processes and standards for sales, because without standards is not possible to establish the quantitative monitoring and analysis to achieve results;
- Possibility monitor the effectiveness of our marketing campaigns and launching mechanism Lead Generation with maximum efficiency;
- Protection of the information about our clients on its loss or disposal by unscrupulous employees, and most restrict access to it depending on the level of office personnel and our trust in him;
- Organization of the help system, which allows fast and cost-effective resource to find an answer to the most common customer questions.

Provides complete entering all the information in the CRM, we can clarify the following questions:

- With how many clients we are now actively working to sell;
- How many customers are now sold certain products;
- What are the reasons customers refuse to purchase;
- What is the average time of customer service, ordering;
- How many contacts with the client carried out to an average of purchase?

After such analytics for a certain period, we can build a personal sales funnel for each of managers and to evaluate the effectiveness of their work.

Loss of information about online sales without the use of Customer Relationship Management systems leads to the following problems:

- Department of sales becomes dependent on its employees (records are kept in their notebooks, with the departure of manager of sales information is lost);
- Due to the fragmentation of the customer base is not the preservation of the history of the relationship, so there is no possibility to conduct an analysis of the target audience, and improve the work with customers;
- Ignorance of the sources and amounts received interests and requests (calls, web applications, email-letters) does not allow to evaluate the effectiveness of marketing (advertising and PR) activities, the appropriateness of spending marketing budget;
- The lack of data of the action developed and implemented interests does not allow to measure the conversion of sales professionals; Orders may simply lost or deliberately not treated; have different managers can intercept the same client;
- Obsolescence of information and failure to update it leads to a failure in communication with customers, to the formation of wrong expectations among buyers;
- Due to the fragmentation of the working files (or lack of access to them), there is no possibility to implement operational control of the work to evaluate the activity and effectiveness of managers, to evenly distribute the load between them.

When planning and implementing online sales, it is important to carry out the analysis of the effectiveness of marketing campaigns that will eliminate the low performers marketing companies; marketing budget redistributed among the most effective.

It is important continuously improve the efficiency of the company in the field of online sales, it does not forget about training, testing and promoting staff. The manager needs to understand that its effectiveness depends on him. At the same time, if he is convinced that the key role played by the price, quality, advertising, sales channels, financial and other

resources, how he or stimulates it, he will take that away from him a little that depends, and will not change behavior.

The set of entrepreneurs think that the key personnel required for the organization of online sales is sales managers and IT experts at the remote support. In fact, most online stores there are the following staff:

- Management - which is responsible for the organization and planning of the business as a whole, to ensure planned results, the selection of an optimal set of products, quality control of all parts of the online store;
- Department of sales - including the head of the unit (to control the quality and standards, the timely recruitment of staff, conflict resolution), sales managers, telephone operators (consulting and taking orders by phone, e-mail and other means of communication (ICQ, SKYPE, LIFE-CHAT), interaction with logisticians);
- The logistics department - responsible for providing timely and optimal price deliveries. Also in his charge are training, monitoring the amount of deliveries based on each carrier, quality of service and deliveries;
- Marketing and advertising department - demand analysis by category of goods, the target audience, the work with the target audience through community Internet portals and sanctioned mailings promoting an online store through SEO, promotion of social networks, work with the contextual and media advertising.

Of course, the entire staff engaged in online sales may consist of a single person who would pull himself all directions, and vice versa - to be extended up to a thousand people.

Automation of online sales is one of the mechanisms of control by solving the following tasks:

- Excluding loss of incoming calls. Gathering statistics on the volume and sources of online sales;
- Fixing and analysis of consumer demand;
- Prevention of data loss in the care, sickness, vacation Officer (information is stored in a single database);
- Centralized storage of the history of relations with customers;
- Evaluating the effectiveness of marketing activities;
- Ordering of routine operations and reduce loss of working time;
- Forming a coherent scheme of communication in the sales process;
- Organization of operational control of sales managers.

Sales - one of the most important areas in any commercial company. From the efficiency of sales directly depends on the organization's profits. To achieve the desired results of each company, focused on long-term performance, develop specific plans to win market share. The right strategy can increase sales and increase customer loyalty.

However, without the daily sales management to implement long-term plans is impossible because:

- In every industry are constantly taking place some changes;
- Competitors regularly improve production technology, quality of service, and advertising support of its products, marketing strategy and social media instruments;
- Standard processes are in need of permanent improvement;
- Specialists units engaged in the sale; do not always have the necessary skills and an appropriate level of responsibility for individual work and others.

That is why the company should not only strategic but also operational management of sales, in the form of continuous monitoring in order to analyze the effectiveness and rapid response to any changes.

3. Conclusion

Optimal operational sales management tools must be chose taking into account the specifics of a particular firm. The choice of certain means influence the level of standardization of processes, the availability of automated data analysis system sales for each employee, the company's position in the market, number of specialists in sell the unit, especially communication between departments.

Operational management of online projects is necessary for any company that is set to a long and successful work Internet space.

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The Identification of Nonlinear Dynamical Systems as Integrated Volterra Series Based on Deterministic Signals

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Abstract: The method of identification of nonlinear dynamic objects as integro-power Volterra series (using deterministic signals of the stepped impact of the certain amplitude) is constructed. The structural diagrams for the implementation of the regular uniform integral operator of the n-th degree in the Simulink environment are proposed. The software tools, the quality of which was analyzed through the calculating experiments, have been developed in the Matlab/Simulink environment.

Keywords: Identification, modeling, nonlinear dynamical systems, series Volterra, Volterra kernels, Matlab / Simulink.

1. Introduction

The development of the theory and methods of mathematic modeling of nonlinear dynamic systems is an urgent problem of the modern applied mathematics. Difficulties associated with the description of nonlinear dynamical systems are significantly rising in comparing with the static systems. Sometimes the studied system can be represented as a series of the serially connected linear dynamic and nonlinear static links, the simulation of which is much simpler than the nonlinear dynamic system in whole. This approach requires the additional priori information about the structure of the system. In this case, we cannot talk about the identity in general [1].

The most common and convenient way of nonlinear systems' presenting is to present them with Volterra series [1, 2, 5, 8]:

$$y(t) = \sum_{m=1}^{n} f_m(t), \tag{1}$$

$$f_m = \int_0^t \dots \int_0^t K_m(s_1, \dots, s_m) \prod_{i=1}^{m} x(t - s_i) ds_i, \; t \in [0, T], \tag{2}$$

where $x(t)$, $y(t)$ – are the input and the output object signals respectively, n – some natural number, T – the transition time, $K_m(s_1, \dots, s_m)$ – Volterra kernels, $K_1(s)$ – determinates the linear part of the dynamical system.

The Volterra functional series are being used in the mathematical modeling of the nonlinear dynamic systems for a long time. Like any universal mechanism, the mechanism of Volterra series has got some advantages and disadvantages. It allows to present the output signal system , interpreted as a "black box", as the form of the integra-power series (1)-(2) to

the external stimuli. The nonlinear dynamic systems' submission, using the Volterra series is common and allows a clear physical interpretation and can be viewed as a generalization of the linear case [1]. Indeed, if we put $K_2 = K_3 = ... = K_m = 0$, then according (1)-(2) we obtain an expression

$$y(t) = \int_0^t K(s)x(t-s)ds,$$

which is widely used to describe the linear systems and is known as the convolution integral.

The main problem lies in the complexity of typical solutions of the inverse task - identifying Volterra kernels $K_m, m = \overline{1,n}$ in (2) by the well-known system reactions to certain test effects. The existence of the efficient algorithms and tools for the identifying Volterra kernels determines the perspectives of (1) - (2) for the mathematical complex physical-technical systems and facilities' modeling [7].

The aim of the work is to develop the methods and tools of Volterra kernels' identification on the basis of deterministic signals.

2. The Method of the Volterra Kernels' Constructing

Let the object be affected by the signals, which are described by the deterministic function of time.

One-dimensional kernel. Let's suppose that the solution of the identification problem is determined in the stationary linear systems' class. The general view of a stationary linear system is given by

$$y(t) = \int_{E^1} K_1(s)x(t-s)ds. \quad (3)$$

The weight function of the system (3) can be determined experimentally, if the $\delta-$function or the stepwise effect of amplitude A is select as the input signal.

In the first case:

$$\int_{E^1} K_1(s)\delta(t-s)ds = K_1(t),$$

and in the second —

$$\int_{E^1} K_1(s)A\cdot 1(t-s)ds = A\int_0^t K_1(s)ds = f(t) \quad (4)$$

After performing the differentiation on the upper limit, we obtain:

$$K_1(t) = \frac{1}{A}\frac{df(t)}{dt}. \quad (5)$$

Two-dimensional kernel. Let's consider a homogeneous regular operator of the second degree [5]:

$$v_2[x(t)] = \int_{E^2} K_2(s_1,s_2)x(t-s_1)x(t-s_2)ds_1ds_2. \quad (6)$$

As the kernel $K_2(s_1, s_2)$ is symmetric, then from the definition of a homogeneous function of second degree, we get that the identity written down is fair for this operator:

$$2v_2[x_1(t), x_2(t)] \equiv v_2[x_1(t) + x_2(t)] - v_2[x_1(t)] - v_2[x_2(t)], \quad (7)$$

where the bilinear homogeneous operator of the second degree is marked through $v_2[x_1(t), x_2(t)]$, that means:

$$v_2[x_1(t), x_2(t)] = \int_{E^2} K_2(s_1, s_2) x_1(t - s_1) x_2(t - s_2) ds_1 ds_2. \quad (8)$$

Let $x_1(t)$ and $x_2(t)$ – are $\delta-$functions: $\delta(t - T_1)$ and $\delta(t - T_2)$. Then from (6) and (7) we obtain:

$$2v_2[\delta(t - T_1), \delta(t - T_2)] =$$

$$= 2\int_{E^2} K_2(s_1, s_2)\delta(t - T_1 - s_1)\delta(t - T_2 - s_2) ds_1 ds_2 = 2K_2(t - T_1, t - T_2) \quad (9)$$

Let's mark $s_1 = t - T_1$, $s_2 = t - T_2$. Without the loss of the generality, we can put the smallest of T_1 and T_2 as zero. Suppose that it is T_1. Then we have $s_1 = t$, $s_2 = t - T_2$. It is – a parametric equation of the line, that has an angle of 45° to the plane, with coordinates s_1 and s_2 and is shifted the axis s_2 on $-T_2$ (Fig. 1.). The kernel K_2 is measured in this line. Because of the causality's conditions the kernel will be nonzero in the first quadrant of the s_1, s_2 plane only. We can measure the kernel $K_2(s_1, s_2)$ in the required area of the first plane's quadrant, by varying the time between the submission of T_1 and T_2 pulses.

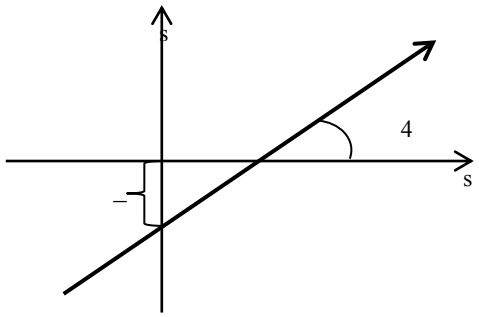

Fig. 1. The plane for the kernel's determining, different from zero

We serve the stepped effect with the A amplitude on the input. Then

$$2v_2[A\cdot 1(t-T_1), A\cdot 1(t-T_2)] =$$
$$= 2A^2 \int_{E^2} K_2(s_1,s_2)\cdot 1(t-T_1-s_1)\cdot 1(t-T_2-s_2)ds_1ds_2 = \quad (10)$$
$$= 2A^2 \int_0^{t-T_1}\int_0^{t-T_2} K_2(s_1,s_2)ds_1ds_2.$$

At different time values T_1 and T_2, we get some surface $f_2(s_1,s_2)$ in the three-dimensional space:

$$2v_2[A\cdot 1(t-T_1), A\cdot 1(t-T_2)] =$$
$$= 2A^2 \int_{E^2} K_2(s_1,s_2)\cdot 1(t-s_1)\cdot 1(t-s_2)ds_1ds_2 = f_2(s_1,s_2). \quad (11)$$

Because of the causality's conditions, the function $f_2(s_1,s_2)$ is different from zero only in the first quadrant. We need to differentiate $f_2(s_1,s_2)$ by s_1 and s_2 for the determination $K_2(s_1,s_2)$, that is:

$$K_2(s_1,s_2) = \frac{1}{2A^2}\frac{\partial^2 f_2(s_1,s_2)}{\partial s_1 \partial s_2}. \quad (12)$$

Three-dimensional kernel. Let's consider a homogeneous regular operator of the third degree [5]

$$v_3[x(t)] = \int_{E^3} K_3(s_1,s_2,s_3)x_1(t-s_1)x_2(t-s_2)x_3(t-s_3)ds_1ds_2ds_3. \quad (13)$$

View of the kernel of the third-order is symmetric, we get:

$$3!v_3[x_1,x_2,x_3] = v_3[x_1+x_2+x_3]-v_3[x_1+x_2]-v_3[x_2+x_3]-$$
$$-v_3[x_1+x_3]+v_3[x_1]+v_3[x_2]+v_3[x_3] \quad (14)$$

Offering the input of the system $x_1(t)=\delta(t-T_1)$, $x_2(t)=\delta(t-T_2)$, $x_3(t)=\delta(t-T_3)$, we get the kernel of the third order:

$$v_3[\delta(t-T_1),\ \delta(t-T_2),\ \delta(t-T_3)] = 3!K_3(t-T_1,t-T_2,t-T_3). \quad (15)$$

Now let's deliver for the input of the system the stepwise signals with *A* amplitude. From (13) we obtain:

$$v_3[A\cdot 1(t-T_1), A\cdot 1(t-T_2), A\cdot 1(t-T_3)] =$$
$$= 3!A^3 \int_0^{t-T_1}\int_0^{t-T_2}\int_0^{t-T_3} K_3(s_1,s_2,s_3)ds_1ds_2ds_3 = f_3(s_1,s_2,s_3). \quad (16)$$

Similar to (12) the three-dimensional Volterra kernel's identification is performed as follows:

$$K_3(s_1,s_2,s_3)=\frac{1}{3!A^3}\frac{\partial^3 f_3(s_1,s_2,s_3)}{\partial s_1\partial s_2\partial s_3}. \tag{17}$$

Multivariate kernel. We use the algebraic equality [5] for the regular homogeneous operator of p degree:

$$\begin{aligned} p!v_p\left[x_1,...,x_p\right]&=(x_1+...+x_p)^p-[(x_1+...+x_{p-1})^p+...]+\\ &+[(x_1+...+x_{p-2})^p+...]+...+(-1)^{p-1}({x_1}^p+...+{x_p}^p)\end{aligned} \tag{18}$$

The first member in (18) - is the sum of all variables x_i raised to p degree. In the second member of equality, which is in the square brackets, each of the sums, which are risen to the p degree, is formed from different $p-1$ variables x_i, $i=1,...,p.$

Those sums will be $C_p^{p-1}.$ in all. Each sum of the third member, that is raised to p degree, is formed from $p-2$ variables x_i, $i=1,...,p$ with different indices i. Those sums will be $C_p^{p-2}=\frac{p(p-1)}{2}.$ in all. Other members (18) are formed in the same way, their number is $\sum_{n=1}^{p}C_p^n=2^p-1.$ After the formation of the system, basing on the equation (18), and giving the input $\delta-$function, we obtain the kernel procedure p

$$v_p[\delta(t-T_1),...,\delta(t-T_p)]=p!K_p(t-T_1,...,t-T_p). \tag{19}$$

For the staircase effects of the amplitude A we have

$$\begin{aligned} &v_p[A\cdot 1(t-T_1),A\cdot 1(t-T_2),...,A\cdot 1(t-T_p)]=\\ &=p!A^p\int_0^{t-T_1}\int_0^{t-T_2}...\int_0^{t-T_p}K_p(s_1,s_2,...,s_p)ds_1ds_2...ds_p=f_p(s_1,...,s_p),\end{aligned} \tag{20}$$

If we differentiate we obtain

$$K_p(s_1,...,s_p)=\frac{1}{p!A^p}\frac{\partial^p f_p(s_1,...,s_p)}{\partial s_1...\partial s_p}. \tag{21}$$

3. Software Implementation

The method of Volterra kernels' identification based on deterministic signals in the environment Matlab / Simulink software tool developed. The block diagrams in the environment of Simulink are built based on the homogenious operator n-th degree (18). The block diagram for determining the one-dimensional Volterra kernels is shown in Fig. 2.

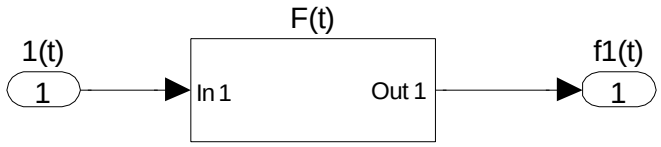

Fig. 2. The block diagram of the identification of the one-dimensional Volterra kernel

The block diagram for determining the two-dimensional kernel is based on (7) is shown in Fig. 3.

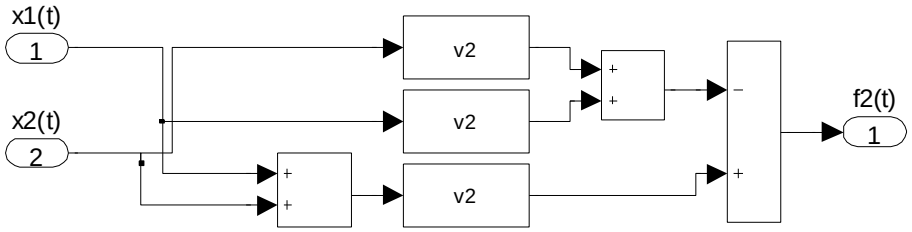

Fig. 3.The block diagram of a homogeneous regular operator of the second degree

The block diagram of the system which will allow to get a three-dimensional Volterra kernel based on (14) is shown in Fig. 4.

Simulink-circuits, which were built, allow to influence them from the outside, including the environment MATLAB, that is, with the possibility to ask and record the input and output (response) signals. The input signals to the block diagrams are given from the MATLAB environment by running the script indentification.m, the output signals are recorded on the basis of which the nucleus of the appropriate dimension are formed. A kernels' set of the corresponding dimension is the result of the program.

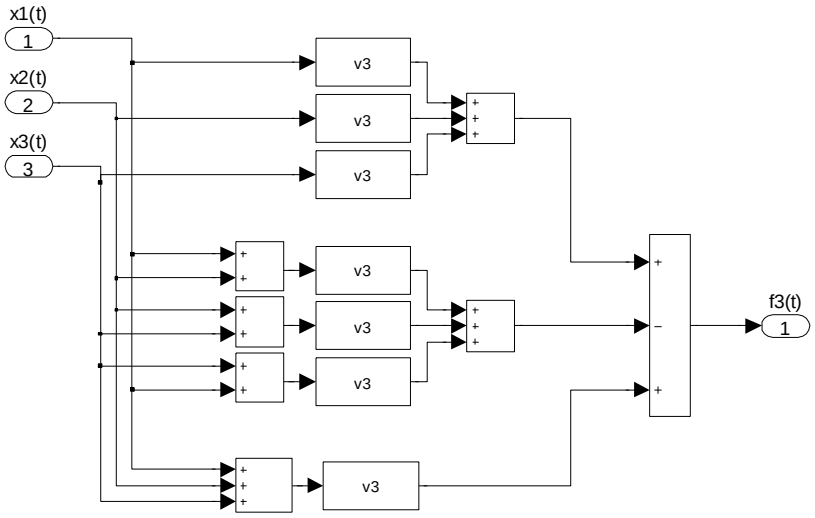

Fig. 4. The block diagram of a homogeneous regular operator of the third degree

4. The Calculating Experiment

The method's researches and tools, constructed based on them, was conducted on the calculating experiments. The simulation models as subsystems, which highlight different types of nonlinearities, in particular, polynomial, trigonometric, exponential, etc. which occur frequently in practice, were built for the research.

The schemes' parameters were selected according to the modern scientific developments in this field and according to the real objects [4]. The problem of the construction of the integral Volterra series for nonlinear system was one of the model's tasks, which is shown in Fig. 5.

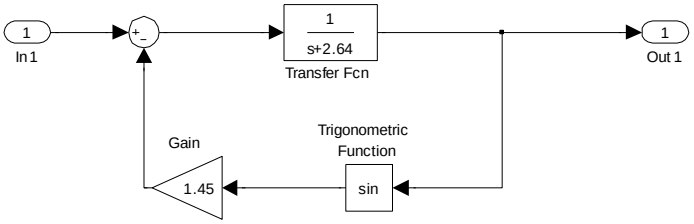

Fig. 5. The model of the exponential type nonlinearity

Applying the developed tools the Volterra kernels of the first and second orders were obtained. The results of solving the direct problem (1)-(2) are shown in Fig. 6 The sinusoidal test signal is supplied for the input of the simulation model. The corresponding values of the absolute errors of the calculation are presented in Fig. 7.

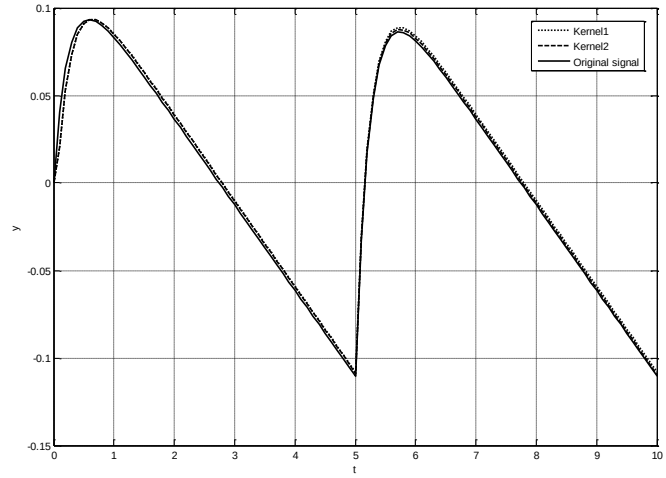

Fig. 6. Exact and approximate solutions of the model

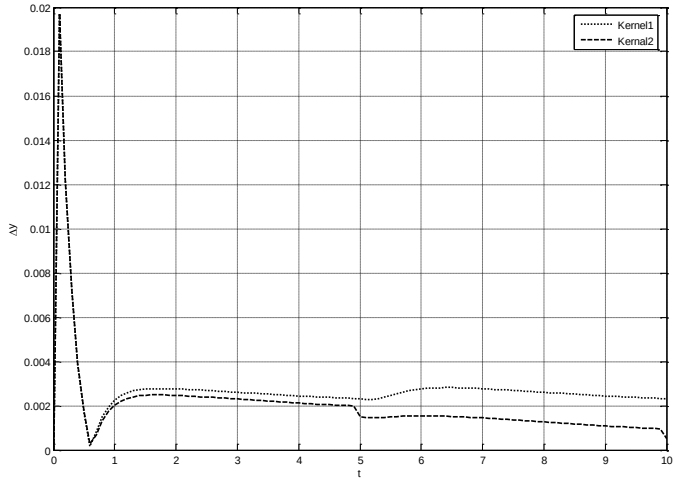

Fig. 7. Absolute error identification kernels

5. Conclusions

The conducted researches showed that the developed software tools for the building of the mathematical models of the nonlinear dynamic "input-output " systems can be successfully used in various fields of science and technology , both independently and as an integral component.

The main disadvantage of this approach is the number of computing operations rapidly grows with the increasing of the nuclei's dimensions, as it relates to solving the direct problem and inverse. To overcome this shortcoming at first, you must use parallel processing techniques, and the second, build a degenerate kernel that allows to use the tool of integro-degree's Volterra series in real-time systems.

The method of identification of nonlinear dynamic objects in the form of integro-power series Volterra using deterministic signals stepped the influence of certain amplitude.

A block diagrams in Simulink environment for the realization of a homogeneous regular integral operator n-th degree. A software environment in Matlab / Simulink, the quality of which is investigated in numerical experiments.

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Power – law versus Lognormal Distribution in a Phone Call Network Graph

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Abstract: An anonymous collection of data, gathered from a telecommunication operator located in south of Albania, is used to construct a phone call network graph. The data set contains the records of phone calls during November 2014. Our aim is to analyze, the tails of empirical distributions related to: the number of phone calls per customer, the total duration of calls per customer in seconds, and the distinct number of calling partners per customer; considering the network in both cases, directed and not directed using open source *R*. We focus only on power – law and lognormal fitting to the empirical distribution.

Keywords: Power – law, lognormal, phone call network graphs, fitting distribution.

1. Introduction

Our era may very well be considered as the era of advanced technological realities in wide use. Almost every one, related on communication, prefer to communicate with mobiles instead of the cable network telephony, because of their facilities and multiple usages. Mobile communication has had its evolution and has increased sophistication on apparatus in very few years.

Despite this fact, the cable network telephony still continues to exist even though nowadays it is not viewed as the preferred way to communicate, but attached to other services such as providing internet services and others, it is still resistant in the market. One of the advantages of having traditional landline services is that it provides more clarity and a stable connection compared to a mobile line [1]. The fixed telephone services are not the only ones in the market, as decades ago, but have competitive services – mobile services. We have chosen to study three key characteristics that attempt to measure the behavior of individual customers in the present circumstances inside a landline operator.

Previous studies are conducted on landline phone call networks based on: the structure of the underlying network (cliques [2], degree distribution [3]); statistical properties of the social behavior of mobile network nodes [4–7]; human interaction in space in networks based on landline and mobile data at the same time [8]). We focus in this paper on fitting and analyzing two heavy – tailed distributions (power – law and lognormal) on data. Our suspicions about them are based on the histograms of the complementary cumulative distribution in log – log plots. It is very rare that these two distributions model all the empirical data, but in our case we are interested to face them particularly in the tail of the empirical distribution. This is important because of Pareto's 80/20 rule, which is about large but rare events [9].

Fitting power – law on empirical distributions by using graphical methods based on linear fitting on the log – log scale is biased and inaccurate [10]. Many 'observed' power – law distributions are highly suspected [11], but a statistical support is needed for them. Moreover, even when there is such a statistical support for a claimed power – law, this cannot be as an evidence of universality without a concrete underlying theory that supports it.

The reminder of this paper is organized as follows: In Section 2, we describe the method that is applied. Next, in Section 3, we see the results, and in Section 4, we discuss about the results. Finally, we present some concluding remarks and future work in Section 5.

2. Methods

A phone call network graph $G = (V, E)$ is constructed using an anonymous collection of data, gathered from a Call Data Records (CDR) of a telecommunication operator center located in south of Albania. The set of vertices in the network graph is denoted by V and represents the set of the landline operator customers, and E is the set of edges of G. Each edge represents a relation between two customers. Data is related to phone calls only inside operator customers, not to foreign operators.

Throughout this paper, we are focused only on calls that last more then10 seconds from the data set which contains the records of phone calls during November 2014. Direction of calls is taken in consideration. Specifically, if v_1 and v_2 are vertices of G, then an directed edge (v_1, v_2) exists only if v_1 has called at least one time v_2 with a call duration more than 10 seconds, and also vice versa. Multiple calls between any two vertices are given by a single edge, which is associated with a weight (equal to one to represent connectivity, equal to the total number of calls, or the numbers of seconds of communication between two vertices during the interval of observation).

We attempt to measure the behavior of individual customers inside the landline operator system analyzing three characteristics in the underlying phone call network graph based in a snapshot data period of one month:

1- The total number of calls made/received by each customer;
2- The total number of distinct callers/called associated with every customer;
3- The total duration of outgoing/ingoing calls for each customer in seconds.

A similar work is conducted before by Seshadri et al. [5] in a mobile network.

Our quantity of interest, in all the cases denoted by x, is a discrete variable. We focus in this paper on fitting and analyzing discrete power – law and lognormal distribution to data, based on the histograms of complementary cumulative distributions in log – log plot, where it is seen a linear or somewhat a parabola decay. In some cases, particularly in the 'tail' part, these two distributions are very close to each other.

A discrete random variable x is said to follow a power – law distribution if its probability mass functions $P(X = x) = p(x)$ is defined by the formula $p(x) = Cx^{-\alpha}$, where C is a normalization constant for $x \geq x_{\min}$ and α the scaling parameter of the distribution. It is said that a discrete random variable x follows a lognormal distribution if its probability mass function is $p(x) = \frac{A(\mu,\sigma)}{x}\exp\left[-\frac{(\ln x - \mu)^2}{2\sigma^2}\right]$, for $x = 1,2,\ldots$,

where μ and σ are parameters and $A(\mu,\sigma)$ is a normalization constant. Throughout our paper, we have worked with their complementary cumulative distribution functions $\overline{F(x)} = P(X \geq x)$, (CCDF).

Estimations on discrete parametric power-law and lognormal distribution, are performed as explained with details by Clauset et al. [12], and implemented by Gillespie [13,14] on poweRlaw package in R platform [15]. We perform a principled statistical framework for discerning and quantifying power – law and lognormal behavior in empirical data via an approach that combines maximum – likelihood fitting methods with goodness – of – fit test [10, 12] based on the Kolmogorov – Smirnov [16] statistics and likelihood ratios. Discrete behavior is approximated with its continuous counterpart using a reliable method, which treats integer values x as they were generated from continuous distributions then rounded to the nearest integer.

At first, are estimated the parameters of the model and the lower cut – off $x_{\min}$. In each fitting, is given also the number of data in the tail of the distribution N_{tail} for which is taken the best fit of the model. Parameter uncertainty is handled by using a nonparametric 'bootstrap' procedure [17]. To derive principled estimates of our uncertainty in the original estimated parameters we generate 2500 bootstrap samples using two cores.

Secondly, the hypothesis we arise here are:

H_0 : Data is generated from the model distribution.

H_1 : Data is not generated from the model distribution.

A standard goodness – of – fit test, which use bootstrapping to generate a p – value, is used to quantify the plausibility of the null hypothesis. If the resulting p – value is greater than 0.1, the model is considered as a plausible hypothesis for data (it is not ruled out), otherwise it is rejected. A large p – value does not mean that the power – law/lognormal model is the correct model for the data, but only that the model is not ruled out. Other distributions can be a better or equal fit for the empirical data.

Thirdly, a direct comparison is done between power – law and lognormal via Vuong's statistic test [18], which is a likelihood ratio test for model selection using Kullback – Leiber criteria. In this part we want to know which distribution is the better fit, if neither of them is ruled out from the goodness – of – fit – test. To apply this test both distributions must use the same $x_{\min}$. The hypothesis we arise here are:

H_0 : Both power – law and lognormal are equally far from the empirical distribution.

H_1 : One of the two distributions is close to the empirical distribution.

The test statistic is the sample average of the log likelihood ratios, standardized by a consistent estimate of its standard deviation. If the null hypothesis is false, and one of the distributions is closer to the empirical, this test statistic goes to +/- infinity with probability 1, indicating the better – fitting class of distributions. Its sign indicates whether or not the first distribution is favored over the second one. This method gives also a p' – value that tells us whether the observed sign is statistically significant. If $p' > 0.1$ the sign is not a reliable indicator an neither of the two distributions is favored.

3. Results

The observed phone call network graph has 4697 vertices, 53341 edges, and is not connected. We have chosen to work with the greatest connected component (GCC) of the network as a very good representative of it. A visualization of GCC of the phone call network is given in Figure 1.

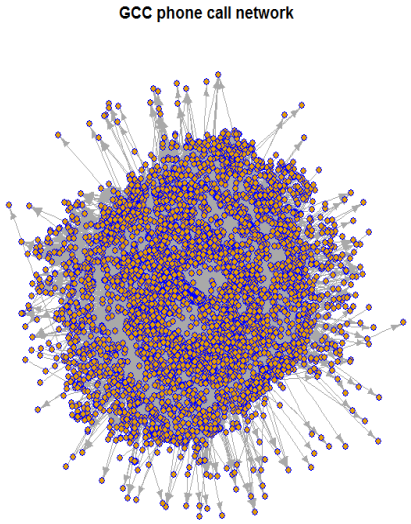

Fig. 1. The directed GCC of the phone call network $G^{GCC} = (V', E')$ *, is connected and has an order* $|V'| = 4695$ *and size* $|E'| = 53340$ *. Igraph [19] package is used to visualize this network.*

a. Phone calls results

In this subsection are given the results of the analysis related to the total number of calls made/received by each customer. Notations used in this subsection are defined as follow:

1. 'Received –In' is used for the number of all phone calls that a customer has received.
2. 'Made – Out' is used for the number of all phone calls that a customer has made.
3. 'P.C – All' is used for the number of all phone calls made or received where a customer is engaged.

Table 1a: Power – law fitting results on phone calls data.

Direction	x_{min}	Sd. x_{min}	Par. α	Sd. Par.	N_{tail}	Sd. N_{tail}	p-value
Received – In	54	2.497	2.884	0.103	361	28.141	**0.15**
Made – Out	15	2.283	1.679	0.037	492	44.789	**0.00(3)**
P.C – All	53	2.069	2.263	0.051	599	31.984	**0.64(5)**

Table1b: Lognormal fitting results on phone calls data.

Direction	x_{min}	Sd. x_{min}	Par. 1 μ	Sd. Par.1	Par. 2 σ	Sd. Par.2	N_{tail}	Sd. N_{tail}	p-value
Received – In	14	2.044	3.172	0.097	0.961	0.051	1307	120.301	**0.31(2)**
Made – Out	1	0.493	-0.209	0.346	2.800	0.135	1818	143.975	**0.48(0)**
P.C – All	37	2.969	-1.749	4.940	2.388	0.606	894	67.699	**0.37(9)**

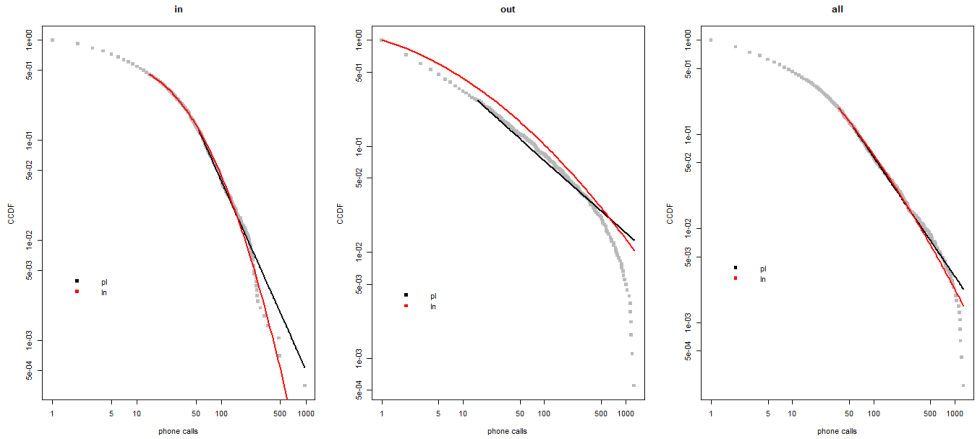

Fig. 2. Separately are fitted power – law (pl) and lognormal (ln) to the Received – In, Made – Out, and P.C – All for each of the customers. The maximal number of Received – In per customer was $x_{\max} = 974$, *while the mean was* $< x >= 25.34$. *The maximal number of the Made – Out per customer was* $x_{\max} = 1276$, *while the mean was* $< x >= 40.1$. *The maximal number of P.C – All per customer was* $x_{\max} = 1276$, *while the mean in this case was* $< x >= 31.05$.

Table 1c. Direct comparison between power – law versus lognormal on phone calls data.

Direction	Test statistic	p' -value
Received – In	-1.449	**0.07(3)**
P.C – All	-1.414	**0.07(8)**

b. Distinct callers results

In this subsection are given the results of the analysis related to the total number of distinct callers/called associated with every customer. Notations used in this subsection are defined as follow:

1. 'Callers – In' is used for the number of all distinct customers that have called a customer.
2. 'Called – Out' is used for the number of all distinct customers called by a customer.

3. 'D.C – All' is used for the number of all distinct pairs of customers (customer v_i, customer v_j), which are related by at least a call without considering the direction, where a customer is engaged.

Table 2a. Power – law fitting results on distinct callers.

Direction	x_{min}	Sd. x_{min}	Par. α	Sd. Par.	N tail	Sd. N_{tail}	p-value
Callers – In	52	4.257	3.742	0.231	238	45.611	**0.01**
Called – Out	4	1.837	1.583	0.062	928	382.131	**0**
D.C – All	33	2.956	2.385	0.051	827	88.056	**0.29(5)**

Table 2b. Lognormal fitting results on distinct callers.

Direction	x_{min}	Sd. x_{min}	Par. 1 μ	Sd. Par.1	Par. 2 σ	Sd. Par.2	N_{tail}	Sd. N_{tail}	p-value
Callers – In	24	6.315	3.390	0.158	0.652	0.061	759	230.428	**0.26**
Called – Out	1	0.801	-0.327	0.484	2.733	0.179	1818	195.038	**0.15(0)**
D.C – All	7	4.209	2.530	0.397	1.302	0.116	2424	484.614	**0.00(1)**

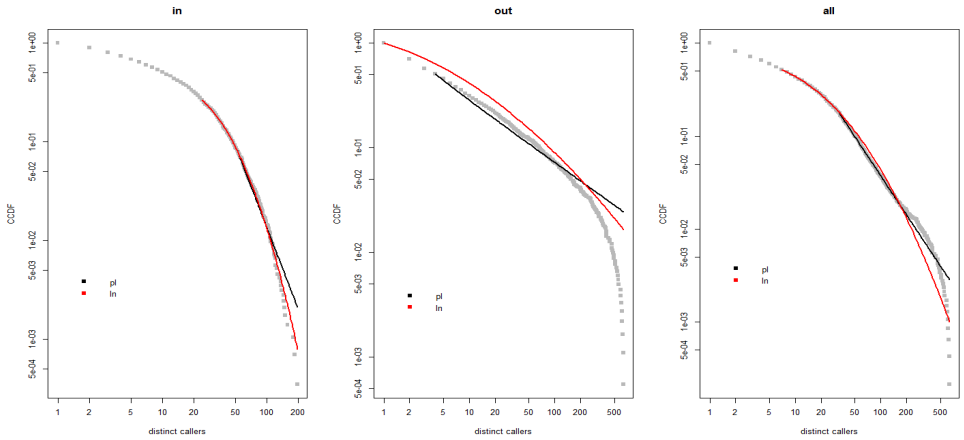

Fig. 3. Separately are fitted power – law (pl) and lognormal (ln) to the Callers – In, Called – Out, and to D.C – All associated with every customer. The maximal number of Callers – In per customer was $x_{\max} = 197$, *while the mean was* $< x >= 18.54$. *The maximal number of Called –Out per customer was* $x_{\max} = 641$, *while the mean was* $< x >= 29.34$. *The maximal number of D. C – All per customer was* $x_{\max} = 641$ *while the mean was* $< x >= 22.72$.

c. Total duration results

In this subsection are given the results of the analysis related to the total duration of outgoing/ingoing calls for each customer in seconds. Notations used in this subsection are defined as follow:

1. 'Ingoing – In' is used as a notation for the duration of all calls that a customer has received.
2. 'Outgoing – Out' is used as a notation for the duration of all calls that a customer has made.
3. 'T.D – All' is used as a notation for the duration of all calls (made or received) where a customer is engaged.

Table 3a. Power – law fitting results on total duration.

Direction	**x_{min}**	**Sd. x_{min}**	**Par. α**	**Sd. Par.**	**N tail**	**Sd. N_{tail}**	**p-value**
Ingoing – In	16257	2.945	3.2	0.156	156	12.118	**1**
Outgoing – Out	2908	5.880	2.151	0.023	1201	20.138	**0**
T.D – All	16588	3.002	3.956	0.146	288	16.338	**1**

Table 3b. Lognormal fitting results on distinct total duration.

Direction	**x_{min}**	**Sd. x_{min}**	**Par.1 μ**	**Sd. Par.1**	**Par.2 σ**	**Sd. Par.2**	**N_{tail}**	**Sd. N_{tail}**	**p-value**
Ingoing – In	5595	3.019	8.761	0.188	0.909	0.081	550	20.686	**0.91(3)**
Outgoing – Out	1017	3.418	8.29	0.027	0.9	0.017	1797	4.542	**4e-04**
T.D – All	368	6.053	8.025	0.020	1.137	0.015	3916	27.015	**0.00(6)**

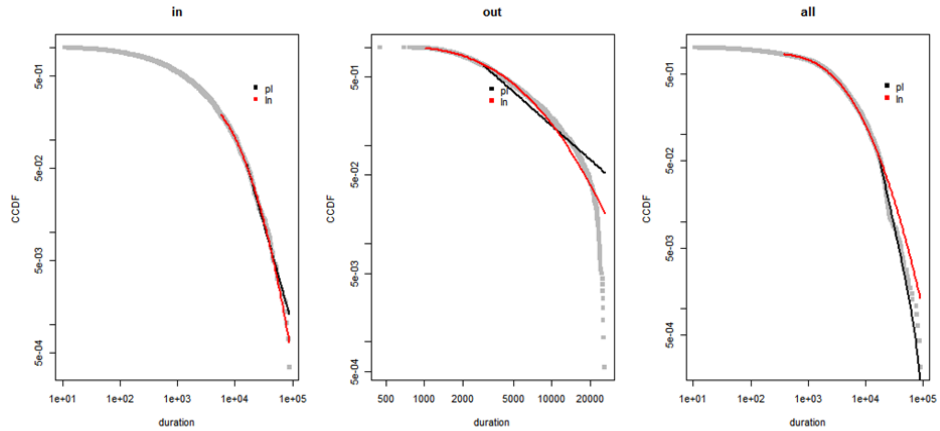

Fig. 4. Separately are fitted power – law (pl) and lognormal (ln) to the Ingoing – In, Outgoing – Out, and to T.D – All duration for each customer in seconds. The maximal total duration about Ingoing – In was $x_{\max} = 88930$, *while the mean was* $< x >= 3917$. *The maximl total duration about Outgoing – Out was* $x_{\max} = 26010$, *while the mean was* $< x >= 6199$. *The maximal total duration about T. D - All was* $x_{\max} = 88930$, *while the mean was* $< x >= 4801$.

Table 3c. Direct comparison between power – law versus lognormal on total duration.

Direction	**Test statistic**	***p'* -value**
Ingoing-In	-1.078	**0.14**

4. Discussion

According to Clauset et al. [12] on estimating:

i. It is obtained a reliable parameter estimation "accurate to about 1% or better provided that $x_{\min} \geq 6$ and $N_{tail} \geq 50$".

ii. Good estimations on $x_{\min}$ were taken provided that $N_{tail} \geq 1000$.

iii. 2500 synthetic data set give a p – value accurate to about two decimal digits.

Related to the cases considered by us, about point *i)* – in all the cases we had $N_{tail} > 50$, meanwhile only in lognormal fit on the total number of calls that a customer has made and to the number of all distinct customers called by a customer, $x_{\min} \geq 6$ was not fulfilled. About point *ii)* – this was fulfilled only for: lognormal distribution on the total number of calls made and received; lognormal distribution on the total number of distinct customers called by a customer and to the number of all the distinct pairs of customers, where a customer was engaged. Also in the power – law and lognormal fit to the total duration of all calls that a customer had made, and to lognormal fit to the total duration of all calls (made or received) that a customer was engaged. About point *iii)* – this was fulfilled for all the cases taken in analysis. All the p – values are accurate to about two decimal digits.

On the direct comparison made through Vuong's test, only in one of the cases (about the total duration of ingoing calls per customer) when neither of the two models was ruled out, p'-value found was not a reliable indicator, because it was greater than 0.1. This suggests that neither of two models is favored.

In most of the cases (six of nine), lognormal dominated over power –law. More specifically, lognormal resulted a better fit for: the total number of all phone calls that a customer had received, had made and was engaged in; the total number of all distinct customers that had called and were called by a customer.

Power – law distribution dominated only in two of nine cases. One case was to the total number of distinct pairs of customers (which had at least a call that lasted more than 10 seconds between each other) associated to every customer, and the second was to the total duration of all calls (made or received) per customer. Meanwhile, there was only one case when both distributions were ruled out. This was for the total duration of outgoing calls per customer. Also was one case, the total duration of all calls received associated to every customer, that neither of two distributions was ruled out, and neither of them was favored by Vuong's test.

Our results are consistent with the findings in [5], where is analyzed user behavior in a large social network at a mobile phone operator. Also in our study, key distributions have different characteristics from power – law and lognormal distributions. As demonstrated in [20], lognormal and power – law distributions connect quite naturally, and it is difficult to make a precise distinguish between them especially in the 'tail' part.

5. Conclusion

As a conclusion, at the end of this paper we can say that the tails analyzed on the greatest connected component of the observed phone call network graph, related on power – law and lognormal fit, showed not a unique behavior for all the cases. They didn't show

characteristics of a pure power – law or lognormal. Since power – law and lognormal in the tail of the distributions are too similar with each other, we couldn't conclude which of them had a determinate dominance over the other in this study. Regardless the complexity, we are considering other models to fit in the three measures considered in this paper, in order to fit all the data. Moreover, even if there is a statistical support for a claimed model, this cannot be as an evidence of universality without a concrete underlying theory that supports it.

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Mid-Term Energy Demand Forecasting in Albania Using Fuzzy Logic

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Abstract: This paper proposes a structure for mid-term energy demand forecasting using fuzzy logic. We have calculated HDD (heating degree days) and CDD (Cooling degree days) based on the average temperature of Albania. These data we have used to forecast the monthly consumption of electricity in Albania based on fuzzy logic. Finally, from the results of the tests done on the models it is confirmed that the proposed models are capable to forecast the monthly energy consumption.

Keywords. Energy Forecasting, Fuzzy Logic, Heating Degree Days, Cooling Degree Days

1. Introduction

Electrical load forecasting is an important tool used to ensure that the energy supplied by purpose of forecasting the load plus the energy lost in the system. To this end, a staff of trained personnel is needed to carry out this specialized function. Load forecasting is always defined as basically the science or art of predicting the future load on a given system, for a specified period of time ahead. These predictions may be just for a fraction of an hour ahead for operation purposes, or as much as 20 years into the future for planning purposes.

Load forecasting can be categorized into three subject areas—namely,

1. Long-range forecasting, which is used to predict loads as distant as 50 years ahead so that expansion planning can be facilitated.

2. Medium-range forecasting, which is used to predict weekly, monthly, and yearly peak loads up to 10 years ahead so that efficient operational planning can be carried out.

3. Short-range forecasting, which is used to predict loads up to a week ahead so that daily running and dispatching costs can be minimized.

2. Fuzzy logic Definitions

Let X be a classical set of objects, called the universe, of which the generic elements are denoted by x. The membership in a crisp subset of X is often viewed as a characteristic function μA from X to {0, 1} such that

$$\mu_A = 1 \; if \; and \; only \; if \; x \epsilon A$$
$$= 0 \; otherwise$$

where {0, 1} is called a valuation set.

If the valuation set is allowed to be the real interval [0, 1], $\tilde{A}$ is called a fuzzy set proposed by Zadeh, and $\mu_{\tilde{A}}(x)$ is the degree of membership of x in $\tilde{A}$. The closer the value

of x in $\mu_A(x)$ is to 1, the more x belongs to $\tilde{A}$ [2]. Therefore, $\tilde{A}$ is completely characterized by the set of ordered pairs:

$$\tilde{A} = \{(x, \mu_A(x)) | x \epsilon X\}$$

It is worth noting that the characteristic function can be either a membership function or a possibility distribution. In this study, if the membership function is preferred, then the characteristic function will be denoted as $\mu_A(x)$. On the other hand, if the possibility distribution is preferred, the characteristic function will be specified as π(x). Zadeh [2] also proposed the following notations When X is a finite set $\{x_1, x_2, \ldots, x_n\}$, a fuzzy set $\tilde{A}$ is then expressed as

$$\tilde{A} = \frac{\mu_A(x_1)}{x_1} + \cdots + \frac{\mu_A(x)}{x_n} = \sum_i \mu_A(x_i)/x_i$$

When X is not a finite set, A then can be written as

$$A \int_x \mu_A(x)/x$$

Sometimes, we might need only objects of a fuzzy set but not its characteristic function to transfer a fuzzy set. To do so, we must consider two concepts: support and α-level cut.

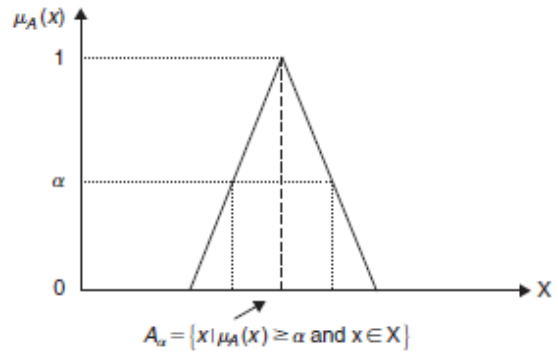


Fig.1.The α-level set (α-cut) of a fuzzy set A.

The fuzzy logic machine accepts fuzzified linguistic fuzzy variables for the inputs. Each linguistic variable belongs to a set of values and is represented by a triangular membership function in the range [0, 1], which corresponds to the degree to which the input belongs to the linguistic class.

3. Concept of Heating and Cooling Degree Days

A "degree day" is a measure of the average temperature's departure from a human comfort level of 18 °C (65 °F). The concept of degree days is used primarily to evaluate energy demand for heating and cooling services.

Using a base temperature of 18 °C, heating degree days (HDDs) are defined as 18 – T, where T is the average temperature of a given day. Thus, a day with an average temperature of 10 °C will have 8 degree heating days. Cooling degree days (CDDs) are calculated in a similar fashion: cooling degree days are defined as T – 18, where T is the

average temperature. We has made HDD and CDD estimates for 13 countries. The methodology for calculating degree days for each country involves two steps: (1) calculation of heating and cooling degree days for all possible locations and (2) weighing degree day data by population, within each country, to obtain a national average.

3.1. Calculating Degree Days

To calculate degree days from monthly average temperatures. We followed the method developed by Erbs et al. (1983), described in Al-Homoud (1998). The Erbs method attempts to correct for under and/or over-representation of heating and cooling degree days when using a monthly average temperature. Typically when using monthly average temperatures, degree days are calculated as $D_m(18- T_a)$ for heating degree days and $D_m(T_a-18)$ for cooling degree days, where D_m is the number of days in the month and T_a is the average monthly temperature. Because this method does not account for temperature variability within the month, it is likely to over or under estimate heating and cooling needs. In order to compensate for this, the Erbs method calculates the standard deviation of the monthly average temperature around the yearly average (σ_y) and the daily average around the monthly average (σ_m). In turn, the standard deviation of the daily average temperatures around the monthly average is used to estimate daily average temperature variability within the month. Degree days for the month can then be calculated as:

$$DD_m = \sigma_m(D_m)^{1.5}[h/2 + ln(e^{-ah} + e^{ah})/2a]$$

where:

$h = (T_{base}-T_a)/[\sigma_m (D_m)^{1/2}]$ *(for heating degree days calculations),*

$h = (T_a-T_{base})/[\sigma_m (D_m)^{1/2}]$ *(for cooling degree days calculations),*

$a = 1.698(D_m)^{1/2}$,

$\sigma_m = 1.45 – 0.29T_a + 0.664\ \sigma_y$

Finally, the degree days for each month were summed to obtain a yearly total. We calculate DD for 13 regions in Albania, based on the average temperature of the regions .

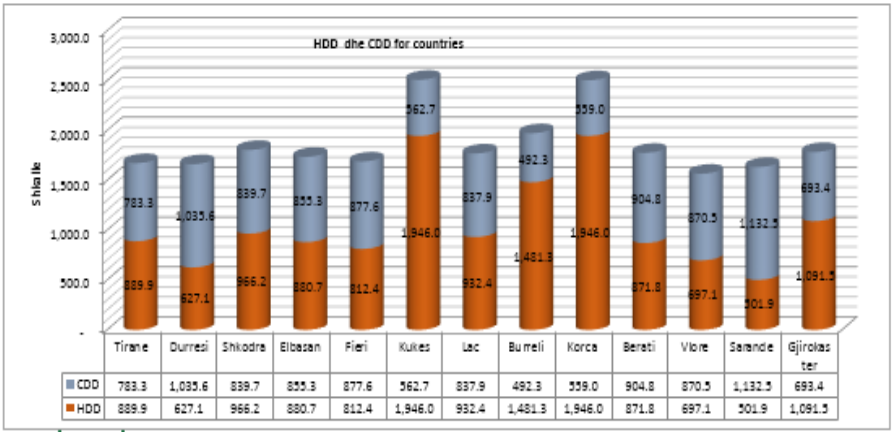


Fig. 2. Show HDD and CDD by regions

As we can see from the chart Korca and Kuksi are two regions that have more need for heating, while Saranda, Durresi, Vlora, which are coastal location so need more cooling. They can be used to forecast electricity consumption by regions, but we should take into

account the number of population of each regions, this will look at another moment because now we will be concerned with the total consumption forecast.

We have calculated HDD and CDD from January – December 2014 based on actual monthly temperature for this period and January – June 2015 based on monthly temperature predicted for this period. HDD and CDD calculated for the period January – June 2015 will use to forecast electricity consumption for this months. As we can see from figure 3, January, July and December are months that have more need for heating and cooling, otherwise from September and October that are comfortable month.

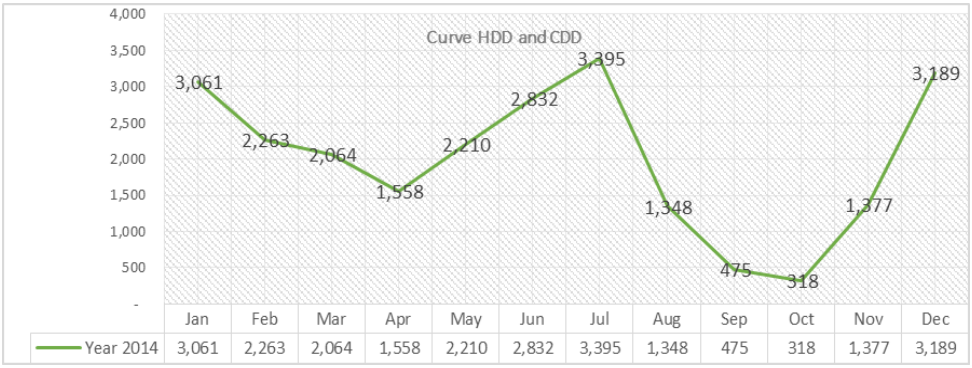


Fig. 3. Show HDD and CDD by month

As we can see that correlation between DD and consumption is strong, taking into account the seasonality we divided the year into four periods the correlation vales for which period are as figure 4.

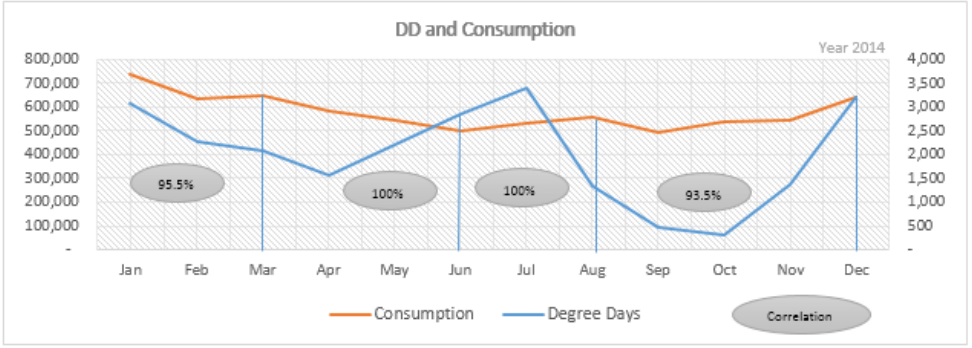


Fig. 4. Correlation between DD and Energy Consumption

4. Application of Electricity Forecasting

Electricity consumption is directly linked to weather conditions this because in Albania the majority of consumers are households, so they use electricity to keep warm in the cold days and vice versa. We have built a model in matlab to predict monthly electricity

consumption. So we used as input (1) actual data for monthly electricity consumption from January – December 2014, (2) degree day HDD & CDD from January–March 2015, (3) degree day's calculated on the average monthly temperature predicted, and as output electricity consumption forecasted from January – March 2015 as we described in 3.1.

The following charts 5 and 6 we can see at the historical trend of electricity consumption since 2009 to 2014 by months and the relationship between energy consumption and degree day.

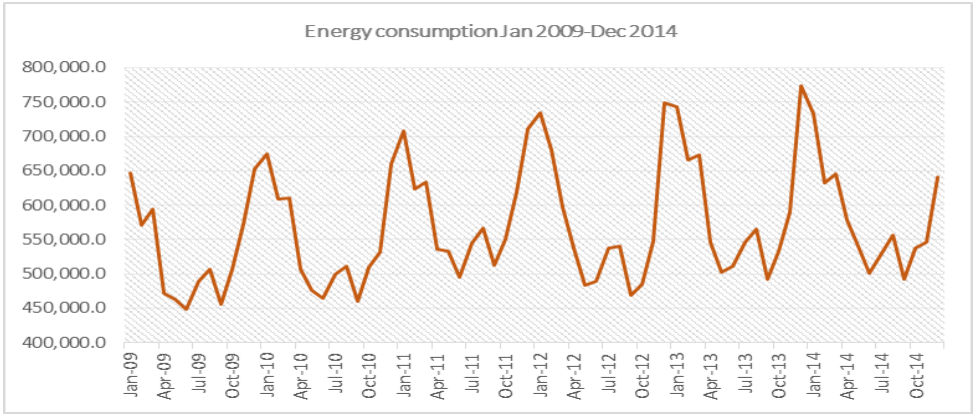


Fig. 5. Energy consumption from Jan-2009-Dec 2014

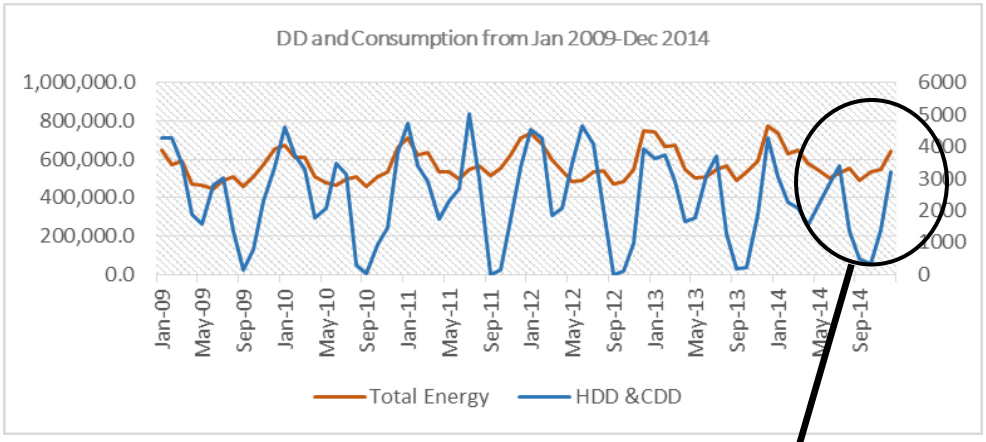
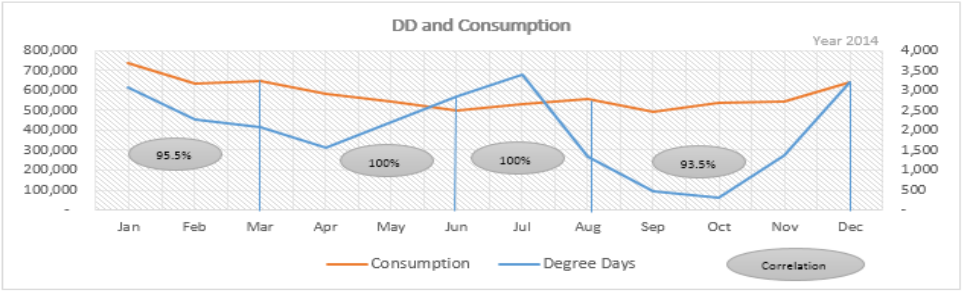
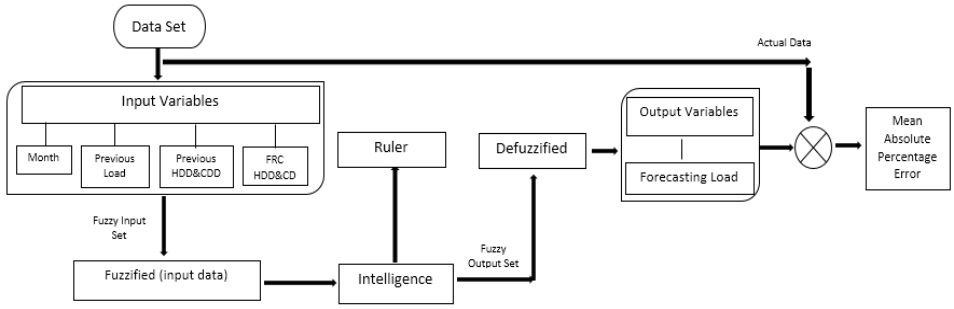


Fig. 6. DD and Consumption from Jan-2009-Dec 2014



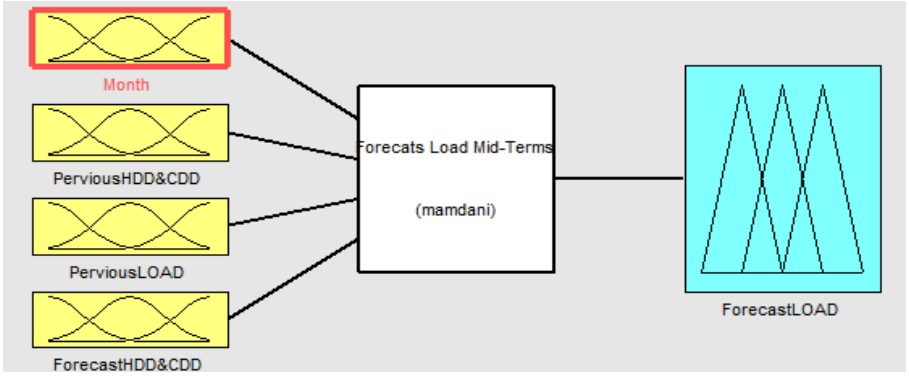
Correlation between DD and Energy Consumption

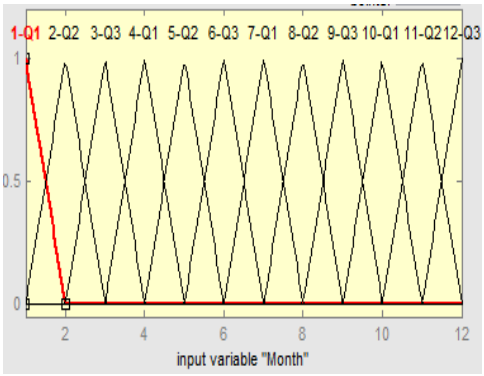


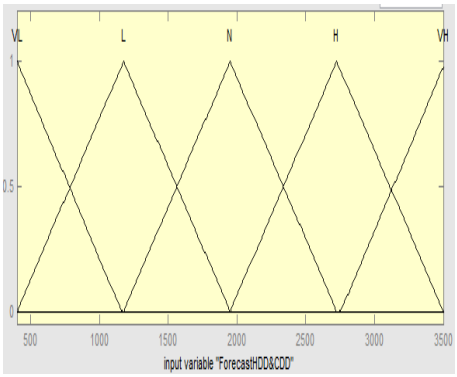
Flow chart of Forecasting Process

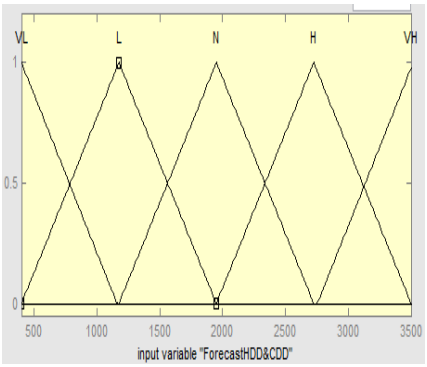
Month of year is one of inputs (named -Month), previous HDD&CDD and pervious LOAD are 2 another inputs representing the time series of HDD and CDD and consumption to the same month of the previous year.

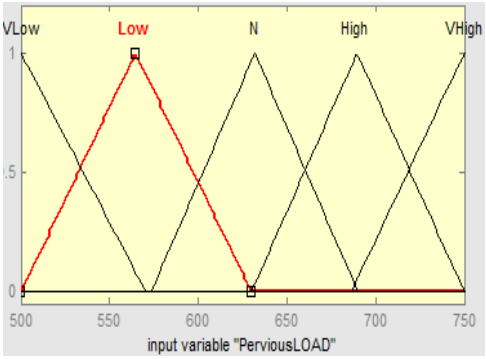
Following we can see fuzzy rule mechanism and fuzzy membership function for input and output plot.

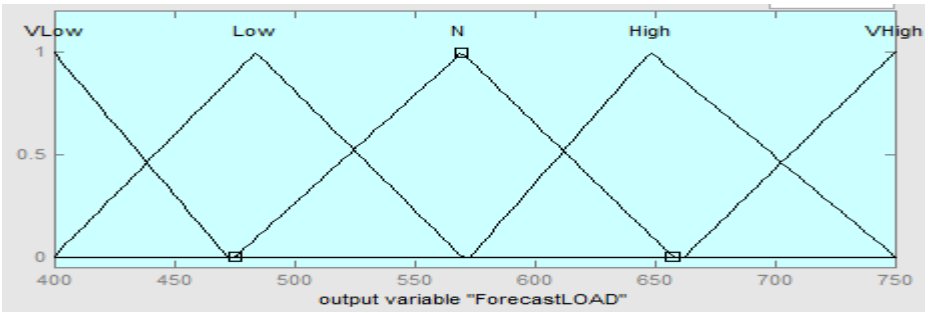



1-Q1 2-Q2 3-Q3 4-Q1 5-Q2 6-Q3 7-Q1 8-Q2 9-Q3 10-Q1 11-Q2 12-Q3
input variable "Month"


VL L N H VH
input variable "ForecastHDD&CDD"


VL L N H VH
input variable "ForecastHDD&CDD"


VLow Low N High VHigh
input variable "PerviousLOAD"


VLow Low N High VHigh
output variable "ForecastLOAD"

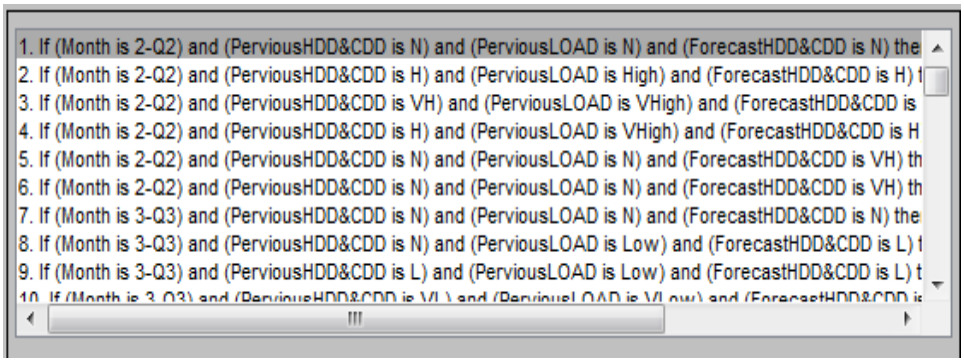


Fig. 7. The Fuzzy rules

The IF-THEN rules are employed to make a more accurate inference for the variations of forecast error from the linear load model. Part of Fuzzy Rule Base is the most important of the fuzzy system. The heuristic knowledge of the forecasted is stored in terms of "IF-THEN" rules. It send information to fuzzy interface system, which evaluates the gained information to get the load forecasted output. The views of our rules is Figure 7.

5. Discussion and Results

Our intention is to predict the monthly electricity consumption with an error of less than 5%, because only that way can we will monitor the situation, to minimize the cost and to secure a good service to electricity.

- Absolute percentage error (APE):

$$APE = \frac{|Actual\ Consumption - Forecasted\ Consumption|}{Actual\ Consumption} x100$$

In the following table are presented results of our method, as we can see the result is satisfactory so for January the percentage error is only 0.73%, February is 0.51% , March is 0.88%, April 2.81%, May 2.88% and Jun 1.95% .

- Mean absolute percentage error (MAPE):

$$MAPE = \frac{1}{N}\sum \frac{|Actual\ Consumption - Forecasted\ Consumption|}{aver\_Actual\ Consumption} x100$$

is 0.71% for first quarter. and 2.6% for second quarter and for the first half of the year MAPE is 1.52%

As we can see from figure 4 we propose to divide the year in quarterly, and predict energy consumption in quarterly, this because we could have forecasted the average monthly temperature, that used for calculation DD, for periods greater than that, the error in predicting the temperature is higher, and therefore the error in predicting consumption will be higher, so at the end of the first quarter we can predict consumption for the second quarter and so on.

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5. Soliman (xxx) Electrical_Load_Forecasting

Logistic Regression to Forecast Customer Behavior

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Abstract: Our aim in this paper is to find the best and most reasonable model for determining the functional relationship between the dependent variable and the independent and determining the unit change for the independent variable. We study a random sample of customers at a market in Vlore to see the relationship between the annual cost of each card and the device with a client as well as their behavior in the days of bidding. It is shown that customers who are client card loyal customer than those who have no customer card.

Keywords: Logistic regression, log likelihood, odd ratio, binary data analysis.

1. Introduction

In logistic regression goal is the same as the method of least squares for linear regression (CEP). Now we want to model the dependent variable in terms of one or more independent variables. However, linear regression is dependent continuous variables; logistic regression is dependent categorical variables. [1] Logistic regression model describes the relationship between a variable Y, encrypted to get a value of 1 or 0, respectively. "The card client" and "without the client card", and k-explanatory variables $x_1,x_2,.....,x_k$. Explanatory variables can be quantitative variables or indicators referring categorical variables levels. Thus Y is a binary variable, which has a Bernoulli distribution with parameter p= P(Y=1), p It is the probability of success for data values x_1, x_2, ...x_k of the explanatory variables. [2] Recalling to the Bernoulli variable, the average is given by:

$$E[Y] = P(Y = 1) = p.$$

Two logistic regression main uses are:

1.The first is the group of variables forecast participant. Since logistic regression to calculate the probability of success probability of failure, the analysis results are in the form of a report to the chances (odds ratio).

2. Regression logistical shows the connections and the strength of connections between variables

2. Logistic regression model

Like other forms of regression analysis, logistic regression enables the use of one or more predictor variables that may be continuous or detailed data. Given that change it is necessary logistic regression get natural logarithm of opportunities (referred to as log-log it

or opportunities) to create a continuous condition. Log it of success is to be adjusted using regression analysis. [3]

Logistic regression model is defined as follows. Assume thatY_1…..,Y_n are independent Bernoulli variables, with the average value of pi shows Y_i and is given : p_i = E[Y_i] = P(Y_i=1). Average value p_i, it can be expressed in terms of explanatory variables x $_{i,1}$, x $_{i,2}$, . . . , x $_{i,k,}$ like :

$$P_i=\frac{1}{1+\exp\left(-\beta_0-\sum_{j=1}^{k}\beta_j x_{i,j}\right)} \quad (1)$$

$$\text{logit}(p_i) = \log\left(\frac{p_i}{1-p_i}\right) = \beta_0 + \sum_{j=1}^{k}\beta_j x_{i,j}. \quad (2)$$

Sometimes the equation (2) is called log it model forms. We note that, log it (p_i) is log odds Success for data values $x_{i,1}$,$x_{i,2}$,.....,$x_{i,k}$ the explanatory variables. In this case, the probability of success, drink, can not be explained as a success ratio, but must be explained as an average of Yi, that is, p_i = E[Y_i] =P(Y_i=1). In logistic regression model variables Yi correspondent are Bernoulli distribution with parameter drink, instead of the normal distribution as linear regression models. Also, Yi corresponding variables have different variance, [Y_i] = p_i (1 – p_i) , i = 1, . . . , n ; unlike linear regression models. [4] Due to the different distribution between logistic regression models and linear regression models, it is not surprising that one can not apply the same method to estimate parameters β_0,β_1……,β_k the two models above. In logistic regression, the parameters are estimated using maximum likelihood estimation.

2.1 Assessing the adequacy of the model

As in linear regression which used statistical $R^2 = \frac{SKR}{SKP} = 1 - \frac{SKM}{SKP}$ to show whether the model is good or not ($R^2 \epsilon [0;1]$and closer to the more accurate 1 k. regression), or F, in the logistic regression assessed the suitability of the model in this way almost but not with these statistics. Mathematically used log likelihood value multiplied by -2 and given the statistics -2LL briefly. This value is obtained by final logarithm value resulting from the above estimated parameters.

Large positive values indicate a better prediction model. The model that contains only the free term and then -2LL represents what the corresponding linear regression deviation (NPS) and denotedD_0. Calculation of D_0It is given by the following relationship:

$$D_0 = -2\{n_{Y=1}\ln[P(Y=1)] + n_{Y=0}\ln[P(Y=0)]\} \quad (3)$$

Where $n_{Y=1}$the number of cases for which$Y = 1$, $n_{Y=0}$ the number of cases for which $Y = 0$, $N$the total number of cases,

$P(Y=1) = \frac{n_{Y=1}}{N}$ is the probability that$Y = 1$ and $P(Y=0) = \frac{n_{Y=0}}{N}$ is the probability that $Y = 0$.

In the model that contains the term as free, as well as the independent variable or variables, so in the full model (different from above), [5] the value of -2LL statistics shows the data that is not explained by equation (thus avoiding error) and marked $D_M$and the smaller it is, the more valuable the equation.

The difference between D_0 dhe D_M it gives the variability of independent variable or variables (variability explained by the model) and denoted $G_M = D_0 - D_M$.

Otherwise G_M it called Hi-square statistics and shows the error in a model reduced, but this is nested (nested). Where a model A is called superimposed on a model B, if the model A consists of several terms that contains the B, while model B has some other additional terms thus:

$$M_A = a + b \Rightarrow M_B = a + b + c$$

In this way, they are superimposed models, statistics G_M used to check the validity of logistic regression through hypotheses:

$$H_0: \beta_1 = \beta_2 = \beta_3 = \cdots = \beta_k = 0 \quad \text{and} \quad H_a : \beta_1 \neq \beta_2 \neq \beta_3 \neq \cdots \neq \beta_k \neq 0$$

where if the variability explained by the model so statistics G_M It turns out to be a big number, so not a negative, and close to zero, then G_M It turns out to be statistically significant, then our model of logistic regression valid H_0 it is not accepted, H_a it is accepted. [6]

Another statistic similar obtained using G_M, D_0, D_M is that pseudo R^2 which resembles a lot with statistics R^2 used in linear regression, and gets maximum value close to 1-shit.Kjo statistic used simple logistic regression and multiple simultaneously.

$$R_L^2 = \frac{G_M}{D_0} = \frac{G_M}{G_M + D_M} \tag{4}$$

The above statistics in the literature known as index I McFadden R_L^2. We may consider the reduction of error in the model and the closer one census to be, the more errors and therefore reduced equation is valid. [7]

2.2 Wald Statistics

When assessing the contribution of individual preachers in a certain model, we can consider the importance of Wald statistics. Wald statistics, the same as in linear regression t-test was used to assess the significance of the coefficients. Wald statistic is the ratio of the square of the square regression coefficient standard error coefficient and is distributed as a chi-square distribution. [8]

$$W_j = \frac{B_j^2}{SE_B^2 j} \tag{5}$$

2.3 Report likely (odds ratio)

To transform the model this is given as follows:

$$L = \ln\left(\frac{p}{1-p}\right) = z = \beta_0 + \beta_1 X_1, \tag{6}$$

where L is the logarithm of the ratio of probabilities, and moreover is not just linear according to variable x, but also according to its linear. So logistic regression works with the likelihood ratio, which means the relationship between two potential entries p and p-1, then between probability 1-sold and 0's, where.

$$odds = \frac{p}{1-p} \tag{7}$$

In this way, we use the reports to assess the relationship between two variables of a function (for examples appreciate the variable y obtained for each level of another variable x). For when odds> 1 we have to grow logarithmic function as long as X rises as the odds <1 have to sit logarithmic function as long as X is reduced but never tends towards -∞. Unlike probability that moves [0.1], the ratio of probability in the interval (0, + ∞), and ln (odds) in the interval (-∞, + ∞) but being deployed to a number of negative not going down indefinitely. It is important to note that the probability, odds and log (ln) are three different ways (different mathematical results), but expressing the same thing [9]. Log it transformation only serves to ensure the correctness of mathematical analysis.

3. Statistical Data Application

It is believed that the total shpenzhimet a supermarket and if a customer has the customer card are two important variables in predicting a customer who has credit card, will be used. Therefore in this study we used a choice which consists of information for n = 1 000 clients (100 and 900 have credit card have credit card). The set of data consists of a dependent variables and forecast variables (predictor variables). [10] Once consumers are provided opportunity to benefit from the promotion of company we look at what the report can be divided by gender. All the clients provided with a customer card you have made a mobile 'after you let you know that market set for two weeks there will be bids for llojsheri articles. So we will see that all these customer that is making calls or you have come across in the days of bids to spend. What percentages of consumers have taken the call and went for expenses in relation to the sex is as is the percentage? To every customer the total costs market Lekë 2000 and {0,1} are listed whether or not the client has kart client (see Table 1). Logistic regression model will be used to assess what kind of potential customer is to benefit from the promotion of the company. [11]

Table 1.Description of features for the database community

Variables	**Description**
Use client card	{0 → don't use and 1 → use}
Total costs	Are in " thousand ALL (Lek)"
Use credit card	{0 → don't use and 1 → use}

If you want to see how consumers are divided according to the sex we can say that 713 customers are women Of which 507 are called out of which 27 have no customer card, 83 not responded of which 13 have no customer card and calling 103 are not out of which 90 have no customer card.. While consumers in total are 287 men of whom 227 are call of which 5 have no customer card, 21 not responded of which 1 no card kart and 39 client and are not calling out of which 33 have no customer card. With great expectation to spend is on those customers who are having card customer answer the call and have come to spend their 96.83% and 3.62% have no customer card but have come to spend. But also customers who do not have the client cart although did not take the call at the time the bids are more favorable to go to these customer costs are only loyal customer in the case of bids in contrast to clients that have the client card.

Figure 1 shows that customers can be grouped as follows:

- Customers who do not use credit cards (89.94% theirs) costs much less (to 10 thousand) that those who buy with credit card (0.50% theirs)
- Consumers, middle class, who spend, who cost by 10-20 thousand cash purchase 16.83 % and credit card purchase 83.17%
- Customers who spend from 20-28 thousand cash purchase 4% purchase credit card 16%.

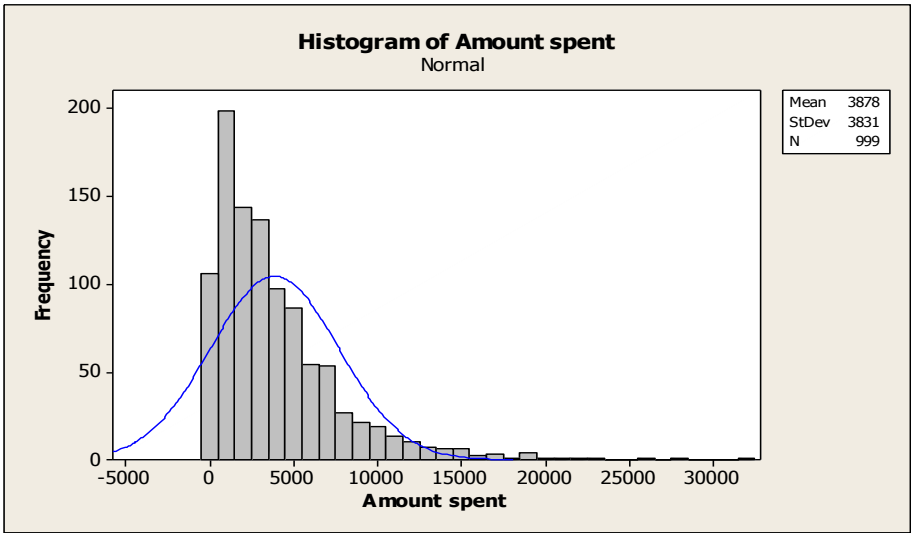

Fig. 1. Shows that customers can be grouped

Logistic Regresion Analysis

The linear logistic regression model was adapted into the set of the data presented in Table 1. In Table 2 are represented the results of RL method performed in Minitab.

Predictor	Coef	SE Coef	Z	P	Odds Ratio	95% CI Lower	95% CI Upper
Constant	1.80229	0.319841	5.63	0.000			
Calls	1.22511	0.340503	3.60	0.000	3.40	1.75	6.64
Credit cart	0.810949	0.771667	1.05	0.293	2.25	0.50	10.21
Total Cost	0.0000016	0.0000451	0.04	0.971	1.00	1.00	1.00

Log-Likelihood = -171.800

Test that all slopes are zero: G = 12.733, DF = 3, P-Value = 0.005

This model is statistically significant for all α= 0.005

Variable

Goodness-of-Fit Tests

Method	Chi-Square	DF	P
Pearson	772.827	799	0.741
Deviance	332.510	799	1.000
Hosmer-Lemeshow	9.090	8	0.335

Table of Observed and Expected Frequencies:
(See Hosmer-Lemeshow Test for the Pearson Chi-Square Statistic)

	Group										
Value	1	2	3	4	5	6	7	8	9	10	Total
1											
Obs	73	79	82	77	79	77	79	82	79	84	791
Exp	71.3	78.8	80.1	79.2	80.1	80.1	79.2	80.2	80.2	81.8	
0											
Obs	10	5	2	6	5	7	4	2	5	0	46
Exp	11.7	5.2	3.9	3.8	3.9	3.9	3.8	3.8	3.8	2.2	
Total	83	84	84	83	84	84	83	84	84	84	837

Measures of Association:
(Between the Response Variable and Predicted Probabilities)

Pairs	Number	Percent	Summary	Measures
Concordant	12108	33.3	Somers' D	0.25
Discordant	3126	8.6	Goodman-Kruskal Gamma	0.59
Ties	21152	58.1	Kendall's Tau-a	0.03
Total	36386	100.0		

The rate of regression equation would be:

$$\hat{y} = \frac{e^{1.53742+0.0000182x1cart-credit-0.156092x2\,total-cost}}{1+e^{1.53742+0.0000182x1cart-credit-0.156092x2\,total-cost}} \quad (8)$$

Now we can use the equation to evaluate the probability of customer card authorization by a client with a very certain. But credit card customer say $x_2 = 1$ and spend 2000 lek

$$\hat{y} = \frac{e^{1.53742+0.0000182*2-0.156092*1}}{1+e^{1.53742+0.0000182*2-0.156092*1}} = 0.79921$$

So the probability is approximately 0.79

If the client does not have credit card and spends 200 lek the probability of use of the Charter is 0.82

$$\hat{y} = \frac{e^{1.53742 + 0.0000182 \cdot 2 - 0.156092 \cdot 0}}{1 + e^{1.53742 + 0.0000182 \cdot 2 - 0.156092 \cdot 0}} = 0.82$$

According to the model, the natural logarithm of odds that a client use client cart is positively associated with both variables (cost and Credit cart) with p=.587 and p=0.001 respectively. In other words, the more money a client has spent a client, the greater will be the chance of being a user (that a client used client cart). Exp (B) for the total cost (expenditure) is equal to 0.702, which means when the total costs are added to a unit (2000 lek), the client is 0.702 times more likely to use the card customer than not. Also based on the 95% confidence interval for the expenditure we see that it contains the value 1 and in such cases it is said that change in expenditures is statistically insignificant, and for other intervals that do not contain the value 1 the opposite is true. [12]

Table.2. Results of the logistic regression analysis.

	B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a] credit card (1)	-.205	.377	.295	1	.587	.815
Value Cost _A	.000	.000	.146	1	.702	1.000
Constant	1.774	.377	22.202	1	.000	5.896

a. Variable(s) entered on step 1: credit card, Value Cost-A.

Equation (8) can be used to assess the probability that a given customer will be used or not client-cart. [13]

The analysis showed that the most reliable clients are those clients that have the client card, and after receiving the call had come to spend the market. Client you do not have a client card are the trustful customer at the time of bidding only.

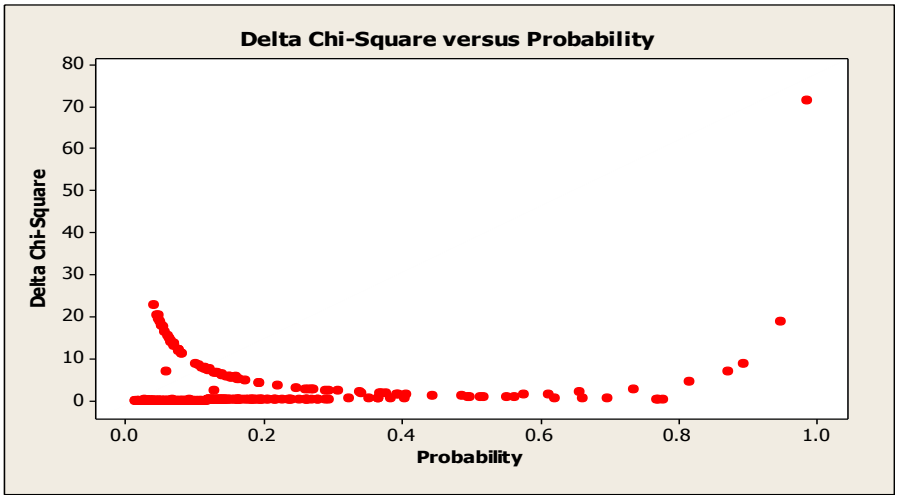

Fig. 2. Yes provide dependency graph to probability square c-hi.

4. Conclusion

The analysis showed that customers using the customer card are more convenient to use the credit card than not compared with those with no client and chances kart certainly increase when the total cost grow. Also it shows that a customer who has received the credit card the call is 3herë most favorable to the client using the card than not compared with those with no client card.

Also 17.52% of the clients who have no customer card after having received the call costs have gone for it means that customers who have not been other clients client card in case offers reliable. End from customers who are calling card client only 5.32% .They have not gone to costs.

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Approach Investigation of Computer Crimes

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Abstract: In this paper was analyzed the scheme investigative tasks of computer crime, allowing through the production of information technology forensics and described the structure of the obvious sign circumstances to unauthorized access, which defined a way to penetrate the computer system and proved a fact of violation, that entailed destruction, blocking or modification of legally protected information security and cause significant damage.

Keywords: Internal and external violator, computer crime, investigation, unauthorized access, electromagnetic and magnetic fields, malicious software.

1. Introduction

Into the 21 century, info communication technology have paved the way and methods for us to experience and wonderful conveniences in the how we are studied, how we are entertained and the manner in which we do business. Our lifecycle lives have been forever changed thanks to rapid advances made in the field of info communication technology. Nowadays in large companies the information security is mainly provided only through researching firewalls, anti-spam systems, a variety of anti-virus software and other means of countering external threats. All these tools help to resist the actions of their own employees or other persons authorized by the company's internal resources. In this case, protected from external violator, the company remains virtually defenseless against the intruder security. Internal violator - it possesses certain rights to access to information resources legitimate employee.

In recent years, major leaks of critical information have been connected with the actions of insiders and therefore protection from the actions of the offender at the moment is one of the priorities.

Existing security systems, monitoring the actions of the companies do not provide guarantee to prevent unauthorized actions and to collect evidence at the commission. The vast majority of systems can only record separately taken the actions of the company's computer. Key actions recorded by such systems include:

- launching applications;
- document printing;
- connect the external recording devices;
- network data transmission, text input from the keyboard and transferring of files.

Because the operating system in conjunction with the installed software is technically difficult such security cannot provide for all possible user actions requiring attention and logging [1]. There is always the possibility of finding a variety of vulnerabilities to circumvent the security system installed. Such a case is not explicitly recorded in the journal and its detection is difficult.

It is well known that some measures of prevention are not always possible to prevent criminal trespass. In this connection it is necessary to deal not only with the protection of computer systems, but also address the issues of computer crime investigation.

2. Analyses scheme Investigative Tasks of Computer crime

During the investigation the main investigative tasks appropriately addressed in the following order (figure 1). Principle scheme organization of breaking the secure mechanisms of information systems is quite similar [2]. Professional computer hackers generally work only after a thorough preliminary preparation. The most common hacking a computer network is performed early when the security forces on duty lose their vigilance, and call for help is difficult.

3. The Structure of Sign Circumstances to Unauthorized Access

In signs of unauthorized access or preparation for it may indicate the following obvious facts (figure 2).

Define the place and time of using technical tools of direct remote unauthorized access is not included in information system or network, in practice it is quite difficult. For establish these data necessary to involve experts. A way of unauthorized access can be installed through the production of information technology forensics.

Unauthorized access to sensitive computer system or network is technologically very complex action. To commit such an action can only specialists with significant skills [3]. Therefore the search for the suspects should be initiated with the technical staff affected computer systems or networks (development of appropriate systems, their managers, operators, programmers, engineers, communications, information security specialists and others).

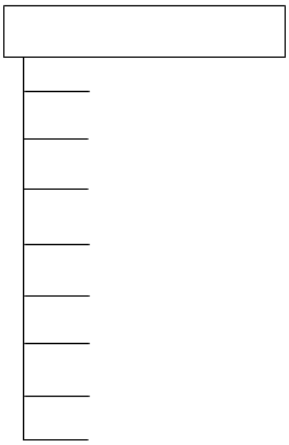

Fig.1. The scheme investigative tasks of computer crime

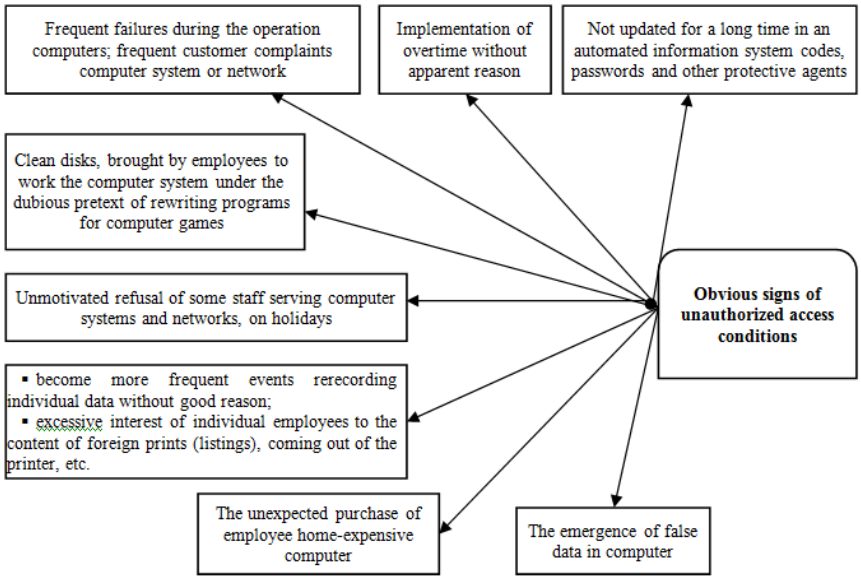

Fig.2. The structure of the obvious sign circumstances to unauthorized access

The investigative practice shows that the more complex technically a way to penetrate the computer system or network, the more easily identify the suspect as a circle of professionals with appropriate skills, usually very limited.

Under investigation of computer crimes, related to the creation, use and distribution of malicious programs to a computer, it is advisable to apply the following steps:

1. Establishing the facts and ways to create a malicious computer programs.
2. Establishing the facts of use and distribution of malicious software.
3. Establishing of those responsible for the creation, use and distribution of malicious computer programs.
4. Establishing of the harm caused by this crime.
5. Establishing of the circumstances that contributed to the commission of the offense under investigation.

4. Investigating Violations of the Rules to Operation Computer

In investigating violations of the rules to operation computer or their network necessary in first to prove a fact of violation, which entailed destruction, blocking or modification of legally protected information security and cause significant damage. In addition, it is necessary to establish and prove:

- place and time (period) violation of the rules to operation computer;
- character information security, subjected to destruction, blocking or modification as a investigating violations of the rules to operation computer or network;
- the way and mechanism for violations of the rules;
- the character and size of damage, caused by the offense;

- the fact violation of the rules determination by person;
- the guilt of the person who committed a criminal violation of the rules of operation to computer;
- the circumstances, that facilitated the commission of the offense under investigation.

In addition, the investigator should be aware that there are many features that should be considered in the manufacture of certain investigative actions. Here are some of them.

If an investigator disposes information that in object of the search is tools of computer technology, decoding data which may give evidence in the case, it has to prepare for their withdrawal. It is necessary to ensure the participation in the course of the search specialist in computer engineering. Upon arrival, the search should immediately take measures to ensure the safety of your computer and available to them data and valuable information. For this to do necessary:

- do not allow someone else from the people working at the facility searched or are there other reasons (personnel), touch the computer for any purpose;
- do not allow someone else from the staff to turn off the power supply facility;
- if at the start of the search utility power is off, to restore it should be disconnected from the power supply all the computer technology located at the facility;
- himself do not make any manipulation by tools of computer technology, if the result of these manipulations is not known beforehand.

After the adoption of the above-mentioned urgent may proceed directly to the search of premises and seizure of computer systems [4]. It should take into account the following adverse effects:

- possible attempts by staff to damage the computer to destroy your valuable data and information;
- possible presence on computers special tools of protection against unauthorized access, which is not received in the time specified special code that will automatically destroy all the information;
- possible presence of a computer in the other tools of protection against unauthorized access;
- constant improvement computer system, which may be a consequence of the presence of on-site software and hardware, unknown to the investigator.

Overall to prevent the harmful effects of these factors, the investigator may use the following guidelines:

1. Before turning off the power possible to correctly close all open programs and in cases of doubt, just turn off the computer.
2. If funds tools to protect computer from unauthorized access to take steps to establish access keys (passwords, algorithms, and so on).
3. Properly power off all computers in the facility (on site).
4. Do not attempt to view the location information contained in computers.
5. If in doubt, do not seek the advice of personnel and to cause the expert is not interested in the outcome of the case.
6. It is necessary to remove all media computer found at the object.
7. When a search does not bring closer than 1 meter to computer technology metal detectors and other sources of magnetic fields.

8. As many people, especially unskilled users record entry and exit procedures when working with a computer system, as well as access passwords, on separate sheets of paper, you should also remove all records pertaining to the computer.

9. Since many commercial and government agencies use the services of emergency and temporarily working professionals servicing a computer system, record the passport data of all persons within the facility, regardless of their explanations of the purpose of stay in the facility.

10. In confiscation of computer system is necessary to ensure strict compliance with requirements of the current criminal procedural legislation. For this necessary to focus on all the witnesses produced by the actions and their results, if necessary, giving them an explanation, as many participants in the investigative action may be incomprehensible produced manipulation. In addition, it should be sealed the computer so as to exclude the possibility of working with them and the dismantling of the physical damage to the main working components in the absence of the owner or expert [5]. When sealing computing devices should impose a single sheet of paper in the power connector on the back panel, the second - at the front of the top with tie-in on the top panel and secure the edges with thick glue. On sheets of paper should be signed by the investigator, witnesses and staff representatives. When removing the magnetic carrier machine information must to remember that they have to move in space and stored only in special sealed and shielded containers or in the standard of discrete or other aluminum case prefabricated excluding the damaging effects of various electromagnetic and magnetic fields and "interference", directed radiation.

11. In the event that it is necessary to refer directly to a specific physical medium, should specify in the report the serial number, type, name or an exact description of his conduct.

Unfortunately, the practice of prosecutors and the investigation shows that the consideration of the recommendations in most cases investigators in practice to investigate computer crimes do not apply. As a result of improper seizure of computer systems extracted information often cannot be evidence in the trial.

5. Conclusion

In conclusion, it should be noted that under analyses general scheme of investigation of crimes related to illegal (unauthorized) access to information, proposed a approach for investigation of computer crimes on the basis of established facts and methods of examination, allowing advisable to present expert with all project documentation for the system under study (if any) and the available data on its certification.

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Construction Hardware Protection Infocommunication Systems from Network Attacks

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Abstract: This article describes how to build hardware intrusion detection systems based on FPGA. The generalized block diagram of the architecture and network intrusion detection systems on platform FPGA. A diagram showing the configuration of the automatic generation of network intrusion detection systems on FPGA, which allows to use many of the important advantages of reconfigurable logic in the first place - flexibility and adaptability.

Keywords: Network, intrusion detection system, FPGA, packet filtering, information security, protection of information communication system.

1. Introduction

The fast development of information and communication technologies in the present day makes it difficult to ensure network security. For protecting of networks commonly, use means of implementing the identification of adverse effects in the process of analyzing network traffic. These means such as determining unwanted network activity is hardware or software of intrusion detection system. For determining of the adverse effects, intrusion detection system uses various methods such as a method of pattern matching, based on the detection of anomalous phenomena and analysis of protocols.

Nowadays in the IT-market, many intrusion detection systems are implemented mostly at the software level. The disadvantage of the software architecture of intrusion detection systems is consecutive character of processor. This means that the processor can analyze only a limited number of network packets. To solve this problem, you must use the architecture allows you to analyze the rules in parallel. This architecture may be obtained using field-programmable gate array (FPGA).

In this paper is given provides detailed information on the design of intrusion detection systems based on a comparison of patterns in a platform FPGA. This approach leads to advantages such as higher processing speed than the software intrusion detection systems.

A number of criteria, including, in terms of complexity and structure, distinguishes intrusion detection systems.

2. Intrusion detection system

Intrusion detection system necessarily includes one or more sensors and the user interface. In structure of the sensor, in turn, generally includes [1]:

- module with sources of information;
- data acquisition subsystem;

• knowledge base;
• control module components;
• intrusion detection module;
• module response.

Fistly analyse must be done possibilities of programmable logic and methods of its using in the intrusion detection system. The main problem in protecting against external attacks, an effective solution that can provide FPGA, is essentially consuming operation signature recognition in the intense flow of network packets.

Depending on the protected object, intrusion detection systems are distinguished:
• controlling individual computers;
• analyzing packets of network traffic across the network.

Using of hardware solutions in the intrusion detection system must be primarily in network version, which requires the maximum load.

Network intrusion detection systems actually used in practice at present, are divided into two main classes, depending on the method of analysis of the events:
• Use the template (Signature-based IDS);
• detect anomalies (Statistical anomaly based IDS).

System anomaly detections opposed to signature used, able to detect new, previously unknown attacks, but nowadays, cause a lot of false positives is unacceptable. Therefore, a network intrusion detection system (NIDS) in the analyzed sources means a system based on the recognition of signatures.

The mechanism of functioning of the network intrusion detection system generally consists of 3 stages:
• capture network packets;
• filtering and fragmentation reassembly;
• pattern matching.

The most resource-intensive is the last step, which is to implement a large number of operations compare the contents of network packets to sequences of characters from a database of signatures.

Network traffic analysis can be performed in two methods:
• by total capturing and inspection of all (raw) packets of network traffic;
• taking into account the network protocols (dismantling the headers of network packets).

Systems based on the first method, a larger number recognize attacks. For them is not an obstacle non-standard port numbers, as well as an artificial distortion of the network packets. But such intrusion detection system is far more resource-intensive in their implementation. For this reason, in the studied sources mainly describe the system, taking into account protocols.

3. The requirements and basic parameters

The analysis of the experience of building the network intrusion detection systems using FPGA allows us to formulate requirements for intrusion detection systems to hardware accelerators, as well as the basic parameters by which to evaluate their effectiveness.

As indicated in work [2], the performance of intrusion detection systems is determined by two main characteristics:
• throughput capacity;
• the total number of templates that can recognize system.

It should be noted that the performance indicator is not an absolutely, it is also important what price it is achieved, that is, the equipment cost and power consumption. Hardware costs when working with FPGA accepted to estimate die size that is used to implement a particular device, absolute or as a percentage of the share of the chip. The units of measurement used in this indicator conditional equivalent logic elements (gates - tracing from the English terminology), system logic elements or some of the structural components of a particular family of FPGA vendor-specific - up table, configurable logic blocks, sections, etc. [3]

An important characteristic of any complex system, these include network intrusion detection system is scalability - the ability to gradually build up possible without disproportionate additional costs. The amount of network traffic and the number of recognizable signatures are constantly changing values, this fact can't be underestimated.

A specific feature of reconfigurable systems, intrusion detection signatures based on a need to regularly add a new template database, and as a result, the generation and loading of the FPGA new configuration. Ease and speed of this operation significantly affect the usefulness of the system.

Due to lack of performance, most modern software solutions of intrusion detection systems are passive, that is, only the signal of the detection of security breaches, in addition, usually with a considerable delay, that is, not in real time. The value of an intrusion detection system is much higher in the case of functions of intrusion prevention (IPS).

The analysis of network traffic at a low level (raw) more efficiently than at a level of the network protocol in terms of information security, but it requires much expensive. Therefore, advanced network intrusion detection systems have to perform the functions of filtration and fragmentation reassembly.

As an essential but useful quality to be mentioned low-level hardware implementation of the network operations resources FPGA (the so-called built-in network interface), which allows cheaper technical solution as a whole and to increase its flexibility.

4. Generalized structure intrusion detection systems based on FPGA

Firstly, you need to formulate in general composition and structure of a hardware implementation on FPGA intrusion detection system that meets the above regulations and requirements. In figure 1 is given a generalized block diagram of the resulting solutions.

Composition of structure includes:

- receiving packets module;
- packet classifier;
- recognition module;
- alarm generation module;
- delay schema;
- packet filter;
- discharge unit packages.

The last three components are present only in the structure of active network intrusion detection systems to implement the functionality of intrusion prevention.

The module provides a low-level packet receive network packet capture and transform it into a more convenient for in-processing type of coding, for example, the format of the XAUI (10 Gigabit Attachment Unit Interface) to the format XGMII (10 Gigabit Media Independent Interface) [4].

Qualifier parses packets based on the header analysis up to a certain level depending on the method of detecting intrusion [5].

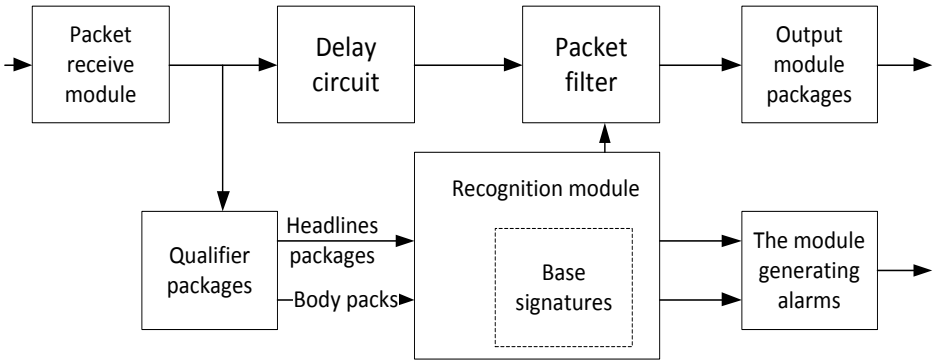

Fig.1. Summarized block diagram of a network intrusion detection system on FPGA

Recognition module performs the most resource-intensive computer search operation signatures in accordance with the selected algorithm. The quality of its implementation is largely dependent on the main characteristics of all intrusion detection systems: performance, scalability and resource-capacity. Consideration of different possible lines of recognition algorithms in the flow of network information used in reconfigurable systems, intrusion detection is beyond the scope of this paper and will be discussed in subsequent publications. In general, for recognition module needed headers and content of network packets as well as the information database of the rules of recognition of signatures, including signatures themselves. Depending on the algorithm implemented by this base or stored separately in the components of internal memory FPGA, either directly "enclosing" in a recognition processing structure [6].

In addition to hardware that implements the actual algorithm for finding pattern matches in the content network packet recognition module generally comprises a recognition circuit and packet header detector rules signature database.

The module is used to generate alarms forming reported intrusion detection. It identifies malicious packets and combines information on the type of attack that comes from the recognition site with additional information from the packet header, allowing to identify the source of the invasion. Generate a message, depending on the structure of the intrusion detection system, obtained either in the response of the sensor module, or via a user interface directly to a security administrator.

A packet filter is to prevent malicious traffic is identified by discarding packets.

Output module package implements the inverse transformation to that performed in the module receiving packets.

Also shown in Figure 2 architecture network intrusion detection system. Here, the unit receives a packet validation downloads each download, which complies with the criteria titles. If the criteria are not the same with any line payload, the network packet is dropped, and further action on the package will not be executed.

In the final stage of the process, if the latter comply with the rules, the headings are linked with rows corresponding to the load header. This unit can verify false positive results of phase comparison of the line, or can send the results to the following processes. This

block sends the results to the output interface FPGA. To demonstrate the output of the results, you can select the RS-232 serial port.

Incoming interface must support throughput-controlled network. This means that the SDRAM memory to be ready for the double processing of data, because the package must be written and read. The rate of outgoing message sharply lower than the rate of incoming packets, and each time only detects malicious package must be able to send a warning signal or a network command. It shows that for each incoming packet should be sent and malicious warning line.

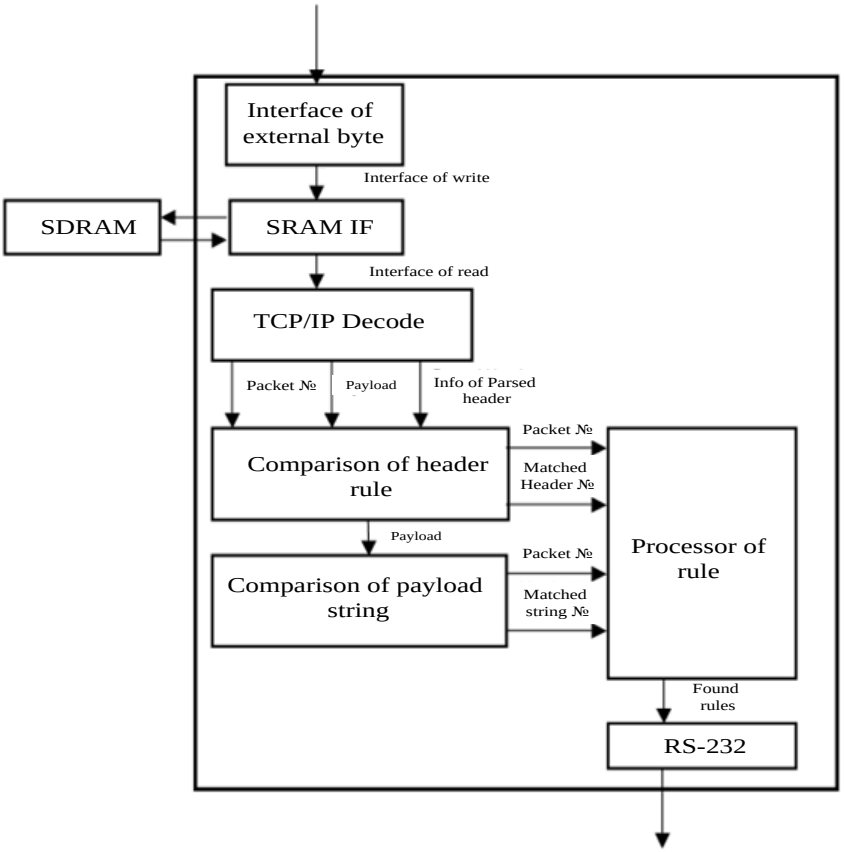

Fig.2. The architecture of IDS on the FPGA platform.

5. Automated generation configurations

As follows from the publications, a network intrusion detection system to allow the FPGA to use many of the important advantages of reconfigurable logic, in the first place - the flexibility and adaptability. In fact, they provide the ability to synthesize a hardware circuit that is optimized not just for a specific task, and a task with a specific set of input parameters (list of analyzed signatures).

In order to efficiently implement this valuable asset, you must take additional measures, namely, to automate the process of generating configurations loaded into the FPGA [5].

In general, the synthesis process configuration for network intrusion detection systems consists of the following stages (Figure 3).

First analyzes signature database currently known attacks. In addition to the templates - sequences of unknown character - the database also contains the rules for their search. As a result of the analysis the actual table of rules, and other support information structures [3].

Most academic research on this topic as the signature sets used database open source intrusion detection systems such as Snort, Hogwash, Bro, etc.

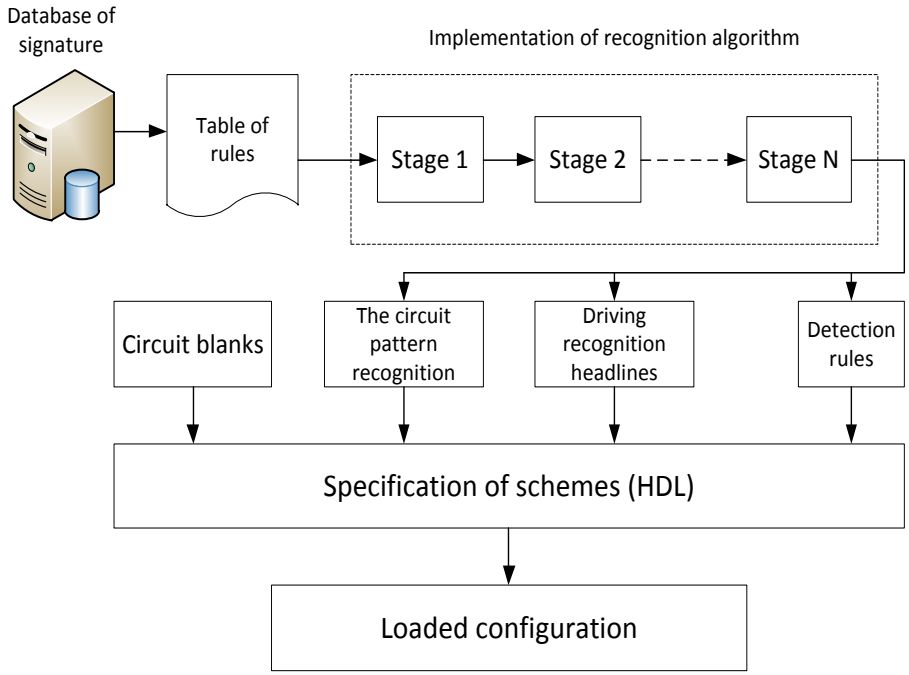

Fig. 3. Stages of synthesis for FPGA configuration as part of the intrusion detection system

This solution enables, on one hand, to bring the ongoing research to real life, thanks to the prevalence of intensive and practical use of the above systems. On the other hand, using the same sets of rules as input for easier comparison of the various methods, algorithms and solutions implemented in particular network intrusion detection systems. A more detailed discussion of issues associated with the use of popular intrusion detection systems with open source hardware implementation on FPGA, and goes beyond the scope of this paper and is scheduled for publication in subsequent articles.

Further stages of synthesis of configurations significantly depend on the algorithms of recognition chosen as a basis for given network systems of detection of attacks. They can consist of various steps and possess various complexities and computing resource intensity. Generally at their exit the following structures are formed:

- templates recognition scheme;
- headings recognition scheme;

• detector of database signatures rules.

At this stage also connected fixed circuit patterns other components that do not depend on a set of recognized rules [3].

Further, by existing structures makes the specification schemes, usually at one of hardware description languages (Hardware Description Language - HDL).

At the final stage of an existing HDL-synthesized description of the configuration file, ready to be loaded into FPGA. This operation can be performed either in the usual way - using proprietary specific manufacturer CAD packages programmable logic chips, or with the help of special software, developed at the same time network intrusion detection systems.

It should be noted that the process is automated generation of configurations for intrusion detection system also requires further study in separate publications.

6. Conclusion

Nowdays, the global scientific community attaches great attention to the problems of creating FPGA-based high-performance systems such as intrusion detection signature

As a base for experimental signatures of network intrusion detection systems on an FPGA in the studied developments often used one of the open source database, supported by the global Internet community on the rights of the open source software.

In this paper was analyzed the existing world experience in developing such systems. The requirements and basic technical parameters were formulated. General structure of reconfigurable network intrusion detection system was described. Several important components are reviewed.

Generalized structure of the automated generation of configurations loaded in the FPGA network intrusion detection systems was described.

At the same in the present paper was indicated many moments that require further research and synthesis, which indirectly indicates the scale and relevance of the research problem.

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Development Method of Code Detection System on Based Racewalk Algorithm on Platform FPGA

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Abstract: In this article shown method of development hardware code detection systems on platform FPGA on based Racewalk algorithm. For this purpose a system of ordinary differential equations is used. Promising directions for future research are outlined.

Keywords: FPGA, code, network traffic, packet filtering, Racewalk algorithm.

1. Introduction

Securing sharing network - one of the problems encountered in the complex (including networked) information and communication systems, and the Internet. To solve it applies filtering and clipping of malicious network traffic.

Used methods of code filtering computationally complex, and some in the spatial plan. Detecting code for network channels with a capacity of more than 1 Gbit/s using calculators, general purpose [4, 5] is difficult or impossible because of the nature of domestic tires and their throughput capabilities, features the organization of access processors to memory, and related overheads associated with the operation of the operating system (OS) and the input-output.

This article discusses one method of solving the problem code detection and filtering network traffic and its implementation on programmable logic integrated circuits (FPGA) type Xilinx. Designed by the filter can be adapted to filter malicious executable sequences of processor architectures, as1-64, MIPS, ARM, SPARC, JVM, which will implement the filtering malicious traffic for mobile operators of mobile communication.

2. Filtering Network Traffic

When implementing a filter network traffic based on the electronic computer (PC) General purpose the following problems occur:

1. Reception and transmission of network traffic on a computer peripherals sold IO. Service peripheral side OS is reduced to transfer data from the buffer of the receiver network device into the computer memory, accessing data from an application analyser, data analysis, as well as the related transactions running on planning processes and switching between them, the treatment data.

2. Evaluators general purpose hard wired to a specific (albeit full terms of computing) instruction set that is physically unable to provide instructions for the effective implementation of specific data processing in applications (for example, calculation of the checksum in one operation of the processor). No less significant limitations are rigid structure and a small amount of internal memory (registers), general-purpose processors.

This feature does not allow effective implementation of streaming data from the high percentage of cache misses, leading to a drop in the actual effective CPU performance to the performance of RAM.

From the above it can be concluded that natural desire to realize the analysis of network traffic in real-time wire-speed hard to implement on a general-purpose computer architectures because of the high overhead costs and no determinism conduct hardware and software, operating system components.

It should be noted that systems using calculators general purpose occupy physically more space and power consumption are usually several times higher than that of embedded systems, oriented to solve a particular problem and showing the performance characteristics in their decision not lower than the computer.

Typical code can attack the vulnerability of memory in some applications, such as the attack on the stack overflow, heap, and as a result, has a well-defined structure, predefined type used vulnerability. Modern operating systems contain specialized mechanisms of protection against buffer overflow attacks, such as ASLR (address space layout randomization), the prohibition of execution stack address randomization library functions. Due to this specific vulnerability often can not accurately predict the address at which the body is loaded code. To increase the likelihood of successful exploitation of this vulnerability in the code introduce large sequence of instructions that "do nothing" - their sole purpose is to control the transfer at any point within a sequence of code execution reached the "payload" code. Such sequences are called NOP-track. Typically, NOP-track has a considerable length in the hundreds or even thousands of bytes correctly disassembles with each byte (in other words, the sequence of bytes obtained by the removal of any number of bytes from the beginning of the original sequence, a correct sequence of instructions target calculator).

The task of finding malicious code can be reduced to the problem of finding a special kind substring in the input string.

In practice, using three classes of algorithms that solve the problem of detecting code: static analysis, dynamic analysis and hybrid algorithms that combine elements of both approaches.

The essence of the static analysis [1, 6] is deciding severity audited sequence based on the analysis of the input sequence as the text of the program in machine language (without design). Typically, during the static analysis verified some heuristics. An example of this is the availability heuristic in the test sequence NOP-track [6], ie, some subsequence that can disassemble and properly comply with any offset with respect to the subsequence. The advantages of this approach are quite low as computational and spatial complexity, a clear focus on the production data processing without the need for buffering. The disadvantages are the high rate of false positives.

The essence of dynamic analysis [7] is to emulate the performance of the analysed sequence or on the title of the target architecture and the calculation of heuristics about the behaviour of the analysed code. This method is more accurate but also more computationally complex than the static analysis.

The use of the calculator, optimized for the needs of specific data analysis algorithms, allows you to remove most of the problems associated with the implementation of network filters, aimed at finding code. One of the technologies for the creation of a calculator specially adapted for solving user problems is the technology of FPGA.

Application of FPGA, due to the possibility of creating a fully specialized and task-oriented architecture ensures a high level of parallelism computation, compact and relatively low power consumption as compared to the "classical" processors.

3. Hardware Implementation of a System to Determine the Method of Attacks

The purpose of this project is to identify network attacks based on FPGA systems. This system is based on the application of the rules for Snort IDS software [5].

In figure 1 block diagram of FPGA-based detection of network attacks, you will need to fulfil the ideal hardware platform for network flow. Ethernet traffic on a platform Ethernet MAC / PHY through. Ethernet MAC /PHY outgoing IP packets sent to the FPGA for data processing and filtering of traffic. Filter incoming packets are stored in the SDRAM and SRAM. Outgoing warning signal, which can monitor other network security interface.

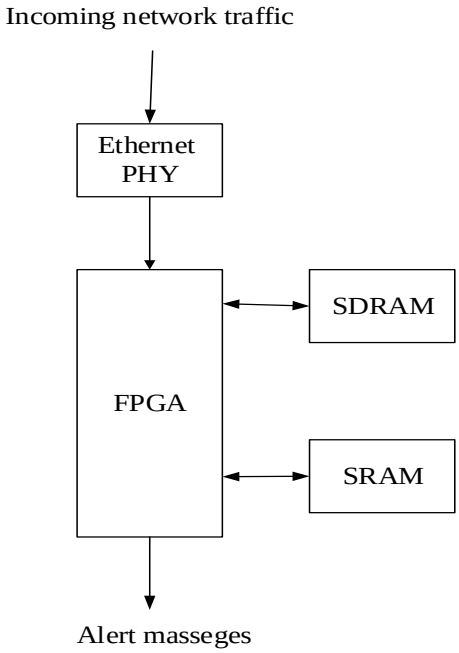

Fig.1. Block diagram of FPGA-based detection.

According to the proposals in this direction aimed at supporting line optimization to compare the projects.

- The first iteration design is based on a limited set of rules.
- IDS only (TCP) protocols and a variety of packages to improve the quality of future research.
- Ethernet packets before the start of the process of decoding the problems associated with the design, test packages can be solved by placing the memory of the FPGA.

This iteration searching for rows of designing different packages together to solve the problems associated with the injection.

4. An Algorithm for Solving

As an algorithm for solving the problem in this study was chosen algorithm static analysis of network traffic Racewalk [6]. The basic idea of this algorithm is to find and allocate NOP-equivalent sequences of the incoming flow and the subsequent classification of each identified sequence using machine-learning methods (Fig. 2).

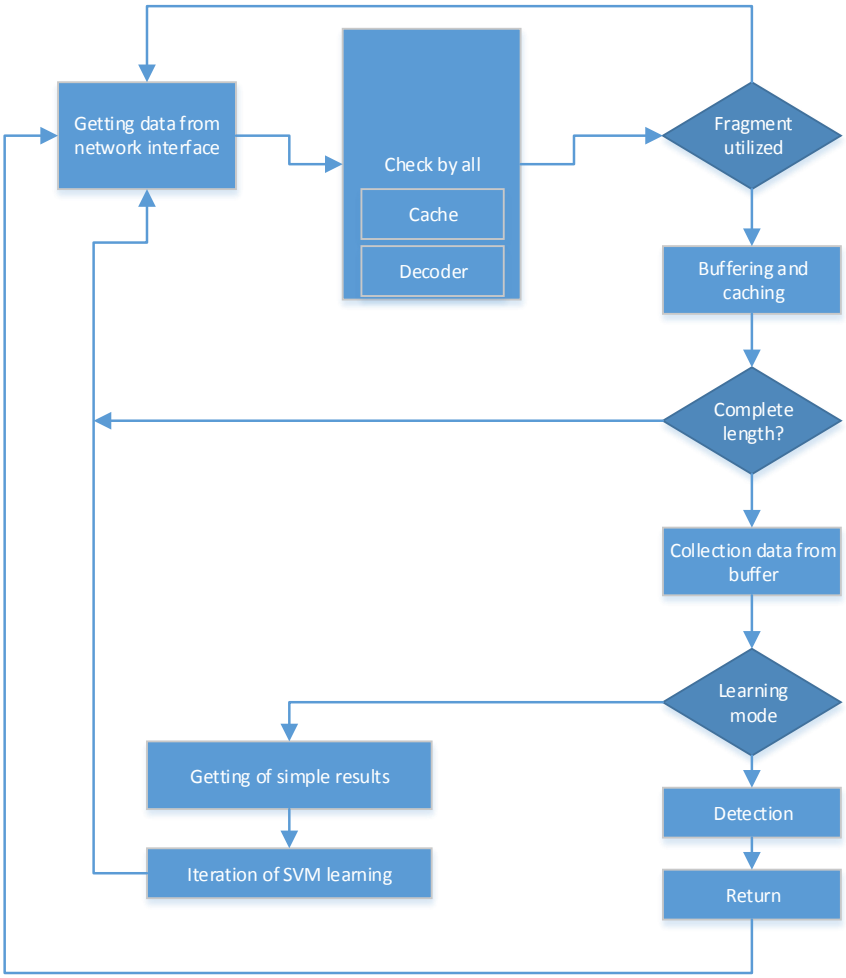

Fig.2. Block diagram of Racewalk algorithm

Search NOP-track is implemented on a specialized calculator (FPGA), for example, in [2-5]. To solve the problem of the search trail used NOP- instruction decoding processor IA-32 [8], in which each section of the input sequence set type of instruction. If the sequence of a given size with each offset is decoded into the correct instructions, though not among the privileged processor instructions x86, such a sequence is considered to be NOP-track.

The classification of the detected sequence is done directly on the computer. For the classification algorithm is used support vector machines (SVM - support vector machine).

5. Hardware design

Improved range of filter FPGA platform developed after analysis of the impact of the implementation of the project to create the filter. FPGA platform with the Altera platform UP3 Educational Board includes Altera FPGA EP1C6Q240. But the platform does not have Ethernet interface for data transmission platform is carried out using the RS-232 serial port.

Serial port Ethernet (10BaseT, 100BaseT, etc ...) is significantly slower. The information packet sent to the hardware package includes analyser 2 stage. The first serial FPGA SRAM array. After 47 MHz, speed data packets are processed on analyser. At the same time filled up the process, platform and RS-232 serial port for the equal distribution of very fast oscillator packages.

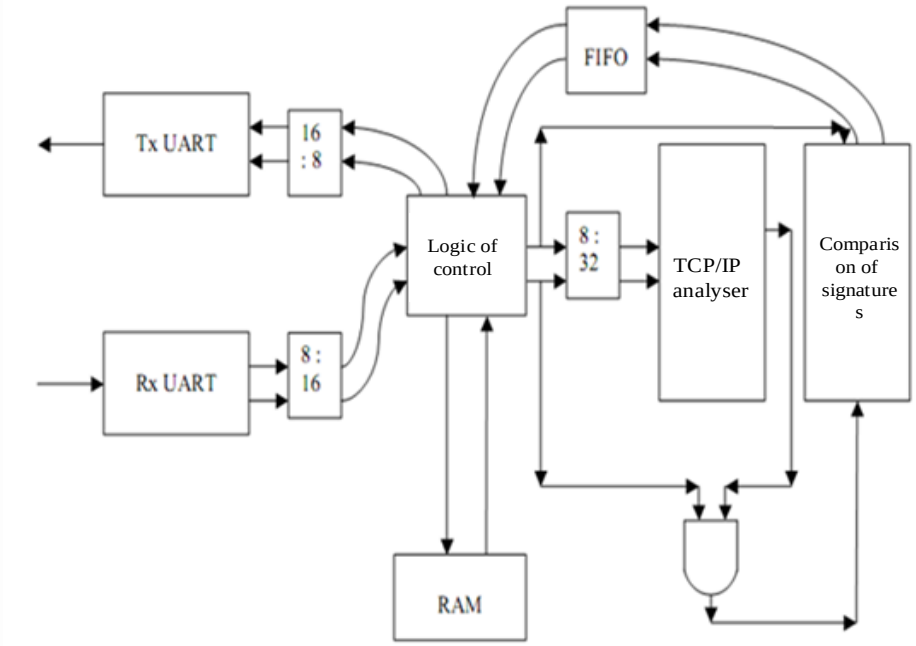

Fig.3. Block diagram of flowchart

The detection system is designed to work in two modes attacks. To put it more precisely, RAM memory package with the installation process and check the components of the package damage. Mode enables the writing of the logical flow of control commands RAM memory packages. UART bits of the sequence flow and converts 8-bit data stream. In addition to the length of the bit within the control logic as applied to 16-bit data stream. Control logic mode, the RAM memory configuration, and the RAM memory in the same way writing compatible software packages. Bit application if the information is not available in the data used tires conveyors are used in the processing of the data stream.

After that, the software provides a logical process control command. Configuration control logic for RAM memory packages and Snort rules set to change and control the flow of information to the processing of packages.

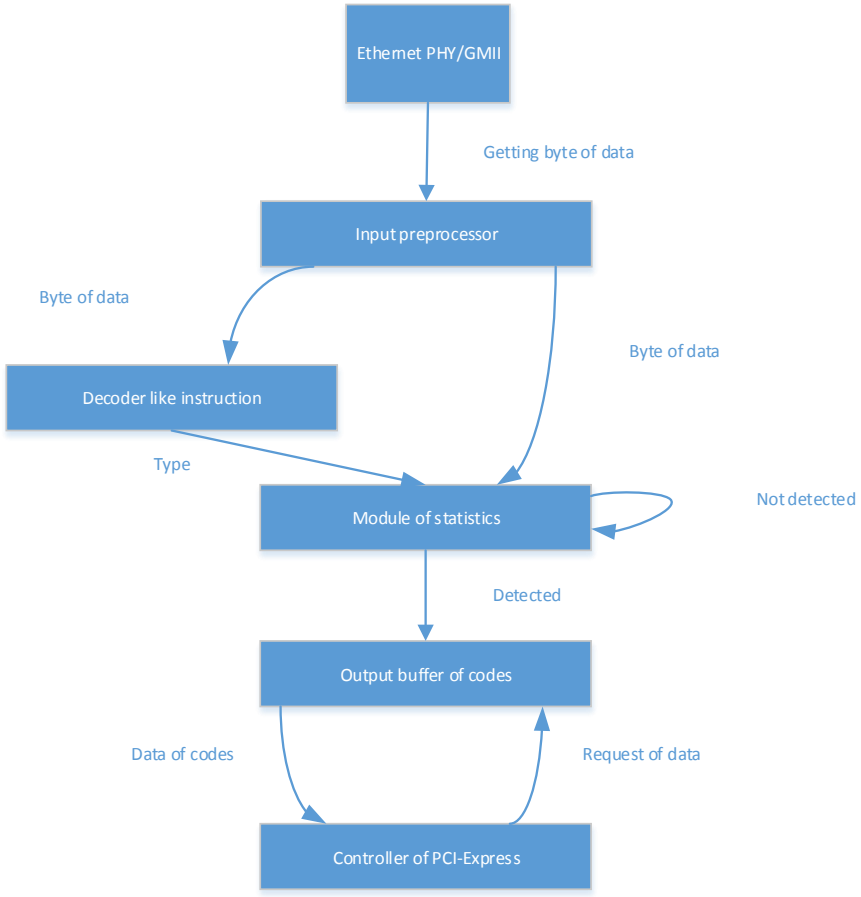

Fig.4. Scheme of flowchart hardware

Management of information flow and logical bit confirming the title stripped and payload rule to analyser packages sent for analysis. 8-bit data stream payload to analyser sent, and Stripped replaced by the 32-bit stream for the title. 32-bit title protocols led to the 32-bit stream are the title. Title analyser title from the principle of the necessary information required for the processor package and analyser of payload bits used to. This bit is used indicates that this makes sense to manage the information flow. Management is a logical transaction and the payload rule of title analyser will be used to check for lice.

Payload rule will be used to enable bits to investigate the flow and begin to send the changed bits and ftp to verify compliance with rules signatures will filter through. I found signature management entity will signature ID. Control logic and will re-UART software. UART FIFO data buffers are used to, because the FPGA speed of 48 MHz speed limit UART 38.4 kHz.

This project serves mainly two things. The first title this time the FPGA generates identification numbers in order to know which package analysing package. Second, the signature corresponds to the load. Compliance with this signature logical to create a signature identification number of the device. The rule package is the title number and the number of packages signature investigation process, the software sends. Information received in the FPGA software to create the type of rule. Software demonstration was payload of package in order to produce a list of numbers and signature.

The final project for the implementation of the above-mentioned processing blocks necessary and required to carry out the following interface modules:

- SRAM interface
- Serial UART
- Serial command processor

6. TCP / IP analyser

The Incoming packets TCP/IP in signature analyser comparison processor using the camera take the information and rules required for the processor. The state of the machine every hour on the 32-bit access and change the status of the agreement, according to the diagram. Every hour in the next 32 bits are entering the machine. 32-bit design used for the title, because the protocol uses 32-bit and efficient design of this concept.

Machine designed as follows:

1. IP version 4 of the check. If the version is not correct 32-bit is discarded and the process finished. If you view the length of the IP header and the total length of the package and the next step (step 2).

2. ID is obtained (used to identify fragments of datagram). The next stage begins (step 3).

3. TCP protocol are checked. If not found, then the next step, which is a 32 bit is discarded, and the first stage is passed, otherwise 4.

4. The transfer of 32 bits. The next step (step 5).

5. IP address of the recipient to accept and go to the next step (step 6).

6. IP title for the transfer of complementary bits (32 bits on the border started filter is used as collateral), and the next step 7.

7. Recipient and source TCP port numbers and the storage subsystem. Next, proceed to step8.

8. The transfer of 32 bits, and the next step 9.

9. 32 bits 10 and missed the next step.

10. Extract the Data offset parameter. Calculate the payload length which is nothing but the total length -IP header length of the TCP header length. Go to the next state (ie State 11). Compensation parameter data. Loading calculate the length, total length, the length of the IP header and TCP header lengths. Next step 11.

11. The next 32 bits for the title TCP send and go to step 12.

12. 32-bit stream and confirming bits (indicating Unleash the true touch) and go to the next step (step 1)

Management processor

Management processor serial software commands, and will affect them. Management processor receives the command of the 4 units:

 Burst Memory Write - indicates the length of this command 16 bit packages on SRAM memory writes.

 Burst Memory Read This, according to the order from the FPGA SRAM memory reads 16 bits long special numbers.

 Set Memory Mode - This command allows data transfer command to change the channel FPGA and SRAM memory so that you can read and write serial port.

 Set Processing Mode - This command allows you to change the FPGA data transmission channel to the instructions, for example, SRAM data memory can be sent to the FPGA for processing.

The format of these commands is described in the following table. Reading or writing SRAM address is the address for the start.

7. Conclusion

Attack detection systems hardware and software implementation of network traffic, speed and quality of analysis. As seen from the article offer FPGA platform built in laboratory systems to determine if the attacks production launch speed of 200 MHz to 1.6 Gb/s speed work.

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Mechanism Prioritize Packet Traffic

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Abstract: In this paper was considered mechanism separation network traffic into a small number of classes with the purpose of each class of a numeric attribute - priority and also was analyzed the structure of the queue for the five traffic classes, which are served consistently and cyclically and each cycle of each line is drawn is the number of bytes, which corresponds to the weight of queuing.

Keywords: computer network (CN), type of service (TOS), weighted queuing algorithm (WQA), weighted fair queuing, (WFQ), quality of service (QOS), access control list (ACL).

1. Introduction

The development of network technology in the direction of wider use of resource-intensive applications and new methods of organizing information interaction makes higher performance requirements of computer networks (CN) as a secure environment access to information resources. Thus, necessary to continuous improvement models, tools and methods of information protection in the CN.

For a long time the problem of information security (IS) in CN were related to data privacy. However, as the information becomes an important subject of legal regulation, all the more urgent task is not only reliable protection of corporate and personal information, but also to provide controlled user access to open information resources with using CN.

2. Traffic classification

Traffic classification presents a separate task. Packets can be divided into classes according to the priorities in accordance with the type of network protocol, example, IP, IPX or DECnet, based on the receiver and sender, number port TCP/UDP and any other combinations of features contained in the packets. Rules for packets classification to priority classes are part of the policy network management. Block traffic classification can be located in the device itself and outside it. Placing traffic classification functions in one or more devices on the edge of the network provides a more scalable solution.

This option requires the classification of a specific field in the packet, which can be entered set point priority, so they can take advantage of all the subsequent network devices for process traffic en route. This field has a head of many protocols [1]. Thus, the IP packet is provided for this purpose three-digit subfield IP precedence in the type of service (TOS). When a special of priority field is not provided, in this case new header with this field input using under helps a specially developed additional protocol. In particular, for Ethernet protocol was taken specification IEEE 802.1Q/p, which defined an additional three-digit priority field.

Priorities can be assigned not only a switch or router, but also for application on the sending node. It should also be borne in mind that each network device may not agree with the priority assigned to this packet in another part of the network. In this case, it changes value of the priority according to the local policy, stored directly on the device. To avoid such precedents should use centralized methods of using the network policy in order to ensure coordinated operation of device.

Independently from selection way of traffic classification in the network device has multiple queues, according to the number of classes. Received in period overload the packet put in the queue according to its priority. In figure 1 shows an example of using four priority queues: high, medium, normal, and low priority.

Priority queues are the absolute nature of preferences in processing: is of higher priority queues are not all packets, the device does not pass to the next processing, lower priority. Therefore, medium-priority packets are always processed only when all high priority packets are empty and packets with low priority - only when all higher queues are empty. The final size of the buffer memory of the network device requires a certain limit the length of each line [2]. Typically, the default priority queue is assigned to all the buffers of the same size, but many devices allow administrators to allocate each individual queue buffer.

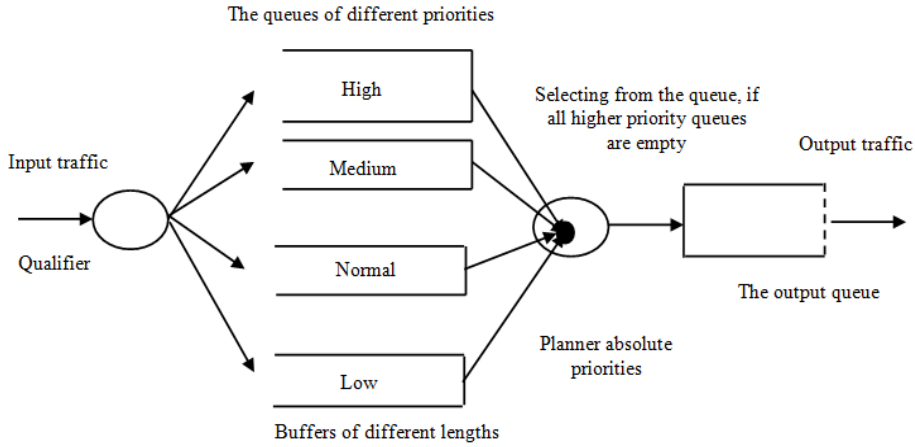

Fig.1. Block traffic classification

Its maximum length determines limit number of packets that can be stored in the priority of queue. A packet received by the time when the buffer is full is discarded. Priority queuing ensures high quality of service for packets from highest priority queue. As for the other priority classes, that quality of their services lower than the packets with the highest priority and to predict the rate of decline is difficult. It can be quite significant, if high priority data is transmitted with a high intensity. Therefore, priority service is commonly used in the case, where the network has a latency-sensitive traffic, but its intensity is low, so that its presence is not too infringes other traffic.

3. Suspended custom queue

Weighted queuing algorithm (Weighted Queuing) is designed to ensure that all traffic

classes could provide a certain minimum bandwidth or meet the requirements for delay algorithm, in which the weight of traffic classes may be assigned by the administrator, called «Custom Queuing ». In this case, where the weight assigned automatically on the basis some adaptive strategy, implemented the algorithm is so-called «Weighted Fair Queuing, WFQ». As with the suspension and with priority service, the traffic is divided into several classes and for each enter a separate packet queue. Each queue is associated proportion bandwidth of the output interface, this class of guaranteed traffic congestion at the interface. In the example shown in figure 2, the device supports five queues for five traffic classes.

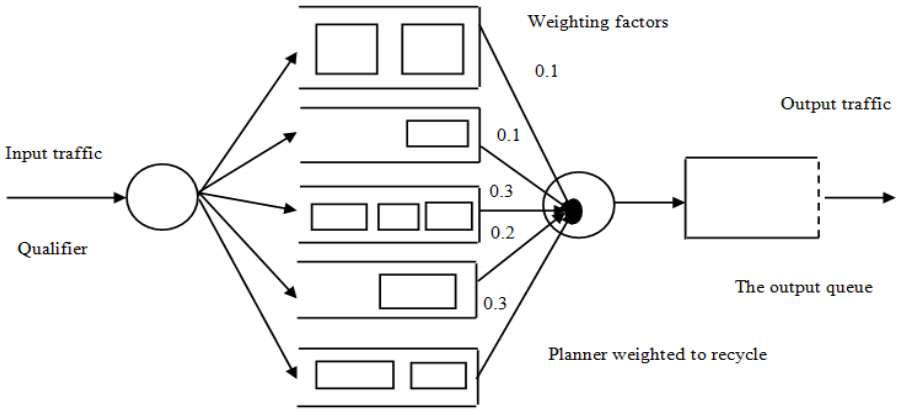

Fig.2. The five queues structure for five traffic classes

This corresponds to the queues 10, 10, 30, 20 and 30% bandwidth of the output interface in case of overload.

The goal is achieved due to the fact that the queues are serviced sequentially and cyclically and in each cycle is taken from each queue is a number of bytes which corresponds to the weight of the queue.

The exact values of quality of service (QOS) for algorithm of weighted services is difficult to predict. They essentially depend on the load parameters dynamically changing network device - the intensity of the packets of all classes and variations of interval time between packets. Generally weighted service leads to large delays and their deviations than the priority service class of the highest priority, even when a significant excess over the allocated bandwidth input intensity of this class. But for the lower priority class weighted fair service is often more acceptable from the point of view of creation of favorable conditions of service of all traffic classes.

4. Weighted Fair Service

Weighted Fair service, (WFQ) - this a combined mechanism of queuing, priority service combines with a weighted. Network equipment manufacturers offer numerous own implementations of WFQ, different way to assign weights and support different modes of operation, so in each case, you must carefully examine all the details of the supported WFQ. The most common scheme provides for the existence of a particular queue, which is serviced by the priority scheme - are always in the first place and as long as all applications from nee

not be executed [3]. This queue is for system messages, network management, and perhaps the most critical packets and demanding applications. In any case, it is assumed that it has the low traffic intensity, so a significant portion of the bandwidth of the output interface is other traffic classes.

The other queue devices scan sequentially, according to the algorithm of weighted services (figure 3).

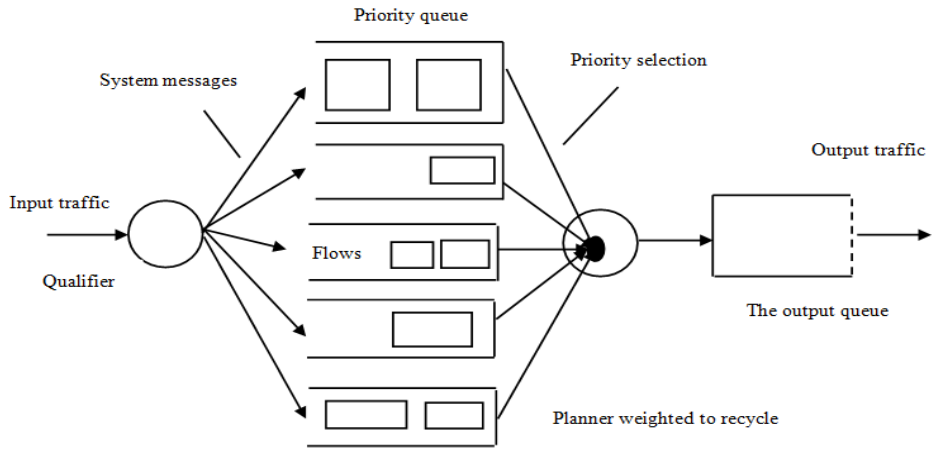

Fig.3. The algorithm is weighted service

The administrator can set a weight for each traffic class the same manner as in the case of weighted service. Option default operation provides for all other classes of traffic equal share of the bandwidth of the output interface (minus the remainder of priority traffic).

Manufacturers complementary add mechanism WFQ with some useful modes. For example, Cisco routers there are several varieties of WFQ:

• based on flows (Flow-based) mode WFQ (FWFQ);

• based on classes (Class-based) mode WFQ (CWFQ).

For the option FWFQ based flows in the router to create as many queues as there are flows in traffic. Under the stream in this case refers to packets with specific IP-addresses of the sender and the recipient and/or TCP/UDP port and destination (such as transport protocols), as well as identical field values TOS. In other words, flows - a sequence of packets from one application with certain parameters of QOS, set in the TOS.

Each flow is assigned its own output queue, for which periods of overload mechanism WFQ allocates an equal share of port capacity. Therefore sometimes algorithm called FWFQ FQ (Fair Queuing) - fair service.

Option CWFQ class-based Cisco routers have two sub-options:

• traffic classes are defined on the basis of the so-called QOS groups, the corresponding set of attributes from the access control list (ACL), for example, the number of the input interface or subnet number and the host;

• traffic classes are defined by the fields TOS.

For the option groups QOS administrator sets the weight capacity allocated to each group QOS and also the maximum length of the queue. Packets, not assigned to any of the groups included in the group 0. When assigning weights WFQ need to take into account the

following:

- QOS group number 0 is automatically assigned to 1% of the available bandwidth;
- the total weight of all the other groups cannot be more than 99%;
- the balance remaining after the appointment of bandwidth allocated group 0.

In option classification based on the value [4] TOS provided weight classes by default. They come into force if administrator explicitly asked them using weight. For the classification used by the two least significant bits of three-bit subfield of the field of IP Precedence from field TOS, so that in this embodiment, there are four traffic classes. By default, the class 0 is allocated 10% of the output bandwidth, the class 1 - 20%, the class 2 - 30% Class 3 - 40%. The higher the class, the more important traffic, therefore a greater proportion bandwidth creates a more privileged conditions of the promotion.

In many network devices the mechanism WFQ is one of the main for support quality of service, including in the case of different protocols using the signaling methods for coordinated behavior of all devices on the network, for example, when using RSVP protocol.

5. General characteristics of the protocols QOS IP

Protocols and mechanisms to support the QOS in IP networks are divided into two categories depending on the level of guarantees provided by the service:

- protocols support «hard» quality of service guarantees service data flows by reserving resources;
- protocols support «soft» quality of service cannot provide quantitative service guarantees, but at the expense of priority and weighted queuing perform a preferential distribution of network resources between traffic classes.

The first categories of protocols are developed by integrated services (Integrated Services Working Group, IntServ). The base model of such a service requires integrated cooperation of all devices on the network to ensure the required quality of service along the flow path. IETF has been developing IntServ for a long time - under the direction of the problem of providing QOS in a TCP/IP networks first began systematically addressed. However, due to considerable complexity to support integrated services across the network such as the Internet, its development received another direction, which currently leads the working group on differentiated services. It specializes at second categories of protocols, which do not provide a «real» quality of service, but it is much easier to implement.

6. Conclusion

In conclusion, it might be bring that when you receive a packet on the network priority queuing ensures high quality of service for packets of the highest priority queue. If the average intensity of their admission in device does not exceed bandwidth of the output interface, that packets with the highest priority always get the bandwidth, which necessary them. On the basis weighted queuing algorithm was researched mechanism prioritizing packet traffic, allowing divide the network traffic on the number of classes.

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The Formalization of Organizational Support Creation for Systems of Situational Management

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Abstract: The paper reviews formalization approaches in creation of organizational support for systems of situation management. These approaches based on classification of business process models describing functioning of system of situation management taking into account specific features of domain of its using. Knowledge about components of organizational support is described as ontology.

Keywords: System of situational management, organizational support, business process model, organizational model, situation semantics, ontology.

1. Introduction

Situation defined as [1] all of the facts, conditions, and events that affect someone or something at a particular time and in a particular place.

In their 1980 paper "The Situation Underground" [2], the first published work on situation formalization, Barwise and Perry wrote on situations:

"The world consists not just of objects, or of objects, properties and relations, but of objects having properties and standing in relations to one another. And there are parts of the world, clearly recognized (although not precisely individuated) in common sense and human language. These parts of the world are called situations. Events and episodes are situations in time, scenes are visually perceived situations, changes are sequences of situations, and facts are situations enriched (or polluted) by language."

The appearance of the word "parts" in the above quotation is significant. Situations are parts of the world and the information an agent has about a given situation at any moment will be just a part of all the information that is theoretically available. The emphasis on partiality contrasts situation semantics from what was regarded by many as its principal competitor as a semantic theory, possible worlds semantics.

Situation management is considered "as a framework of concepts, models and enabling technologies for recognizing, reasoning about, affecting on, and predicting situations that are happening or might happen in dynamic systems during pre-defined operational time" [3, 4].

2. The analysis of the current state of research and publications

Modern approach to situational (strategic, operational, preventive, crisis, emergency) management poorly structured processes in complex systems based on the use of expert methods of decision making. Technological and informational support of experts carried out with the use of tools for different purposes, united under the integrated solutions that are called systems of situational management (SSM). SSM is designed for group meetings to

develop solutions for different management tasks (problems situations) using automated tools and comprehensive analysis of multiple aims scenario and forecasting of situations in the various subject areas.

In terms of organizational support SSM is an organization that provides support services for processes of collective analysis and decision-making aimed at solving problems related to situational management in the relevant subject area. So building an effective organization is a prerequisite for effective SSM work. The organization is based on the appropriate model of organizational support, the choice of which depends on the set of factors that are determined by the environment and the organization function.

The main factors influencing the choice of SSM organizational model are the following activities: the mission of the organization; overall vision and strategy for the implementation of this mission; policies that ensure the mission; objectives to be achieved in the implementation of activities; problems (tasks) solved in carrying out the mission; set of services, providing the solution of the problems; the models (programs) of activities; databases of problem-oriented knowledge; repositories of carried out activities protocols; repositories of precedents descriptions etc.

The system approach to describing, analyzing and building of organizational structures that carry out purposeful activity, based on the use of standardized principles and tools for multidimensional representation of such structures. These principles and tools described in the relevant standards, generally accepted guidelines and frameworks and allow a unified position to consider various aspects of organizational structures and carry out their comparisons.

Functioning of organizational system (company, enterprise) is associated with ensuring of coordinated collaboration of staff to implement the mission and the objectives of the organization based on solving problems that are implemented through business processes and is supported by organizational mechanisms [5].

SSM is a separate type of organizational systems that perform the functions of situational management. Situation management systems based on information technologies are used in various branches of human activity [3, 6].

Situational management is based on adequate formalized description of the situation. This description might make using models of situational semantics. Situation semantics is an information-based theory [7, 8, 9, 10], that seeks to understand linguistic utterances in terms of the information conveyed. Barwise and Perry [2] began with the assumption that people use language in limited parts of the world to talk about (i.e., exchange information about) other limited parts of the world. Call those limited parts of the world situations.

In Keith Devlin work [7] was proposed formal description of the situation based on the infon concept. Infons are composite informational entities represented in the form:

$$\langle\langle R, A, Pol\rangle\rangle$$

where R is an n-place relation, A= $<a_1,\ldots, a_n>$ tuple of appropriate objects for R, and the value Pol = {0 or 1} represent polarity.

To indicate that the infon σ is made factual by the situation s, we write

$$s \models \sigma$$

and tell that s supports σ.

If in the situation s, the objects $a_i \in A$ stand in the relation R, we write

$$s \models \langle\langle R, A, 1\rangle\rangle$$

If in the situation *s*, the objects $a_i \in A$ not stand in the relation *R*, we write

$$s \models \langle\langle R, A, 0 \rangle\rangle$$

Infons may be combined, recursively, to form compound infons. The combinatory operations are conjunction, disjunction, and situation-bounded existential and universal quantification.

Using infon notion R. Cooper and H. Kamp define such notion of situation in situation theory [11]: "Situation is an object in situation theory which is defined by the collection of infons that it supports, where an infon is a situation theoretic object which has a relation, an appropriate number of arguments and positive or negative polarity".

Infons objects formally can be described as agents with different activities grades and internal models.

$a_i = f(M, U, R, K)$,

where *M* – motivations set, *U* – resources set, *R* – role functions set, *K* – body of knowledge of agent's object.

Thus, the situational management is the implementation of process-based activities on the base of organizational support functions to achieve the target situation from identified current situation, which is described as a sequence of infons, taking into account conditions of the environment:

$\sigma_0 \rightarrow \ldots \rightarrow \sigma_t$.,

where σ_0 – infon, that describes the current (initial) situation, σ_t – infon, that describes the target situation.

3. Statement of the problem

Situational management is carried out on the basis of the proved (reasonable) possibilities of certain control actions to achieve the target situation. Therefore, to justify and verification of stakeholders control actions for situational management can be used formal systems, particular on the base of constructive (intuitionistic) logic [12] in the form of formal sequent calculus [13; 14; 15; 16]. During the situational management sequent calculus methods can provide additional validation for decision making and allocate non formalized and formal components of this process.

Each infon describing the situation defines the context of the business process of situational management at every stage. Situations that actualize infons, defined by states and connections between objects of environment, each of which has an appropriate context or semantics. A partial nondeterminism in the context of situational management should apply appropriate approaches to its formalization. To construct formal models the modal logic can be applied [17]. Because purposeful activities related to situational management can be considered as performing a specific action program then formalizing such activities can be based on approaches to formal description of the programs and one of these approaches is the composition nominative approach based on the concept of composition nominative system (CNS) [18]. Composition nominative modal logic (CNML) is synthesized capabilities of traditional modal logic and composition nominative logics of partial quasiary predicates [19].

CNML basic concept is the concept of composition nominative modal system (CNMS). Such systems describe the world of consideration of modal logic. An important class of KNMS is transitional modal systems (TMS), within which naturally can be considered traditional modal logic – alethic, temporal, epistemic, deontic etc.

Organizational support of activity can be presented in a diagram of activities, nodes of which are control actions and arcs – activities initiated by the respective control actions. These diagrams can be described at the elementary level by Petri nets formalism or more semantically rich notations, such as, BPMN, UML.

The functioning of the organization described as [20] set of aspects related to:

- formal communication flows, based on authority and responsibility domains;
- flows of regulated activity;
- informal communication flows;
- flows of decision making;
- sets of working groups with different circulating flows.

These aspects may be called explicit aspects of the organization. An activity related to the functioning of the organization at different levels carry out its staff with the use of implicit and explicit subjective knowledge and appropriate means. To implicit components (aspects) of subjective knowledge of can be attributed education and training level of employees, their psychological traits, social roles etc. Implicit aspects, in particular, determine requirements for profiles of employees in various working groups. Transformation of subjective knowledge in the aggregate can be described as a spiral model of the evolution of corporate knowledge proposed by Ikujiro Nonaka [21]. According to this model corporate knowledge from explicit representation is internalized (individualized) in implicit knowledge of individual employees with regard to self-awareness of each employee its roles and functions in a particular professional group also in the organization as a whole. While should distinguish some stages of individualization of knowledge: *observation – awareness – explanation – usage – reproduction and enrichment – differentiation*. In the next stage internalized tacit knowledge also implicitly spreads in groups through communications between employees. Then widespread knowledge externalized in the group and represented explicitly in standardized form of some type. And at the last stage of development the evolutionary spiral explicit knowledge are combined between groups and used in the organization. During the activity corporate knowledge are internalized by its employees, opening a new stage of evolution of corporate knowledge. Formalization and combination of aspects of organization functioning and evolution of corporate knowledge allows to reveal key aspects of activity and identify areas of optimization through formal transformations. In the simulation of organization should separate formal communication flows that suitable for formalization and informal flows, which can carry stochastic perturbation to the process of organization activity and require subjective reactions of decision maker (DM).

4. The main problem

Situational management system is a specific type of organization. Therefore arise the problem of determining the structure of formal model, its representation, implementation and use in the practice of the organization, taking into consideration specific features of creation and operation of systems for situational management (SSM) with the use of modern methods of formalization.

5. Integrated Model of System of Situational Management

The main features of organizational model there are the mechanism of coordination, a key part of the organization, design parameters (type of decentralization), and situational factors (motivations).

Formal model of SSM activity is based on determination of SSM category model M_K, organizational model parameters M_O, architectural model M_A, processing (functional) model M_F, logical model (including model of modalities) M_L:

$$W=<M_K; M_O; M_A; M_F; M_L>. \quad (1)$$

Category model is defined on the base of mission, objectives and tasks of SSM functioning using composition of classification parameters groups. The first (general) group contains parameters of aim mission, subject domain, scale and tasks determinacy. Parameters of second group determine control aspects of SSM functioning, in particular, subordination, staff, methods of situational information processing, and time restrictions for decision making. Third group parameters define constructive specifics of SSM and contain deployment technique, universality, number and type of physical locations etc. Fourth group parameters define engineering and technological aspects of SSM functioning with technical equipment list, situation modeling tools nomenclature, using technologies, security level, grade of automation of situational assessment etc.

Parameters of SSM organizational model are defined by main coordination mechanism, organization core type (main part), general design parameters, situational factors (motivations).

The architectural model is defined by chosen architectural pattern (framework) for modeling of architecture for software intensive systems [22]. In particular, Zachman Framework for Information Systems Architecture [23], developing by Zachman Institute for Framework Architecture (ZIFA) involves six aspects of architectural representation system description:

- motivational intentions, organization's goals and basic rules by which it operates and which determine its activity (A_M);
- personnel, units and other elements of the organizational structure, relations between them, the distribution of powers and responsibilities within the organization structure (A_S);
- entities and data handled by the organization and a list of tools that are used for this (A_D);
- performed by the organization and its various departments functions and operations on the data, and processes that implement them (A_f);
- spatial distribution of elements and relationships between remote parts of it, within the distribution network of the organization (A_G);
- time characteristics and limits on the organization functioning, events, appreciable for its coordinated activities that meet the implementation of processes time cycles in the organization (A_R).

Thus architectural model has the form:

$$M_A = <A_M, A_S, A_D, A_f, A_G, A_R >$$

Modalities model of SSM based on logical models that take into account the relevant modalities [17]. Modal logic and their extensions are used to formalize statements of weakly-formalized systems, including natural languages. Alethic logic operates by basic modalities of necessity, possibility, and probability. Deontic logic operates with modalities of obligation, permissibility, prohibitions concerning the norms and normative concepts. Axiology logic operates with modalities of good, neutral, bad. Epistemic logic can describe the state of agents knowledge in agents systems where knowledge (ignorance) means that the group of agents has (not has) some knowledge and for this group may be veracious some

assertions. Temporal (time) logic operating with the modalities of the truth of assertions in the past, present, future. In a logical model of the SSM also uses space modality (there, here, nowhere), doxastic modality (define set of trust assertions), hybrid modality (uses additional nominal characters that are true in only one of the possible semantic worlds).

The logical model of modalities formed on the Kripke scale with the corresponding semantics (Kripke) [24]. Using of Kripke models to systems modeling can be based on Computation tree logic (CTL) [25]. Advanced modeling applications provides by CNML.

Providing formal model of the SSM in the format of ontology concepts of knowledge model represents as concepts of categories model, structural and architectural models. Relations between concepts are represented as the relations between ontology concepts. Functions of the interpretation given on concepts and/or relations of ontology are represented by expressions of description logic that is equivalent to expressions of modal logic model. To establish the equivalence with expressions of description logic the modal logical model is formalized as multimodal logic with n independent modalities. Then propositional variables of each modality are interpreted as atomic concepts of description logic. Boolean functions of conjunction, disjunction and negation are interpreted as intersection, union and complement of concepts, modal expressions of necessity and possibility are interpreted by quantifiers of universality and existence. So, the logical model represented as:

$$M_L = <L_M, L_A, L_C, L_U, L_R>,$$

where $\boldsymbol{L_M}$ – set of modalities, $\boldsymbol{L_A}$ – set of logical system axioms, $\boldsymbol{L_C}$ – set of logical conditions and restrictions, $\boldsymbol{L_U}$ – set of rules to constructing of logical terms, $\boldsymbol{L_R}$ – set of relations between logical terms.

Model of SSM organizational support is the basis for the implementation activities processes for situational management in a changing environment with adaptation to specific problems subject area of decision making support. Based on the characteristics of SSM functioning Adhocracy is the most adequate model of the structural configuration of SSM.

Model of organizational support is based on particular organizational structure. Formally, the model of organizational structure described by tuple:

$$M_O = <O_E, O_K, O_C, O_D, O_S, O_R >,$$

where $\boldsymbol{O_E}$ – set of structural elements of organization; $\boldsymbol{O_K}$ – set of main coordination mechanisms; $\boldsymbol{O_C}$ – set of types of core (main part); $\boldsymbol{O_D}$ – set of basic design parameters; $\boldsymbol{O_S}$ – set of situational factors (motivation); $\boldsymbol{O_R}$ – relations between sets of $\boldsymbol{O_E, O_K, O_C, O_D, O_S}$.

Specific parameters of organizational support model are defined by SSM category. Categorize SSM may be based on the classification of SC with using of the various classification criteria. In particular, by such SSM classification features as: the composition of tools of situational modeling; the scale of tasks; the method of allocation; determinacy of the level of tasks; the goal direction; the method of processing of situational information; the universality; the subordination of management; the level of automation evaluation of the situation; by the number of premises; the number and structure of staff; necessary for decision making time; the composition of the tools; used technologies; the level of protection; the problem domain. Some of these classification features are basic (decisive), and the rest are additional or clarifying. SSM category is determined based on its mission, goals and objectives of activity in accordance to organization functioning model [5].

We can offer the following hierarchy of classification criteria. The first (general) level includes criteria of goal direction, problem domain, scale and determinacy of tasks. Criteria of second level determine administrative aspects of the SSM activity, in particular, the

subordination, staffing, method of situational information processing, limitations of the time of decision making. Criteria of third level determine the specific design of SSM and include a method of placement, universality, the number of premises. Criteria of fourth level determine the technical and technological aspects of the SSM activity and include a list of technical equipment, structure of situational simulation tools, used technology, the level of security, and level of automation of the situation evaluation. The hierarchical category model is represented as a tuple:

$$M_K = <K_G, K_U, K_B, K_T, K_R>,$$

where K_G – set of general features categories; K_U – set of parameters of management aspects; K_B – set of specific parameters of design; K_T – set of technical and technological parameters, K_R – relations between sets of K_G, K_U, K_B, K_T.

According to aspects of the organization functioning, its model can be represented by a tuple:

$$M_F = <F_L, F_A, F_N, F_{Cnt}, F_P, F_R>,$$

where F_L – set of formal communication flows, based on the authority and responsibility domains; F_A – set of regulated activity flows; F_N – set of informal communications flows; F_{Cnt} – set of flows of decision making processes; F_P – set of working groups in which are circulating flow of various types; F_R – relations between sets of $F_L, F_A, F_N, F_{Cnt}, F_P$.

Activity of the organization can be represented as a composition of functions of separate components that are implemented through appropriate services. Main types of services composition are orchestration and choreography. A formal description of orchestration based on the proposed model can be implemented by means of BPEL [26] or YAWL [27]. Choreography of services can be formalized by means of Chor [28], BPEL4Chor [29], WS-CDL [30].

Use of YAWL allows building models of decision-making processes using a unified interface to access the list of services of organization, involving personnel and on the base of web services standards, which supports workflow patterns [31]. This interface allows developers to build their own worklist service to support human tasks according to their needs. In addition, the YAWL system comes with a default worklist service that supports several types of human task allocation and handling.

Collaborative activities of staff can be viewed from the point of view agents-based approach and use the behavioral model of agents for this [32]. The behavior of staff agents is based on its knowledge and has some sense (situation semantics). Hence, the formalization of organizational support for staff agents' activity in situational semantics aspect is actual problem.

Resulting integrated behavioral model of service agent is presented as tuple:

$$A_b = \langle T, P, C, M, D, W \rangle,$$

where T is a means of situation description; P is a means of communicative control in changeable communication environments; C is a means of coordination mechanism; M is a means of messaging between agents; D is a means of action description, W is a formal model of SSM functioning (1) and defines the context of components T, P, C, M, D.

Typical workflow patterns (scheduled procedures) are supported by SSM services [33]. Information technologies in SSM implemented based on the hierarchy of procedures of infrastructural (routine), organizational (administrative) and subject area (profound, special)

levels. In particular routine procedures (infrastructure level) should provide the functions of [34]:

- authentication and authorization of meeting participants from any workstation of SSM;
- registering of meeting participants;
- centralized control of microphones of meeting participants;
- control of information displaying by the collective and individual use screens;
- procedures for the implementation of different models of voting of meeting participants;
- control of simultaneous translation;
- audio communication between the participants of the meeting and their consultants;
- control of presentation materials from any workplace;
- informational support of meetings with data about participants, agenda and some other service operations.

Organizational procedures (administrative level) realize functions of [35]:

- filling a database of SSM experts;
- making a list of meeting participants (that is, search experts with appropriate specialization);
- drawing up the agenda of the meeting;
- notification of potential participants of the meeting;
- providing meeting all necessary information (formulation of the problem, the final list of participants, agenda items, papers, etc.);
- saving the results of the meeting in the knowledge base of SSM for use in preparing and carrying out the following meetings, and to calculate the rating of experts.

Procedures of subject (problematic, meaningful) area level should provide means of modeling, analysis, classification of processes of subject area to make grounded, appropriate to situation management decisions and their evaluation.

Effective implementation of technologies hierarchy for SSM can be made based on service-oriented information systems. Services of higher levels may apply lower levels of services, and organize internal cooperation in accordance with the logic of decision making in the SSM. Coordination of this interaction can be based on mechanisms of orchestration and choreography of services [36].

The specifics of SSM functioning as an organization is a combination regular routine procedures with the procedures determined by the current situational management tasks solved by means of SSM. Thus, the target model of implementation of business processes may vary. The variability of target models of situational management determines the complexity of determining standardized procedures for handling various situations that arise in practice.

It should be noted that in a real organization can not be achieve complete formalization of processes because of influence on activity of organization uncertainty of environment states of and other random factors. But isolation of activity fragments which exposed to formalization allows simplifying and increasing the efficiency of the whole organization operating. Components of defined model of SSM have poorly structured and informal nature. An adequate representation for them is the use of knowledge-oriented technologies.

6. Conclusion

The proposed model of organizational support of SSM include set of concepts represented the union of the sets of organizational structures and features of SSM category, the relationship between concepts and categories determine the properties of organizational structures and functions define the rules of interpretation superposition of the models.

Development of models of organizational maintenance for systems of situational management is associated with the activity support of these systems in accordance to their purpose. In the paper proposed the metamodel of integration of formal activity models based on situational semantics with models that describe aspects of organizational maintenance that process. Taken into account the key components of the activity process implementation for SSM and was proposed methods to implement them.

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Event-Task Metamodel of Meeting

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Abstract: The meeting is one of the most productive forms of the collective human activities that are implemented at the informational level. Despite of the potential diversity of the real meetings, all of them could have the common external form – metamodel. Metamodel of meeting developed in terms of the business modeling (with identification of events occurring in a given subject area and performed tasks) may be used for research purposes and/or for creation of the corresponding automation facilities. In the paper such metamodel of meeting is proposed. In particular, it can be used for support of the decision-making process in the situational centers.

Keywords: Meeting, metamodel, automation, decision making, situational center.

1. Introduction

The meeting is the most common form of cooperation of people to whom the task to solve a problem is set. In this paper, we proceed from the obvious assumption that the meeting can be made more efficient through the use of automation.

The question concerning the automation of meetings seems relevant especially in connection with the problems of creation and implementation in the management practices of the specific organizational instruments of situational management – the situational centers [1].

Development of automation facilities for meeting activity should be based on the model of this activity.

2. Activity Modeling

Practical modeling of meeting, as a kind of activity, should use certain technology that takes into account the specifics of activity as a phenomenon. Further an outline of the technology to be used in this paper is presented.

Objects, Knowledge, Information

We call real object a certain amount of space / time.

Unlike real objects we will distinguish so-called abstract objects.

The living beings (real objects), including people, are the carrier of knowledge. Some knowledge can be presented at the information level, that is, becomes information.

A real object that is carrier of information is called information object. Some of information objects obtain / have the status of a document.

Thus, we distinguish between the concepts of "knowledge" and "information", and use them in certain way [2-5].

Activity

Activity realizes as a process that takes place in space / time. It is necessary to clarify that the object of our consideration is the activity of living beings, including people, which has a purpose / function.

Specific activities may be of certain type. Implementation of activity can be considered quasi-endless in time.

"Unit" of activity is an action that must be completed. Typical action we call operation. The activity, action, operation are the abstract objects.

The process of the operation can be managed. That is, with respect to certain problem operation a corresponding management operation can be considered.

In the implementation of activities the events can occur. The occurred events should obtain a certain reaction.

Operation shall be described. The plan of implementation of operation is created on the basis of its description. The plan is a description of real object.

As a result, the implementation of the plan generates the actual process, the description of which is called a protocol (log, record).

The knowledge of performer of an action can be seen in the following aspects:

as resource element containing the method of execution;

as input element – the part of knowledge, related to the subject of action;

as output element - the increment of knowledge that the performer becomes as a result of participation in the execution of action (a knowledge about the subject of the action, a knowledge about the method of execution).

Models & Metamodels

The description of any object is its information model. If this model has a high level of generality, we call it a metamodel. Also, the description of the format of the model can be called a metamodel.

A (meta)model of an object is complementary, if it consists of two or more components related to various aspects of this object and these components are complementary and not contradictory.

Metamodels of operation and management operation as abstract objects are shown in Tables 2.1 and 2.2 respectively.

3. An Approach from the Nature of Activities

Actions performed in meeting different in nature, namely:

- implementation of the knowledge possessed by the meeting participants to meet the challenges of the meeting;
- management of the meeting process;
- logging (documentation) of the meeting process.

Through these activities, the performers can act in different compatible roles (see Fig.3.1)

Thus, the implementation of substantive work of the meeting is carried out by an “Expert” - one of several / many of the participants of the meeting, which are expected to contribute to the intellectual issues facing the meeting. As a rule, he / she is entitled to vote.

During the meeting, this role may be complemented by other roles, that is, he / she can be a "Reporter", "Speaker", "Voter", "Listener", "Disturber".

Table 2.1. Metamodel of operation.

Topic	Comment	
Name	Name / code of operation to enable the unambiguous links	
Type	Type of operation (in a particular type system)	
Purpose / function	The purpose is formulated for purposeful activity	
Input	Types of acceptable / appropriate inputs (if any)	
Output	Types of acceptable / appropriate outputs (if any)	
Method	Description of a typical method of execution - instruction, procedure, program and more. In particular, the list of auxiliary operations	
Resources	Time	Estimation of the time required for performing of the operation (may depend on the input)
	Performers	Type (s) of performer (s) that can / should be involved in performing
	Other types of necessary resources (equipment, materials, etc.)	
Events	Events to trigger and / or to catch	
Records	Requirements to records (metamodel, carrier, placement, storage, etc.)	
Recording	Requirements for process logging (documentation) – performer and means of logging, responsibility, etc.	
Management	References to management operation (if any)	

Table 2.2. Metamodel of management operation.

Topic	Comment
Name	Name / code of operation - to enable the unambiguous links
Object	Link to object operation (name / code), the implementation process of which is managed
Characteristics	Nomenclature of characteristics of object process that should be monitored
Monitoring	Methods / means of obtaining the values of characteristics
Criteria	Criteria for evaluating the values of characteristics with a focus on identifying anomalies
Reaction	Description of standard ways to respond to the identified anomalies
Beginning terms	Required / sufficient conditions to start implementing object process, including requirements for environment
Completion terms	Required / sufficient conditions to consider the object process as completed
Suspension terms	Required / sufficient conditions to suspend the object process
Restoration terms	Required / sufficient conditions to restore the suspended object process
Interruption terms	Required / sufficient conditions to interrupt the object process
Performers	Types of performers who can / should be involved in the management process
Method	Description of a typical method of execution - instruction, procedure,

	program, etc. In particular, the list of auxiliary operations
Events	Events to trigger and / or to catch
Records	Requirements to records (metamodel, carrier, placement, storage, etc.)
Recording	Requirements for process logging (documentation) – performer and means of logging, responsibility, etc.

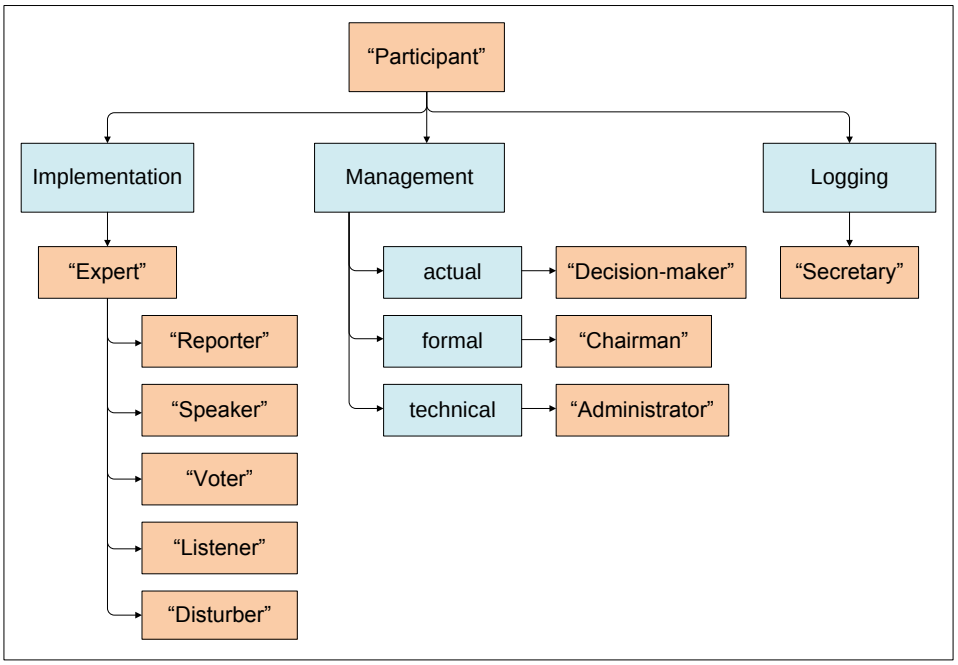

Fig. 3.1. The roles of participants of meeting.

Formally, the management of the meeting is carried out by a "Chairman", but in fact it can be a "Decision-maker" - a customer of meeting, which is responsible for decision-making. Under the conditions of use of the automation the technical management can be done by "Administrator" (with managerial guidance of "Chairman" and / or "Decision-maker").

The Logging (documenting) of meeting is carried out by a "Secretary". Despite the fact that the means of automation, in particular means of audio and video recordings, can provide "total" documenting of the meeting, may remain a need of prompt fixation ("from voice") of some information, such as formulations of vote subjects offered «ad hoc».

Thus, in the meeting take place operations such as "Implementation", "Management", "Logging"; for their simplified models (metamodels) see Tables. 3.1-3.3 respectively.

Table 3.1. Operation "Implementation".

Topic	Content
Type	Creative activity
Purpose	To solve specific problem
Input	Information object containing the formulation of the problem
Output	• information object (s) generated by the performer • increment of knowledge obtained by the performer

Method	Bases on the professional skills of the performer complemented by instructions "in place and depends on the established rules
Performer	"Expert"
Events to trigger	"Request to speak", "Request to speak disclaimed", "Disturbance"
Events to catch	"Beginning of speech", "Speech completed", "Beginning of report", "Report completed"
Management	Operation "Management"

Table 3.2. Operation "Management".

Topic	Content
Object	The processes – instances of operation "Implementation" (in an amount equal to the number of participants) and "Logging"
Purpose	Ensuring compliance with the plan and regulations
Characteristics	Duration of reports, duration of speeches
Monitoring	• compliance with time limits • disturbances
Criteria	• time limit of the report duration violated • time limit of the speech duration violated • disturbance beyond the regulations
Reaction	In accordance with regulations
Performer (s)	"Administrator" / "Chairman" / "Decision-maker"
Events to trigger	"Speech started", "Speech completed", "Report started", "Report completed"
Events to catch	"Speech requested", "Request of speech disclaimed", "Disturbance"

Table 3.3. Operation "Logging".

Topic	Content
Function	Fixation of information on the meeting
Input	Information obtained from the observation of the meeting
Output	Log (protocol) of the meeting
Method	Depending on specific conditions, tools and protocol requirements
Performer	"Secretary"

4. Structural Approach

The structural model is constructed in terms of a particular set of elements that can be combined in a certain way in the planning process, or be added during the meeting upon. It is important to stress that, based on the fact that every element is a typical action, without exception, elements of the structure can be represented as operations.

Elements of Structure

The root element of the structure is the "Meeting", which may include other elements, namely:

"Agenda Item" (see Table 4.1);
"Report" (see Table 4.2);
"Speech" (see Table 4.3);
"Discussion" (see Table 4.4);
"Vote" (see Table 4.5);

"Disturbance" (see Table 4.6).

Note. The agenda items can be routine or substantive. Routine agenda items relate to the organization of the meeting. These, for example, may include:

assessment of compliance with the requirements for the organization of the meeting;
election of the chairman, secretary (suggestions, voting);
approval of the agenda;
approval of the regulations;
consideration and decisions on contingencies;
signing the protocol of the meeting.

Substantive agenda items detail the main goal of the meeting. Without the need to detail meeting agenda does not contain items.

Table 4.1. Operation "Agenda Item".

Topic	Content
Purpose	To discuss and solve the problem
Input	Information object with formulation of the problem
Output	• information object (s) created during the process • increment of knowledge obtained by the "Participants"
Method	Determined by the applicable auxilary operations
Performers	"Participants"
Management	Operation "Management"

Table 4.2. Operation "Report".

Topic	Content
Purpose	Bring to the attention of the meeting participants relatively large amount of information on a certain topic
Input	Information that fits the theme of the report
Output	Information received by the "Participants" and transformed in the increment of their knowledge
Method	Determined by used means and skills of the "Reporter (s)"
Performer (s)	"Reporter (s)"
Resource (s)	Materials that reveal some aspects of the report
Management	Operation "Management"

Table 4.3. Operation "Speech".

Topic	Content
Purpose	Bring to the attention of the meeting participants relatively small amount of information on a certain topic
Input	The information prepared beforehand or generated in the course of the meeting
Output	Information received by the "Participants" and transformed in the increment of their knowledge
Method	Messaging by the voice
Performer	"Speaker"
Management	Operation "Management"

Note: the contents of the speech can acquire status, if needs to be reflected in the protocol of the meeting (for example: "Question", "Answer", "Suggestion", "Remark",

"Other"). This status can be determined in advance, if the speech was planned, or during (after) the meeting by the person who manages it.

Table 4.4. Operation "Discussion".

Topic	Content
Purpose	To exchange views on some topic
Input	Information obtained during the meeting
Output	• information object (s) created by participants of the discussion • increment of knowledge obtained by the participants of the discussion
Method	Messaging by the voice
Performers	"Participants"
Management	Operation "Management"

Note: discussion, if necessary, can be divided into separate speeches.

Table 4.5. Operation "Vote".

Topic	Content
Purpose	To decide on a specific issue (subject to vote)
Input	Information object containing the formulated subject to vote (document)
Output	Information object containing results of voting (document)
Method	Depending on the chosen method of voting
Performers	"Voters"
Management	Operation "Management"

Table 4.6. Operation "Disturbance".

Topic	Content
Purpose	To affect the process of meeting or some of its participants
Input	The information generated in the course of the meeting
Output	Information received by the "Participants" from "Disturber" and transformed in the increment of their knowledge
Method	Messaging by the voice
Performer	"Disturber"
Management	Operation "Management"

Note: "Disturbance" is unpredictable and inconsistent with the management of meeting (hence unplanned) intervention in its course. On the one hand, one can not ignore the possible value of the message as the initiative to address the issue. On the other hand, one can not ignore the possibility of improper, unethical and unconstructive interventions in the course of the meeting. As for the "Speech" this message can acquire its status promptly or after the meeting.

From Operations to Plan, and from Plan to the Fact

The plan of the meeting is based on the elements of the structural metamodel. These elements can be combined practically without restrictions.

The transition from the initial plane to the fact may be accompanied by a change of plans. The actual structure of the meeting, as opposed to the planned, contains elements corresponding to the "Disturbance".

5. Meeting as an Operation

Having epy meeting activity considered from two different points of view, we can present it as an operation (see Table 5.1).

Table 5.1. Operation "Meeting".

Topic	Content
Purpose	To discuss and solve the problem
Type	Professional activity
Input	Information object with formulation of the problem
Output	• information object (s) created during the process, in particular, the formulation of obtained solution or an explanation of why it is not found • increment of knowledge obtained by the "Participants"
Method	The operations "Implementation", "Management", "Logging"
	The combination of the necessary operations from the set: "Agenda Item", "Report", "Speech", "Discussion", "Vote" with the possible appearance of "Disturbance"
Performers	"Participants"

6. Conclusion

The metamodel of meeting built in this paper: is complementary, because includes two components that complement each other; almost entirely uses traditional terminology; can serve as a basis for design of automation means for the meetings.

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Information and Analytical Tools of Enterprises Competitiveness Management

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Abstract: The information and analytical tools of management mechanism of metallurgical companies competitiveness in unstable currency environment is offered with the aim of creation, development and implementation of competitive opportunities both internal and external competitive advantages. It will ensure the efficiency of enterprises activity in unstable environment.

Keywords: Competitiveness, complex spatial and dynamic study, currency environment, factors, forecasting, management, mechanism, models

1. Introduction

Special attention should be given to increasing the enterprises' competitiveness of the branches that form the Ukrainian industrial sector, in particular iron and steel industry. These companies are the object of this research. So far since the metallurgical industry is export-oriented and provides more than 30% of foreign exchange earnings to our country, and therefore may suffer significant losses due to unfavorable exchange rate dynamics, the research of precisely those environmental factors that affect the formation of foreign exchange rate is of primary importance [6].

Today despite the wide range of research on this subject the system aspects, nature and mechanisms of complex estimation of the industries' competitiveness including branches features and non-stationary environment conditions, the issue of the exchange rate's factors that have impact on the enterprises' competitiveness haven't been studied enough. Of course, scientists theoretically delineate the external factors impact, but the degree of this effect and its consequences are not defined. Insufficient attention is paid to tools analytical formation mechanism of the enterprises' competitiveness. Both theoretical aspects of the mechanism and their instrumental basis and practical implementation still require solution. Therefore the paper proposes the improvement of enterprises' competitiveness mechanism in the volatile foreign exchange environment, which contains a set of interconnected blocs, presented in Fig. 1. Let's consider the blocks' content and objectives. Mechanism management of enterprise competitiveness, aimed at the formation, development and implementation of competitive advantage and provision of the viability of the company in a volatile currency environment and constant competition must meet the goals and objectives of management.

2. Formation of the Information Base

Formation of the information base of research enterprises' competitiveness and environmental factors that affect the formation of the exchange rate in Ukraine. This block includes searching, collecting and processing of data information space according to the main areas of the enterprise and exchange rate formation factors, analysis of the sample's representativeness and the formation of indicators system. The purpose of this block is the formation of a representative statistical database of research.

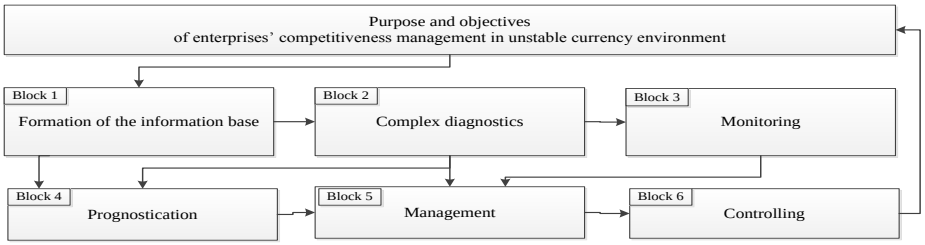

Fig. 1. Enterprises' competitiveness management mechanism

Indicators that evaluate the analyzed local areas best of all are selected by the logical method based on the analysis of indicators used in existing methods and techniques. While forming the information space of parameters they were tested so that not to be interrelated and interdependent. Also it was necessary to meet the general requirements put forward to information space, namely: unique features of indicators, lack of redundancy; completeness i.e. the possibility of adequate description of various processes, facts, events of the subject that is studied by using these indicators; reliability i.e. the correspondence of the selected items of semantic information to their real value; consistency i.e. lack of homonymy.

Also the possibility of calculating the indicators by using the available information concerning the financial activities of metallurgical enterprises was taken into account. Thus 37 indicators of the 2005-2011 years for twelve metallurgical companies were formed.

Information base for environment's research is the government's official publication, government statistical reports, periodicals etc. The system of the 46 factors analyzed for 2001-2011 years is formed and united into three groups:

- forming factors that directly determine the exchange rates' dynamics (directly related to the process of international trade);
- regulatory factors, which influence the forming factors and affect exchange rate's mechanism;
- warning factors whose thresholds indicate the output of the economic system of dynamic equilibrium and the possibility of the economic crisis.

3. Complex diagnostics

Complex diagnostics consists of two modules, whose algorithm is presented in Fig. 2.

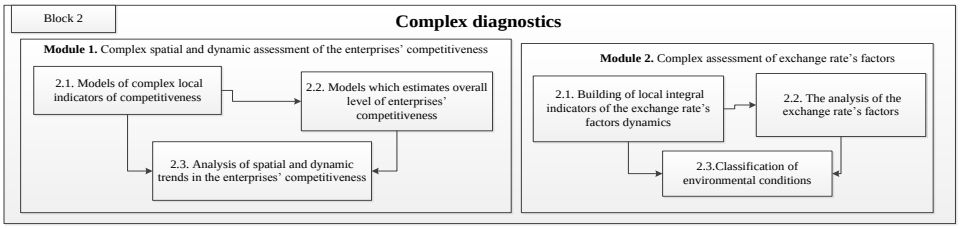

Fig. 2. The algorithm implementing a comprehensive diagnosis of internal and external competitive environment

Module 1. Complex spatial and dynamic assessment of the enterprises' competitiveness. The study aim is the calculation of the integral rating indicators for local components of competitiveness and the overall level of enterprises' competitiveness on the basis of complete reduction factor space methods (taxonomic evaluation method) [8]. The choice of mathematical tools is determined by the possibility of comparisons and measurement of multidimensional objects, consisting of heterogeneous essentially indicators.

The model of information space rolls and evaluation of the company performance is [10]:

$I_1 = f(X_{11}, X_{12}, X_{13}, X_{14}, X_{15})$ - competitiveness of products;

$I_2 = f(X_{21}, X_{22}, X_{23}, X_{24}, X_{25})$ - enterprise's production efficiency;

$I_3 = f(X_{31}, X_{32}, X_{33}, X_{34}, X_{35}, X_{36}, X_{37})$ - enterprise's financial development;

$I_4 = f(X_{41}, X_{42}, X_{43}, X_{44}, X_{45})$ - effectiveness of marketing and promotions;

$I_5 = f(X_{51}, X_{52}, X_{53}, X_{54}, X_{55}, X_{56}, X_{57})$ - effectiveness of the enterprise's labor potential;

$I_6 = f(X_{61}, X_{62}, X_{63}, X_{64}, X_{65})$ - efficiency of investment and innovation activity;

$I_7 = f(X_{71}, X_{72}, X_{73})$ - position on the stock market.

$$I = f(\{I_1\},\{I_2\},\{I_3\},\{I_4\},\{I_5\},\{I_6\},\{I_7\}),$$

where X_i – indicators of system-level of the enterprises' competitiveness indicators; I_i – local integral indicator of the enterprises' competitiveness; I – complex index of the overall competitiveness level.

Module 2. Complex assessment of exchange rate's factors, which involves the construction of integrated local factors of the exchange rate formation dynamics based on the method of integral taxonomic evaluation [8]. The convolution's model of information space factors of the exchange rate is [10]:

$F_1 = f(X_{11}, X_{12}, X_{13}, X_{14}, X_{15}, X_{16}, X_{17})$ - macro;

$F_2 = f(X_{21}, X_{22}, X_{23}, X_{24}, X_{25}, X_{26}, X_{27})$ - market;

$F_3 = f(X_{31}, X_{32}, X_{33}, X_{34}, X_{35}, X_{36}, X_{37}, X_{38})$ - bank;

$F_4 = f(X_{41}, X_{42}, X_{43}, X_{44})$ - fiscal;

$F_5 = f(X_{51}, X_{52}, X_{53}, X_{54}, X_{55}, X_{56})$ - stock;

$F_6 = f(X_{61}, X_{62}, X_{63}, X_{64}, X_{65}, X_{66}, X_{67}, X_{68})$ - provoking;

$F_7 = f(X_{71}, X_{72}, X_{73}, X_{74}, X_{75}, X_{76})$ - destroying.

where X_i – the first level of the exchange rate factors;

F_i – local integral indicator of exchange rate factors dynamics.

Classification of environmental conditions. Clustering of environmental factors using hierarchical (natural methods of classification) and iterative method (k-means) method is proposed [5]. Cluster analysis is multivariate statistical procedure that allows us to organize objects into relatively homogeneous groups [5]. Objectives of research, solved by using the methods of cluster analysis are:

- conducting of spatial and dynamic clustering based on the features reflecting the essence and nature of objects that allows for in-depth evaluation set of objects classified in the following way;
- testing hypotheses concerning the existence of some structure in the examined indicators;
- identification of existing structures.

Implementation of hierarchical method in STATISTICA [12] provides a following dendrogram of environment states classification (objects are researched years). Analysis of dendrogram classification obtained by Ward's method makes it possible to recognize three clusters of homogeneous states in the data set study.

These statistical characteristics are the basis for the interpretation of environmental conditions: a neutral state of the environment (2001, 2002, 2003), unfavorable (2004, 2005, 2006, 2007, 2008) and aggressive states (2009, 2010, 2011).

4. Monitoring

Monitoring is a system for continuous observation of the processes and trends in the object's external and internal environment for their timely evaluation [11]. So, properly organized financial and economic monitoring helps companies adapt to changes in the internal and external environment and successfully survive in a competitive environment as well as enhance the validity of administrative decisions through timely measures for elimination of adverse factors of the exchange rate on the enterprises' competitiveness.

To ensure the efficiency of economic activity and competitiveness the company must promptly detect adverse trends in its development and predict the probability of bankruptcy, to find adequate ways and means of solving the crisis promptly and with minimum losses. One of the conditions for the successful resolution of this issue is the monitoring of external and internal environment on an ongoing basis. This monitoring system is responsible for the selection, evaluation and interpretation of financial, economic and other data that affect the decision making process.

Monitoring involves the implementation of two interconnected modules, which are presented in Fig. 3.

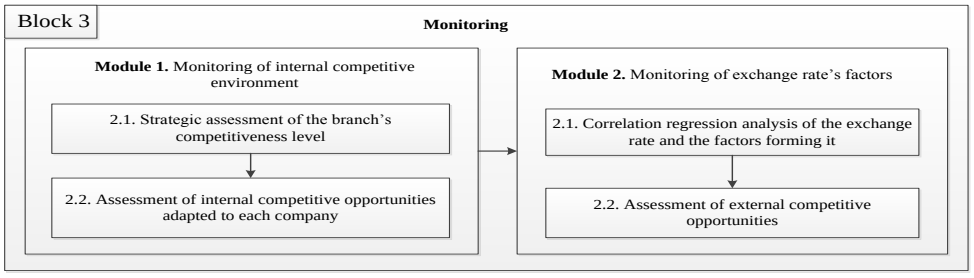

Fig. 3. Algorithm of monitoring implementation

Module 1. Monitoring of internal competitive environment. Strategic assessment of the branch's competitiveness. The purpose of monitoring of internal competitiveness is to assess both general trends in the industry, and peculiar characteristics for each company on the basis of econometric panel data models [3, 4] assessment of local indicators on the overall competitiveness of enterprises.

The choice of these mathematical tools for assessment, analysis and prediction of enterprises' competitiveness and the competitive environment is determined by the following features:

- the use of panel data for construction of enterprises' competitiveness assessment models (including sectoral orientation) can solve the problem of the information base expanding;
- the use of panel data increases the efficiency of parameter estimates;
- the use of panel data makes it possible to obtain robust estimates of model parameters even with the missing data;
- panel data allow us to build more flexible and meaningful models and analyze individual differences in enterprises' competitiveness levels which is impossible with models based in particular on spatial data.

One of the problems of panel data use is the problem of choosing the type of model (ordinary regression, fixed or random effect) [13]. To select the model specification between the fixed and random effects we apply Hausman test. Model with fixed effects has the following form:

$$I = \mu_i + 0{,}12 \times I_1 + 0{,}26 \times I_2 + 0{,}26 \times I_3 + 0{,}11 \times I_4 + 0{,}29 \times I_5 + 0{,}22 \times I_6 + 0{,}37 \times I_7,$$

where μ_i - fixed effect, reflecting the influence of environmental factors on the overall competitiveness of enterprises [9].

The resulting model is adequate for the coefficient of determination ($R^2 = 0{,}94$) and Fisher criterion ($F = 133{,}06$). Estimates of parameters are statistically significant by Student's criterion ($t_{ai} > t_{кр} = 1{,}99$). The obtained values of fixed effects (μ_i) for the companies in question vary in the range [-0,213; -0,138], confirming the strength of the negative impact and indicate the need for studies of environmental factors on the enterprises' competitiveness.

According to the obtained panel data model, we can conclude that the greatest impact on the enterprises' competitiveness is rendered by: the position in the securities market, the efficiency of labor potential, financial development and the efficiency of production. This occurs because the stock market solves the problem of lack of money and lack of real sources of their attraction.

Evaluation of internal competitive opportunities adapted for each company, provides evaluation and analysis of cause-effect relationships of competitiveness indicators by Granger causality test and elasticity of competitiveness indicators [2, 14].

Granger causality analysis of the results allowed the following conclusions on interaction and causality studied indicators of competitiveness of enterprises to be made. For example, for companies with high level of development observed the existing impact of the efficiency of production on the efficiency of investment and innovation activity. In companies with an average level of competitiveness there exists a cause-effect relationship between the competitiveness and effectiveness of marketing activities etc. In-depth analysis confirms that the strategic monitoring should also be carried out for each company.

Analysis of competitiveness elasticity indicators allows us to monitor internal competitive business opportunities, identify local resources needed to increase competitiveness, strengths and weaknesses as well as establish priority strategy to increase the competitiveness of enterprises.

Module 2. Monitoring of exchange rate's factors. Provides for the construction of correlation and regression relationships between exchange rate and its forming factors. Since the currency portfolio of metallurgical enterprises form such currencies as the dollar, euro and Russian ruble, it is necessary to determine the factors that most affect these rates. The results of linear multifactor econometric model for U.S. dollar, euro and Russian ruble allow us to confirm the significant influence factors on the dollar and the euro. The most significant impact have macroeconomic and bank factors on exchange rate.

5. Prediction

One of the prerequisites for successful management of enterprise competitiveness is to predict the level of enterprises' competitiveness and the state of the environment. The main functions of the forecast for the company include:

- scientific analysis of competitive trends, objective relations of these processes in specific circumstances in a particular period;
- complex assessment of object prediction;
- identification of alternative development to financial situations and processes;
- forming the base of analytical and statistical information for the formulation and optimal solution.

This block provides implementation of 2 modules:

Module 1. Predicting the level of competitiveness method for autoregressive panel data.

Module 2. Prediction of the exchange rate factors (using VAR-analysis) and their status (using discriminant analysis). Selection of mathematical tools for predicting factors of the exchange rate due to the following features VAR-models [3]:

- this mathematical tool is a convenient for short-and medium-term time series forecasting;
- can detect dynamic relationship between current and lagged values of the studied parameters;
- can set simultaneously the modeling multiple time series by means of dynamic equations.

The model is adequate and can be used for forecasting. Prediction of the factors of the exchange rate is based on the discriminant analysis methods [5] for the performance indicators of the environment in order to determine the projected state of the environment. Using discriminant analysis in the diagnosis and identification of future states of the environment solve the following tasks:

- the formulation of rules, based on feature space according to which the objects are set to one of the existing clusters (classification of education);
- the obtaining of estimates for the classification of new objects included in the aggregate and predicted performance characteristics for objects investigated;
- interpretation of the difference between the existing clusters (it determines which variables discriminate aggregates).

6. Management

The management of enterprise competitiveness refers to a systematic, orderly and meaningful impact on the competitiveness of the system in order to maintain stability or

transfer from one state to another using the necessary and sufficient methods and means of influence (fig. 4).

This block includes assessment of the environmental factors impact that affect the formation of exchange rates, the overall level of competitiveness based on the selected state of the environment and their numerical characteristics with the use of fuzzy logic (fuzzy set theory) [1], the algorithm consists of the following steps:

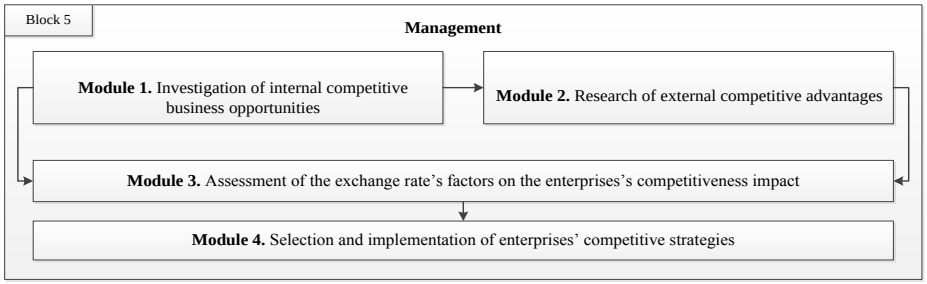

Fig. 4. Algorithm of enterprise competitiveness management

1. Identification of possible ranges of external environment state levels.

2. Determination of linguistic variables which are defined on basic level sets of external currency environment and output variable.

3. Construction of membership functions of basic values levels of environmental changes and output variable to linguistic variables.

4. Formation of rules of fuzzy logic output relationship external environment state levels and impact on competitiveness level.

5. Decisions-making position concerning the formation of possible alternatives of development based on the fuzzy logic rules.

The ranges of environmental conditions based on the minimum and maximum values for each cluster are built, their combination is the basis for administrative rules and determines the strength of their influence. The obtained results of predicted degree the foreign exchange environment influence factors on the competitiveness of the majority of experiments will relate to the fuzzy set "critical impact level".

7. Controlling

Controlling is a system of governing based on the economic system, control system and automated system management. Controlling is a management methodology, a set of organizational, mathematical and information models that provide the most optimal management system. Strategic and tactical controlling models used may differ, but the goals are the same - to improve the quality of decisions [7].

The task of monitoring is to verify the correspondence of the obtained results to defined goals and objectives, leading to the following possible situations:

- no deviation - efficient management of financial situations, local goals are achieved;
- minor deviations - the problem of regulation, i.e. monitoring of possible variations in the destabilization of the system and the question of expedient measures for minimizing currency risks are solved;
- significant deviation - is an in-depth analysis of internal and external competitive

environment, adjusting the goals and objectives of competitiveness management. On this base the revised strategy and a lot of management actions management competitiveness are solved.

8. Conclusion

The proposed mechanism of metallurgical enterprises' competitiveness management will make it possible to assess adequately and systematically the level of analyzed enterprises competitiveness and to ensure efficient operation of the enterprise in unstable currency environment. Implementation of this mechanism allows the management to ensure effective activities in order to increase the enterprises' competitiveness level and to identify the factors with the largest reserves increase for competitiveness and thus to improve the quality of management decisions on formation, selection and realization of strategic alternatives for development of competitive advantages in conditions of unstable currency environment.

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Experimental Verification of Possibility of Human Identification by the Electrocardiogram

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Abstract. The paper deals with the problem of human identification by electrocardiogram. By using three orthogonal leads, electrocardiogram can be represented as a three-dimensional hodograph. A segment of hodograph, which is related to QRS complex, was approximated via canonical parametric splines (Bezier curve). It gave us a set of points which describe the curve shape. An electrocardiogram is assigned to the certain class by comparison of the coordinates of the points which describe the shape of approximating spline. For classification the known statistical methods and neural network were applied.

Keywords. electrocardiogram (ECG), characteristic features of ECG, identification, Bezier curve, QRS complex, approximation.

1. Introduction

The problem of algorithm for classification of various objects by their shape often arises in researches. There are many examples of such a task, e.g. analysis of dynamic series, spectrograms, cyclical signal elements in medicine, classification of binary and halftone images by their contours, etc. What unites these problems – they all can be reduced to the classification of shape of one or several arcs of curves in one-, two- or three-dimensional space.

Biometric identification of a patient by the electrocardiogram (ECG) is challenging indeed and is discussed widely in the literature lately [1, 2]. It also requires the arc shape classification of a curve. This problem had arisen in the "Medgrid" project during creation of database of depersonalized ECGs [3]. It is requisite for unequivocal identification of the patient to extract some characteristic features of the ECG signals, which, along with the open personal data (sex, region of residence, and year of birth), will define whether a new entry in the database is needed or an amendment of the existing one.

2. Problem statement

A typical ECG contains 12 leads, i.e. 12 signals. These signals can be converted into the three orthogonal leads and marked as cycles and elements of cycles by using the special algorithms [4].

With the three orthogonal leads, an ECG can be represented as a three-dimensional phase hodograph. The number of points of this hodograph is rather great. It was reduced significantly via approximation of the QRS-complex fragment of the hodograph with the parametric splines . This approximation can be realized by using the cardinal spline or Bezier curve [5].

Figure 1 demonstrates a three-dimensional curve corresponding to the QRS-complex approximated via the cardinal spline. An example of approximated QRS-complexes of two humans is shown in Figure 2.

Representation of a fragment of a three-dimensional ECG via spline, firstly, reduces the number of points that determine its shape, and, secondly, is invariant to affine transformations.

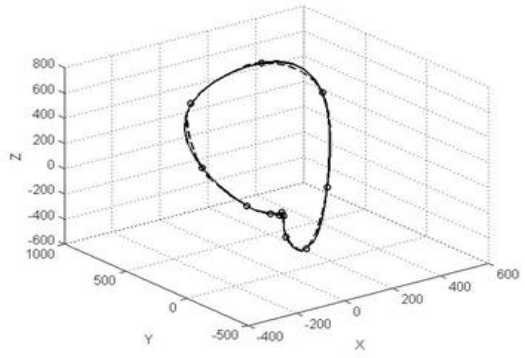

Fig. 1. Three-dimensional curve corresponding to the QRS-complex approximated via the cardinal spline

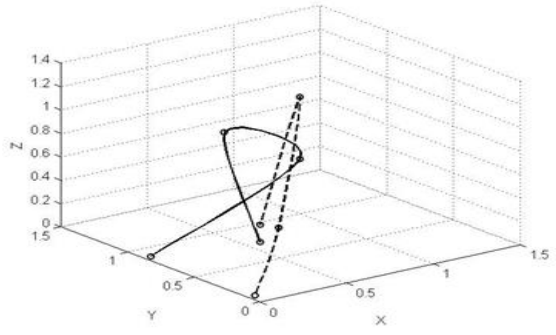

Fig. 2. An example of approximated QRS-complexes of two humans

The next important step is sorting of ECGs into classes. It is implemented by juxtaposition of coordinates of points responsible for the shape of an approximating spline.

Besides the typical ECG with 12 leads, there also exists the ECG with 6 leads. In this case, the three-dimensional curve can be defined using the first three leads.

Classification of ECGs can be carried out using either common statistical methods or neural networks.

3. Experimental verification of the method

To verify the suggested methodology, two experiments were conducted. In the first the standard ECG with 12 leads was treated with.

For the experiment, the ECGs of seven healthy people, 25 to 55 years old, three men and four women, were recorded – ten ECG samples for every person. Researches were conducted at different times of day; the test subjects were in varying emotional and physical condition.

The ECG data pre-processing included the following: conversion of 12 leads into the three orthogonal leads, splitting of a signal into cardiac cycles, and extraction of the QRS-complex of each cycle. Then the representative cycle of ECG was determined using the Hausdorff distance and all three-dimensional QRS-complexes were approximated via cardinal splines. From here on, the shape of each QRS-complex is determined by the four control points of the cardinal spline.

The approximated ECGs were classified using neural networks. The experiment was realized in two forms: (a) pairwise classification, i.e. each patient was compared by turns with each other, (b) "one versus all" classification when the ECGs of a patient were to be discerned among the complete set of all other ECGs. In both cases, the neural network training was carried out using one of the patient's ECGs; the remaining nine were used for identification. The training was performed by all the ECG cycles, identification – by the representative cycle.

For each pair of test subjects, the sensitivity and specificity of the method were calculated based on the identification results. As sensitivity we imply the capacity to identify correctly the first patient of a pair, which is defined as the fraction of the correctly identified ECGs of the first patient ("true positive" results) of all the ECGs attributed to the first patient (equation 1).

$$TPR = \frac{TP}{TP + FN} \times 100\%, \qquad (1)$$

where TPR – sensitivity (true positive rate), TP – true positive results (correct identification of the first patient), FN – false negative results (incorrect identification of the second patient).

As specificity we imply the ability of the method not to give false results of identification of the second test subject of a pair; it is defined as the fraction of the correctly identified ECGs of the second patient ("true negative" results) among the ECGs attributed to the second patient (equation 2).

$$SPC = \frac{TN}{TN + FP} \times 100\%, \qquad (2)$$

where SPC – specificity (true negative rate) of the method, TN – true negative results (correct identification of the second patient), FP – false positive results (incorrect identification of the first patient).

The average sensitivity for the experiment with the three orthogonal leads of the twelve-leads ECGs was equal to 97.0% in pairwise classification, the average specificity was 97.0% as well. The average sensitivity for the same experiment in "one versus all" classification was equal to 83.9%, the average specificity – 97.7%.

In the second experiment, the ECGs with six leads were registered. They were taken from five healthy patients, 25 to 55 years old, a man and four women – ten ECG samples for every person. Researches were conducted at different times of day; the test subjects were in varying emotional and physical condition. For calculations the first three leads of an ECG were used.

The ECG data pre-processing included the following: splitting of a signal into cardiac cycles, and extraction of the QRS-complex of each cycle. Then the representative cycle of ECG was determined using the Hausdorff distance and all three-dimensional QRS-complexes were approximated via cardinal splines with the four control points.

The approximated ECGs were also classified using neural networks. The experiment also was realized in two forms: (a) pairwise classification, i.e. each patient was compared by turns with each other, (b) "one versus all" classification when the ECGs of a patient were to be discerned among the complete set of all other ECGs. In both cases, the neural network training was carried out using one of the patient's ECGs; the remaining nine were used for identification. The training was performed by all the ECG cycles, identification – by the representative cycle.

For each pair of patients the parameters of sensitivity and specificity of the method were calculated from identification results using equations (1) and (2) respectively.

Both the average sensitivity and the average specificity for the experiment with the first three leads of the six-leads ECGs were equal to 96.7% in pairwise classification. The average sensitivity in "one versus all" classification was equal to 87%, the average specificity – 94.8%.

Hence, the sensitivity and specificity for the experiment with the first three leads of six standard decreases negligibly compared with those of the three orthogonal of twelve leads method. In addition, this option does not take the preparatory calculations required for transformation of the twelve leads into the three orthogonal leads.

4. Conclusion

Approximation of a three-dimensional arc via the parametric splines for the three leads of an ECG allows setting up of a system of features that will be sensitive to the shape of this arc. This system is useful for further solving of classification problems, one of which is the task of biometric identification of a patient.

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Approximation of the Experimental Curves by Piecewise Smooth Functions

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Abstract: Usually approximation of experimental data (graphs, contours of objects, etc.) using splines can be effectively implemented if the process or phenomenon, generating experimental data, is defined by continuous smooth functions. However, very often the functions that define the process or phenomenon are not continuous smooth, but we can assume they are the piecewise smooth functions. In this case, the approximating function should also be piecewise smooth. The task of the experimental data segmentation to determine the break points of the approximating function is considered.

Keywords. Approximation, experimental curves, piecewise smooth functions.

1. Introduction

For the majority of information systems is characterized by the accumulation of information in the form of various graphs, various kinds of images, which are required to obtain the opinion of the expert, in other words, to take this or that decision. A large and constantly growing amount of data causes the development of tools to due to automatic and / or automated processing of the initial data to reduce the load on the decision makers.

Input data or experimental curves are measurement results are generally distorted noise. It is assumed that the measured data is an implementation of some unknown function $y=f(x)$, existing at the measurement interval $[a, b]$. The result of measurement is a finite sequence of pairs $I\{x_i, y_i\}$; $i = 1,I$. In other words, there is a realization of a table or function. In this paper we consider only the functions of a single argument. However, the experimental curves often are planar or spatial graphics. Moreover, they may be closed curves such as image object contours. The contours of the binary image objects presented flat closed curves. The contours of halftone image objects represented by spatial closed curves, and as the third coordinate values using the appropriate brightness values of images points. As shown in [1], space curves and contours of binary and grayscale images can be represented by one-dimensional functions depending on parameters and results of the proposed research can be used in the processing of spatial objects. Graphs, object contours of images - it seems the simplest and long used method for cognitive representation of experimental measurements in various fields of human activities, which allow to evaluate the quality property of the process, form the object, despite interference measurement error.

The most basic feature of a graph or contour is its shape, which corresponds to the function that generates a visible realization of the curve. Various implementations may vary the scale, the number of measurements, other affine transformations. Moreover, they are often distorted by noise. However, the basic features of the form are saved. For automatic or automated processing graphics or analytic representation of the object contour must be

obtained. The proposed method of analytical evaluation of arbitrary graph or contour discussed further.

Parametrically defined splines [2,3,4] can be used to approximate the experimental curves. Usually, in computer graphics splines are used to obtain of smooth curves, passing through given points. Thus the quantity of the points should not be excessively numerous, to available computer resources could provide the solution of the corresponding systems equations. However, the number of measured points may be too large to use the traditional methods. In [5.6], the method is developed of using spline approximation to the experimental curves, which are given in tabular form. Moreover, the number of points of the curve unlimited.

2. Experimental Curves as Realization of the Process Described by Piecewise Smooth Functions

The methods of approximation of the experimental curves parametrically given splines use the assumption that the experimental curves are the realization processes or phenomena that are determined by unknown smooth functions. At the same time a large number of practical problems involve the processing of the experimental curves, which cannot be satisfactorily represented by smooth functions (Figure 1).

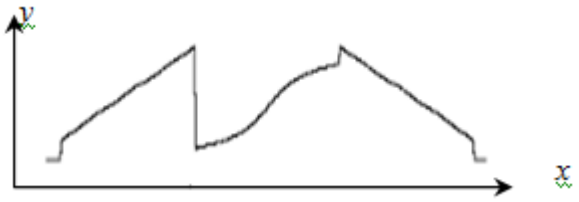

Fig. 1. An example of the experimental graphic, which may not be adequately represented by a spline.

Apparently, these graphics are the realization of the process determined by the unknown piecewise smooth function. It is natural to assume that the approximating function must also be piecewise smooth. The curve defined by the function $y = f(x)$, $(a \le x \le b)$ is a piecewise smooth if the function $y = f(x)$ has a finite number of discontinuities of the first kind on $[a, b]$ and the segment $[a, b]$ can be divided into a finite number of partial segments points

$$a = t_0 < t_1, < \ldots < t_N = b$$

so that at each of them function y = f (x) has continuous derivatives are not simultaneously equal to zero [7], where N - number of partial segments. If as the approximating function to use splines, the latter takes the form of a sequence of polynomials:

$$y = f^{(1)}(x)\left|(t_0 \le x < t_1), \ldots, f^{(N-1)}(x)\right|(t_{N-1} \le x \le t_N), \text{where}$$

$$f(x)\left|(t_n \le x < t_{n+1}) = a_0^{(n)}x^k + a_1^{(n)}x^{k-1} + \ldots + a_{k-1}^{(n)}x + a_k^{(n)}\right.$$

In practical applications generally use polynomials of the third degree (k = 3). The closeness of approximating and experimental curves can be estimated as S - the area between the curves. Approximation of the experimental curve comes down to the determination of the parameters that correspond to the minimum value of the area Smin.

$$S_{\min} = \min_{\forall t_n, N, \forall a_0^{(n)}, \forall a_1^{(n)}, \forall a_2^{(n)}, \forall a_3^{(n)}} \sum_{n=0}^{N-1} \sum_{x=t_n}^{t_{n+1}} \left| a_0^{(n)} x^3 + a_1^{(n)} x^2 + a_2^{(n)} x + a_3^{(n)} - y(x) \right|$$

Thus, the experimental curve approximation by a piecewise smooth function involves the optimization of the parameters (coefficients) of each the pieces the function $y = f(x)$ and by the set of boundary points (t_0, t_1, ..., t_N) and by their number N. A direct solution of this problem becomes cumbersome.

In setting described the task of approximation can be represented as two related tasks:
- the define of the set of boundary points (t_0, t_1, ..., t_N) and their number N;
- approximation either of the partial segments (t_n, t_{n+1}), $n = 1, N\text{-}1$ by continuous functions (splines).

As for the task of approximating the experimental curve, defined on each of the partial segments as a continuous function, this task solved in [5.6].

Defining the set of boundary points and their number - is the task of the experimental curve segmentation to pieces, be approximating by continuous functions. The task of segmentation of the experimental curve is considered below.

3. Segmentation of the Experimental Curve

Segmentation of the experimental curve is considered under the assumption that this curve is a realization of the process determined by the unknown piecewise smooth function. Solution of the segmentation task will be considered as the definition of break points of unknown approximating piecewise smooth function according to its realization in the form of experimental curve.

Finding the solution will be implemented according to classical definition of continuity the functions and new research results in the field of neurophysiology of visual perception. It is known: Definition 1 (Cauchy) continuous function [8].

The function f, defined in the interval (a, b), said to be continuous at the point $x_0 \in (a,b)$, if $\lim_{x \to x_0} f(x) = f(x_0)$

Otherwise: Definition 2of a continuous function.

For any $\varepsilon > 0$ exist such $\delta = \delta(\varepsilon) > 0$, that for all x, satisfying the condition $|x - x_0| < \delta$ following inequality holds

$$|f(x) - f(x_0')| < \varepsilon'. \quad (1)$$

Note, that for the other values of the argument $x_0' \neq x_0$ under the condition $|x - x_0'| < \delta$ following inequality

$$|f(x) - f(x_0')| < \varepsilon', \quad (2)$$

wherein $\varepsilon' > \varepsilon$, if the derivative of the function $f'(x_0') > f'(x_0)$. When attempting to use in (2) ε instead of ε' the inequality fails.

This definition has been used successfully for the analysis of functions, but it cannot be used to analyze the experimental curves. The experimental curves are the realization of some unknown functions represented by a sequence of measurements. The sequence of measurements, in turn, is a set of isolated points in a discrete space.

We note only that for the analysis of continuity of the function at some point x_0 consider the sequence of function values in the neighborhood of this point. And used **varying** neighborhood of x_0, namely, from some finite value $| x_1 - x_0 |$ a neighborhood of x_0, decreasing, ($|x_1 - x_0| > |x_2 - x_0|, |x_2 - x_0| > |x_3 - x_0|, \ldots$) tends to zero. Wherein

$$| f(x_1) - f(x_0) | > | f(x_2) - f(x_0) |; | f(x_2) - f(x_0) | > | f(x_3) - f(x_0) |; \ldots$$

4. Some questions of the signal processing in the visual system

In the 70s of the last century in the field of neurophysiology it was made a remarkable discovery - changing the resolution of the visual system for a visual act [9], which again was investigated and confirmed already at the present level (the year 2010) [10].

As it is known [11] after the conversion of the visual information into electrical signals, the latter, after a preliminary treatment come into neurons (ganglion cells) of visual system (Figure 2). The neurons of the visual system is anatomically arranged in layers. Much of neurons of each layer transmits signals to the next layer.

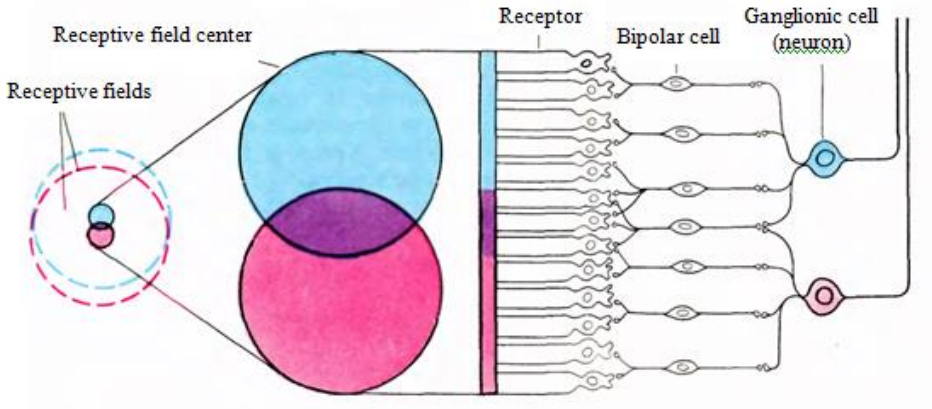

Fig. 2. Receptive fields of neighboring neurons are overlapped

A number of receptors signals supplied to each neuron of the retina. These receptors are called the receptive field of the neuron. Each receptor may be associated with several neurons of the same layer. Simple receptive fields of neurons are circular. Receptive fields of neighboring neurons overlap.

The central part of receptive fields is called the zone of excitation, peripheral portion (a ring around the central part) – zone of inhibition. When feeding light stimulus in the receptive field of the excitation zone neuron generates a certain number of pulses. The greater the stimulus, the greater the number of pulses will be generated. If the size of the light stimulus exceeds the diameter of the excitation zone, occupying part of the zone of inhibition, the number of pulses will be reduced.

As a result of investigations it was found [13] that the size of the exciting areas of receptive fields is not constant throughout the visual act. If at the beginning of the visual act this size has a maximum value - tens (sometimes hundreds) receptors, by the end of the visual act is reduced to the lowest possible – 1-2 receptor (fig. 3). Thus, we can assume that there is the maximum resolution of the visual system, which is determined by the number of receptors in the central part of the retina and a **variable resolution, changeable for a visual**

act – coarse-to-fine, determined by the size of the exciting area of the receptive field of the neuron.

5. Segmentation of the experimental curve using the process of a variable resolution - coarse-to-fine

The receptive field of the visual neuron is a discrete analogue of the neighborhood of a point in a continuous two-dimensional space. There is a suggestion that the variable resolution, changeable during visual act, - coarse-to-fine - delivers segmentation of grayscale images in the course of visual perception.

Reducing the size of the excitation zone of the receptive field can be seen as decrease of the neighborhood of a point at the center of the receptive field. The process that is used in the analysis of continuity of the function at the point in the classical mathematical analysis, is repeated in the visual system of humans and animals for each visual act.

The essential difference of coarse-to-fine process from continuity analysis of the function at point is that the elements of the receptive field are the objects a discrete space of. But as long as the neighborhood of the points (excitation zone) is not empty, the using of the continuity definitions to the brightness functions in a discrete space of the receptors does not contradict continuity definition of the classical mathematical analysis.

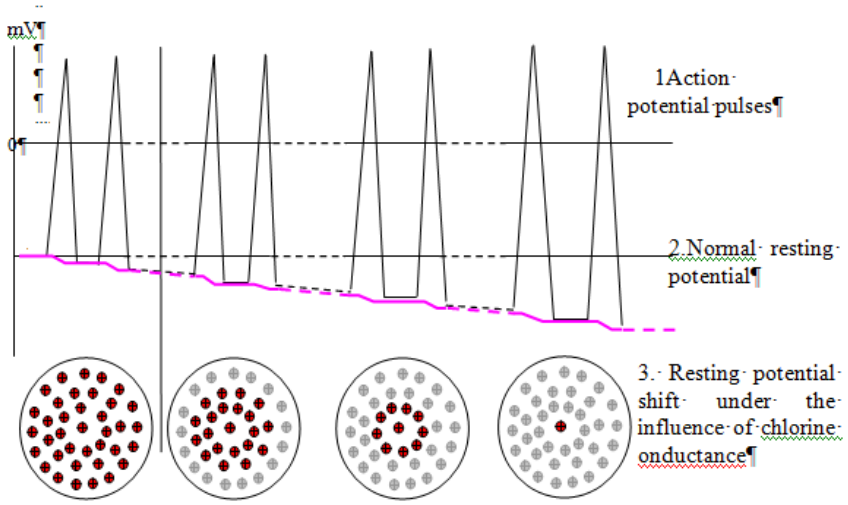

Fig. 3. Changes in receptive field excitatory zone

Thus, the processing of visual information in the visual system can be regarded as the processing of experimental data in the environment neurons. We use a procedure of the variable resolution in the visual system to develop the segmentation method of the one-dimensional experimental curves. As already mentioned earlier, the solution to the problem of segmentation will be considered as the definition of break points unknown approximating a piecewise smooth function according to its realization in the form of an experimental curve. In accordance with the definition of a continuous function 2: if not the have the inequality (1) at a point x, then there is the continuity break of the function $y = f(x)$.

Using the concept of continuity in the analysis of the experimental graph for the purpose of decomposition the domain of definition into partial segments is as follows. Suppose there is some experimental graph - a sequence of measurements of a physical quantity, such as the brightness along the line of the image Figure 4. For a sequence of N values of the argument $X = \{x_0,\ldots,x_n,\ldots,x_N\}$, $n = 0,N$, $(x_n\text{-}x_{n\text{-}1}) = \Delta x$, a sequence of N values of $Y = \{y_0,\ldots,y_n,\ldots,y_N\}$. Function $X \rightarrow Y$ given its measured values, and is the realization some function, the subject of interest is the question of continuity of this function. We assume that the neighborhood of each point x_n includes at least the point x_n, x_{n+1}, $x_{n+2},\ldots$, x_{n+k}, wherein,

$$\left|x_{n+k} - x_n\right| > \left|x_{n+k-1} - x_n\right| > \left|x_{n+k-2} - x_n\right| > \ldots > \left|x_{n+1} - x_n\right|.$$

Then, as mentioned above,

$$\left|f(x_{n+k}) - f(x_n)\right| > \left|f(x_{n+k-1}) - f(x_n)\right| > \ldots > \left|f(x_{n+1}) - f(x_n)\right|$$

and the measurement sequence has a tendency to inequality (1). Consequently, if we consider the implementation of $X \rightarrow Y$ the unknown function $y = f(x)$ sufficiently accurate, then, based on this realization, the unknown function $y = f(x)$ could be evaluated as a continuous.

Now consider another implementation of unknown function $y = f(x)$. Combine every l ($l << N$) adjacent measured values $(x_n,\ldots,x_{n+l})$, for each n we calculate $z_n = \frac{1}{l}\sum_{s=n}^{n+l} y_s$.

Form the sequences $Z_1 = (z_1(x_1), z_1(x_{1+l}), z_1(x_{1+2l}),\ldots)$,

$Z_2 = (z_2(x_2), z_2(x_{2+l}), z_2(x_{2+2l}),\ldots),\ldots$, $Z_l = (z_l(x_l), z_l(x_{l+l}), z_l(x_{l+2l}),\ldots)$.

The functions $X \rightarrow Z_1$, $X \rightarrow Z_2,\ldots$, $X \rightarrow Z_l$ also be regarded as the implementation of the unknown function $y = f(x)$, but with a different, less, more "rough" resolution. If the function $y = f(x)$ has a discontinuity of the first kind at the value x_n, which may, as a result of distortions in the measurements, was smoothed, then, at least one of the functions $X \rightarrow Z_1$, $X \rightarrow Z_2, \ldots, X \rightarrow Z_l$, containing the points x_n, $x_{n\text{-}l}$ and x_{n+l}, will experience a sharp change that will not diminish when approaching x_n. As a result, inequality (1) of Definition 2 is not performed (Figure 4). That is when "coarse" resolution fixed a jump function that can be used to its segmentation, in other words, to find the boundaries of the partial segments, pieces of the piecewise smooth function as the parameters of the approximating function.

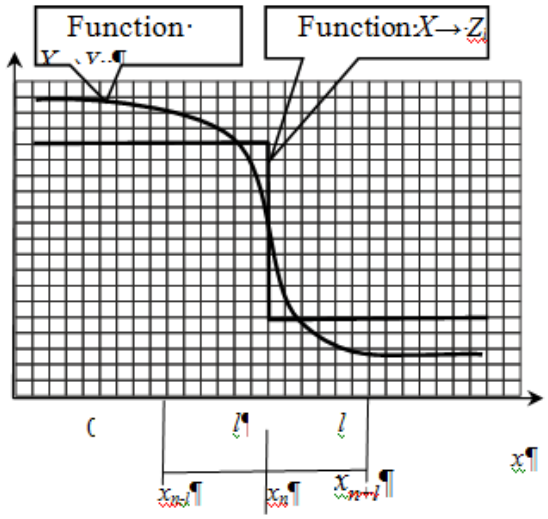

Fig. 4. Selecting the jump function by means of low, "rough" resolution

6. Experiments on the Approximation of the Curve by the Piecewise Smooth Function

Solution of the problem of approximating the experimental curve the piecewise by a smooth function is achieved by the preliminary approximation of the experimental curve as a sequence of line segments that can be considered as a sequence of splines of the first order. A certain number of iterations is executed, and for each iteration the length of the segments is reduced, which corresponds to the procedure for changing resolution - coarse-to-fine.

Approximating sequence of segments can be constructed with the required accuracy as possible to the experimental curve.

Approximating sequence of segments for each iteration is segmented into line segments and arcs of curves. Partial sequence of segments corresponding to the arcs of the curves can be approximated by splines of higher order [12].

An example of approximating the experimental curve shown in Fig. 5

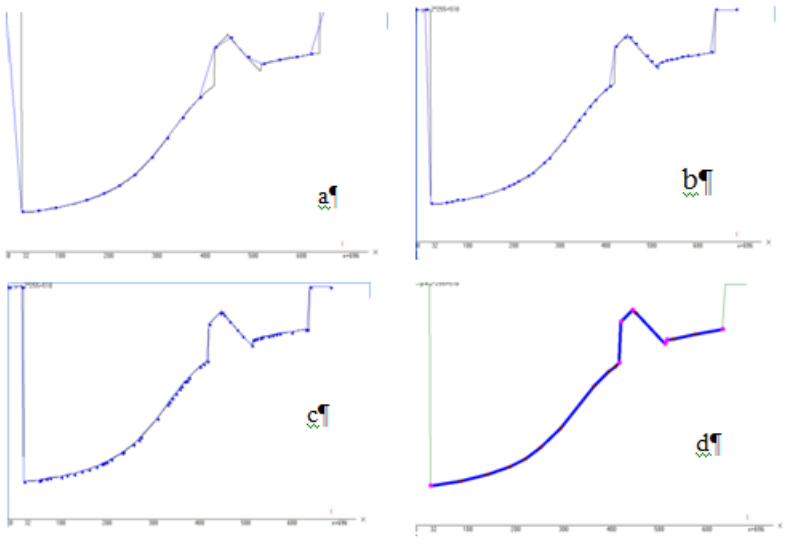

Fig. 5. Approximation of any of the experimental function - graphics by the piecewise a smooth function using a variable resolution: a) Approximation of the experimental function by line segments - 1 iteration. b) Approximation of the experimental function by line segments - 2 iterations. c) fitting the experimental function by line segments - 3 iterations. d) Segmentation of the experimental function on line segments and arcs of curves.

7. Conclusion

Much of the experimental curves can be considered as the realization of processes described by piecewise smooth functions. Approximation of experimental curves in general is quite complex and CPU intensive task for the calculation. It is shown that in the process of visual perception similar tasks are solved at the subconscious level many times. This uses a variable resolution mechanism. Experiments on the approximation of the experimental curves of piecewise smooth functions have shown perspective in this area of satisfactory quality and affordable computational cost.

The theoretical justification for the use of the continuity definition for the approximation of the experimental curves by piecewise smooth functions should be continued.

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The Model of the Spatial Object Described by Parametric Splines

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Abstract: A new model of spatial object that is represented by two of its three-dimensional projections from four-dimensional space in two three-dimensional sub-space is proposed. This object is described by pairs of control form surfaces and parameter. The control surfaces of the form and parameter are offered to encode using parametrically defined splines.

Keywords: Spatial object, surfaces, cardinal splines.

1. Introduction

This paper considers the method of describing the spatial object by defining surfaces, which in turn is described by the spatial curves.

Usually spatial object is considered as a geometric body. However, there are areas where it is necessary to describe the spatial object with distributed parameters of the material forming the spatial object, or some other parameters of interest.

In such a problem we should choose some spatial function f (x, y, z), that determines in an acceptable manner parameter p (x, y, z), on the set of points belonging to the object. It is assumed that the value of the parameter p admit its definition by the continuous function.

This paper proposes options for modeling spatial object. It is assumed that such an object is limited by pieces of simple surfaces (hereinafter - surfaces) (Fig. 2c), that are single-valued functions of (x,y). The change of parameter in each column of the spatial object (with fixed value of x,y) is considered as dependence the parameter of the height p (z). To encode these dependence the third-order polynomials - cardinal splines are used. The shape of the spline, which is corresponding to the parameter distribution along each column of the object, is determined by the control points. Two last control points of the spline belong to the upper and lower defining surfaces, and internal control points of the spline belong to inner defining surfaces, which are introduced for representation of parameter distribution inside the object with the help of splines. Further these defining surfaces will be called as "control surface".

All columns of the object having the same value of coordinate "y" form a vertical cross-section (Fig.1), thus the object may be represented as a set of vertical cross-sections, the definitions of which are described in Sec. 2.3 and Sec. 2.4 of this paper.

Paper [1] describes method for encoding grayscale image into curves that can be later used for original image restoration. In this paper these control curves for any section of the object are calculated similarly to simple surfaces that describe the object (Sec. 2.3 and Sec.2.4).

In the examples given in the article we describe the use of regular control surfaces to determine the distribution of the parameter along each column of the object and building a cross-section of these columns.

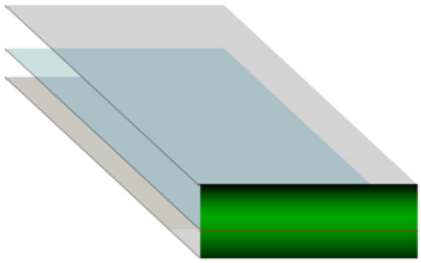


Fig.1. Description of the spatial object by three control surfaces. Parameters of cross-section points of the spatial object are represented with brightness levels.

The proposed analytical representation of spatial objects is invariant to some affine transformations, which significantly simplifies the handling of such objects.

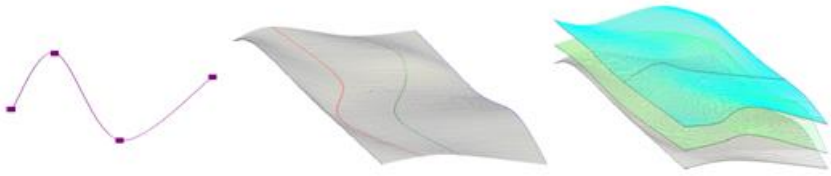
In the present description of model of the spatial object, the following statements contained in papers [2,1] are used:

- the shape of the spline is determined by control points (Figure 2a) [3].
- The form of the surface is defined by the spatial cardinal spline (Fig. 2b) [1];

In the described model of the spatial object and the parameter change inside the object is defined by the control surfaces (Fig. 2c).

It is assumed that the values of the parameter p and coordinate z of a representative number of points of the object, that is sufficient for the construction of control surfaces that define this object, are known.

In this article we consider two options: a description of the spatial object by the surfaces with the same value of parameter [4] and the description of the spatial object by the surfaces with the parameter that is distributed among surface in a certain way. In the first case it is assumed that the sets of points belonging to the object, form the field (pieces of the surface) with equal values of the parameter p (hereinafter - surfaces of equal parameter). These surfaces do not intersect. In order to simplify the presentation we will describe the spatial object by the three pairs of such surfaces, which will be called the control surfaces (Fig. 1, 4d, 6e). These surfaces define the shape of the spatial object and distribution of the parameter within it.



a *b*

c

Fig. 2. From the control points to the control surfaces: a) the form of the curve depends on the control points; b) the form of the surface depends on the control spatial curves; c) the

form of the of the spatial object and each of its points characteristics depend on control surfaces and their parameters.

All surfaces in this study will represent as halftone raster image files which are encoded by using cardinal splines [1]. The results of this coding are a compressed description of the spatial object (Fig.3).

The developed program allows you to edit the original surface by the change in the spatial spline (Fig. 2b) [1]. For clarity, in this study we formed the images of the spatial object cross-section, in which the parameter value at each point of the cross-section is shown as the brightness level of its image. In the formation of cross-sections of the spatial object the third-order polynomials – cardinal splines are using. Spline form that corresponds to the change of the parameter in each column cross-section is given by control points (Fig. 4b). According to the results of encoding surfaces we can determine the value of the parameter at any point of the spatial object (Sec. 2.3 and Sec. 2.4).

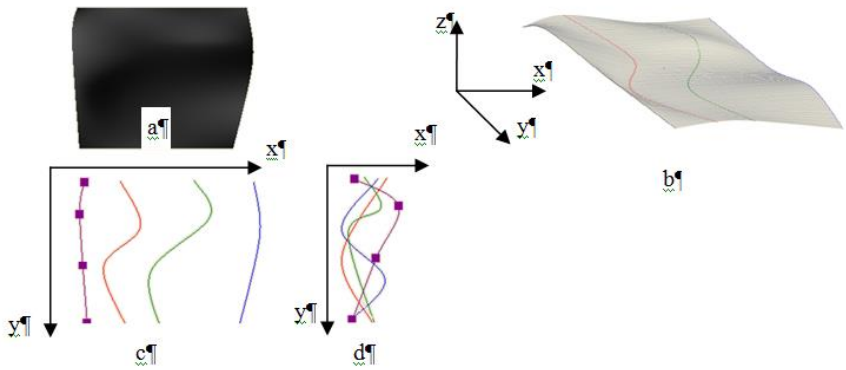


Fig. 3. Approximation of grayscale image by spatial splines and presentation the results of approximation: a) grayscale image; b) image representation in the form of piece of the simple surface and representation of spatial splines that are made of the sets of control points identified as a result of the approximation of brightness functions of all image lines by splines representation; c,d) spatial splines projection on the plane xOy and zOy.

2. Description of the spatial object

2.1. The shape of the spatial object

In order to clarify the problem, we'll put some restrictions on the shape of the spatial object (hereinafter - the object). The object is placed in Oxyz space, where Oxy plane is horizontal. The object's surface is defined by simple surfaces u(x,y) on the top and b(x,y) on the bottom, u and b are single-valued functions of (x,y). Side surface of the object is a cylinder.

2.2. General characteristics of the object

It is assumed that the shape of the object and a parameter value at each point are defined by some simple surfaces, which do not intersect. These surfaces will be called control surfaces. The intersection of the control surface by the plane, which is parallel to Oxz for some fixed y, forms the trace of this surface. This trail is a function z (x).

Using the values of the parameter p, obtained from all control surfaces as the control points for the cardinal spline for the fixed pair of coordinates (x, y), we calculate an array of values of parameter p, which reflects the dependence of the parameter p on the coordinate z for vertical column n of the object with coordinates (x, y). Cross-sections of the object by the planes, which are parallel to Oxz, are successively formed from these columns for various values of coordinates y.

For simplicity, all the following descriptions will be used three control surfaces. All the control surfaces will be presented in the form of gray-scale images, limiting the same contours. Cross-sections of the object, in which the value of the parameter p is transmitted by brightness of image points, will be also presented as a halftone images. Thus obtained cross-section of the object unambiguously characterizes this object.

2.3. Description of the object by the planes of equal parameters

In this case each control surface of the spatial object will be characterized by a constant value of parameter p at any point of this surface. As to the geometric characteristics of the object points is added the value of the parameter p, we assume that any point has 4 measurement.

It is a special case when each control surface of the object is turns into a plane, which is parallel to Oxy. These planes located one above the other, depended on the coordinate z, are shown in Fig. 4d. The trace of any of them, as a function of z (x), will take the form of a straight line, which is parallel to the axis Ox (a definition of trace you can find in Sec. 2.2).

Fig. 4b illustrates the drawing of the cardinal spline by three control points derived from the corresponding control surfaces (Fig. 4a). This spline represents the change of parameter p along the one of the columns section of the object (Fig. 4c). It is obvious that the change of the parameter along any other column of represented cross-section (and the whole object) will be the same in this case.

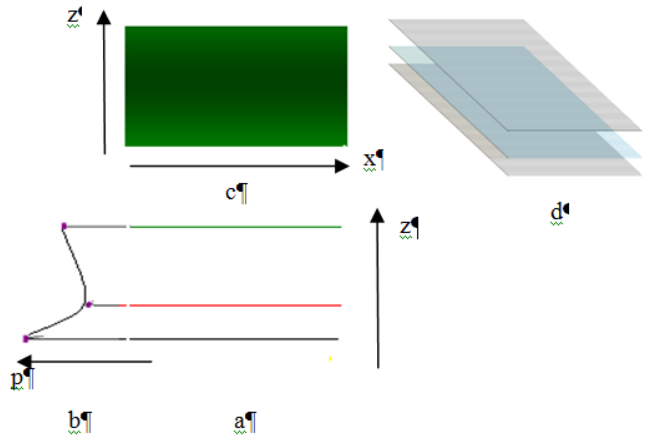


Fig.4. Calculating the object column characteristics for the construction of its cross-section. a) Traces of all three surfaces as a result of their sectional plane parallel to xOz (y=1). b) Drawing canonical curve used to calculate the characteristics of the first column of the cross-section of the object. The parameters p for all three surfaces are defined by user.

c) Representation parameters of all points of the cross-section as brightness levels of halftone image. d) Surfaces describing the object do not intersect.

The procedure for building a cross-section of the object under consideration is as follows:

1. Traces of three control surfaces (Fig. 4a) are formed as a function of z(x).
2. A set of control points (Fig. 4b), which are defined for each of the control surfaces and their traces, is formed on the basis of values of the parameter p.
3. From these control points cardinal curves (Fig. 4b) are built, which describe the dependence of the parameter p on the coordinate z for each column section. For this particular case they are all identical.
4. From these identical columns the cross-section of the spatial object is formed. This cross-section is represented as a halftone image, where the brightness level of the image points corresponds to the value of parameter p at every point of section.

All of the above corresponds to the particular case of the proposed further description of the object.

Each of the three control surfaces in this case is a regular and characterized by the constant value of the parameter p. They are represented by halftone images (Fig. 5). Trace of any of them as a single-valued function of the form z (x).

Fig.5. Halftone images corresponding to regular surfaces.

Analytical description of the object is formed from the results of coding the control surfaces [1] and the values of parameter p, which are constant for each of these surfaces. This description is used for the construction of traces of three control surfaces (Fig. 6a). Using these traces and corresponding values of parameter p for each of them the object cross-sections are constructed (Fig. 6d). Control regular surfaces with a constant value of the parameter p in each of them are shown in Fig.6e.

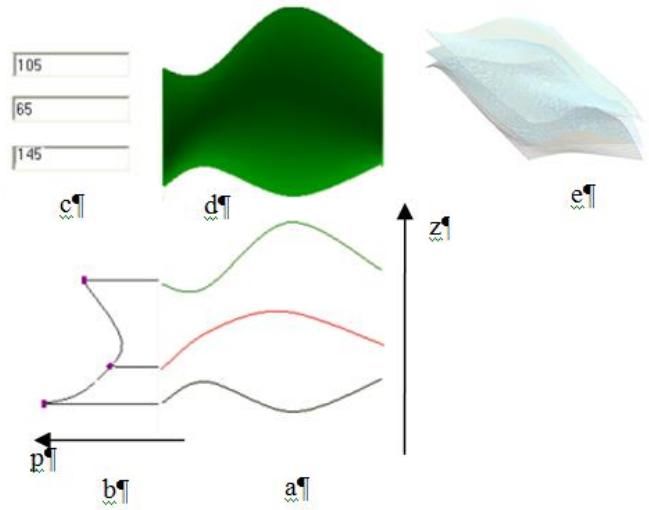


Fig.6. Calculating the characteristics of the first column points.
a) Traces of all three surfaces as a result of their sectional plane parallel xOz (y=1).
b) Canonical curve used to calculate the characteristics of the first column points belonging to cross-section of the object (for x=1). c) Setting all three surfaces parameters by user.
d) Representation parameters of all points of the cross-section as brightness levels of halftone image. e) Regular control surfaces of equal parameter.

2.4. Description of the object by fragments of surfaces, which have a regular law of distribution of the parameter p

The object with distributed parameter can be represented by two of its three-dimensional projections of four-dimensional space Oxyzp in two three-dimensional subspaces formed by the coordinate axes Oxyp and Oxyz.

It is assuming that some the object can be described by several fragments of surfaces. Definition of fragment is given in [4]. All fragments of surfaces are bounded of the same curves because the object side surface is a cylinder (Fig.7). To simplify the statement, we will assume that three fragments of surfaces are enough for the description. Each of these three fragments could be identified by pair of control surfaces: form control surfaces and parameter control surfaces. The form control surface is a projection of the object in three-dimensional subspace formed by the coordinate axes Oxyz, and the parameter control surface is a projection of three-dimensional subspace formed by the coordinate axes Oxyp.

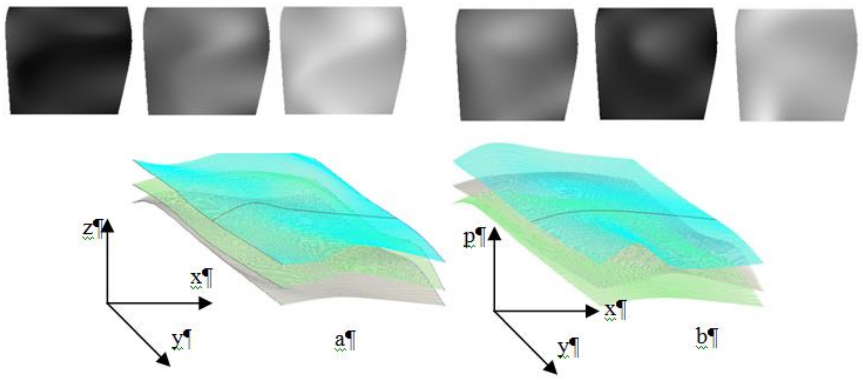


Fig.7. Visualization and plotting control surfaces of the form (a) and control surfaces of the parameter (b), represented by halftone images.

All three pairs of control surfaces in this study are represented as halftone images with the same border (Fig.7). All three pairs of control surfaces are encoded by cardinal splines [1]. As a result of this coding the files is generated that make up a complete description of the object.

Results of the spatial object encoding are used to build traces of this six surfaces which are linked pairwise. Traces of control surfaces of shape, such as z(x), and control surfaces of parameter, such as p(x), are single-valued functions of x (Fig. 8b, 8c).

Fig. 8d shows the construction of cardinal spline by three control points, derived from the corresponding control surfaces for parameter (Fig. 8c) and shape (Fig. 8b), which represents the change parameter p along the one of the columns of cross-section of the object. A cross-section of a spatial object (Fig. 8a) is formed from these columns.

The procedure for constructing this cross-section is as follows:

1. The traces of three control surfaces are formed as a function z(x) (Fig.8b).

2. The traces of three parameter control surfaces are formed as a function p(x) (Fig.8c).

3. The set of control points is formed (Fig.8d).

4. From these control points cardinal curves (Fig. 8d), which describe the dependence of the parameter p on z coordinate for each cross-section column, are built.

5. From these columns the cross- section of the object is formed (Fig.8a).

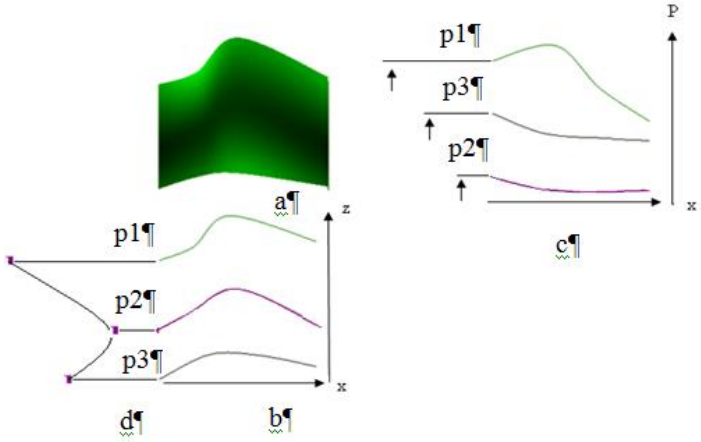


Fig.8. Halftone imaging of the object cross-section and calculation the characteristics of the first column points belonging to cross-section of the object.
a) Representation parameters of all points of the cross-section as brightness levels of halftone image. b) Traces of all three surfaces of form as a result of their sectional plane parallel xOz. c) Traces of all three surfaces of parameter as a result of their sectional plane parallel xOz (y=1). d) Canonical curve graph used to determine the parameter value for all the points of the first column belonging to the cross-section of the object.

Such section is represented as a halftone image, wherein the value of parameter p at each point of cross-section corresponds to the brightness level of the image points.

According to abovementioned and papers [1], [4], the object that is represented with three pairs of control surfaces of shape and parameter, in our case has 96 coordinates of control points of cardinal splines (since each control surface is defined with four control cardinal splines containing 4 control points each). In general case if we define an object with n pairs of control surfaces where each of them can be defined with m cardinal splines containing k control points each, we obtain a full description with 2*n*m*k control points. With this description we can calculate parameter value p in each point of the object, also any cross-section, vertical or horizontal can be calculated.

3. Software for editing and simulation of the objects

The described algorithm forms the basis of the software that can be used to simulate a variety of the objects.

The software can be used for modeling the object described by control surfaces of equal parameter (Sec. 2.3). In this case, it is possible interactively to change the value of the parameter p, assigned to any of the control surfaces, and to watch the corresponding changes in images of the cross-sections of the object (Fig. 6). Also it is possible to model the object described by the pairs of corresponding form and parameter control surfaces (Sec. 2.4).

This program allows to read the description of the object in a proprietary format, and to visualize it's analytical description in the form of grayscale images. The characteristics of each control surface, which is a part of the object description, can be changed and then the results of editing can be saved to a file.

The program has the ability to build the vertical section of the object for any interactively selected coordinate value y (Fig. 8). It is also envisaged the construction of horizontal cross-sections. In this case a value of coordinate z, for which the section is constructed, is selected interactively (Fig. 9).

Fig. 9. Visualization of the horizontal cross-section of the spatial object.

4. Conclusion

The proposed model of the object description by the parametric splines allows to retain the characteristics of this object compactly with the possibility of recovery for each point. The object is represented in the form of several pairs of form and parameter control surfaces, each of them can be approximated by parametric splines. If the object is represented by n pairs of control surfaces where each of them can be defined with m cardinal splines containing k control points each, we obtain a full description with 2*n*m*k control points. This description allows restore the characteristics of the object with the required accuracy.

The proposed analytical representation of the objects is invariant to some affine transformations, which significantly simplifies the handling of such objects.

The software for simulation and editing the object is developed, wich allows to change the characteristics of an object interactively that can be useful for its study. Among the features of software there is also a construction of any vertical and horizontal sections of the object and visualization them of a halftone image.

Further development of the algorithm assumes the ability to solve the inverse problem, i.e, encoding an object using its cross-section.

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Determination of the Relationship Enterprise's Responsibilities with Components Social Responsibility

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Abstract: The advanced concept of responsibilities A. Carroll, which is complemented by environmental and socio-labor duties, as well as enhanced legal obligations to regulatory. The author 's definition of «duty of the enterprise», which should be understood as provided by legal and social norms need to adhere to certain rules of conduct in respect of activities, as well as their consolidation in the documents regulating the relations of participants of internal and external business processes. Proposed responsibilities of the enterprise group as the basis of social responsibility component of the enterprise. Reasonably logical connection components in the scheme of the relationship: the legal, social, labor, environmental, economic.

Key words: social responsibility of the enterprises, the legal, social, labor, environmental, economic, duties, component.

1. Introduction

In the current economic conditions, more position that is social affects the reputation and image of the enterprise. In assessing its activities, it is necessary to consider not only the operational and financial performance, but also the extent of its functioning in the interests of participants in business processes. Public confidence in the enterprise expressed confidence in respect of conformity to the declared values: stability, transparency, integrity, honesty and integrity to all participants of internal and external business processes. This is the basis for the formation of the institute of trust, which is of particular importance in the economic, environmental, social, labor and regulatory balance between the enterprise, shareholders, directors, employees, customers, suppliers, local community, and the state. Implementation of the principles of social responsibility in business processes is a factor in the further development of the enterprise and is of paramount importance in solving a number of social problems.

2. Basic Concepts of Social Responsibility of the Enterprise

There is a wide variety of concepts of social responsibility of the enterprise, but the basic concept can be considered the duties A. Carroll and the concept of «stakeholders» (stakeholders) [1, 2].

Such a policy of the company provides that the task of the manager is to seek an optimal balance between the different interests of the participants in the internal and external business processes and the interests of the enterprise itself. This concept is called «stakeholders» (stakeholders) and provides that the company is not simply pursuing financial interests, and has a social responsibility.

Social responsibility is inextricably linked to performance of the company because it cannot be socially responsible without profit. US researcher Joel Makouer claims «most socially responsible thing most companies can do is to be profitable» [3]. Profit important not only to reward investors, but also to pay fair wages, pay taxes, upgrade equipment, invest in charity, contribute to the prosperity of society in which the company exists.

There are seven main groups of participants in internal and external business processes, to which the company is responsible: managers, shareholders, employees, customers, suppliers, local community, and the state. If the company interacts with them correctly and take into account their interests - it has a high level of social responsibility and correspondingly high productivity activities.

Through socially responsible operations, the company sells not only its economic objectives, but also shows the social effects of business activity participants' internal and external business processes, which is carried out in conjunction with an activity and satisfies their interests.

3. Duties of the enterprise and their relationship with the components of social responsibility

In accordance with the concept of A. Carroll entity shall perform the following duties [1, 4]: economic, legal, ethical, philanthropic.

According to the authors, in the current economic conditions, it is advisable to improve the concept of responsibilities A. Carroll, adding to its environmental, social and labor responsibilities extending to the legal regulatory. Graphically, the result can be expressed as the relationship of the enterprise with the obligations of social responsibility components (Fig. 1).

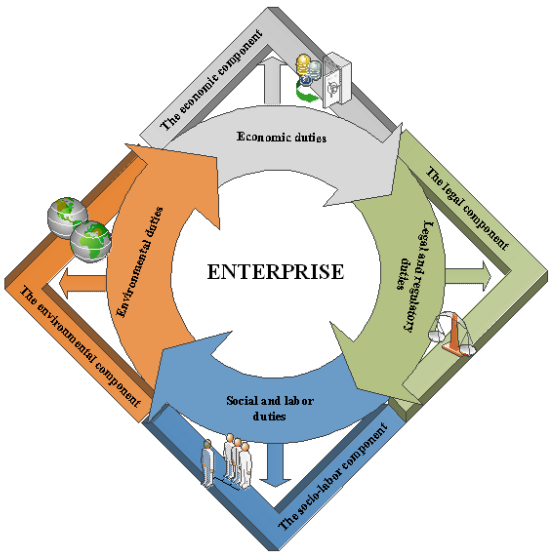

Fig. 1. Interconnection obligations of the enterprise with the components of social responsibility

If we consider the definition of «duty» from a legal point of view - is the legal regulations need to follow a certain type of behavior, and as it is enshrined in the law of the State and society to the behavior of the individual. [5].

The authors propose to apply this definition to the enterprise, then laws require the «duty of the enterprise» and social norms need to follow a certain type and extent of behavior, as well as legislated requirements of participants of internal and external business processes in the enterprise.

1. Legal and regulatory duties. Every company must carry out its activities, observing the current legislation.

In the current economic conditions in Ukraine, there is no law that would regulate the activities of socially responsible companies. However, there are regulations governing the activities of the company with respect to each of the seven groups of participants in internal and external business processes:

- Leadership: The Constitution, the Labor Code, the Charter of the enterprise, the Law of Ukraine «On Labor Protection», the Criminal Code of Ukraine and others;
- The shareholders: the Constitution of Ukraine, Law of Ukraine «On Joint Stock Companies», the Criminal Code of Ukraine, and others;
- Employees: The Constitution, the Labor Code, the Charter of the enterprise, the Law of Ukraine «On Labor Protection», the Criminal Code of Ukraine; internal rules and others;
- Distribution: The Constitution of Ukraine, the Economic Code of Ukraine, Law of Ukraine «On Business Associations», the Criminal Code of Ukraine, and others;
- Consumers: the Constitution of Ukraine, Law of Ukraine «On Protection of Consumer Rights», Law of Ukraine «On Environmental Protection», the Criminal Code of Ukraine and others;
- The power of the local community: the Constitution of Ukraine, Law of Ukraine «On Environmental Protection», the Criminal Code of Ukraine and others;
- State: The Constitution, the Labor Code, the Law of Ukraine «On the supply of goods for state needs», Tax Code of Ukraine, Law of Ukraine «On Environmental Protection», the Criminal Code of Ukraine and other normative-legal acts and others.

2. Social and labor obligations of the enterprise include obligations to employees for the quality of work and the maintenance of working conditions, training of personnel and training, the level of middle-aged workers in the enterprise. As a result, all of the above contributes to the productivity of employees, their initiative, process efficiency, increase innovation products.

3. Environmental responsibilities despite the difficult situation with the environment, every company should take care of the environment, taking into account the specifics of its own production.

4. Economic responsibilities: if all the previous obligations, the enterprise will be able to achieve its main goal - making a profit.

Duties of corporate social responsibility by the authors represented in the form of a circle, interrelated and interdependent [6, 7, 8, 9, 10, 11, 12, 13].

4. Mathematical basis of the component's order of enterprise's social responsibility

Duties of corporate social responsibility by the authors represented in the form of a circle, as the interrelatedness and interdependence. However, from a mathematical point of view can be substantiated order of the components of social responsibility as follows. We consider social

responsibility as (SR) set of four components: economic (E_R), environmental (Ec_R), social and labor (SL_R) and legal (L_R). Then the model of social responsibility components of the relationship will be the following:

$$SR = \{E_R; Ec_R; SL_R; L_R\}. \quad (1)$$

Enforcement of obligations of the enterprise in each of the four specific component governed by the relevant legal documents. In this regard, it is proposed regulatory component to accept the beginning of the terms of reference (Fig. 1). Thus, if you enter LR_i as a subset of regulatory documents under the respective components (economic, environmental, social and labor and legal), we obtain the following system dependencies:

$$\left.\begin{array}{l} \{E_R\} \subseteq \{LR_E\}; \\ \{Ec_R\} \subseteq \{LR_{EC}\}; \\ \{SL_R\} \subseteq \{LR_{SL}\}; \\ \{L_R\} \subseteq \{LR_L\}; \end{array}\right\} \Rightarrow LR = \{LR_E\} \cup \{LR_{EC}\} \cup \{LR_{SL}\} \cup \{LR_L\}. \quad (2)$$

On the basis of showing the relationship (Formula 2), reflecting the presence of regulatory components in each of the components of social responsibility, we can assume legal responsibilities (L_R), and consequently the legal component of the beginning of the terms of reference of socially responsible enterprise (Fig. 1) .

To justify the second part of the terms of reference should first consider in more detail the concept of «stakeholders».

In modern enterprises affected not only by domestic factors, but by also environmental factors, almost no measurable impact management. Nevertheless, businesses must have a system of regulation ties with rogue elements of the environment and adapt to the interests of participants in internal and external business processes.

Participants of the business processes have been described in the concept of «stakeholders» (stakeholders). It should be noted that single sets of stakeholders does not exist, they will differ depending on the sector, type of business, its location [2]. All interested persons can be divided into two groups - internal and external.

However, the interests of participants in internal and external business processes have to be taken into account when defining the objectives and functioning of the enterprise in the process of achieving them. Participants of the business processes, whose interests are most aligned with the goals of the enterprise, according to the authors, are: shareholders, executives, employees, customers, suppliers, local community (representatives of public opinion), the State (local authorities and regulatory authorities).

Thus, the kinds of objects, which a lot of the legal components of the L_R effect on social and labor component (SL_R) is a party to the enterprise business processes, which are listed above, so

$$O(L_R) = \{A; M; S; C; P; L; G\}, \quad (3)$$

where A - shareholders;
M - heads;
S - workers;
C - consumers;
P - providers;

L - local communities;
G - government.
then:

$$\{SL_R\} \subseteq \{O(L_R)\} \subseteq \{LR\}. \quad (4)$$

Based on the properties of the logical transformation (if A = B and B = C then A = C), we obtain the following relation:

$$\{SL_R\} \subseteq \{LR\}. \quad (5)$$

That is, the second most important part of the fundamental responsibilities of social responsibility is a social and labor (SL_R). This is due to the fact that the effective and successful functioning of any enterprise is not possible if the staff does not have proper working conditions, relevant qualifications, and the average age of employees is greater than the pension. All of this will lead to lower productivity, efficiency, product innovation, etc. (Fig. 1).

Based on the core mission of the enterprise, it can be argued that the closing part of the terms of reference should be the economic component. After all, the main purpose of the enterprise, even socially responsible, is making a profit. Social responsibility requires a significant investment. Thus, the third element - is an environmental component. In the current economic climate, more companies are paying attention to the protection of the environment. Without environmental responsibilities, the company will not be able to be socially responsible and to maximize the impact of its activities.

5. Conclusion

It was found that the social responsibility of the company consists of four components - economic, environmental, social and labor and legal. They are based on the duties of the enterprise to meet the interests of the participants in the internal and external business processes in these areas. Improved concept responsibilities A. Carroll, which is complemented by environmental and socio-labor duties, as well as enhanced legal obligations to regulatory. Disabled author's definition of the «duties of the enterprise», which should be understood as provided by legal and social norms need to adhere to certain rules of conduct in respect of activities, as well as their consolidation in the documents regulating the relations of participants of internal and external business processes. Group's duties enterprise delivered in component-based enterprise social responsibility. Mathematically proved logical connection components in the scheme of the relationship: the legal, social, labor, environmental, economic.

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Architectural Solutions for Situational Management

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Abstract: The paper is devoted to overview of architectural approaches of situational center creation. Different combinations of hardware and software solutions are discussed, special focus was made on specialized remote voting and stenography solutions and their software support. Unified flexible architecture is proposed.

Keywords: situational centers, specialized solutions, architecture of situational centers.

1. Introduction

Program-technical complex (PTC) of situational management system (SMS, by then - system) is the basis for automation of informational support (listed below) of situational management, based on collective decision-making:

- registration of participants of decision-making meetings;
- maintenance of actualized database of personal accounts of participants of decision-making meetings;
- registration of participants directly in the room of decision-making meetings;
- voting in open, roll call and secret modes;
- sound accompaniment of registration and voting processes in the room of decision-making meetings (by then - the meeting room);
- archiving of the voting results of all decision-making meetings;
- support of basic functions which provided by the rules of meetings procedures (regulations);
- using of electronic display boards in the meeting room to display information about progress of decision-making meetings;
- microphone control at workplaces of participants of decision-making process;
- timing of speakers' speeches to comply regulations of decision-making meetings;
- informational support of chairman of decision making meeting concerning queue of participants' speeches from workplace and from the tribune, voting results and other supplemental information, which is necessary according to regulations of decision-making meetings;
- sound reproduction during of progress of decision-making meetings;
- formation and printing of protocols and other necessary documents regarding the results of the decision-making meetings.

Application fields of PTC are basic automated services providing for the system to support its users during preparation and carrying out decision-making meetings, and to form consolidated documents.

Auxiliary services of PTC for the system are:

- computer diagnostics of participants' consoles in real time during decision-making meetings, as well as during regular maintenance;

- administration and backup of system databases with intervals specified in the regulations;
- maintenance of data processing hardware.

2. Reasoning a promising architecture of SMS

We have considered the following classes of situational management systems:

- conference system [1; 2; 3];
- parliamentary system [4; 5; 6];
- decision support systems [6; 7];
- video-conferencing systems [8; 9].

Analysis of architectural solutions of these systems shown following their shortcomings:

- the excessive binding to specialized hardware solutions – such an approach does not allow quickly make changes to the system architecture; carries a danger in terms of being tied to one manufacturer of hardware solutions (if the manufacturer disappears in global market – the system will has all the chances to stop functioning without maintenance and spare parts);
- the excessive fragmentation of automated working places of system – this approach makes system maintenance extremely difficult and (in fact) inseparable from the developer of these automated working places (in fact, very difficult to train staff on the customer side. Also it affects the overall system reliability);
- lack of flexibility in terms of formats of information which circulating and stored in the system – usually very difficult to introduce into system new data for which the system is not designed, organize their storage, transmission and processing;
- poor openness of architectures – very difficult to organize the automatic exchange of information between systems, which in turn leads to loss of efficiency of their use.

Considering all the above, the following principles of SMS architecture were formulated:

- openness of architecture on the base of access interfaces definition and data formats;
- focusing on the thin client – as far as possible, all functionality and data should be kept on the server with providing access to customers using standard unified protocols;
- flexibility of data storage system – should be chosen and implemented such methods of storage which resistant to changes of data structures;
- modularity of architecture – the system should be split on well granulated and standardized modules and services with well-designed interaction interfaces;
- cross-platform solutions use – should attempt to build a system that will be maximally independent of the operating platform to be used;
- focusing on standard protocols – should minimize creating own data exchange protocols and maximally use possibilities existing protocols and solutions.

Taking into account these requirements the following architecture was proposed (Fig. 1).

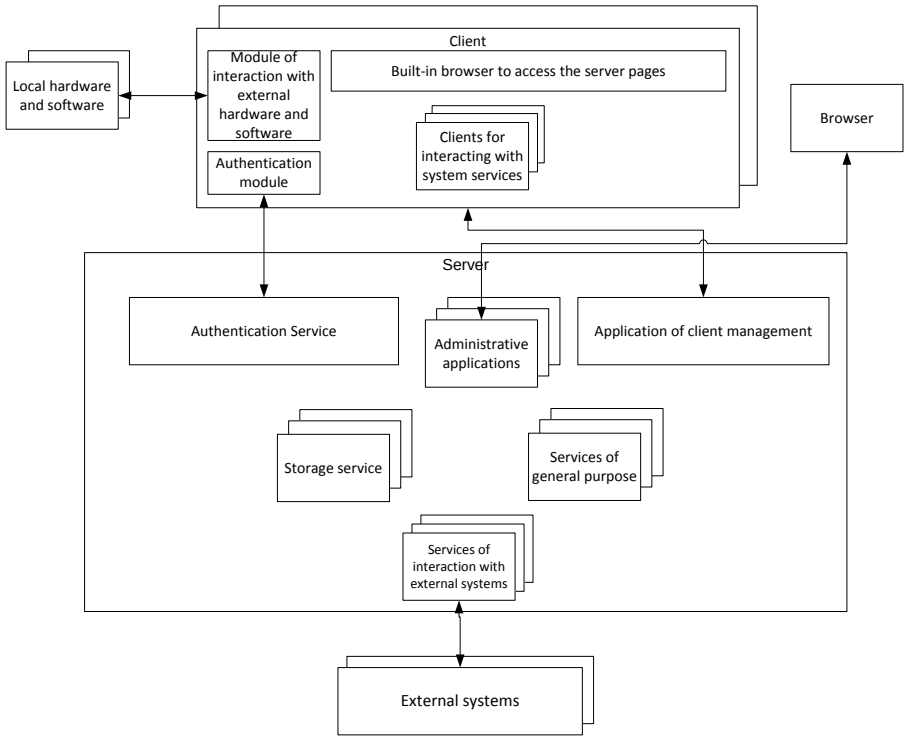

Fig. 1. The proposed architecture of situational management system

Data storage service. This service is designed for data storage of the system. Service should be established on the basis of a RDF-triple store. We were suggested to use BigData [10]. Flexibility is a significant advantage of this type of data storage. We are not tied to the structure of the tables. The data structure in this storage is described by scheme, which can be easily changed. Storage provides support of SPARQL language, which allows you to run queries on data obtaining and manipulating.

Authentication service. This service is designed to identify and authenticate users. Sequence diagram of the user authentication process is depicted on fig. 2.

As a result of execution of authentication process, an application that initiated this process will get either an authentication error (BadRequestException/ForbiddenException), or JSON with stored user information and access key for the current session. This passkey must be used by application for the further interactions with other system services as header or as query parameter.

File storage service. This service is designed to store data files. The service allows to carry out operations similar to the operations of the file system:

- create/rename/move/delete folders;
- create/rename/move/delete files;
- providing access rights to files and folders based on user roles;
- obtaining directory structure;
- getting file contents.

The structure of file storage service is shown on Fig. 4.

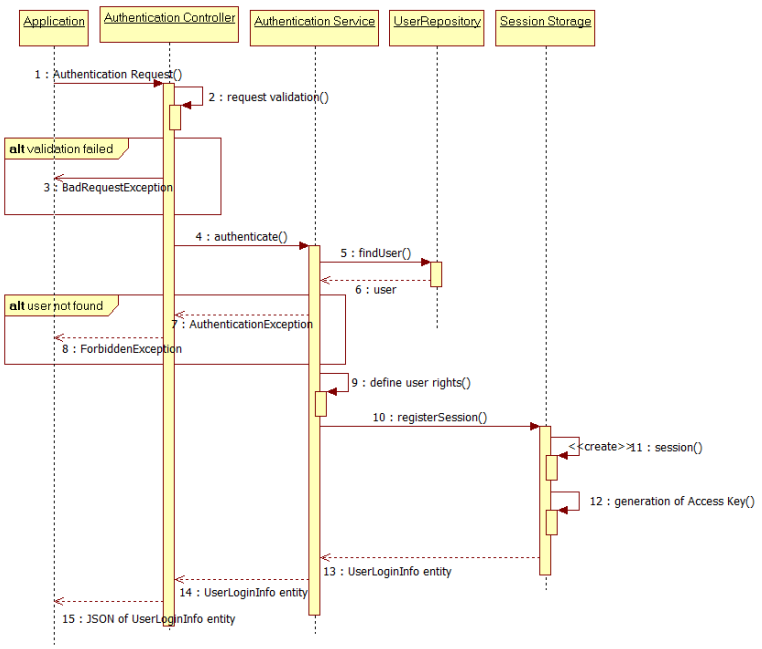

Fig. 2. Sequence diagram of the user authentication process

Example of sequence diagram of interaction between application and web service is shown on Fig. 3

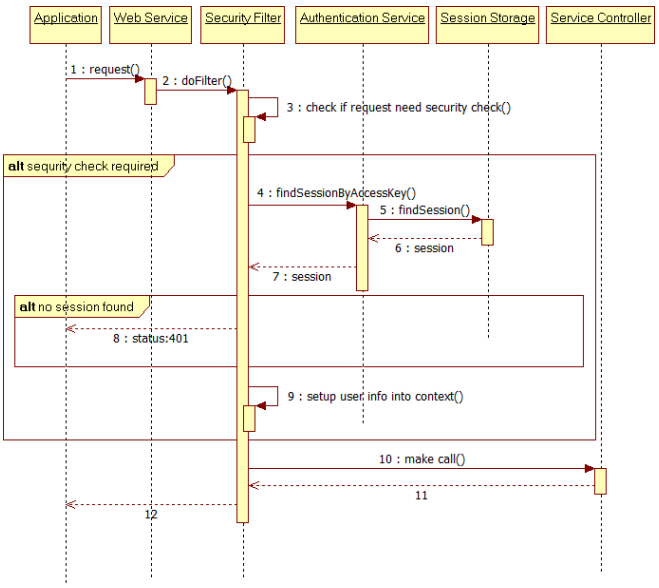

Fig. 3. Sequence diagram of interaction between application and web service

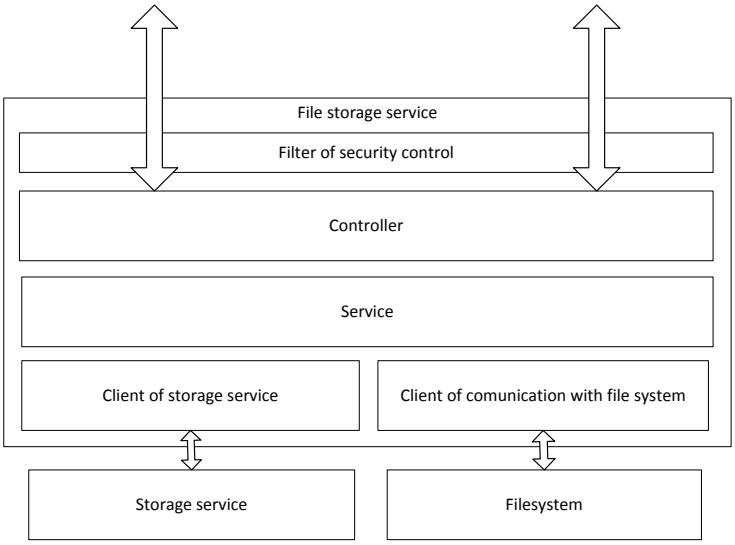

Fig. 4. Structure of file storage service

Metadata about the directory structure and file locations are stored by means of storage service. Also there are stored links on real files in the real file system.

Cartography service. This service is intended for storing map information and making it available to other apps. For this purpose are used GeoServer (http://geoserver.org/) and OpenLayers (http://openlayers.org/).

Service of videoconferencing. This service is intended for organization of video streams and presentations. The structure of this service is shown on Fig. 5.

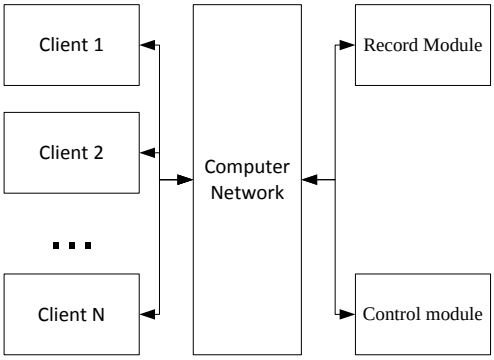

Fig. 5. Structure of videoconferencing service

This service distributed and consists of following components:

- control module;
- recording module;
- client.

Control module designed to manage of clients and recording module. Software of upper levels can organize the collection and interchanging of video information with support of this module.

This module implements the following functions:

- clients' registration;
- creating of multicast groups for specified clients;
- termination of multicast groups existence;
- enable/disable of videotranslation in a specified multicast group;
- enable/disable demonstration mode in a specified multicast group;
- managing of recording module.

Structure of control module is shown on Fig. 6.

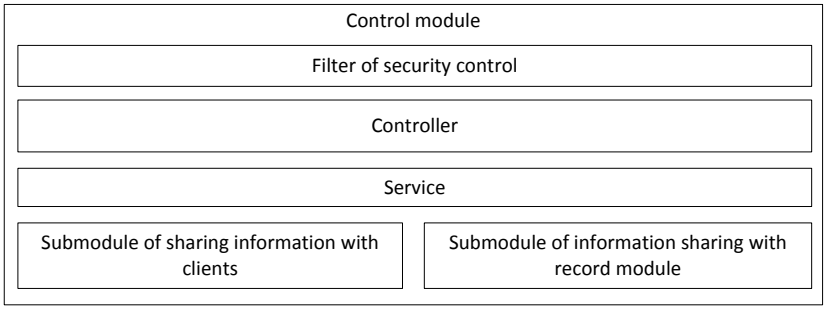

Fig. 6. Control module structure

Recording module is designed to record video broadcast that occurring in the main multicast group. This module receives the transmission in this group and records it to disk storage. The recording can be turned on or turned off by command from the control module.

Structure of recording module is shown on Fig. 7.

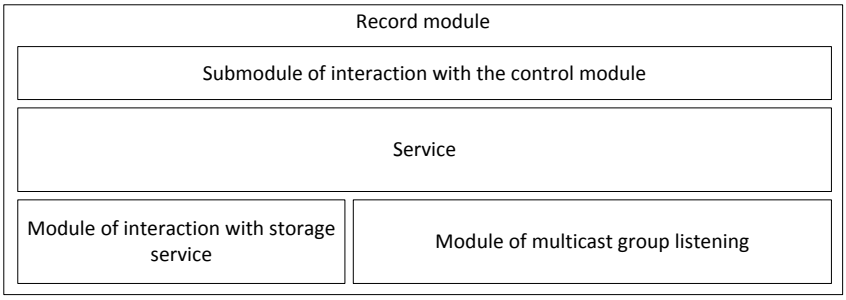

Fig. 7. Recording module structure

Client is designed to work on computers of situational center as part of visualization application. This module implements the following functions:

- registration in the control module;
- joining multicast group;
- recording video from a video camera;
- video recording from computer display where installed this client;
- transmition of video data to active multicast group;
- receiving video data from multicast group.

Client structure is shown on Fig. 8.

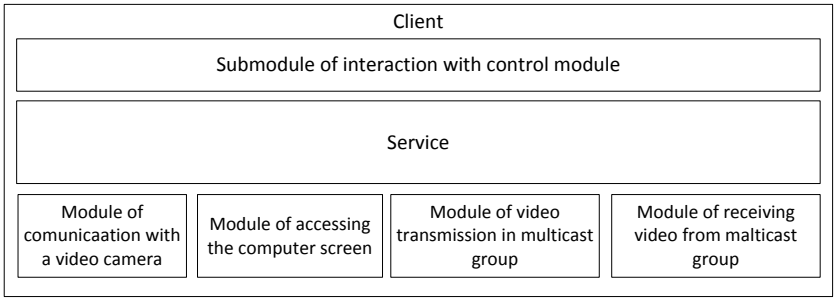

Fig. 8. Client structure

Service of protocol maintenance. This service is intended to registration events that occur during meetings in the SMS. These events include:

- registration of meeting participants;
- participants' speeches;
- voting on various issues and storing results of voting;
- introduction of amendments to the regulations of the meeting.

In addition this service can do automatic conversion of voice to text.

Application of user administrating. This app is designed to perform the following functions:

- creating users accounts;
- editing user roles;
- activating/deactivating users;
- registration of user cards;
- user registration at meetings in the SMS.

Structure of application for user administrating is shown on Fig. 9.

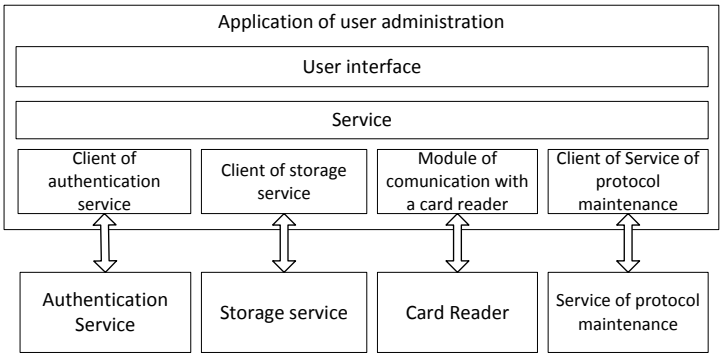

Fig. 9. Structure of application for user administrating

Application for preparation of regulations. This app is designed for preparation of meetings in situational room of SMS. Its functions include:

- meeting creating;
- defining the list of meeting participants;
- defining of the meeting agenda;
- downloading additional materials that may be needed during the meeting;
- creating protocols for completed meetings;
- archiving of the meeting materials.

The structure of the application is shown on Fig. 10.

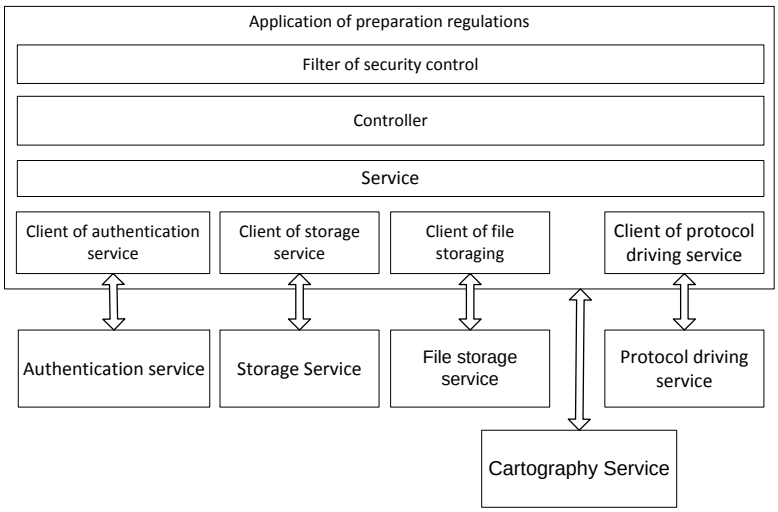

Fig. 10. Structure of application for regulations preparation

The application of regulations performing. This application serves for carrying out meetings. It is designed to control visualization applications during the meeting. Its functions include:

- downloading prepared regulations;
- defining the meeting agenda;
- possibility of the agenda amending;
- taking into consideration of the agenda;
- queuing presenters and speakers;
- granting permits for presentations demonstration;
- giving the floor to participants of the meeting;
- carrying voting on issues on the agenda.

The architecture of the application is shown on Fig. 11.

The component of visualization. This application is used to automate various aspects of participants work at the meeting. The application implements the following functions:

- users identification and authentication;
- access to the agenda;
- providing access to additional materials;
- providing opportunities for the report/presentation from the workplace;
- enable record on performance;
- provide opportunities of voting;
- provide opportunities for teleconferencing.

The architecture of the application is shown on Fig. 12.

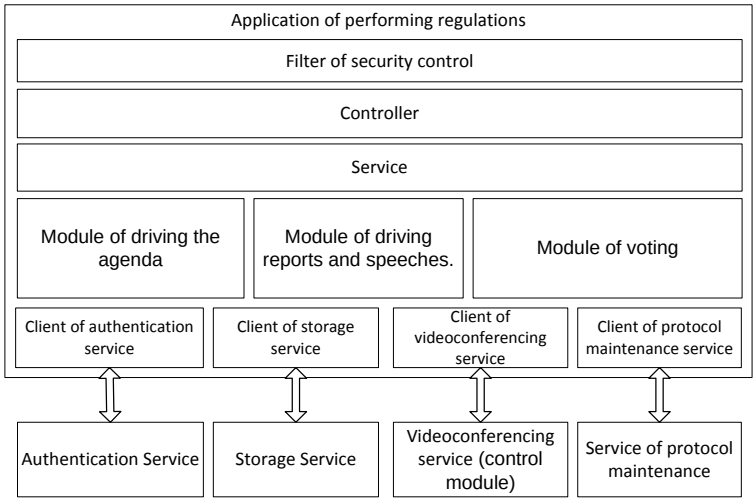

Fig. 11. Architecture of application for regulations performing

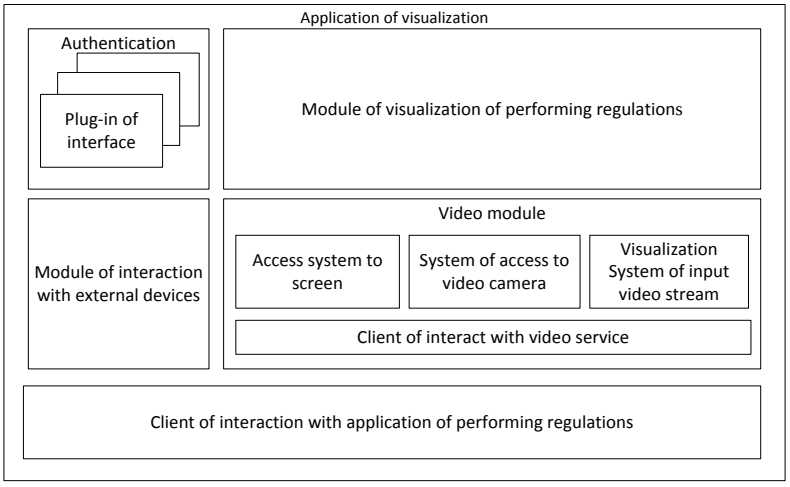

Fig. 12. Architecture of visualization component

3. Conclusion

Creation of situational management systems requires the integration of technical, organizational, methodological decisions and involves the use of information technology spectrum for different aspects of decision-making. In particular, it is necessary to combine in one system means of visualization, simulation, organization and supporting of collective decision-making procedures, documentary and organizational support, etc.

In the article are proposed the architectural models for components of flexible integrated environment of situational management. Generalized structures and functions supported by their components are described. Special focus was made on specialized remote voting and stenography solutions and their software support.

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ICAICTSEE-2015 PAPERS

BY

BULGARIAN AUTHORS

Public Funding of ICT in Bulgarian School Education (2012-2015)

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Abstract: The article aims to present state policy in respect of the provision of ICT in schools and more specifically – computerized workplaces. The definition of the author for computerized workplaces: desktop, laptop, terminal or (hybrid) tablet. For this purpose, the presented and analyzed data are from the execution of the Ministry of Education and Science in Bulgaria National Program "Information and communication technologies (ICT) in the schools" for the period: school years 2012/2013, 2013/2014 and 2014/2015. The data are obtained from the Ministry of education and science in February 2015 in response to a request for access to public information by the author. In this article some of the analyzed data give objective information about the state funding for securing computerized workplaces and the total amount of investments and effectively covered schools, for the survey period.

Keywords: ICT, education, public funds, schools, computers, students.

1. Introduction

The introduction of new technologies, such as broadband internet and personal devices with access to the global network has had a most noteworthy effect on education. A large number of students are connected to the global network either via computers at home or via personal devices – primarily cell phones with access to the Internet. At present, schools are getting behind with personalizing education and, more importantly, with providing a computerized workstation for each student. Recent studies pertaining to the use of ICT in schools are:

- The PISA survey in 2012 – Program for International Student Assessment of the Organization for Economic Co-operation and Development (OECD) intended as a periodical standardized assessment of 15-year-old students. This was the first time a computer – based problem-solving module was introduced. According to the survey, an average of 94% of students in OECD countries have computers at home which they also use for educational purposes. An average of 72% use computers at school, yet in some countries less than 50% of students have claimed so. An average of 94% of the surveyed students have at least one computer at home; 93% of Bulgarian students also have at least one computer at home.

- The European Commission's Survey of Schools: ICT in Education, conducted in the 2011/2012 academic year, which included 31 countries – the 27 EU members, Iceland, Norway, Croatia and Turkey, and a total of 190 000 respondents (teachers, students, principals). The survey defined 'computer' as 'a PC or laptop, netbook or tablet, which is used for educational purposes at school, regardless of whether it is connected to the Internet

or not. The survey was aimed at assessing the different aspects of ICT in schools among students in the fourth, eighth and eleventh (general and vocational education) grades.

The purpose of this article is to present the country's policy regarding the provision of ICT in schools and computerized workstation in particular. The definition of the author for computerized workplaces: desktop, laptop, terminal or (hybrid) tablet. The data from the National Program "Information and Communication Technologies (ICT) in Schools" for the academic years 2012/2013, 2013/2014 and 2014/2015 of the Bulgarian Ministry of Education and Science will be used for the purposes of this article. The data are obtained from the Ministry of education and science in February 2015 in response to a request for access to public information by the author. This article analyzes part of the data which presents objective information about the financial provision for computerized workstations, as well as the total ammount of the investments made as well the schools which were and were not covered in the assessed period.

2. Bulgaria's place in comparison with other European Union countries

As of now, no information has been released on the actual number of computerized workstations in Bulgarian schools and it is difficult to acquire such data since the presence of a computer does not guarantee that it is being used as a computerized workstation. Before the National Program "Information and Communication Technologies (ICT) in Schools" of the Ministry of Education and Science, the only national provision of computers was in 2005-2007 when "more than 65,000 computers" were divided between all Bulgarian schools as a measure for the fulfillment of the National strategy for introducing ICT in Bulgarian schools. Since then, there have not been any centralized deliveries and it has been up to the schools to decide how much of their delegated budgets should be spent on ICT. Numerous businesses and non-governmental organizations supposedly took up the initiative to give ICT equipment to schools for the period 2008-2012 but there is no consolidated information. The only official information released about the provision of computers in schools is the one from the aforementioned survey of the European Commission Survey of Schools: ICT in Education. Table 1, in which the results for Bulgaria are compared to averaged results for the EU countries, shows the ratio of computerized workstations to 100 students. The EU results show a decrease in the ratio in the higher grades. Even though Bulgaria is significantly lagging behind compared to the other EU countries, the data show a compliance with European tendencies: elementary school pupils have the least access to ICT in schools and students in vocational education have the largest number of computerized workstations at their disposal. Bulgaria rates among the last five countries in the survey, together with Italy, Romania, Greece and Turkey. There are primarily PCs, and the ratio of a student to a workstation connected to the Internet is 1 to 13, the EU standard being 1 to 7. Laptops are a scarcity, with a ratio of 1 to 125. More than 80% of computers are placed in computer labs. As for broadband internet access, Bulgaria is among the leading countries, with a mere 4-5% of students attending schools not connected to the Internet.

Table 1. The ratio of computerized workstations to 100 pupils

Country	4th grade	8th grade	11th grade – General education	11th grade – Vocational education
BULGARIA	6.5	9.4	8.7	15.6
EU Average	14.5	21.1	23.2	33.6

8th -11th grade students fall in the scope of the survey which assesses the usage of technology in class (shown in *Table 2*). Between 65% and 71% of students utilize school computers while between 19% and 22% use personal laptops. The results concerning cell phone usage are most curious, with 40% to 46% having claimed that they use one. Compared to other EU countries, the percentage is significantly higher. Despite the negative tendencies concerning the student-computer ratio, Bulgaria rates high among the countries using ICT at school for educational purposes, particularly via cell phones.

Table 2. Using technology in class

Level of education	Country	Personal cell phone	Personal laptop	School computer
8th grade	BULGARIA	39.5%	19.3%	70.6%
	EU average	28%	11.2%	53.3%
11th grade – General education	BULGARIA	46.1%	21.6%	67.5%
	EU average	34.6%	10.7%	50.5%
11th grade – Vocational education	BULGARIA	44.8%	21.9%	65.2%
	EU average	45.6%	15.5%	64.3%

Based on a number of criteria the European Commission Survey of Schools: ICT in education divides schools in three levels of digital provision, defined as follows: the school has broadband connection to the Internet (more than 10 mbps), as well as one of the following: a website, an e-mail for students and teachers, a local web, a virtual educational environment.

1. Schools with a high level of digital provision
2. Schools with partial digital provision
3. Schools with a low level of digital provision that have little or no Internet access

19% of 4th grade Bulgarian schools and 14% of 8th grade Bulgarian schools fall in the last category. Only 11th grade schools are anywhere near close to the average EU levels.

3. National ICT in Schools Program

The data cited above concerns the academic 2011/2012 year. In 2012, a National Program "Information and Communication Technologies (ICT) in schools" of the Bulgarian Ministry of Education and Science was introduced and approved. Its primary aim was to financially aid schools in renewing ICT equipment by "guaranteeing a minimum of technological provision by facilitating each school with computer terminal solutions". In the four years that the program covers the schools are to utilize the financial aid given and to

renovate ICT equipment. As of 2012, the program fixates an opportunity for providing computerized workstations, namely terminal work stations. The program lists the following benefits:

- Obtaining and renovating terminal based workstations is cheaper: one server caters for numerous workstations; the only expenses have to do with renovating only the server since the other components last longer
- The cost of maintenance is lower: this is an important argument when it is taken into consideration the fact that most schools in the country cannot afford the services of professionals and the role of ICT support and maintenance is often taken up by Informatics and/or IT teachers.
- The technology is easily applicable to the learning process.

The criteria the program requires are clear: at least 3 servers per school, or at least one server per 13 pupils, both of which provide a maximum of 39 workstations per school. The budget is 6 500 000 BGN, of which up to 5 000 000 BGN is designated for renovating the present technologies. Each school in the country applies for centralized financing by stating in advance the number of workstations needed and the amount for co-funding. The maximum price per workstation allowed by the Ministry of Education and Science is 750 BGN. Should a school manage to provide a workstation at a lower price, the rest of the money can be used for purchasing more workstations or for other ICT related expenses. The process is completed on a school level but the Ministry of Education and Science provides two specifications for minimal technical requirements for terminal solutions of a high-end and a low-end performance.

During the first year of the program totally 1168 schools applied. In order to fit the financial restrictions, only 496 schools were approved (see *Table 3*).

During the second year – school year 2013/2014 – the requirements were slightly altered. Schools which had a pre-existing network received 700 BGN per workstation while schools which required building a network received 750 BGN, and it was expected of the Internet providers to include setting up the network in the final price. Whether a school was approved or not depended on what percentage of the sum they co-funded. 836 schools applied and 516 were approved (see *Table 3*).

During the third year – the school year 2014/2015 – the program was significantly changed regarding ICT equipment. In addition to the initial "terminal solutions", "personal and portable computers", tablets and various hardware, such as multimedia projectors, interactive whiteboards and software products were included. The maximum price allowed was increased for the following:

- Terminal – 850 BGN
- Computer – 800 BGN
- Laptop – 800 BGN
- Tablet – 500 BGN
- Projector – 1000 BGN
- Interactive whiteboard – 1000 BGN

Each school could apply for additional hardware and software products, again providing exact co-funding. Schools were required to fill out a survey in which they had to sort out their priorities – the priority of each product they were applying for if it were to be bought. Two additional components were added when considering a school:

- Innovative capacity of the school, which was defined by the school's readiness to measure its e-maturity by filling out an international survey conducted by a European Union project

- A school action plan – filled in a form provided by the Ministry of Education and Science

The final rating was by component and not by school as it has been in the previous two years, i.e. a school could receive funding for some of the components it had applied for but not necessarily for all of them. For the first time there was separatel funding for all applied Protected Schools and all the components they applied for were funded. Totally 1171 schools applied in the school year 2014/2015 but only 623 were approved (see *Table 3*).

The data for the schools which applied and those which were funded by the National program "ICT in schools" give precise information about the interest toward the program - a program which allows schools to facilitate computerized workstations according to the latest educational standards. For the first three years of the programs, which are analyzed in this article, the number of schools is 2479 – elementary schools, secondary schools, high schools, vocational schools, evening high schools and prison schools. *Table 3* shows the percentage of schools which took part in the program and were funded compared to the total number of schools in the country for each year of the program.

Table 3. Covered and not covered schools – by years

	School Year 2012/2013	**School Year 2013/2014**	**School Year 2014/2015**
Totally Applied Schools	1168	836	1171
Approved for funding	496	516	623
Percentage of schools approved for funding from all applied schools	42.47%	61.72%	53.20%
Percentage of applied schools compared to all the schools in the country	47.12%	33.72%	47.24%
Percentage of funded schools compared to all the schools in the country	20.01%	20.81%	25.13%

Taking into account the information in *Table 3*, the following conclusions can be made:

- Fewer than 50% of all the schools in the country applied for the program. The main conclusion that can be made is that the schools that did not apply is due to lack of delegated budget funding and cannot afford to spend money on renovating or purchasing computerized workstations. IT in secondary schools and Informatics and IT in high schools are compulsory subjects in Bulgarian schools. Since the last national program that facilitated schools with computers was in 2005-2007, it is logical to deduce that obsolete technology is being used in computer labs throughout the country. Even if some of the schools renovated their ICT equipment through special programs or with their own budget, they do not represent 50% of Bulgarian schools. The second, and more unpleasant by far, conclusion is that more than 50% of the schools in Bulgaria are not interested in updating their computer labs.
- Interest in the program significantly dropped in the second year. A logical explanation is that what schools want for technology is different from the pre-defined "terminal solutions". This is probably why the program was opened for

different types of technology in its third year when the number of applicants was the same as the first year.

- Even though the program's budget of 5 000 000 BGN remained unchanged for the first three years, the number of approved schools increased. Due to increase of co-funding in 3rd year.

A detailed analysis shows the following:

- In the school year 2012/2013 the following areas have the highest percentage of approved schools: Shumen (39%), Varna (36%) and Vidin (31%). Ruse (10%), Pazardzhik (8%) and Kardzhali (4%) have the lowest.
- In the school year 2013/2014 40% of all the schools in the Yambol area were funded, as well as 39% of schools in the Varna area and 30% in the Burgas area.
- In the school year 2014/2015 42% of Yambol schools, as well as 36% of Sliven, Vratsa and Pleven schools, were funded. Lovech (11%), Veliko Tarnovo (15%) and Vidin (15%) are among the areas which received the least funding.
- For the entire duration of the program, 77% of all the schools in the Vratsa area were funded, as were 66% of the schools in the Pleven and Shumen areas. Pazardzhik (26%), Kardzhali (35%) and Stara Zagora (35%) are at the bottom of the rating.
- More than 50% of all the schools in 15 areas in the country were funded.

It is important to note that the total number of funded schools does not mean funded unique schools. 35 schools received funding for all three years of the program. A lot of schools were part of the program for two of the three years. 1227 out of 2479 schools were funded.

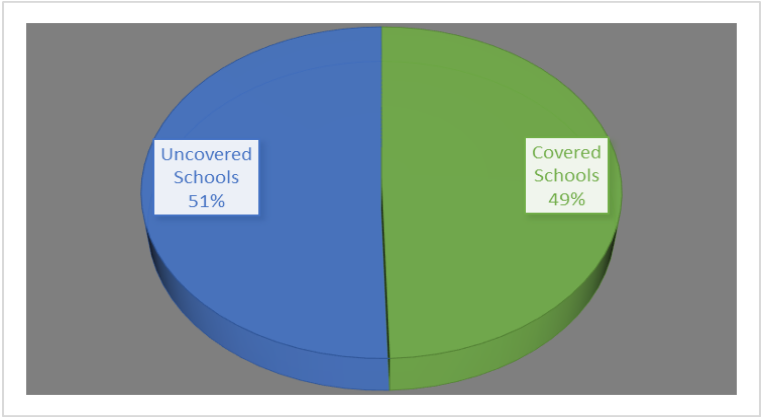

Fig. 1. Schools which took part in the program and schools which did not for the first three years of the program

4. Public funding of ICT in school education

The National program "ICT in Schools" supports schools in purchasing computerized workstations by co-funding. The final sum of a computerized workstation is defined by the Bulgarian Ministry of Education and Science and each school applies for a number of computerized workstations, stating the percentage of the co-funded sum it can cover. The program provides the rest of the money for any number of schools until reaching the

financial limit. For the first three years of the program the Ministry of Education and Science has provided a total of 22 522 849 BGN.

As can be seen, there is a sudden decrease in the second year of the program but in the third year there is a pronounced increase. This results from the increase in the budget (courtesy of the Ministry of Education and Science and achieved by using additional unused funds from other programs) and proves that there is more interest in the program when schools have a variety of technologies to choose from.

A detailed analysis shows the following:

- In the school year 2012/2013 schools in the Sofia area (38.41%), in the Targovishte area (38.08%) and the Kyustendil area (37.97%) give the greatest percentage of co-funding. The smallest percentage is in the Gabrovo area (24.52%). 30.24% is the average percentage of co-funding.
- During the second year of the program there is little to no change in the aforementioned percentages. Schools in the Kyustendil area (34.48%) give the greatest percentage of co-funding. The smallest percentage is in the Silistra area (26.77%). 29.45% is the average percentage of co-funding.
- The percentage of co-funding is greatest in the third year, with an average of 37.43%. Schools in the Stara Zagora area contributed 49.24%, a stark contrast with the Pernik area where schools contributed the least – 30.94%.

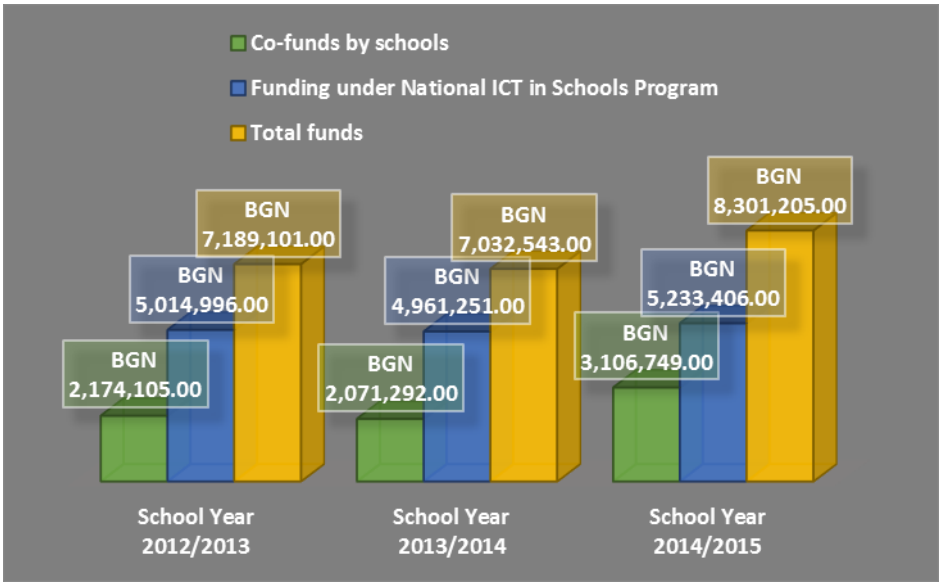

Fig. 2. Money invested in the National program ICT in schools

5. Conclusion

The analysis of the National program "ICT in schools" (2012 – 2015) shows that the program fails to achieve its goals – namely, renovating the ICT equipment, computerized workstations in particular, in all schools in the country for the entire duration of the analysed period. More than 50% of the schools have not taken advantage of the program in the past three years. Despite the great interest in the program in the first year, applicants decreased in the second, perhaps because of the fixed prerequisite – "terminal workstations". This called

for a change in the conditions – personal computers, laptops and tablets were included in the list of components to be financed. Hardware and software were also included even though they cost money but do not provide new computerized workstations.

Another thing that might have contributed to the failure of the program is the prerequisite for co-funding, because of which only schools with a great number of students and large budgets were able to benefit from the program. Schools with fewer students and thus smaller delegated budgets would have had considerable difficulties for co-funding. If all students cannot have access to modern technology and education, it can be seen as financial discrimination. In order to fix that, in the third year all protected schools who applied were approved, regardless of the percentage of co-funding, but they were only 47.

In the 3rd year of the National program, it remains to be proved that the schools funded have achieved the ratio of 1 computer to 12 students (per computerized workstation) which is a prerequisite of the program, since there has been no information about the number of the already available computerized workstations, prior to the National program.

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Strategy for Extracurricular Entrepreneurship Academic Education

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"…technological innovations created substantial changes to how we make a living and over time increased our standard of living by creating greater economic wealth overall."

Palladium, the Birth of the Impact Economy

Abstract. This paper shows the developed by the authors Extracurricular Entrepreneurship Programmes strategy for University Education and a translation of the Extracurricular Entrepreneurship University Educational Programmes strategy into different strategic objectives, views and goals. Methodology/approach: the paper follows an innovative balanced scorecard (BSC) methodology, specialised for non-governmental organisations work and including innovative perspective set, developed in previous papers. Findings: a balanced scorecard strategic model is developed and it is used to model the strategic objectives and initiatives for enhancing the extracurricular university entrepreneurship education for students. Practical implications: the framework can facilitate different organisations to get ready to collaborate for Extracurricular Entrepreneurship University Educational Programmes, to measure strategic management decisions and to create a competitive educational environment at extracurricular university education. Originality/value: the value of the framework is in integrating competences, experience, best practices and tools within one dynamic strategy BSC-based management system.

Keywords: strategy; modelling; strategy map; table of strategic choices; balanced scorecard methodology; universities; entrepreneurship.

1. Introduction

This paper presents authors' research and current results from an experience on modelling and implementation of innovative strategy for Extracurricular Entrepreneurship University Educational Programmes in Bulgaria [4, 12]. It is aimed towards supporting different organisations in offering curricular Entrepreneurship University Educational Programmes in Bulgaria. It proposes an innovative strategy, strategy map and a table of strategic choices according an innovative 5-step model of Balanced Scorecard Methodology (BSC) [1, 2, 5, 9, 10]. The results from the developed innovative strategy are implemented

and presented using Software BSC Designer Pro [2]. The presented strategy can be used for further development of educational entrepreneurship programmes in extracurricular education in universities and higher educational institutions.

2. Research and current results on developing of strategy for extracurricular entrepreneurship academic education

Identifying entrepreneurship education as a priority of change is justifying why central and state governments and private institutions led the formulation and implementation of educational strategies and programs [3, 8, 16, 17]. While this is of major importance, the quality of education available to a large section of the population also depends on the community and social educational institutions. Much of existing education initiatives and programs do not support the required level in terms of employment opportunities for the proceeding students and new innovative approaches are needed to fill the gap. While the education sector has been growing exponentially to support the live long training and education needs, the quality of the innovation and technology entrepreneurship education being provided was below average and often not relevant to the needs of the industry and society [6, 7].

The current research is focused on implementing a strategy for extracurricular entrepreneurship academic education, which to fill in this gap. A presentation of the Strategic Business Goals and Relationships in the strategy for extracurricular entrepreneurship academic education was implemented with Strategic Tool Balanced Scorecard Designer Pro. The basic perspectives in the development of the strategy were identified as: Customer perspective, Product perspective, Internal processes perspective, Learning and growth perspective and Financial perspective standing in the bottom, as the developed strategy is aimed towards application in organisations working in public benefit [15].

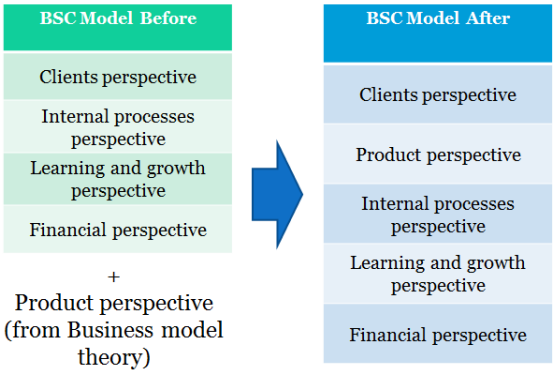

Fig. 1. Author-developed innovative model of Balanced Scorecard methodology

The chosen innovative model of Balanced Scorecard is previously tested and developed by co-author of this article [15] and specifically aimed towards supporting the strategic process in non-for-profit organisations. This is the reason for positioning financial perspective at the bottom of the model, since it is the source of supporting the implementation of all perspectives, the most important of which is answering the customers'/clients' needs.

The proposed model of Balanced Scorecard Methodology is based on previously developed five-step Balanced Scorecard model for business (for-profit) organisations, which

was tested amongst 153 representatives of start-up companies and received 85% approval in front of the classical four-step Balanced Scorecard methodology model.

Fig. 2. Innovative Balanced Scorecard Methodology model with five perspectives for non-for-profit organisations

2.1. Strategy development

The development of this strategy starts with a general overview on the strategic goal of Entrepreneurship education at university level and the specifics in its implementation as extracurricular university education [7, 13, 14].

Mission of this type of extracurricular education: Offering a competitive entrepreneurship education, additional and improving the curricular entrepreneurship university education for students.

Vision: The importance of quality entrepreneurship education is fostering all fields of science, economic progress and human flourishing as a whole. An innovative entrepreneurship education should be available to all university specialities, faculties and directions and offering quality entrepreneurship education as extracurricular discipline is a very efficient way for providing an engaging, effective and up-to-date entrepreneurship education to all students at universities. For this reason, a development of effective extracurricular university education on entrepreneurship, is a basic factor for success of each economy.

Strategy: Addressing students searching entrepreneurship education at universities with extracurricular entrepreneurship university education, offering up-to-date program, possibilities for further development practice and introduction to the entrepreneurship theory and practice basics and specifics, answering to the needs, problems and requirements of all participants in the process.

The **basic strategic goal** identified with this strategy is: Identification of the general needs of students and lecturers in entrepreneurship education, as well as the general problems in front of the successful implementation of an extracurricular entrepreneurship

education in universities. Development of the general goals for students and lecturers is followed by development of the strategic objectives for the program's implementation, internal processes strategic goals for improvement, resources application and development, as well as strategic objectives in identifying sources of support for the program's implementation.

Strategic objectives: The strategic choices are described, following the Balanced Scorecard Methodology, specifically updated for this research and following the strategic choices described in the five upper described perspectives. The identified general strategic objects in the Customer perspective of an entrepreneurship education are: Schools, Universities and Business, but this strategy is focusing only on Universities and it is showing in all perspectives the specific strategic objectives for University entrepreneurship education only. Additionally for each group of strategic goals, a specification was implemented by defining sub-goals and objectives and the relations between them have been identified, by defining the perspectives and goals which are contributed with the implementation of each defined strategic goal.

Table 1 shows the Strategic objectives in Customer perspective visualised with Software tool Balanced Scorecard Designer Pro – BSC Designer Pro.

Table1. Strategic Objectives Goals and Relationships in the strategy for extracurricular entrepreneurship academic education in Customer perspective

Name	Contributes to / Target
BSC Strategic Goals	
Customer Perspective	BSC Strategic Goals
(Schools)	Customer Perspective
Universities	Customer Perspective
Goals for Lecturers	Universities
To engage and motivate lecturers in sustainable process	Goals for Lecturers
To become mentors	Goals for Lecturers
Goals for Students	Universities
To change mind-set	Goals for Students
To create student companies	Goals for Students
(Businesses)	Customer Perspective

The Universities lecturers and students are the major participants from the customer segment, because they both are customers of the developed extracurricular entrepreneurial university education, which is subject of this strategy. The main goals in this perspective are connected with meeting the needs and goals in front of lecturers and students in the field of entrepreneurial education. The development of such educational materials should target the strategic objectives of engaging lecturers to become mentors in the extracurricular programs and motivating them to participate in a sustainable process of entrepreneurial education in universities. This will be achieved by including programs including methodology, educational process and materials specifically developed for lecturers and such, developed for students.

Main features in a successful entrepreneurship curriculum [1] are:

- Combining theory & practice (basic knowledge areas covered and testing knowledge in practice)
- Real entrepreneurial activities

- Innovative forms of delivery: modules-based and allows flexibility in adaptation
- Role of the professor as mentor and facilitator and practitioners/business consultants as advisers
- Localization
- Extracurricular activities
    - Start-up/boot camps
    - Competitions
    - Public events
    - Forum participation

The Key Performance indicators for reaching the Goals for lecturers and Goals for students are aimed towards measuring the level of achievement in qualitative and quantitative measures.

Table 2 presents the KPIs for the goals for lecturers and students.

Table 2. Strategic objectives and their corresponding Key performance indicators in Customer perspective

Strategic objectives	KPIs
Goals for Lecturers	Number of lecturers, Evaluation of lecturers' satisfaction from the methodology, number of study materials, innovative educational process and curriculum, hours of organised education, hours of trainings and events
Goals for Students	Number of students, Evaluation of students' satisfaction from the implemented educational process, number of materials and methodology of education; Evaluation of the organised education, hours of trainings and events

The product perspective in the Balanced Scorecard model of this strategy includes development of the following elements: Extra Curriculum Programs (semester/year), Extracurricular Short Trainings (1-5 days) and Inspiration & PR 1-Day Events. Their application was considered due to the need for: (1) thorough knowledge on entrepreneurship, acquired with the Extra Curriculum Programs; (2) practical skills and application of theoretical knowledge in practice at the entrepreneurial process, acquired with the Extracurricular Short Trainings; and (3) initial informational and motivational events for supporting the entrepreneurial process and its participants, implemented with Inspiration & PR 1-Day Events.

Further in the development of the strategy, strategic objectives for each part of the strategic objects in the Products perspective are defined.

Table 3. Strategic Objectives Goals and Relationships in the strategy for extracurricular entrepreneurship academic education in Product perspective

Name	Contributes to / Target
BSC Strategic Goals	
Product Perspective	BSC Strategic Goals
Extra Curriculum Programs (semester/year)	Product Perspective Universities
Increase number and variety of Programs and Courses	Curriculum Programs (semester/year)
To involve senior university managers to join HEI EU Process	Curriculum Programs (semester/year)
Extra Curriculum Short Trainings (1-5 days)	Product Perspective

	Universities
Increase number and variety of Trainings and Courses	Extra Curriculum Short Trainings (1-5 days)
Lower training cost per trainee	Extra Curriculum Short Trainings (1-5 days)
To enhance career development	Extra Curriculum Short Trainings (1-5 days)
To clarify real business operations (including in startups)	Extra Curriculum Short Trainings (1-5 days)
To discover opportunities for start-ups	Extra Curriculum Short Trainings (1-5 days)
To learn the lessons and improve content	Extra Curriculum Short Trainings (1-5 days)
Inspiration & PR 1-day Events	Product Perspective Universities
To disseminate best practices and positive results	Inspiration & PR 1-day Events
To discover opportunities for start-ups	Inspiration & PR 1-day Events

The main strategic focus in the Product perspective programs and trainings is on increasing the number and variety of the programs/trainings/events, as well as involving senior managers, disseminating best practices, increasing the discovering of opportunities for start-ups, enhance career development for the participants, as well as further developing and improving the content of the programs and training courses.

The strategic objectives are connected with measuring the performance by the following Key performance indicators in the Product perspective: Number and variety of the Programs/Trainings/Events, Number of the lecturers and senior managers involved in the events, Number of the business mentors and volunteers, as well as number of the students and ratio of students starting and finishing successfully the program.

Table 4 presents the key performance indicators according the strategic objectives in the Product perspective.

Table 4. Strategic objectives and their corresponding Key performance indicators in Product perspective

Strategic objectives	**KPIs**
Extra Curriculum Programs (semester/year)	Number and variety of Programs, Number of lecturers, Ratio of students starting and finishing successfully the program
Extra Curriculum Short Trainings (1-5 days)	Number and variety of Short Term Trainings, Number of lecturers and entrepreneurs/business mentors included in the initiatives, Ratio of students finishing successfully the program
Inspiration & PR 1-day Events	Number of Inspiration & PR 1-day Events, Number of senior university management members included in the initiatives, Number of lecturers and entrepreneurs/business mentors included in the initiatives, Number of the students participating in the initiatives

The Internal processes perspective includes the basic strategic objectives allowing the development and offering of the products perspective objectives. The identified necessary

basic strategic internal processes objectives are: Opportunity search and initialisation, Projects oriented processes, Trainings-oriented processes and Management and Support Processes. All the internal processes are further detailed into strategic objectives including all stages of the processes and also identifying the most important elements from the strategic internal processes perspective. Table 5 presents the detailed internal processes strategic objectives and the relationships in the target and contribution fields.

Table 5. Strategic Objectives Goals and Relationships in the strategy for extracurricular entrepreneurship academic education in Internal processes perspective

Name	Contributes to / Target
BSC Strategic Goals	
Internal Processes Perspective	BSC Strategic Goals
Opportunity search and initialisation	Internal Processes Perspective Curriculum Programs (semester/year) Extra Curriculum Short Trainings (1-5 days) Inspiration & PR 1-day Events
Relations and Opportunity Establishment	Opportunity search and initialisation
Negotiations and Resource Acquisition	Opportunity search and initialisation
Projects oriented processes	Internal Processes Perspective Curriculum Programs (semester/year) Extra Curriculum Short Trainings (1-5 days) Inspiration & PR 1-day Events
Projects Initiation	Projects oriented processes
Projects Planning	Projects oriented processes
Projects Execution	Projects oriented processes
Projects Monitoring and Controlling	Projects oriented processes
Project Closing	Projects oriented processes
Trainings-oriented processes	Internal Processes Perspective Curriculum Programs (semester/year) Extra Curriculum Short Trainings (1-5 days) Inspiration & PR 1-day Events
Develop Strategic Plan	Trainings-oriented processes
Develop Curriculum	Trainings-oriented processes
Design, Deliver and Support Trainings	Trainings-oriented processes
Execute and Manage Trainings	Trainings-oriented processes
Develop and Manage Stakeholder Services	Trainings-oriented processes
Management and Support Processes	Internal Processes Perspective Curriculum Programs (semester/year) Extra Curriculum Short Trainings (1-5 days) Inspiration & PR 1-day Events
Accounting and Finance	Management and Support Processes
Human Capital and Innovation Processes	Management and Support Processes

ICT	Management and Support Processes
Office Management	Management and Support Processes

The development of good internal processes is of key importance for the successful implementation of the strategic goals and objectives in each developed strategy. For this reason development of smooth and optimal internal business process is crucial, together with defining the appropriate structure of the processes. These are the basic indicators for good performance in the development of key internal processes. The percentage of developed processes with specific structure and work-flow from all necessary identified processes is the key performance indicator type of measure, showing the progress towards development of good internal processes. These key performance indicators for the Internal processes perspective are shown on Table 6.

Table 6. Strategic objectives and their corresponding Key performance indicators in Internal processes perspective

Strategic objectives	**KPIs**
Opportunity search and initialisation	Number of new partnerships, number of active projects, number of projects under development
Projects oriented processes	Percentage of developed and approved by the team processes for projects initiation, planning, execution, monitoring and controlling and closing
Trainings-oriented processes	Percentage of developed and approved by the team processes for developing strategic plans, educational curricula, design, deliver and support trainings, execute and manage trainings, develop and manage stakeholder services
Management and Support Processes	Percentage of developed and approved by the team processes in field accounting and finances, human capital and innovation processes, ICT and Office Management

The Key performance indicators are including also the number of new partnerships, number of active projects and number of projects under development. This indicator will support the opportunity search and initialisation strategic objectives. In the process of developing successful internal processes the amount of active projects is presenting a general overview on the current successful results from the implementation of the other internal processes. The development of all internal processes needs further training and preparation of the team, learning initiatives and structural development of the departments of the organisation. These strategic objectives are presented in the Learning and growth perspective.

The Learning and growth perspective is a key perspective, necessary to support all strategic objectives, which major identified strategic objectives for this strategy are: Human capital – Lecturers and mentors education and ensuring career growth, Organisational Capital - Static and Dynamic Structure and Informational Capital - IT Systems and Textbooks & Materials.

Table 7. Strategic Objectives Goals and Relationships in the strategy for extracurricular entrepreneurship academic education in Learning & Growth perspective

Name	**Contributes to / Target**
BSC Strategic Goals	
Learning & Growth Perspective	BSC Strategic Goals
Human Capital	Learning & Growth Perspective

	Opportunity search and initialisation Projects oriented processes Trainings-oriented processes Management and Support Processes
Lecturers and mentors education	Human Capital
Improve lecturers expertise	Lecturers and mentors education
Support and share mentors expertise	Lecturers and mentors education
Ensure Career Growth	Learning & Growth Perspective Human Capital
Improve working competence	Ensure Career Growth
Staff Trainings	Ensure Career Growth
Organisational Capital	Learning & Growth Perspective Opportunity search and initialisation Projects oriented processes Trainings-oriented processes Management and Support Processes
Static and Dynamic Structure	Organisational Capital
Clear job description and responsibilities	Static and Dynamic Structure
Effective reporting system	Static and Dynamic Structure
To promote pro activeness and creativity	Static and Dynamic Structure
Flexible hour-working system per month	Static and Dynamic Structure
Informational Capital	Learning & Growth Perspective Opportunity search and initialisation Projects oriented processes Management and Support Processes Trainings-oriented processes
IT Systems	Informational Capital
Up-to-date and reliable information and IT infrastructure	IT Systems
Textbooks & Materials	Informational Capital
Develop attractive & useful online textbooks and learning materials	Textbooks & Materials
Innovation Capital	Learning & Growth Perspective Opportunity search and initialisation Projects oriented processes Trainings-oriented processes Management and Support Processes
Striving to grow as an innovative organization	Innovation Capital
To be recognised as a life-long entrepreneurship learning organisation	Innovation Capital
To encourage growth mind-set	Innovation Capital

The Learning and Growth perspective includes objectives aiming the continuous improvement of educators and mentors expertise and competence, skills and structure necessary for effective and motivational working labour, as well as up-to-date materials and systems and create an innovative educational organisation. The key performance indicators, specific for measuring the progress in these strategic objectives include: number of educators/staff/mentors trainings, job positions description and payment indicators, number of developed online interactive tools/textbooks/materials/courses, etc. A list of the basic key performance indicators for the strategic objectives in the Learning and growth perspective are included in Table 8.

Table 8. Strategic objectives and their corresponding Key performance indicators in Learning & Growth perspective

Strategic objectives	KPIs
Human Capital	Number of educators trainings, Number of staff trainings, Number of mentors trainings, Percentage of successfully graduated participants in the trainings/courses
Organisational Capital	Percentage of prepared typological jobs description, Percentage of job position included in a flexible hour-working system, Percentage of job positions included in a developed reporting system
Informational Capital	Percentage of interactive online educational textbooks and courses, Percentage of the departments offering online information about their activity in the informational system
Innovation Capital	Percentage of students who recognise the educational organisation as a life-long learning organisation

The strategic objectives in Learning and growth perspective will be funded by the financial resources of the educational organisation. For this reason, strategic objectives for insuring the necessary resources are defined at the fifth strategic perspective in the Balanced Scorecard model. The strategic objectives in the financial perspective, supporting the implementation of all other objectives in the different perspectives include the following directions: education and training fees, Projects and Business Sponsors. The specific strategic objectives are connected with the sources of increasing the financial resources and include: increasing of the total number of educational activities, expanding the educational fields, making successful educational activities sustainable and repetitive, increasing the number of the projects and their variety, as well as establishing best practices amongst projects as sustainable and continuous practices and finally improving the number of business sponsors, improving the process of work with business sponsors and co-creating value with stakeholders. Table 9 shows the strategic objectives in details.

Table 9. Strategic Objectives Goals and Relationships in the strategy for extracurricular entrepreneurship academic education in Financial perspective

Name	Contributes to / Target
BSC Strategic Goals	
Financial Perspective	BSC Strategic Goals
Education and Training fees	Financial Perspective
To increase number of education and training groups	Education and Training fees
To repeat successful trainings and make some of them sustainable processes	Education and Training fees

To extend and expand fields of educational courses and training	Education and Training fees
Projects	Financial Perspective
To increase number of projects and their amount of sponsorship	Projects
To repeat successful projects and make some of them sustainable processes	Projects
To extend and expand fields of application	Projects
Business Sponsors	Financial Perspective
Sponsors' financing to meet our values and goals	Business Sponsors
To clarify outcome of the sponsored initiatives in advance	Business Sponsors
To co-create value for all stakeholders	Business Sponsors

The financial perspective shows the most important directions, in which the company should focus its resources in order to ensure success in the resource acquiring which will further support the results acquring of all other connected strategic objectives from the other perspectives. The key performance indicators in the financial perspective are connected with measuring the number of education and training groups/projects/initiatives with business sponsors, successful trainings/projects/initiatives with value co-creation with stakeholders and amount of income from education and training groups/projects/business sponsorship. The basic key performance indicators in the financial perspective are presented at Table 10.

Table 10. Strategic objectives and their corresponding Key performance indicators in Financial perspective

Strategic objectives	**KPIs**
Education and Training fees	Number of education and training groups, Number of successful trainings turned into sustainable processes, Amount of income from education and training groups
Projects	Number of projects, Amount of sponsorship
Business sponsors	Number of initiatives with business sponsors, Number of initiatives with value co-creation with the stakeholders, Amount of business sponsorship

As described in the beginning of this article, the sequence of setting objectives is opposite to the sequence of achieving results (see figure 2.). After creating the strategy with all five perspectives and its interconnected strategic objectives, a strategic map of those interconnections and inter-dependencies is built. The following strategy presents a set of interconnected strategic goals and objectives, which are allowing reaching of the primary strategic goal, described in the introduction of this article. The final strategic map of the presented in this article strategy is presented at Figure 3 at the end of the report. Figure 3 is showing the developed Strategic map is visualised with Software tool Balanced Scorecard Designer Pro.

The presented strategy is ready for further practical application, by describing specific target values and specific initiatives, allowing the company to implement the proposed strategy for educational institution in the field of Extracurricular Entrepreneurial Education.

3. Conclusions

The presented strategy, developed according the presented innovative Balanced Scorecard Methodology Model with five perspectives, includes table of the strategic objectives for all five perspectives, key performance indicators for each strategic objectives group and a developed strategic map with innovative patterns of goals and activities that add value and allows further improvement and growth of the expertise on the future of entrepreneurship education. It is not enough to invest in people, information systems and organization separately, but to innovate and engage people and support their creativity and empathy. Data and knowledge of a staff and mentors strengths and opportunities for both learning and growth is important to the success and sustainability of the successful cooperation with universities. With data from strategic planning and execution and adequate knowledge, we can identify those collaborative academic products, service and program offerings, processes, competencies, and performance metrics and initiatives that are unique. We can develop capacity by understand, share and use best practices and learning lessons. The proposed strategy aims to support exactly the type of educational institution in the field of Extracurricular Entrepreneurial Education by uniting all these directions.

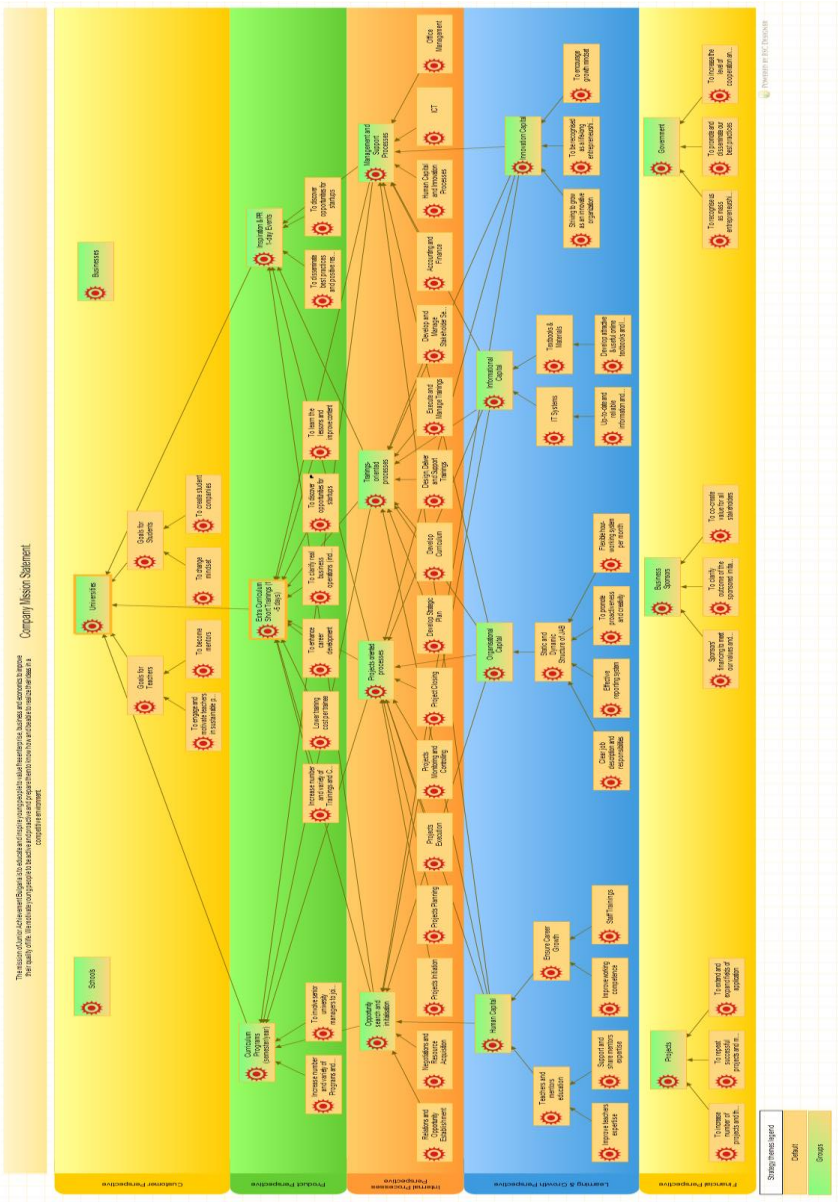

Fig. 3.Strategic map created with Software BSC Designer Pro

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Information Approach to Time Quantified Pressure Signal for Computer Based Verification of Electric Sphygmomanometer

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Abstract. The computer based technology suggested by the author in an earlier exploration with application the information approach to definition of BP along with data arrays about the pressure signal of electric sphygmomanometer is based on complex of specific algorithms the computer computes BP. Thus, computer – receiver the signals from the electric sphygmomanometer becomes a real alternative measurer of the artery BP. This circumstance encourages to production of some verification algorithms. Do the data array signals of electric sphygmomanometer for upper arm of Hartmann contain specific data, which exactly correspond to their measured results? Information approach to time quantification of the pressure signal with account the character moments corresponding by time to data of wave sensor signal provides answer of the verification question with high performance and sophisticated analysis.

Key words: Verification, sphygmomanometer, pressure signal, wave signal, computer.

1. Introduction

The contemporary assessment technology of electric sphygmomanometers in accordance to the "International protocol for validation of blood pressure measuring devices in adults" is a multipurpose process and uses the skills of several medicine specialists for multiple measurements of the blood pressure (BP) with several medical stethoscopes to one cuff of an assessed sphygmomanometer. It is applied on a large group patient of depicted age ranges. This BP-measurement technology does not account the individual random background of the complex of factors, determining and influencing on the human BP, but defines statistic distributions which fulfil obligation performance. The authors of the protocol confess: "These factors have made validation studies difficult to perform and very costly, with the result that fewer centres are prepared to undertake them."

The European Standard for assessment of the electric sphygmomanometers for upper arm contains a set of mathematic inaccuracies, although it is a base for validation the devices for measurement the BP.

The computer based technology suggested by the author in an earlier exploration [1] with application the information approach to definition of BP along with data arrays about the pressure signal of electric sphygmomanometer is based on complex of specific algorithms the computer computes BP. The results are similar to the measured ones with the device and the computer – receiver the signals from the electric sphygmomanometer becomes a real alternative measurer of the artery BP.

At the same time, an unexplored theoretic scenario exists. Do the data array signals of electric sphygmomanometer for upper arm of Hartmann contain specific data, which exactly correspond to their measured results? The explorations for decision of this scenario can origin several computer algorithms aiming computation of results about BP, which cover the

measured ones with electric sphygmomanometer. For this aim an information approach to time quantification of the pressure signal with account the character moments corresponding by time to data of wave sensor signal is applied. Another earlier exploration [2] substantiates the frequency quantification the pressure signal from the tension sensor by the wave extremes of the wave signal from the microphone. It established the first and second wave extremes as pointing the key pressure values about computation the systolic BP. Moreover, it also is a base for the foundation rule about definition the diastolic range and diastolic BP – the last of large amplitude extreme before series of decreasing impulses of step down amplitudes toward end of measurement. These author's rules are applied also at computer based verification here.

The expected computed results about BP, which are equal to the measured results of the appreciated sphygmomanometer or they are weakly deviated from them, can serve about a foundation for verification of the electric sphygmomanometer.

2. Information Approach to Time Quantified Pressure Signal for Verification of Electric Sphygmomanometer

The Tensoval® duo control electric sphygmomanometer of Hartmann [3] had been explored at multiple computer based statistic analyses [4, 5, 6] and showed good stability of the results. The scheme of connection: electric sphygmomanometer – analogue converter – analogue to digital converter DT9810 – personal computer is represented in [6]. The synchronization of time serials is applied at the last only connection. Actually the sphygmomanometer, analogue converter and analogue to digital converter are neither synchronized, like Vostroknutov recommends [7], nor compensated at level quantification. Thus the converters can produce multiplied deviation of the pressure and wave signals, although the performance of the restored signals on the fig. 1 is representative enough.

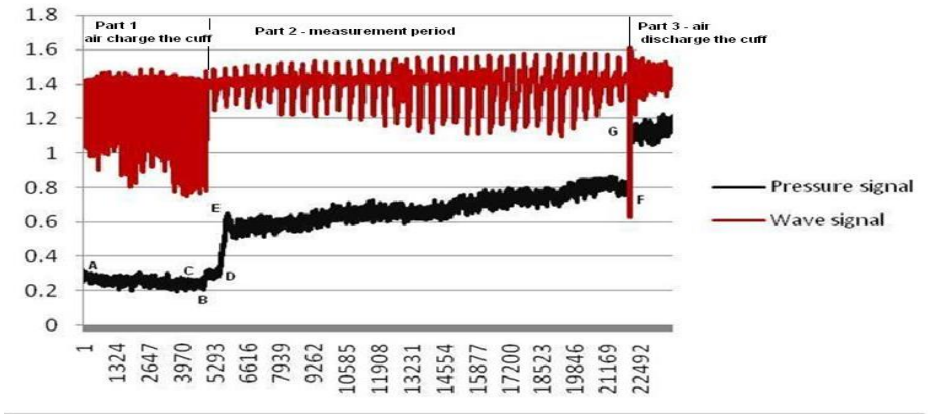

Fig. 1. Three periods the electric sphygmomanometer works.

The upper wave graphics on fig. 1 reflects the wave sensor signal characterized by a series of artery waves during the measurement period. The lower dropped linear graphics noted by points of graphic segments: p. A – p. B – p. C – p. D – p. E – p. F – p. G provides information about pressure signal. Every one array contains around 20 000 data readings obtained by scanning frequency 500 Hz and 2.5 V range.

The computation of heart pulse rate is formulated in a way, which widely supports the process of its measurement:

$$P = 60*(N_p - c_p)/(t_e - t_{bp}) \quad (1)$$

where c_p– number of the upper pulsation, t_{bp} – corresponding to the pulsation time moment, t_e – end moment of the last pulsation; N_p – number of pulsations during the measurement. The pulsations here are for the upper waves which are situated higher than the neutral line of waves during the measurement period. The controller of the sphygmomanometer can take any of the pulses c_p and its time moment t_{bp}. It just counts the N_p and defines beginning moment by stop the pump and end moment – by automatic air discharge the cuff. The algorithmic logics of verification the measured value of the pulse requires record the values about each one pulsation: upper wave value and its time moment value. The parameters c_p and t_{bp} represent interest at verification the pulse measured value. Hence some double arguments cycle by c_p, t_{bp} for series of all pulsations can clarify the process of measured pulse values. The both variables must have one and the same address, noted here by **p**. For example it is obviously, when the pulsation No 3 has time moment No 2 or any other than 3, it is not adequate solution of the pulse.

The computation of systolic BP depends on pressure values at p. D and p. E, which correspond to first and second lower pulsations of the wave signal. The lower pulsations are situated under the neutral line of the wave signal during the measurement period. It is well accepted, when the lower wave pulsations are connected to the upper ones, correspondingly and their pressure values are also recorded. Hence, the equation about systolic BP is:

$$X_s = (C * (L_s - ((x_D (t) + x_E (t))/2) / (L_s - x_{max}) \quad (2)$$

where x_{max} in [V] – a reading of the pressure signal at the moment of C or of stop the air pump; x_D and x_E – readings in [V] of the pressure signal at moments of the first and second wave signal quitting impulses. The verification of the systolic BP measured value depends on two arguments. Double argument cycle by time moment quantification of the pressure signal solves this task.

Similarly, the verification values of diastolic BP can be computed by equation:

$$X_d = C * (L_s - x_{l-(n-1)} (t)) / (L_s - x_{max}) \quad (3)$$

where $x_{l-(n-1)} (t)$ – the pressure signal, which responds by time to the n-1 number of impulse of the wave signal from the last moment pulsation of the measurement. The verification of the measured diastolic BP value along with the computed diastolic pressure values by time quantification here is accomplished by singular argument cycle. The algorithm can be carried out by preliminary counting the moment $_{l-(n-1)}$ of the last important wave pulsation after which a series of impulses of falling down amplitudes follows. This moment is a challenge not only for the current algorithm, but for the controller solution as well. It requires going back to the measurement process and looking for small wave deviations. Good sensor sensitivity is need, but the uncertainty often pursues it.

The character extremes of the lower wave signal are computed with principle of two-point algorithm [2]:

$$\text{If } y_{n+i} < y_n \quad \text{then } y_{n+i} \rightarrow \min \quad (4)$$

and with account some value threshold and time threshold.

3. Computer Based Verification of Measured Results

The electric sphygmomanometer verification is performed with a program of different beginning settings, corresponding to peculiarities of the measurement data on a set of 12 files – measurements of the BP. The main program contains the following sub programs: count of

readings inside the input data array; charge of the input data into work sheet; computation the extremes of the pressure signal; computation the verification values of the pulse per minute by numeric description of the upper impulses of the wave signal, systolic BP, diastolic BP with data of the pressure signal extracted by time quantification.

The results of frequency quantification of the pressure signal by lower impulses of the wave signal and established on its base principles of frequency definition the systolic and diastolic cycles allow reduction of the time domains at looking for verification values of the pressure signal.

The verification of the pulse per minute is accomplished with eq. 1 by computation cycles for each pair – current upper pulsation, time moment of it and time moment of the last upper pulsation. At recognition of coincidence of computed and measured values of pulses per minute the results about pulse value, current upper impulse and time variable are printed in the work sheet. In parallel, the minimal and maximal values about pulse per minute during computer classification are carried out.

The verification of the systolic BP uses extremes of the lower impulses about first and second waves as pointers to p. D and p. E, which belong to the pressure signal. With a procedure of time quantification inside those point's domains the program finds such pressure readings whose substitution into eq. 2 will provide result, equal to the measured systolic BP value. Once these points are established the following: systolic BP value, reading of the pressure signal corresponding to p. D and its time moment, reading of the pressure signal corresponding to p. E and its time moment, time distance between time moment of the first wave extreme about p. D and first time moment of the founded first pressure signal, time distance between time moment of the second wave extreme about p. E and second time moment of the founded second pressure signal are printed in the work sheet.

The verification of the diastolic BP is based on the extreme of the last significant lower impulse of the wave signal, after which a series of lower impulses of falling down amplitudes follows till the end of measurement. The program finds this impulse extreme and completes time quantification around it along with the pressure signal. When a reading of the pressure signal is inserted on the place of the variable in the eq. 3 and measured value of the diastolic BP is also computed, all pursued data and results are printed. They are: diastolic BP value, reading of the corresponding pressure signal and its time moment, time distance between time moment of the diastolic wave extreme and time moment of the founded pressure signal.

All distances of the time coordinate of negative values define points of the pressure signal, situated before characterized wave extreme of the wave signal. Corresponding positive values of time distances belong to points of the pressure signal which follow after the wave extreme.

The numerical description of the lower wave signal bases on the rule of two-point algorithm, represented by expression 4 and its extremes are connected to the upper pulsations.

The verification of measured results about pulse per minute, systolic BP and diastolic BP represents a multistage process, during which the wave signal serves for foundation of: stop moment of air charge and start of the measurement; numerical description of the upper pulsations of it, numerical description of the lower impulses of it, verification values of the pulse per minute by time quantification of the upper pulsations, verification values of systolic BP by time quantification within time domains surrounding p. D and p. E of the pressure signal, verification values of the diastolic BP by time quantification within time domain of point about pressure signal, corresponding to the last most important wave extreme of the wave signal, time moment of end the measurement.

These stages are described on the example of the first file among twelve.

Table 1 represents complex of numerical description of upper and lower pulsations and corresponding pressure signal values. The time distances between upper pulsations highlight an equally distanced wave signal. At the same time, difference of the pressure signal can vary in large range. The values of fourth signals approximate their main variations on fig. 2.

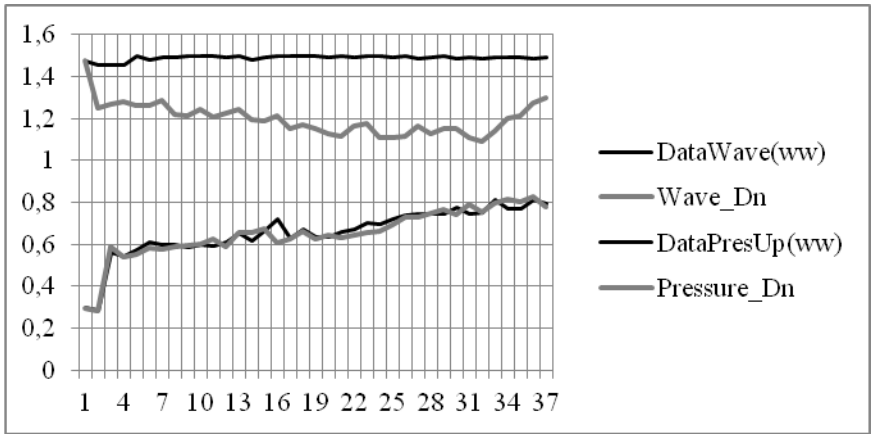

Fig. 2. Approximation the wave signal and corresponding pressure values.

First two columns point the time distance between both upper and lower extremes and define the front of cardio pulsation. It can vary until 200 ms. This range is accepted as excellent at verification the measured values.

Complex of parameters represents on table 2 results of verification about 12 files – measurements.

Table 2 shows the parameters and corresponding results of verification the electric sphygmomanometer. The pulse is fully positively verified by rows 2 and 3. The non-equality for file 11 can be explained by some uncertainty resulting from the fact that computer passed to maximal value, which is larger the computed and measured ones, but without recognizing the intermediate data value, corresponding to the measured pulse rate value.

The systolic BP is correctly computed and all results are equal to the measured ones. The time distances between preliminary established points of wave extremes No 1 and No 2, and points of data readings about pressure signal, corresponding to p. D and p. E and meeting the equality of computed to the measured values are within permissible range, less than 1 second. For the majority of solutions the intermediate results about time distances are quite nearby to the preliminary established.

Table 1. Numerical description about wave frequency quantification of the pressure signal

No	Upper wave moment	Lower wave moment	Wave distance	Upper wave	Lower wave	Upper pressure	Lower pressure
0	9.904		9.904	1.475	1.475	0.298	0.298
1	10.568	10.624	0.664	1.453	1.248	0.288	0.286
2	11.43	11.49	0.862	1.455	1.267	0.562	0.591
3	12.292	12.35	0.862	1.458	1.279	0.542	0.542
4	13.154	13.242	0.862	1.497	1.262	0.571	0.552
5	14.056	14.134	0.902	1.482	1.265	0.613	0.581
6	14.938	15.048	0.882	1.494	1.287	0.596	0.576
7	15.884	15.95	0.946	1.492	1.221	0.598	0.586
8	16.804	16.872	0.92	1.497	1.216	0.588	0.593
9	17.718	17.79	0.914	1.497	1.243	0.598	0.601
10	18.638	18.708	0.92	1.497	1.206	0.591	0.627
11	19.578	19.652	0.94	1.494	1.223	0.613	0.588
12	20.52	20.592	0.942	1.497	1.245	0.652	0.657
13	21.414	21.526	0.894	1.482	1.196	0.618	0.659
14	22.388	22.464	0.974	1.494	1.189	0.664	0.676
15	23.308	23.398	0.92	1.497	1.211	0.718	0.610
16	24.246	24.332	0.938	1.497	1.155	0.627	0.625
17	25.17	25.254	0.924	1.497	1.169	0.674	0.664
18	26.12	26.192	0.95	1.497	1.152	0.637	0.627
19	27.078	27.152	0.958	1.492	1.125	0.635	0.642
20	28.026	28.096	0.948	1.497	1.113	0.659	0.632
21	28.978	29.042	0.952	1.489	1.162	0.669	0.642
22	29.954	30.026	0.976	1.497	1.174	0.703	0.659
23	30.914	30.976	0.96	1.497	1.108	0.696	0.662
24	31.854	31.906	0.94	1.494	1.111	0.720	0.693
25	32.796	32.848	0.942	1.497	1.113	0.740	0.728
26	33.748	33.786	0.952	1.484	1.165	0.742	0.732
27	34.684	34.73	0.936	1.494	1.130	0.745	0.747
28	35.624	35.668	0.94	1.497	1.150	0.747	0.769
29	36.604	36.7	0.98	1.487	1.152	0.779	0.740
30	37.572	37.642	0.968	1.494	1.111	0.745	0.793
31	38.53	38.586	0.958	1.487	1.094	0.750	0.757
32	39.488	39.534	0.958	1.494	1.138	0.811	0.796
33	40.454	40.57	0.966	1.492	1.199	0.767	0.818
34	41.398	41.502	0.944	1.494	1.211	0.771	0.803
35	42.336	42.55	0.938	1.487	1.277	0.815	0.825
36	43.304	43.398	0.968	1.489	1.299	0.796	0.781

The verification of diastolic BP is immediately connected to the whole sensitivity of the controller of the sphygmomanometer. Here the recognition of the last important pulsation is not only result of the corresponding sensor, but also of the controller reaction. We have discrete lower pulsations in close connection to the analogue presentation of the wave signal, what is principally difficult task for solution with a controller of limited computational power. As result, for the file No 2 diastolic BP point of verified value belong not to the last important lower wave extreme, but to another wave extreme distanced to more than five seconds (see table 1) before the explored range, established by computer program. This result is also found by time quantification, but range of it is manually varied.

The result of diastolic BP for file No 6 for the measured value could not be found. The most neared to it is among the last readings. It is some unexpectedly to see the controller could not recognize any feature for diastolic BP and it took the last one possible, belonging to the end zone of measurement.

Table 2. Verification results by numerical description for pulse, systolic BP, diastolic BP

	File No	file No1	file No2	file No3	file No4	file No5	file No6	file No7	file No8	file No9	file No10	file No11	file No12
	Number of waves	36	30	30	27	32	36	31	29	28	22	20	25
	Measured pulse	62	64	59	60	59	60	61	60	56	51	49	53
	Computed pulse	62	64	59	60	59	60	61	60	56	51	50	53
	Number of variants of computed pulse	7	21	9	8	21	13	18	12	16	10	0	16
	Measured systolic BP	132	134	116	130	122	126	107	117	112	115	111	120
	Computed systolic BP	132	134	116	130	122	126	107	117	112	115	111	120
	Number of variants of computed systolic BP	16	1	11	10	11	8	13	7	26	6	2	12
First point of systolic BP	Time distance of the right systolic reading from 1-st wave, [s]	0.012	-0.156	-0.108	-0.956	0.002	0.704	0.560	0.338	0.426	0.000	0.000	-0.008
	Right 1-st pressure systolic reading	0.315	0.439	0.190	0.178	0.229	0.283	0.422	0.313	0.303	0.244	0.259	0.295
Second point of systolic BP	Time distance of the right systolic reading from 2-nd wave, [s]	0.008	0.028	-0.008	-0.938	0.022	0.228	0.014	0.006	0.130	0.122	0.002	0.038
	Right 2-nd pressure systolic reading	0.610	0.830	0.325	0.286	0.476	0.396	0.437	0.540	0.527	0.498	0.615	0.574
	Measured diastolic BP	79	79	70	74	73	65	72	76	74	77	68	81
	Computed diastolic BP	79	79	70	74	73	66	72	76	76	76	68	83
	Number of variants of computed diastolic BP	1	2	8	15	13	0	5	4	0	0	2	0
	Time distance of the right pressure diastolic reading from the wave moment, [s]	-0.010	-5.074	-0.008	-0.006	-0.006	6.428	-0.014	-0.030	-0.432	-12.740	-0.912	-0.642
	Right pressure diastolic reading	0.718	0.918	0.413	0.457	0.579	0.679	0.615	0.647	0.583	0.564	0.657	0.620

Finally, the verification of the diastolic BP for the file No 10 is result of uncertainty the controller computes this value. It could find maximal value about diastolic BP larger than measured one but not recognized for the computed one. The right diastolic measured value is found in the range of wave extreme No 10, situated on 12.766 s before the computed wave extreme No 21 and being a local extreme between wave No 9 and wave No 11.

4. Conclusion

The verification of electric sphygmomanometer is accomplished with definition of parameters the author points as characterizing the work and the technical peculiarities of it. The series of 12 files – measurements of the sphygmomanometer demonstrates variety of

solutions of one and the same tasks, but also united by majority of equal results of them. Every one measurement has own unique explanation without being far away of the general logic reasoning. The sphygmomanometer shows different results only in the range of the diastolic cycle. They can be in the middle of the measurement process (file No 10) or at the end of it (file No 6). These uncertainties do not fluent to excellent work the sphygmomanometer operates. All results are noted by author's definitions and they can be characterized as proximate and not accepted by medicines – professionals. The programs are written on Excel.

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Non-linear Models' Researching

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Abstract: In this paper we consider a common used in economic pendulum's non-linear equation. A Galiorkin's variation method is introduced. For solving the concrete differential equation we use a combination of the variation method and the method of the step by step consideration. The solutions that we obtain are useful for analyses and researching of the systems' quality behavior. On the other hand these systems are constructed of equations which are equivalent to the equations used in the economic systems.

Keywords: Variation methods, asympthotic methods, oscillation theory.

1. Introduction

The linear differential equations' theory is well studied by using some effective algorithms for some analytic and numerical solutions. But the situation of the non-linear equations' solutions is not the same. Although they can be solved numerically their analytical solution can't be used as a problem of developing a common method.

The analytic solution gives an opportunity for detailed researching of the system's phase portrait as a function of the parameters. There are some different types of asymptotic methods which are significant for the non-linear differential equation's solution.

In this paper we introduce the Galiorkin's method which is a variation method. The other method which we use is the method of the step by step consideration. Often in the economic models we have to analyze the pendulum's equation. In this work we introduce a case of a pendulum when there is a dry friction.

2. Galiorkin's variation method

Let the following functional is given [1]:

$$I(\gamma)=\int_{t_0}^{t_1} f(x,\dot{x},t)dt \text{ , where } \gamma \text{ is a curve } \gamma=\{t,x: x=x(t)\} \quad (1)$$

Theorem: Necessary and sufficient condition for that the curve $\gamma: x=x(t)$ to be a functional's extremal in curves' space passing thought the points $x(t_0)=x_0$ and $x(t_1)=x_1$, is that it has to satisfy the following equation:

$$\frac{\partial f}{\partial x}-\frac{d}{dt}\frac{\partial f}{\partial \dot{x}}=0 \quad (2)$$

The equation (2) is called Euler-Lagrange equation.

It can be shown [2] that the differential equation of second order

$$\ddot{x} - \varphi(x, \dot{x}, t) = 0 \tag{3}$$

with final conditions

$$x(t_0) = x(t_1) = 0 \tag{4}$$

can be considered as Euler-Lagrange equation.

The function that we search has to satisfy the final conditions. On the other hand the integral (1) has to take a minimum value. The function can be approximately searched in the form:

$$x(t) = \sum_{i=0}^{n-1} a_i x_i(t) \tag{5}$$

Then the derivative is the following:

$$\dot{x}(t) = \sum_{i=0}^{n-1} a_i \dot{x}_i(t) \tag{6}$$

We compare (3) to (4) and find the clear aspect of $f(x, \dot{x}, t)$.

The Galiorkin's method allows defining the coefficients of the follower solution without making the variation problem's functional [2]. The differential equation (3) can be considered as Euler-Lagrange equation. We substitute the supposed solution (5) and its derivative (6) in the function $f(x, \dot{x}, t)$ of the equation (1). Then we differentiate over the coefficients a_i and obtain the following:

$$\frac{\partial I}{\partial a_i} = \int_{t_0}^{t_1} \left[\frac{\partial f}{\partial \dot{x}} \frac{\partial \dot{x}}{\partial a_i} + \frac{\partial f}{\partial x} \frac{\partial x}{\partial a_i} \right] dt = \int_{t_0}^{t_1} \left[\frac{\partial f}{\partial \dot{x}} \dot{x}_i(t) + \frac{\partial f}{\partial x} x_i(t) \right] dt = 0$$

After integrating the right part of the equation we obtain:

$$\frac{\partial I}{\partial a_i} = \frac{\partial f}{\partial \dot{x}} x_i(t) \Big|_{t_0}^{t_1} - \int_{t_0}^{t_1} x_i(t) \frac{d}{dt} \left(\frac{\partial f}{\partial \dot{x}} \right) dt + \int_{t_0}^{t_1} x_i(t) \frac{\partial f}{\partial x} dt = 0$$

Using the final conditions we notice that the first term is equal to zero. Then we obtain:

$$-\frac{\partial I}{\partial a_i} = \int_{t_0}^{t_1} x_i(t) \left[\frac{d}{dt} \left(\frac{\partial f}{\partial \dot{x}} \right) - \frac{\partial f}{\partial x} \right] dt = 0$$

Seeing the connection between (3) and (4) we obtain:

$$-\frac{\partial I}{\partial a_i} = \int_{t_0}^{t_1} x_i(t) \left[\ddot{x} - \varphi(x, \dot{x}, t) \right] dt = 0 \tag{7}$$

To define the coefficients we substitute (5) and (6) in the equation (7).

3. Finding a solution for pendulum's equation in a case of a dry friction

Problem's formulation:

Let the Cauchy's problem for non-linear equation is given by:

$$\ddot{x} + \omega_0^{\,2} \sin x = -a\,,\ \dot{x} > 0; \tag{8}$$

$$\ddot{x} + \omega_0^{\,2} \sin x = a\,,\ \dot{x} < 0\,,\ a > 0\,; \tag{9}$$

$$x(0) = l\,,\ \dot{x}(0) = 0\,. \tag{10}$$

We consider the oscillations with a little amplitude in comparison of the number one. Then if we expand the sine in Taylor's series we can limit the problem to the first two terms. Then the equations (8) and (9) can be written like this:

$$\ddot{x} + \omega_0^{\,2} x - \frac{\omega_0^{\,2}}{6} x^3 = -a\,,\ \dot{x} > 0; \tag{11}$$

$$\ddot{x} + \omega_0^{\,2} x - \frac{\omega_0^{\,2}}{6} x^3 = a\,,\ \dot{x} < 0; \tag{12}$$

$$x(0) = l\,,\ \dot{x}(0) = 0\,.$$

We solve the problem by using a combination between the Galiorkin's method and the step by step consideration's method [3]. At first we solve the equations by using an arbitrary parameter and after that we define the first derivative's signs of x. We will break the time interval into subintervals in such way that in every subinterval the first derivative's sign of x will not be changed. At the end of the first time interval we find the function's value x_1 - a solution of (11) and it will become a first condition for the function x_2 - a solution of (12).

4. How to use the variation's method?

We consider the following equation:

$$\ddot{x} + \omega_0^{\,2} x - \frac{\omega_0^{\,2}}{6} x^3 = \alpha \tag{13}$$

where $\alpha \in \boldsymbol{R}$, $|\alpha| < 1$.

We put

$$\xi = x - \frac{\alpha}{\omega_0^{\,2}} \tag{14}$$

Then the equation (13) with a precision of second power of the parameter α is the following:

$$\ddot{\xi} + \omega_0{}^2 \xi - \frac{\omega_0{}^2}{6} \xi^3 - \frac{\omega_0{}^2 \xi^2 \alpha}{2} = 0 \tag{15}$$

If we take in mind the initial conditions in Cauchy's problem we find out that it's appropriate with accuracy of first harmonic to search the solution with a function:

$$\xi = C_1 \cos \omega t \tag{16}$$

We find the derivatives of ξ and substitute them in (7) and obtain the following:

$$\int_0^{\frac{\pi}{\omega}} \cos \omega t \left(-\omega^2 C_1 \cos \omega t + \omega_0{}^2 C_1 \cos \omega t - \frac{\omega_0{}^2}{6} C_1{}^3 \cos^3 \omega t - \frac{\omega_0{}^2 \alpha}{2} C_1{}^2 \cos^2 \omega t \right) dt = 0$$

Solving the integral we obtain the vibrating's amplitude:

$$C_1 = \sqrt{\frac{8}{\omega_0{}^2} \left(\omega_0{}^2 - \omega^2 \right)}$$

Then the solution of (13) is:

$$x = \sqrt{\frac{8}{\omega_0{}^2} \left(\omega_0{}^2 - \omega^2 \right)} \cos \omega t + \frac{\alpha}{\omega_0{}^2} \tag{17}$$

5. How to combine the result of Galiorkin's method with the result of the step by step consideration method?

We will use the result which we obtained for solving the problem (10), (11), (12).

For $\dot{x} < 0$ we have the following:

$$\ddot{x}_1 + \omega_0{}^2 x_1 - \frac{\omega_0{}^2}{6} x_1{}^3 = a \,, \tag{18}$$

$$x_1(0) = l \,,\ \dot{x}_1(0) = 0 \,.$$

The solution is:

$$x_1 = \sqrt{\frac{8}{\omega_0{}^2} \left(\omega_0{}^2 - \omega_1{}^2 \right)} \cos \omega_1 t + \frac{a}{\omega_0{}^2} \ . \tag{19}$$

Taking the initial conditions we obtain:

$$\sqrt{\frac{8}{{\omega_0}^2}\left({\omega_0}^2-{\omega_1}^2\right)}+\frac{a}{{\omega_0}^2}=l$$

Thus we obtain the following solution:

$$x_1=\left(l-\frac{a}{{\omega_0}^2}\right)\cos\omega_0\sqrt{1-\frac{l^2}{8}\left(1-\frac{a}{{\omega_0}^2 l}\right)^2}\,t+\frac{a}{{\omega_0}^2} \tag{20}$$

We find the moment in which the first derivative is zero i.e. $\dot{x}_1(\tau_1)=0$ and after that we obtain the searching result:

$$\tau_1=\frac{\pi}{\omega_0\sqrt{1-\frac{1}{8}\left(l-\frac{a}{{\omega_0}^2}\right)^2}}$$

At the end of this stage x_1 will have the following value:

$$x_1(\tau_1)=-l+\frac{2a}{{\omega_0}^2}$$

This will be the initial conditions for the next stage $\dot{x}>0$

$$\ddot{x}_2+{\omega_0}^2 x_2-\frac{{\omega_0}^2}{6}{x_2}^3=-a$$

The solution is:

$$x_2=\sqrt{\frac{8}{{\omega_0}^2}\left({\omega_0}^2-{\omega_2}^2\right)}\cos\omega_2 t-\frac{a}{{\omega_0}^2}$$

We will find the result for some value of the time variable by taking the cosine equal to minus one. After that if we find ω_2 on these conditions we will make a correction to the correct value of τ_1 by using the following phase variable:

$$\omega_2\tau_1+\delta_2=\omega_1\tau_1$$

$$\omega_1\tau_1=\pi$$

Then the first equation will have the form:

$$\sqrt{\frac{8}{{\omega_0}^2}\left({\omega_0}^2-{\omega_2}^2\right)}-\frac{a}{{\omega_0}^2}=-l+\frac{2a}{{\omega_0}^2}$$

By making all calculations we obtain the following equation:

$$x_2 = \left(l - \frac{3a}{{\omega_0}^2} \right) \cos\left[\omega_0 \sqrt{1 - \frac{l^2}{8}\left(1 - \frac{3a}{{\omega_0}^2 l} \right)^2}\, t + \delta_2 \right] - \frac{a}{{\omega_0}^2} \tag{21}$$

The correcting phase has the expression:

$$\delta_2 = \pi \left(1 - \sqrt{\frac{1 - \frac{l^2}{8}\left(1 - \frac{3a}{{\omega_0}^2 l} \right)^2}{1 - \frac{l^2}{8}\left(1 - \frac{a}{{\omega_0}^2 l} \right)^2}} \right) \approx -\frac{la\pi}{4{\omega_0}^2}$$

At the end of this stage the moment of time is the following:

$$\tau_2 = \frac{2\pi - \delta_2}{\omega_0 \sqrt{1 - \frac{l^2}{8}\left(1 - \frac{3a}{{\omega_0}^2 l} \right)^2}}$$

and for the final conditions we can write:

$$x_2(\tau_2) = l - \frac{4a}{{\omega_0}^2}$$

$$\dot{x}_2(\tau_2) = 0$$

We can conclude that for "n" periods the amplitude will be:

$$A_n = l - n\frac{4a}{{\omega_0}^2} \tag{22}$$

And the frequency will increase as follows:

$$\Delta\Omega_n = \frac{\omega_0}{16}\left(l^2 - {A_n}^2 \right) \tag{23}$$

After n periods the phase will have the value:

$$\Phi_n \approx -n\frac{la\pi}{2{\omega_0}^2} \tag{24}$$

6. Conclusion

The examined problem shows how useful can be the methods for the approximating solution of the non-linear differential equations. They give an opportunity to obtain a large quantity of data and also to make analyses of the system's quality behavior. The parameters' analyses gives an opportunity to find their bifurcation values if they exists and also to have the chance to examine the system's phase portrait.

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Integrated Approach for Creating E-Learning Materials

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Abstract: The paper discusses some aspects of the implementation of the Content Management Systems (CMS) in the creation of e-learning materials and the integration of imitation modeling in electronic textbooks. As an example are considered CMS Moodle to create the main content of electronic textbook Operating systems and GPSS World environment for creating educational demonstration models. It considers some of the potential extensions GPSS World - the Extended Editor of models and the Universal Editor of Forms demonstration capabilities for improving the educational Simulation models.

Keywords: Content Management Systems, simulation models, electronic textbooks.

1. Introduction

Today education in the all world is characterized by the rapid rate of informatization. Moreover the informatization takes place in several directions, which interact and depend on each other [1]: The development of the intellectual potential of the learner; forming habits alone gaining knowledge, implementation of various types of independent activity in receiving, processing, transmission and production of academic information; Distributed learning opportunities for the application of the means of information and communication technology (ICT) in the absorption of different subject areas; Implementation of the opportunities of education information interaction and the potential of distributed information resources of local and global network as a basis for the functioning of a single information educational environment; etc.

The current work is an example of such an interaction between the different strands. The presented educational site is developed by means of the environment Content Management System (CMS) Moodle [2] and with the collaboration of students from third course learners specialty "Informatics and Information technology", at College - Dobrich of Konstantin Preslavsky University of Shumen. The work serves to develop the intellectual potential of students and skills for self-knowledge and solving practical problems; involvement of the students in the improvement of the educational process in the College, and hence the acquisition of the confidence for the future realization of the students taking part in the development and the satisfaction and importance of the fulfillment of the tasks; and last but not least the students - future users of the site - will show desire and ambition take part in such projects, which will contribute again to the implementation of the above-outlined goals. The result is a course in which it will be a small local conversion of the above mentioned areas of the development of the informatization of education.

The electronic study materials included in the educational site presented in this paper are organized following the example of the training course on Spreadsheets on the web site presented in [3]. In addition to some of the topics as "Means of process' synchronization and interaction processes. Critical section. Deadlock" and "Process. Concept. Conditions processes. Operations work processes", where necessary, the system can be displayed " on

the fly ", included videos captured by CamStudio performance simulation models [4] of algorithms for process' synchronization by Mutual exclusion [5]: Dekker's algorithm, Peterson's algorithm, etc.

2. Features of CMS Moodle

CMS Moodle is one of the most popular platforms for e-Learning. [2] and [6] Moodle is a free open-source e-Learning system and became popular thanks to the various options offered to administrators and teachers. CMS Moodle is designed to create high-quality on-line courses by educators.

From the perspective of teachers benefits for Moodle are [6]:

- Moodle is based on the pedagogy of social constructivism, which are an integral part of the interaction, active learning, critical reflection, etc. Moodle is designed specifically for online-courses.
- Moodle has a simple, friendly web-interface, compatible with different browsers.
- The list of courses includes a brief description of each course on the server and this information is available to each guest.
- The courses are divided into categories. There mechanism to search for a course by keyword. Moodle can support thousands of courses.
- Most text elements (resources, forums, journals, etc.) can be edited using the built-in WYSIWYG HTML editor.

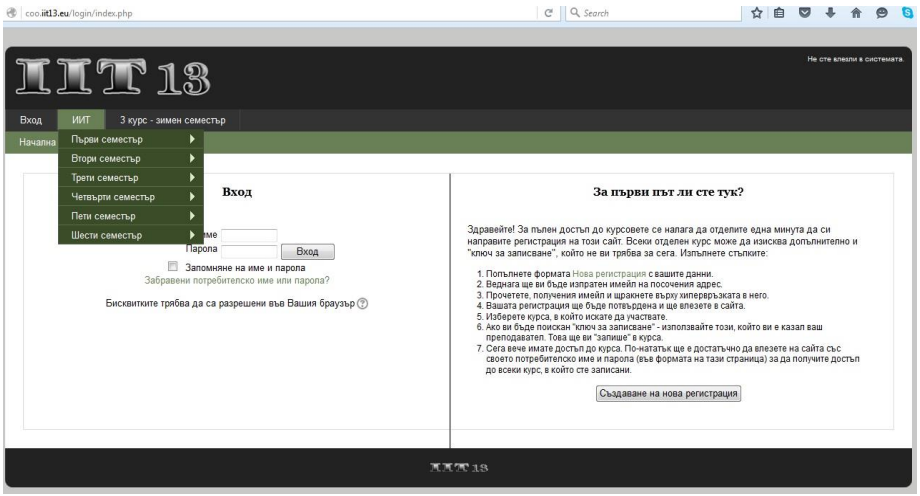

Fig. 1. Appearance of the site specialty

Fig. 1 shows the home page of the web site of the specialty "Informatics and Information Technology", created using Moodle (URL: coo.iit13.eu) [7]. A student from the group created the website using Moodle, as the system can control access and systematize information. With this platform, it can create multiple categories (in the example, this is the semester) and them to create courses (subjects), as shown in Fig. 2

The opportunities of the Moodle, which are of interest to administrators of web sites [2] are:

- Moodle works without requiring modification in Unix, Linux, Windows, Mac OS X, Netware and many other operating systems, which are supporting server-site scripting

language PHP.

- Moodle is designed as a set of modules and allows flexibility to add or remove different elements virtually all levels.

- Moodle easily is updated. It has an internal system for the renovation and restoration of their database.

- Moodle requires only one database and can be used in conjunction with other applications.

- Moodle uses a universal database that supports different data types.

- Special attention was paid to security at all levels. The forms and the data check for authenticity, cookies encrypt etc.

CMS Moodle is a very suitable management system educational content, but for the "presentation" of the school and taught courses Moodle does not have the means and having to use another CMS, which can be made freely accessible site, as shown in [3].

3. Creation of Electronic Textbook in Operating Systems by Means of CMS Moodle

The course structure on the site is the following:

- The first section is about discipline - Name of discipline leading discipline Assistant discipline coordinates with the teacher, workload and the complete for the student.

- In the following sections there are study materials from various sources - lecture notes freely distribute educational materials on the subject, material taken from other courses. Some courses have additional information on the criteria for the evaluation of assignments, term papers, etc...

- The last section is "Important Dates". It specified dates for ongoing monitoring, and dates for the exams.

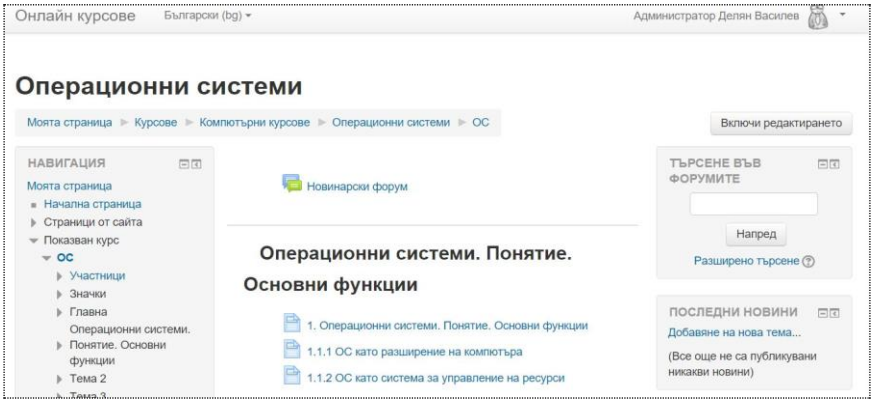

Fig. 2. Home page of the e-Textbook on Operating systems

The Home page of the course on Operating system is shown in fig. 2. CMS Moodle allows us to upload information in several ways - by free text, by attaching the file, by incorporating another source. The platform also allows to create tests. Another convenience is the organization of content in groups - for example, "Information for course", "Content", "Important Dates", etc. (fig. 2).

4. Incorporation of Simulation Models in E-Textbook

Primary imitation modeling is applied in the study of different types of systems. But our experience of work in the environment of GPSS World induce the idea that the imitation modeling can be used as a learning tool especially in engineering disciplines Computer systems, Operating systems, Concurrent programming [4], Database systems [8], etc., where topics related to the synchronization of concurrent processes/transactions (They are modeled easy by GPSS transactions in the terms of the Queuing systems).

The work of modeled system in different modes can be watched in graphical windows of GPSS World: Facilities Window, Blocks Window, Dynamic Matrix Window (Every matrix in the GPSS model can be shown on the screen), Storages Window, Table Window, Savevalues Windows , Queues Window, etc.

To be demonstrated performance of the modeled system for educational purposes in the environment of GPSS World by several windows (in combined window [4]), the teacher must manually "ranking" the windows on the screen, as shown in fig. 3. In the movie Peterson.avi (fig. 3) is shown serving two flow processes Peterson's algorithm.

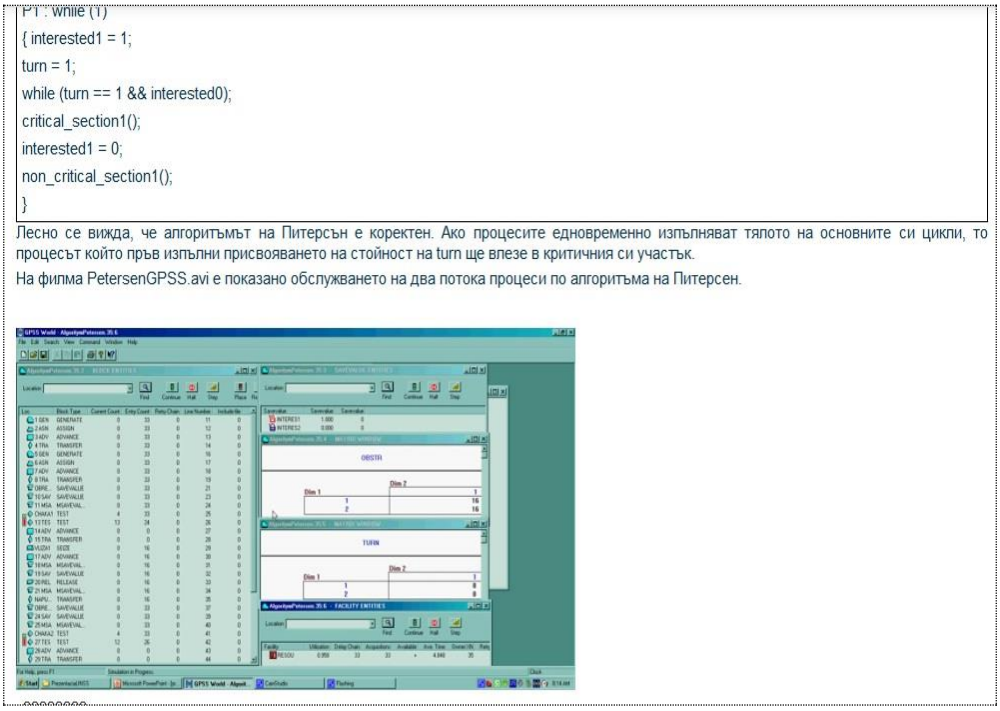

Fig. 3. E-Textbook page with embedded simulation of the Peterson's algorithm

In the movie PetersonGPSS.avi (at the bottom of fig. 3) students can watch the process' synchronization on Peterson's algorithm by:

- Change the values of the flags interested0 and interested1 (in the simulation - variables INTERES1 and INTERES2 - the window below, right);

- Change the value of the variable turn (in the simulation - matrix TURN - first cell processes from the first stream and the second cell denotes the process of the second stream - window TURN right);

- The part of the critical section, modeled with single-channel device RESOU (under theTURN window);

- Service processes from two streams - window units in the left pane. Visible busy Is critical section at a time, how many processes are generated and serviced in each of the streams, etc.;

- Number completed their work processes. gone through the critical section (the window above right).

Extremely rich opportunities for incorporation of simulation models in e-Textbooks and in the educational process on the whole provides the Extended editor (EE) for developing models of language GPSS World [8]. The Extended editor [9] contains a set of graphical and text tools, allowing not only to simplify the processes of formulating research goals and objectives and the development of models, but their use not only by researchers, but also of teachers. On figures 4-5 will show windows presenting an implementation of process' synchronization on Writer-Reader model [5] by means of the EE for GPSS World. The modeling algorithm is described in details in [10]. We made some modifications in the modeling algorithm for the purposes of its submission by means of Universal editor of forms, such as the shape of the dynamics of the experiment presented on the fig. 7.

Fig. 4 shows the simulation of "Writers-Readers" model. The movie Writerreader.avi shows process' synchronization of "Writers-Readers" model in the environment of the Extended editor mode trace. In the window of the variables in the right pane can be observed: NumProd - the counter of generated Writers; NumRead - the counter of generated Readers; EndProd - the counter of ended Writers; EndRead - the counter of ended Readers. A left panel (fig. 4) can be observed the operation of the processes.

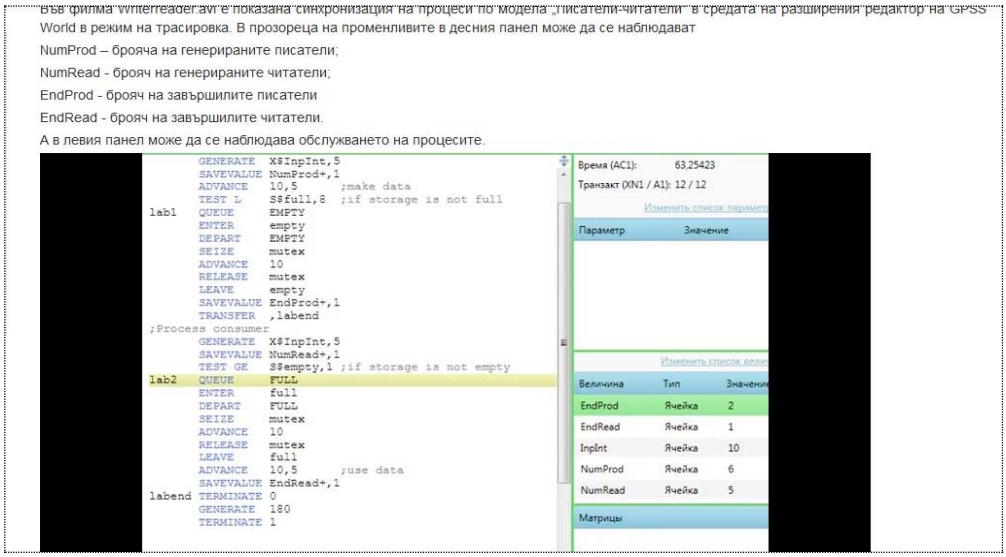

Fig. 4 Page of the E-textbook with embedded movie for tracing of process' synchronization on "Writer-Reader" model

Another possibility to integrate the imitation modeling in the E-Textbook is the publication of the all text of the corresponding GPSS model as is shown in fig. 6. The students can copy the text of the model in the EE environment and they can start the simulation in trace mode. In such a way they can watch the simulation with speed, as would have been handy to individual capabilities of the student. Besides speed monitor, this way provides to students opportunities to make changes in the model and watch different simulations in various initial parameters.

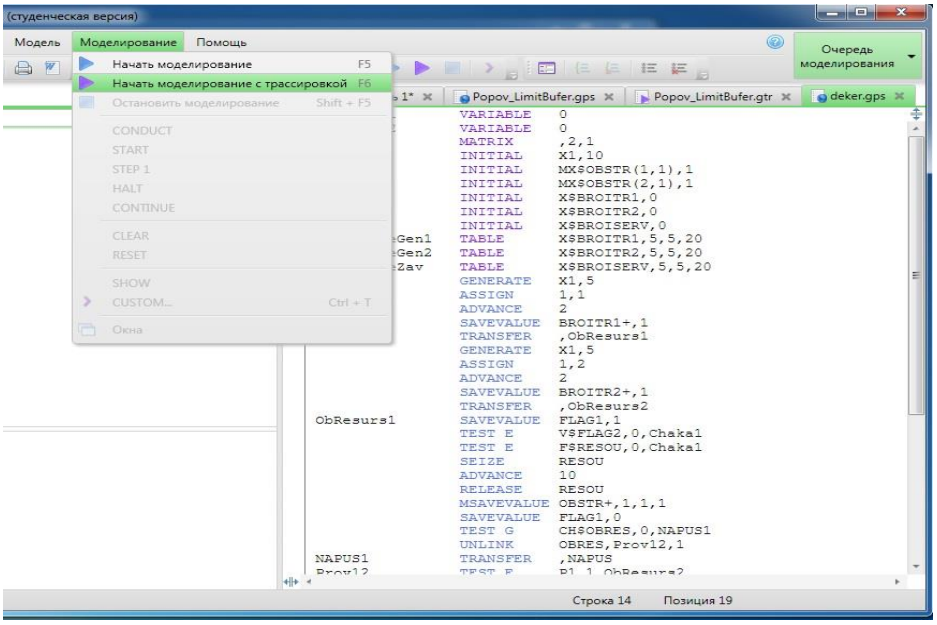

Fig. 5 Start of GPSS model of Dekker's algorithm in trace mode in the Extended editor' commands

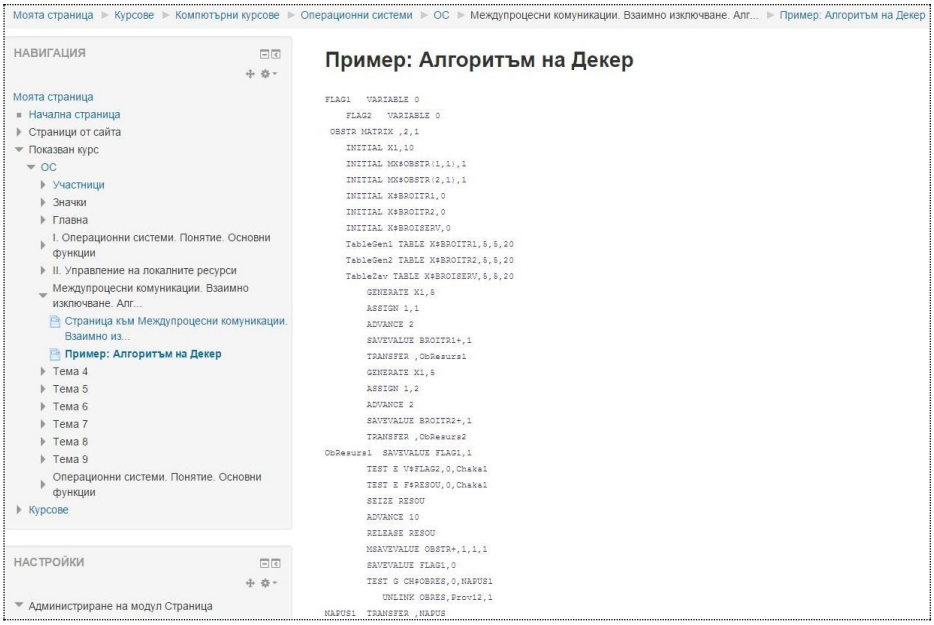

Fig. 6 Program code of GPSS model of Dekker's algorithm included in e-Textbook

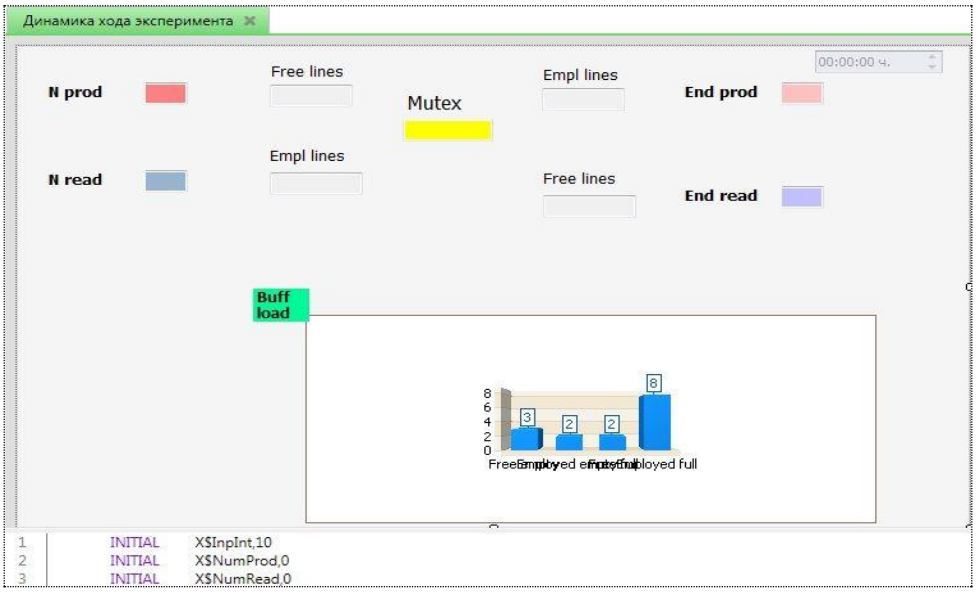

Fig. 7 Form of Dynamics course of the experiment designed in Universal editor of forms

Demonstrations materials showing the various approaches for process' synchronization can be embedded in E-textbooks like hyperlinks to the corresponding materials. The films like the demonstrated on fig.3 and fig. 4, have big size and it can be a problem the size of the files. Therefore, it can be used the opportunities of cloud computing.

In clouds as example OneDrive, Dropbox, etc. the movie files could be uploaded previously, and then their hyperlinks can be included in the corresponding places in the e-Textbook.

5. Conclusion

The development of information and communication technologies and the transition to an information society challenges the teachers at all levels of education to develop "new" strategies and technologies of keeping the lesson / lecture and tutorial. Now every university has specialties in which training is remote. In this main assistants of teachers are content management systems, which has intensified in recent years and are one of the latest technologies for constructing web sites. The ability to create their own e-learning materials in support of the work is an important part of today work for university professors and teachers.

Extension editor of GPSS World automates a large number of operations and actions during the simulation study. Automated creation of simulation models, "standard combined window" to monitor implementation of the model and convenient GUI editor of the EE make it suitable for educational demonstrations of the work of different systems. And by the forms that can be created in the Universal editor of forms the demonstration models could be more attractive and informative for students. Furthermore the films and the animation forms can present the work of the systems in various modes almost real "in fly". And they could be embedded in e-Textbooks (in online courses or just in textbooks implemented distributed asynchronously by files (by e-mail, CDs, DVDs, etc.)

Realized by means of the CMS Moodle web site of the group of college students studying in the specialty "Informatics and Information Technologies" is a project that reflects the process of creating teaching materials in the form of a web site using CMS. The work on project for distance learning IT shows how easy and affordable means the Internet can develop a web site not only useful for the training of students in the chosen specialty, but for expanding their horizons, and also to refine their knowledge by acquiring additional information and skills. The good practice working on this project is that students except of their participation in solving real practical problems, learn to work as a team. Furthermore, working with a teacher always benefit both the teacher and the students. And last but not least: in working on such a project, students acquire a sense of satisfaction, not only the acquired knowledge and skills in their specialty, but the satisfaction that were useful and were involved in something meaningful.

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Bulgaria's Place with regards to the European Leaders in Provision of E-services

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Abstract: In Bulgaria we are witnessing the continuing efforts of state and local government to achieve an electronic management which is important part for data integration for the citizens. At the same time researches made show us clearly that Bulgaria has to achieve many aditional options for process management and society does not use the full potential of electronic services, provided by the administrations. The paper shows systematic analysis of Bulgaria's place in the worldwide trends and it will examine in detail the results by region. On this basis conclusions are formulated.

Keywords: Iinformation technologies, e-government, e-services, development of Bulgaria

1. Introduction

Continuing the presentation and analysis of the world e-government rankings, this chapter reports on global progress in online service delivery as evidenced by the 2014 United Nations E-Government Survey data and considers factors. The analysis attempts to shed light on the meaning behind the numbers by highlighting successful strategies and discussing some common challenges and barriers to achieving an efficient and effective public administration as a condition of good governance.

The online services component of the E-Government Development Index (EGDI) is a composite indicator measuring the use of ICT by governments to deliver public services at national level. It is based on a comprehensive Survey of the online presence of all 193 United Nations Member States. The Survey assesses the technical features of national websites as well as e-government policies and strategies applied in general by specific sectors for delivery of and services.

Of particular note in this Survey round was an increased emphasis on e-participation features and evidence of open data initiatives on national websites given evolving expectations about transparency and participation in public affairs. The provision of environmental e-information was also added to the basket of basic online services assessed—alongside education, health, finance, labour and social welfare functions—given current attention to questions of environmental stewardship in the global picture of the future we want. As technology evolves and countries make progress, goals are also set higher and the Survey is adjusted accordingly.

On the whole, there is a substantial variability in the scope of online service delivery. Differences between the highest and lowest online service scores and between the four stages of e-service development are considerable, despite progress in a number of areas. A large number of countries fall in the bottom third of the OSI. Improved access to telecommunication infrastructure has facilitated e-government development in some cases,

but in general the most advanced countries have continued to outpace the less developed in online service delivery.

Progress in online service delivery is related to income but other factors also play a role. Although each country faces particular conditions and challenges, a strong association with GNI can be discerned in the extent of online service delivery as well as the type of services provided. This finding reaffirms the need for a close connection between online service strategies, telecommunication infrastructure, human capacity and other social and economic factors.

Where high-income countries are concerned, the Survey finds an apparent trend towards convergence in online features with increasing commitment to expanding e-participation opportunities and promoting open government data. All countries, including those with lower incomes, can improve online services by ensuring high-level political support and administrative leadership and by strengthening institutional capacity and public accountability. Cooperative arrangements such as international benchmarks appear both to guide progress and hasten activity in priority practice areas such as those covered by the Survey.

2. World Trends in Electronic Governance

The worldwide introduction of e-government begin to be seen more and more as an investment, reducing public expenses on administration and making services more user-friendly and accessible to citizens and businesses. In some countries, such as the UK, Netherlands, Denmark, is placed particular emphasis on the effectiveness of implemented subsystems of e-government and their impact on reducing public expenses for administration.

Its development has become a priority in the administration of most leading economies. Worldwide a number of studies are periodically published on the status and trends of e-Government. The studies of United Nations present an opportunity to be made some main conclusions about the place of individual countries, their challenges in this field and some comparative analysis. The organization publishes the results from the reports. They might be used as a basis for comparison because they are organized periodically in the same manner. The general framework of a UN study on e-Government is based on the following principles:

- The E-Government research is considered as a mean to achieve the main purpose - development of all. It is a powerful tool which, if it is effectively implemented, could contribute significantly to reducing extreme poverty, improving environmental protection and promoting social inclusion and economic opportunities for all
- The research and its results must be placed in the context of the overall model and the level of development of each particular country.
- The focus of the research is on providing socio-economic conditions for the population and it is based on the understanding of the importance of e-Government for social inclusion.

The best implemented government portals provide multi-channel access to e-services of all government agencies, opportunities for payment of administrative services and online voting.

In the latest edition of the UN report on the state of e-government in the world "E-Government Survey 2014", entitled have been analyzed the performance of 190 countries. All of them are ranked according to their achievements in the index EGDI (E-government development index), as the place assigned to them is based on three components:

- online services;

- telecommunications infrastructure;
- human capital;

Since 2003, in the UN survey are considered three components of e-Government, forming a common index for the development of e-Government (EGDI). The survey was made among 193 countries. Bulgaria is ranked in the first half of them. But this puts us last among the European countries, but between 2012 and 2014 is recorded a decline - from 60th place falls on 73rd. All these results show that Bulgaria still lags far behind the leading European countries in offering electronic services for citizens and businesses. It needs more expansion and improvement of the electronic services efficiency and better technological compatibility. Citizens and businesses do not have enough confidence yet in the electronic services, because of the fact that a significant part of the population is not qualified to work with more complex systems.

3. Bulgarian Progress in Provision of E-services

Development of electronic services offered by the state administration in Bulgaria is a priority of successive governments since before joining the EU. Our country, right from the accession is significantly behind in the technological modernization of the public administration and the optimization of its performance in comparison with most other Member States.

On the map below you can see the average level of development of electronic services in areas for 2014:

1. *E-services are not provided*
2. *Information on public services is electronically provided*
3. *Available electronic access to forms and documents*
4. *It is electronically possible to process forms and personal identification*
5. *Electronically possible to conclude deals, including payment*

Map clearly outlines the best and worst performing areas in 2014. Areas whose municipalities were providing e-services at relatively the highest level in the country are Yambol (4.23), Varna (4.17), Sofia City (4.00), Gabrovo (3.56), Razgrad (3.46), Vratsa (3.41), Kardzhali (3.09) and Stara Zagora (3.02). At the other end of the spectrum are the regions of Shumen (1.00), Vidin (1.00), Ruse (1.08), Silistra (1.09), Kyustendil (1.32), Blagoevgrad (1.32), Sofia (1.43) and Montana (1.97).

Five of the eight areas with the lowest average levels of e-services are concentrated in the western part of the country; the only exceptions to this poor performance are Pernik and Sofia. North Bulgaria is much sharper in this respect - the most poorly performing areas in the country are located in the northeastern and northwestern region, but some of the areas with the highest average levels are also concentrated in these regions. It is interesting to look at the level and dynamics of the electronic services provided by the municipal administrations in areas over the past few years. The table below stipulated levels of provision of electronic services for the period 2012-2014, again weighted by population in each municipality.

Region	**2012**	**2013**	**2014**	**Change for the period**
Blagoevgrad	1,09	1,36	1,32	0,23
Burgas	2,06	2,36	2,29	0,23
Varna	3,30	4,08	4,17	0,86
VelikoTarnovo	1,69	2,05	2,21	0,52
Vidin	1,13	1,11	1,00	-0,13
Vratsa	2,99	3,02	3,41	0,43
Gabrovo	2,03	1,35	3,56	1,53
Dobrich	2,67	2,67	2,84	0,17
Kyustendil	1,00	1,00	1,32	0,32
Kardzhali	1,51	1,35	3,09	1,57
Lovech	1,70	2,44	2,80	**1,10**
Montana	1,99	2,05	1,97	-0,02
Pazardzhik	2,57	2,49	2,46	-0,11
Pernik	2,59	2,56	2,46	-0,13
Meven	1,78	2,47	2,62	0,84
Movdiv	1,20	2,89	2,94	1,75
Razgrad	3,46	3,46	3,46	0,00
Ruse	1,12	1,12	1,08	-0,04
Silistra	1,00	1,00	1,09	0,09
Sliven	1,39	2,73	2,86	1,46
Smolyan	2,32	2,40	2,61	0,28
Sofiya	1,02	1,01	1,43	0,41
Sofiya-grad	1,00	1,00	4,00	3,00
Stara Zagora	2,48	2,89	3,02	0,54
Targovishte	2,79	2,42	2,42	-0,37
Haskovo	1,48	1,55	2,81	1,33
Shumen	1,00	1,03	1,00	0,00
Yambol	3,13	2,79	4,23	**1,10**
Country	*1,75*	*2,07*	*2,81*	*1,06*

In 21 regions the level of services provided electronically has increased in 6 deteriorated and two no change from 2012 to 2014 noted that the areas where the level has improved, are relative majority those which worsened or not changed, which in itself is a positive sign for the development of e-government in Bulgaria. If you look at the number of municipalities, grouped by level of their electronic services, the situation is actually worse than we assumed on the basis of the above data. On the table below you can see what was the number of municipalities which offered a level of electronic services for each year of the period 2012-2014:

	2012	**2013**	**2014**
Level 1	200	189	179
Level 2	6	11	4
Level 3	35	39	43
Level 4	12	17	22
Level 5	8	7	13

4. Conclusion

The electronic government is seen as an important part for the process of modernization of public administration in Bulgaria. It is committed to provide modern and efficient governance by means of modern information technologies in order to meet the needs of the citizens and businesses at any time and at any place. To achieve good results the e-government should be developed and updated according to the respective needs and requirements of the citizens. One of the effective ways is to borrow techniques and methods from the leading countries in the field of E-governance.

The development of e-government is a very important step for the optimization and modernization of public administration. A broader and quality of services electronically by the municipal administrations would significantly improve the administrative services and would save time and taxpayers' money by reducing unnecessary costs and procedures. Although the last few years the average level of e-services in the country has improved, the process has been extremely slow pace. This leads to serious fragmentation in the quality of administrative services and the business environment in the country, because while some municipalities and regions develop, any further behind.

Criteria and Priorities Influencing the Choice of Financial Information System

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Abstract: Bulgarian companies often make decisions about implementation of systems just to be part of a global trend and they do not think about the actual benefits they will bring to their business. Financial information systems are expensive products and they should be chosen very carefully in order to justify the investment in them. This paper provides specific criteria and priorities that can help companies in choosing and described the methodology by which they can be grouped.

Keywords: information technologies, financial software, criteria and priorities

1. Introduction

Software projects are expensive, and most client company must allocate money not only for the software itself but also for the preliminary audit to show whether the company network is ready to implement the required software as well as to attract consultants recommend appropriate system and to occupy itself with the project.When we talk about software that is expected to support decision-making and management of business units, we should not forget that its implementation is not a single act. Each system or subsystem can act as an entry point - to add and integrate new programs and modules depending on the activities of the company. So the choice and implementation of the necessary business software solutions are inherently an ongoing process of monitoring and analysis of internal corporate processes reassess the direction of development, adding and integrating new technologies and ultimately better governance, improve operations and increase competitiveness.

Whether for identifying new business opportunities, whether in response to market dynamics or to obtain new knowledge about financial results, large companies need an integrated solution for financial management that supports complex requirements. Financial software helps control multinational financial processes and provides insight into the entire company.

The software solution for financial management combines robust core financial functionality to manage cash flow and liquidity, as the mandatory statutory reports and project management, and also provides a broad analytical insight to serve and to non-financial managers to understand data

The software solution streamlines financial processes and simplifies the overall accounting so that financial professionals can spend more time analyzing, not the processing of financial data and reports. Financial software helps business managers improve financial performance with current and accurate information.

Modern solutions for managing finances allow managers of high level to reduce the overall costs of the company by reducing the cost of software licensing and construction and

maintenance of the technical infrastructure that accompanies it, by offering a service in a cloud environment, allowing easy integration other available specific software.

2. Criteria and Priorities Influencing Choice

Undoubtedly when taking a decision to start a project for introducing a financial software, the managers are put in a situation where they have to set a criteria and priorities which are important for the firm and which guide the project.

Quite often people are put in a situation where the criteria considered important at the beginning, turn out to be of little importance once the process has started.

A survey on this subject is conducted by Deloitte among 1500 respondents. Using this survey different criterion concerning the organizations in the process of introducing analytical software are examined. The firms which are about to introduce it, are firstly given a task to rate the criteria, important for them, using marks from 1 to 10. They have to do that before the beginning of the process and after the end of it they have to rate them again.

Judging by the opinions of the survey the difference in the order of the factors is quite big. These, which were of the highest importance at the beginning, become a lot less important at the end and vice versa.

The scale for estimation is of the type "1-the most important", "10-the least important". A typical example for this is the factor "Level of maintenance". In the first inquiry it is estimated with 8, which places it together with the less important criteria while in the next stage, the rate for it is already 2 which put it in the top.

Choice 1	Choice 2	Criteria
1	5	Price
2	9	Ease of deployment
3	8	Ease of use with the system
4	3	Responding to the needs
5	7	Functionality of the system
6	10	Compatibility with existing hardware
7	4	Opportunity to grow
8	1	Level of support
9	6	Quality of documentation
10	2	Successful implementations of supplier

In order to decrease the considerable difference between "expectation" and "reality", what is needed is for the clients of financial decisions to be acquainted with the process. The analysis of the situation is the most important thing which guarantees the success of the project. The fact if a simple introduction is started, without conducting a survey of the needs, managers take high risk.

The comparison of the projects specifically for the enterprise is considered to be the best method for proper estimation which would help the managers have more realistic

expectations of the results of the new software and of the strong and weak points, opportunities and threats of the two scenarios as well as compare them in order for the managers to make their expectations more real.

Of extreme importance is to set not only the **criteria** which would be used to choose the software but the **priorities** of the firm as well.

Firstly the question of **how many installations** this software has to have, is put, namely what is the number of firms, introduced the software of this company and hence the percentage of compatibility of the software and the business needs of the firm. Apart from this, the **price** and the **time of optimization** needed for the supplementary works on the software are also questions of importance. After that comes the question of the **percentage of compatibility with the requirements** of the client and the time necessary for the installation in the firm. In terms of finances, of considerable importance is the **price of the license** and after it comes the level of personalization in percentage.

For the secure and successful functioning of the chosen software the **number of satisfied clients** is also important. With the development of information systems the opportunity for **integration of data** from other systems also needs to be taken into consideration as well as the time necessary for training of the staff.

With the progress of technologies the manufacturers aim at **decreasing the time** taken to create a single article. That's why the decreasing of it is quite an important criterion for choosing a software.

The development of business depends on the clients and because of this all of the firms aim at satisfying the necessities of clients and their satisfaction of the quality of the products on the market. Through this the relations between the firm and the clients are improved and that's why every manager needs to choose a suitable software which would be a **precondition for better relations** with the clients. Meetings this condition would mean that the chosen financial system increases and improves the quality of production.

Every business aims at its expanding and development of the business activity. That's why the criterion for expanding the market share and opportunity for future development and expanding of the firm is extremely important.

Of course, the need of financial stability in a firm is of utmost importance. That's how the **price of maintenance**, simple use of the users and brief time for implementation of business processes, increasing of the income and decreasing of the expenses are taken into consideration.

All these criteria need to be defined by each organization in order for it to take the right decision in choosing a software. Apart from the defining them, they have to be arranged in **a few stages of sequence**. Using them the strong and weak points of the project can be defined as well as the influence of the external factors. Their right understanding gives a clear image of the situation of the project in a certain moment and directions for improvement in the following stages because all people involved in the process are engaged.

The documentation of the project is advisable to be done in **a 7-stage methodology**:

- **The first stage** is where the criteria given the **most general information** for the software are. These are: how many installations in the field thee are, compatibility of the software with the business needs and the processes, price of optimization, time for optimization. The sources of information for these criteria are The National Statistical Institute, documentation of the software, an offer of the firm as well as one of the firm introductor.
- **The next second stage** is related to **the initial introduction** of the information system. These criteria include: does the software decision have the necessary functionality,

the time for installation, the price of the license and their respective sources of information: the introductor firm and an offer on the firm itself.

- **The third stage**, which is the **level of customization and use** of the custom software and
- **the forth**, related to the opportunity for **integration of data** from other systems, both examine the functioning of the software in the firm. Enough information for these stages can be found in documentation of the software and questionnaires of personnel.
- **The fifth stag** is dedicated to the **training time of employees** and the result on its ease of use by consumers and shortened turnaround time of business processes
- **The sixth stage** of the model for valuation is related to the **financial development and the relations of the firm**, which could be influenced by a decreasing in the expenditures for labor, a decreasing in the time taken to produce a single product, an improvement in the relations with the clients, better awareness of the leadership, an improvement in the quality production, an increasing in the market share. The information for all these criteria can be obtained from the leadership of the firm, questionnaires for all the employees, an inquiry of the clients and The National Statistical Institute.
- **The seventh last stage** is related to **the future developmen**t of the firm, which involve not only an opportunity for future development and expanding of the company but also price for the maintenance. The introducing firm and an offer by the firm itself document the last stage.

The migration of the firm data to a suitable software is a mandatory step guaranteeing competitive power of the firm. Our country became an attractive destination for foreign investitors from different segments of the economy, who come here with practices built long ago, including the availability of automated systems of management – entire or at segments.

3. Conclusion

When talking about software, which is expected to help taking decisions and management of the firm units, we cannot forget that the introduction of it is not a single act. Each system or sub-system could be the entry point for adding and it integration of new programs and modules depending on the activities of the firm. That's how the choice and implementation of the software decisions needed for business are actually a ceaseless process of observation and analysis of processes inside the firm, reevaluation of the lines of development, adding and integrating new technologies and eventually better management, improvement of the activities and increasing of the competitive power.

Deploying software for financial management, and general management software, is of strategic importance. The business model for realization in the process of implementation must meet the current and future business requirements. It is vital for management to be directly involved in supporting the changes. In terms of complexity, unity and integrity of modern software solutions, implementing them in a particular company laid the foundation for building a new paradigm for doing successful business.

A Research on the Influence of Some Factors on the GPA of Students

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Abstract: The purpose of this paper is to find the main factors influencing the GPA (grade point average) of students studying "Informatics" at Varna University of Economics. An online survey with Google forms among fourth-year students is carried out in April 2015. A codebook and coding of answers is done. Statistical and artificial intelligence methods are applied to answer the main research question. Statistical methods (such as descriptive statistics and nonparametric tests) are used to find statistically significant dependencies. Neural networks are used to find practically significant dependencies. Formal description of the most important dependencies is given. The results of the application of statistical and artificial intelligence methods are compared. The results of this study are also compared with previous research work of other authors trying to find the most important factors influencing the GPA of students.

Keywords: Educational data mining (EDM), SPSS, Alyuda NeuroIntelligence.

1. Introduction

Datasets with many records are generated in the educational sphere. These datasets contain demographic information about students as well as information on the passed exams. These datasets usually contain hidden dependencies, templates and trends revealing the factors influencing students' GPAs and complacency from education. Forecasting future GPAs for forthcoming exams is very difficult.

Educational data mining (EDM) is a new science about the application of Data Mining methods in education. The main purpose of EDM is to better the educational process.

The purpose of this paper is to find the main factors influencing the GPA of students studying "Informatics" at Varna University of Economics. An online survey with Google forms among fourth-year students is carried out. A codebook and coding of answers is done. Statistical and artificial intelligence methods may be applied to answer the main research question. Statistical methods (such as descriptive statistics and nonparametric tests) are used to find statistically significant dependencies. Neural networks are used as an alternative method to find practically significant models. Formal description of the most important connections is given. The results of the application of statistical and artificial intelligence methods are compared. The results of this study are also compared with previous research work of other authors trying to find the most important factors influencing the GPA of students.

This paper is created within the national project "NP-156/2015: Methodology for intelligent data analysis for students and creating a knowledge database". An online survey among four-year bachelor students (studying specialties "Informatics" at Varna University of

Economics) is conducted. The response rate is 87%. The dataset is saved as a MS Excel spreadsheet. After that a codebook is created, describing the coding of the answers. Answers to questions with checkboxes are coded as different variables. Text data are coded with numbers. The dataset is transferred to SPSS and Alyuda NeuroIntelligence. Cross-sectional data are used. This study is an observational one.

We assume that GPAs of students are affected by several factors. The type of finished secondary school (Q5, Q6) may influence GPA (Q11). The complacency from education (Q10) may affect the GPA. We assume that students who are satisfied from education have high GPA scores. We assume that students who liked the good connection between theory and practice (Q12.1) have high GPA scores. We also assume that the good preparation of the academic staff (Q12.2) influence the GPA. The kindness of teachers (Q12.3) may also affect the GPA. Studying many technologies and software products (Q12.4) may influence the GPA of students. Students who have work experience (Q12.5) may have greater GPA than those who do not have. We think that people who work are well organized and better prepared. We may also check the opposite research hypotheses – students who have practical experience do not make enough efforts to get high grades. Attending lectures (Q14) and exercises (Q15) may have a direct impact on grades. The time for self-preparation (Q16) may correlate with GPA. People who look for additional educational resources (Q18) may have higher GPA. Students who worked during their education (Q32) may result in high or low GPA. People who have active sporting activities (Q35) are expected to have high GPA. The place of living in Varna (Q36) affects GPA.

2. Survey Questionnaire and Data Collection

According to some researchers, the heart of each survey is its questionnaire (Marsden, 2010): it has crucial influence on the results of the survey. Therefore, questionnaires should be carefully designed, taking into account recommendations about best practices.

For the purposes of the research, the project team has developed an online questionnaire with Google Forms. An online student survey was conducted in late April, 2015 – those were the last days of attending lectures at the university for the 4th year students. 76 students, studying "Informatics" responded and filled the questionnaire.

The questionnaire comprises 39 items. Most of the questions are "closed", i.e. respondents select an answer from a set of alternatives. The majority of the closed questions are multiple-choice. Some dichotomous and Likert scale questions are also included in the survey questionnaire. There are also several "open" questions permitting respondents to enter free text.

In terms of their content, the questions are categorized as follows:

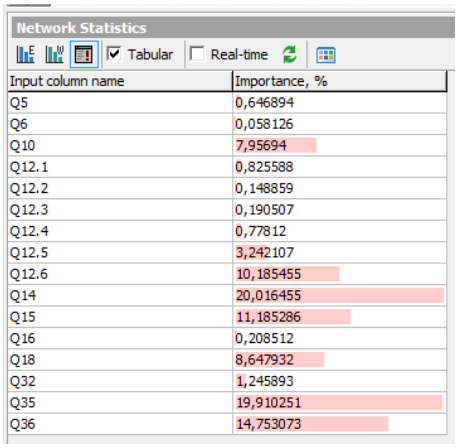
- Social and demographic characteristics of students;
- Motives for choice of specialty;
- Students' attitude to specialty studied;
- Students' attitude to the university;
- Participation in the education process;
- Students' expectations for further career, education and training.

3. Analyzing the dataset in Alyuda NeuroIntelligence

The introduction of this paper describes the input variables. These variables are set as input variables in Alyuda NeuroIntelligence. The output variable (Q11) is GPA.

A multi-layer perceptron with backpropagation is used. The architecture of the neural network is 40-27-1. The weighted connections are 1135. The most appropriate architecture is chosen. The errors are the following: train error – 0.33, validation error – 0.63, test error – 0.20.

The analysis of the connections in the neural network shows that the most important factors influencing the GPA of students are (fig. 1): the attendance of lectures (Q14), having sporting activities (Q35) and the place of living in Varna (Q36).



Input column name	Importance, %
Q5	0,646894
Q6	0,058126
Q10	7,95694
Q12.1	0,825588
Q12.2	0,148859
Q12.3	0,190507
Q12.4	0,77812
Q12.5	3,242107
Q12.6	10,185455
Q14	20,016455
Q15	11,185286
Q16	0,208512
Q18	8,647932
Q32	1,245893
Q35	19,910251
Q36	14,753073

Fig. 1. Relative importance of factors affecting the GPA of students

4. Analyzing the dataset in SPSS

A series of statistical tests have been executed in order to check and compare the results from the described neural network. Two types of statistical tests have been applied: (1) for testing the correlation between each of several independent variables and GPA and (2) for testing the difference in GPA between groups, formed by the values of the chosen independent variables. The applied nonparametric tests include Spearman's correlation (for ordinal independent variables), Kruskal-Wallis Test for testing difference between groups (for nominal independent variables) and Mann-Whitney U Test for testing difference between particular groups (nominal and ordinal independent variables). A summary of the results is shown in table 1. The dependent variable for all tests is Q11 (GPA).

The results represented in table 1 reveal that there is no statistically significant correlation between Q14 (attendance at lectures) and GPA (r=0.043, 0.725). The Kruskal-Wallis Test (χ^2 (df=3)=5.67, p=0.129) confirms this. On the other hand, there is a weak to moderate statistically significant correlation (r=0.296, p=0.013) between Q15 (attendance to exercises) and GPA (r=0.296, p=0.013). A further comparison of students attended from 50% to 80% of excesses (N=14, Md=3.95) and students attended more than 80% of exercises (N=55, Md=4.13) revealed statistically significant difference in GPA with medium effect size (U=182, z=-3.082, r=0.36). The comparison of the medians shows that the increased attendance to exercises (more than 80%) causes greater GPA (4.13 compared to 3.95).

The nonparametric tests for comparing groups (Kruskal-Wallis and Mann-Whitney U Test) revealed no statistically significant difference in GPA between groups, formed by the values of Q35 (having sports activities), Q18 (looking for additional educational resources) and Q12.6 (good attitude from teachers) as shown in table 1.

Table 1. Statistical analysis in SPSS

Independent variable	Test	Results
Q14. Attendance at lectures	Spearman's rho	r=0.043, p=0.725
	Kruskal-Wallis Test	χ^2 (df=3)=5.67, p=0.129
Q15. Attendance at exercises	Spearman's rho	r=0.296, p=0.013
	Kruskal-Wallis Test	χ^2 (df=2)=11.784, p=0.003
Q35. Having sports activities	Kruskal-Wallis Test	χ^2 (df=2)=4.304, p=0.116
Q36. Place of living in Varna	Kruskal-Wallis Test	χ^2 (df=3)=9.758, p=0.021
Q18. Looking for additional educational resources	Mann-Whitney U Test	U=357.50, z=-0.386, p=0.699
Q12.6. Good attitude from teachers	Mann-Whitney U Test	U=383.5, z=-1.225, p=0.221

When comparing groups of students by their place of living in Varna using Kruskal-Wallis test a statistically significant difference is found. The biggest difference in GPA is between students living in rented flats (N=45, Md=4) and those living with their parents (N=16, Md=4.38). The results from Mann-Whitney U test (U=218.5, z=-2.371, p=0.018) show that this difference is statistically significant with a moderate effect size (r=0.3).

5. Conclusion

The main research question of this paper is aimed at finding the most important factors influencing the GPA of students studying "Informatics". Statistical and artificial intelligence methods are applied to answer the main research question. Statistical methods (such as descriptive statistics and nonparametric tests) and Neural Networks are used to find statistically significant dependencies. Formal description of the most important dependencies is given.

The analysis of the connections in the neural network shows that the most important factors influencing the GPA of students are the following: the attendance of lectures (Q14), having sporting activities (Q35) and the place of living in Varna (Q36).

The analysis in SPSS showed the following results. There is a weak to moderate statistically significant correlation between "attendance to exercises" (Q15) and GPA. The increased attendance to exercises causes greater GPA.

The nonparametric tests for comparing groups revealed no statistically significant difference in GPA between groups, formed by the values of "having sports activities" (Q35), "looking for additional educational resources" (Q18) and "good attitude from teachers" (Q12.6).

When comparing groups of students by their place of living in Varna a statistically significant difference is found. The biggest difference in GPA is between students living in rented flats and those living with their parents. The second group has a higher GPA. This difference is statistically significant with a moderate effect size.

Future research may focus on finding other independent variables that may influence the GPA of students. Future research may focus on using the same set of independent variables to measure the influence on other dependent variables.

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Solving the Traveling Salesman Problem with the Alldifferent Constraint in MS Excel

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Abstract: The purpose of this paper is to show how to use the Alldifferent constraint in Solver in MS Excel to solve the traveling salesman problem (TSP). Previous research on the topic uses the Alldifferent constraint in combination with the INDEX function in MS Excel to select the shortest path that reaches all customers. This paper offers another approach in solving the TSP with the MS Excel Solver tool using the VLOOKUP function. Constraints for a minimal travel distance and visiting each place once are satisfied. The solution of the TSP is given as a consequence of places that may be visited. The practical implication of the proposed approach is in the sphere of distribution and transportation logistics. The example described in this paper is innovative. It may be used by other researchers and business organizations to extend their software products by adapting the proposed technology.

Keywords: MS Excel, Solver, traveling salesman problem.

1. Introduction

The traveling salesman problem (TSP) is an interesting problem in economics. It has a formal description. A lot of researchers give solutions to it. Heuristic and genetic algorithms may be used to solve the TSP. Its practical implication is in the sphere of distribution and transportation logistics. A distributor has to visit several towns or shops within a town with minimal travel costs, for minimal time, without visiting a shop (or town) twice, without using one way twice. Graphical interpretations of the solution may also be found.

The formal description of the problem helps mathematicians in creating formulas, describing the problem and writing a formal mathematical solution. In some cases the adaption of the formal mathematical equation in practice is difficult. In these cases operational managers seek for open source software solutions or try to extend their proprietary software. Making software changes is a difficult task. That is why many managers prefer to use the MS Excel spreadsheet to describe their dataset and use some of its instruments to analyze the dataset.

Describing a dataset usually is an easy task. But finding the best MS Excel instrument and using it in the appropriate way is quite difficult. Online tutorials and video clips may help us in finding a solution to a common problem. But making a replication of the solution within an own dataset in some cases does not lead to the expected result.

Nowadays the dilemma (to use ready-made software or to ask the software provider to extend the used proprietary software) is also topical. Nowadays managers have little time to make decisions. That is why in many cases they choose to analyze their data within MS Excel. MS Excel offers a lot of instruments. One of them is Solver.

Solver is used to solve a great variety of tasks, concerning logistics – finding the minimal time for operations on different machines, distribution of limited resources, making cutting plans. Solver is also used to find the minimal travel distance by solving the traveling salesman problem.

The purpose of this paper is to show how to use the Alldifferent constraint in Solver in MS Excel to solve the traveling salesman problem (TSP).

Previous research on the topic uses the Alldifferent constraint in combination with the INDEX function in MS Excel to find the shortest path that reaches all customers.

This paper offers another approach in solving the TSP with the MS Excel Solver tool using the VLOOKUP function.

Constraints for a minimal travel distance and visiting each place once are satisfied. The solution of the TSP is given as a consequence of places that may be visited. The practical implication of the proposed approach is in the sphere of distribution and transportation logistics.

The example described in this paper is innovative. It may be used by other researchers and business organizations to extend their software products by adapting the proposed technology.

2. Literature Review

The "Alldifferent constraint" in MS Excel Solver is used usually in one-dimensional arrays, when each cell has a different integer meaning [1]. If the array consists of five cells, they contain the numbers from 1 to 5 in different order. If we have a 5-element array the possible solutions are the permutations of five elements (5! = 120). Finding the best solution manually takes too much time.

Other researchers also tried to solve the TSP within MS Excel. A complex solution is given by Jiang [2]. Jiang uses Solver in combination with VLOOKUP function. Jiang uses also the Alldifferent constraint with the TRANSPOSE function.

A simple solution of the TSP using MS Excel Solver and the Alldifferent constraint is given in [3]. The INDEX function is used to extract the traveling distance between two objects (shops or cities). MS Excel Solver is used to find the best route. The result of the Solver is the consequence of shops (or cities) to be visited with minimal travel distance. A replication of the given example on a blank worksheet gives the same result as the given example in the cited paper. A replicable example gives confidence in other researchers and businessman in applying the given steps in solving the TSP.

Calculating Euclidian distances between each pair of nodes is a common technique that has a mathematical representation [4]. Rasmussen gives also a graphical interpretation of the TSP solution. A direct permutation approach is used. Rasmussen uses several MS Excel functions to solve TSP.

Different types of optimizations using the Alldifferent constraint are given by Harmon [5]. Optimizing minimal space and solving the TSP problem are some of the problems described by Harmon.

Sudoku is a game that may be easily solved by the Alldifferent constraint [6]. Since all the cells in each rectangle, in each column and in each row have to be different. Books on Android programming show how to build the Sudoku game for Android devices.

The literature review shows that many researchers try to find the TSP using Solver. Each researcher uses a unique approach for describing the dataset and the constraints within MS Excel. This fact shows great innovation in solving the TSP. Even though there are a lot of known solutions we may offer a new one.

3. Description of the solution of the TSP with MS Excel Solver and Alldifferent constraint

We use this consequence of numbers (1, 2, 3, 4 and 5) to find the consequence of visiting towns. If we succeed in making the formal description of the TSP in MS Excel, we will try to find the solution.

An MS Excel spreadsheet is used to enter the input data.

Table 1. Distances

	B	C	D	E	F
1	Table 1. Distances				
2	Way	1	2	3	4
3	1		134	197	446
4	2	134		252	387
5	3	197	252		305
6	4	446	387	305	

Table 2. Towns

	H	I
1	Table 2. Towns	
2	code	name
3	1	Varna
4	2	Burgas
5	3	Ruse
6	4	Sofia

Table 3. Travel route

	B	C
8	Table 2. Towns	
9	Town	Distance
10	1	
11	2	
12	3	
13	4	
14	Total	

A named range “distances” is created. It consists of the cells in Table 1 (from B3 to F6). This named ranged will be used later on in formulas.

We assume a round trip. The first travel distance is calculated as the distance between the forth and the first visited town. The following formula is entered in cell C10.

=VLOOKUP(B10;distances;B13+1;FALSE)

The second travel distance is calculated as the distance between the first and the second visited town. The following formula is entered in cell C11.

=VLOOKUP(B11;distances;B10+1;FALSE)

The last formula is pulled down until cell C13.

The total travel distance is calculated in cell C14 simply by using the SUM function.

=SUM(C10:C13)

The Solver tool is used (Data/Analysis/Solver).

The Solver parameters are the following.

Set objective: $C$14 (the cell with the total travel distance) to minimum.

By changing variable cells: $B$10:$B$13 (the travel route – the consequence of visiting towns or shops).

Subject to the constraints: $B$10:$B$13 = Alldifferent

Select a solving method: Evolutionary

MS Excel Solver finds a solution to the problem. The initial travel route (before using the Solver tool) is "1, 2, 3, 4" with total distance of 1137 km. After using the Solver tool, the new route is "3, 1, 2, 4" with total distance of 1023 km.

The Solver tool uses the power of the computer processor to simulate different routes and chooses the one with minimal travel distance. If this task is done manually, for four towns we need to test 24 models. The count of permutations of four numbers is calculated by the following formula 4!=24.

The increase in the number of visited places increases the complexity of the task (to find the best travel route) exponentially.

4. Conclusion

The traveling salesman problem may be solved in different ways. One of the easiest ways is using the Solver tool in MS Excel. Constraints for a minimal travel distance and visiting each place once are satisfied. The solution of the TSP is given as a consequence of places that may be visited.

The increase in the number of visited places increases the complexity of the task (to find the best travel route) exponentially. That is why using the MS Excel Solver tool the TSP may be solved easily without concern on the number of visited shops.

The practical implication of the proposed approach is in the sphere of distribution and transportation logistics. The example described in this paper is innovative. It may be used by other researchers and business organizations to extend their software products by adapting the proposed technology.

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Possible Automation of Scenario Set-up in Agent Based Simulations of Floods

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Abstract: The aim of the paper is to explore the possibility to automate the scenario set-up for Agent Based Simulation (ABS) by using the connection between GIS and ABS software. The automation can be used in early stages of flood risk assessment, when the fast and raw estimation of threats is needed. Automated simulations can save time and efforts in such assessment. GIS, ABS software and flood models inputs and outputs will be studied in order to define requirements for processing the data. The OpenStreetMap format is appropriate for the study with its vast classification and possibilities for easy filtration of required items – as roads, buildings, etc. The filtered OSM data can be used as input both in GAMA platform (ABS software). Finally, the flooded area and other properties can be added to the scenario, based on results of the physical flood model. The quality of the automatically created model will be assessed against expert-build models.

Keywords: GIS, Natural Disasters, Disaster Impact and Assessment, Spatial Analysis.

1. Introduction

In civil emergency planning, natural and other types of crisis and disasters it is very important to have a good assessment of possible threads and risk. It is crucial for evacuation to predict with a high level of certainty how the crisis situation will develop and which routes will be saved and secure.

There are many methods developed for physical assessment of natural disasters and their output can be used for prediction of effects which disaster will cause to the area and to the infrastructure. Nevertheless, the possible behaviour of the people within affected area and action of rescue teams still have to be predicted and simulated in order to identify the best option for saving people's life and properties.

The Agent Based Model simulation (ABM) is one of the most suitable approaches for simulation of human behaviour during natural disasters. Within this approach it is possible to model and simulate behaviour of different group of people depending as an example from their age and sex, depending of the time of the event – it is important whether it is working hours or it is late at night.

The ABS is an excellent option, but from the other hand it is also very resource expensive approach. It is not a routine task to set up the scene for agents. The scene setup requires georeferenced information of different kinds. Despite of these difficulties it is possible to automate the natural disaster scene set-up through well developed georeferenced data repository and synchronisation with ABM software.

In this regard the aim of the paper is to define the data, sources and procedures which can be used for automation of ABS scene setup, thus decreasing time and cost of ABS use in natural disaster analysis. The scope of the paper is limited to floods as the most frequent type

of natural disasters. There are no significant differences in setting up the scene for other types of disasters.

2. ABM Simulation – the Framework

The idea which stays behind the Agent Based Modelling (ABM) is to simulate action of autonomous agents. The agents actually can be regarded as pieces of software consisting from several rules (software code) settled into the model scene – bigger picture of agents' relationships and interactions. The target of simulation is to identify the equilibrium between the agents behaviour and their environment.[1]

The ABM was developed during 70's years of 20th century and one of the most famous first uses was the Thomas Schelling's model of segregation[2]. Since then the ABM received a lot of attention and use by many scientists and practitioners from many different fields of science and practice – from biology and engineering to economics, management, marketing and social sciences.[3] Several international and many national ABM users association were found.

The popularity of ABM (which is actually a computational method) was supported by development of software frameworks including specific languages for setting up the rules and relationships of the agents. One of the most popular frameworks are NetLogo, Repast and AnyLogic. Usually at the start of ABM use and software development the euclid measures or regular grid were used for environment description of distances. Currently, in relation to fast GIS software applications development most of the ABM software frameworks have ability to set up georeferenced environment. ABM is also frequently used in civil emergency planning. Coupled with GIS capabilities the method is used for evaluation of evacuation options, direct and indirect costs, etc .[4].

3. ABM Simulation – The Agents Behaviour and Environment Setup

The wide use of the ABM can be explained with another significant result of the approach. Through these models interaction of many agents with relatively simple behaviour (i.e. software rule) can explain much complex issues. If we focus on natural disasters and especially on floods we can see that the behaviour of agents also does not require some complex rules. We can simplify the agents' behaviour just to this type of behaviour which is related to the flood event. To the usual agent movement rules the following rules can be added:

- Rules about time – how fast the agents will react if emergency occur in certain time of day or night.
- Rules about reaction of the population – run apart the dangerous places, run to higher grounds, listen to the messages issued by rescue teams;
- Rules about rescue teams – to follow evacuation plan, to manage population agents movement according to plan, to stay in the dangerous places until the last possible moments, etc.;
- Rules related to the type of the agent: Human - age, sex, profession, disability; Building - structure, use, height, etc.
- Characteristics of infrastructure related to economic assessment of damages: direct costs of damages and indirect costs occurred with relation to the damaged infrastructure;
- Perspective places for evacuation;
- Rescue agents – fire brigades, police and medical teams, etc.;
- Time and speed of the flood.

All of these rules are related more or less to the geographical characteristics of the environment. Therefore the geo characteristics of the model scene are important for agents' behaviour. The already mentioned popular ABM software frameworks have their own software language for agents' rules implementation. For current research it is important to stress that implementation of rules is indifferent to the type of environment data – i.e. all data is imported or created within the ABM software and then it is used by all agents. Other useful aspect of such agent wide data interoperability is the fact that even some agents can be created directly from the data. The buildings, streets and other 'environmental' agents are usually created simultaneously with environment data set-up, because these agents has very simple setup and do not need special initialisation – they cannot move or react – they can only sustain some level of damages or to serve as terrain movement obstacles for other agents.

4. ABM Simulation – Use of Geo-referenced Information

Most of the current ABM software frameworks has capabilities to import most frequently used GIS file formats for environment setup. Usually ESRI Shape file is used for vector GIS layers. Model creators can use these files for exact description of streets, buildings and other types of features related to infrastructure as hospitals, police and fire departments, power or sewage lines, pipelines, etc. vector files can be of different kinds – line vectors – for streets, rivers and power lines; polygon vectors – describing area of the objects – such as buildings, lakes and fields; and point vectors – for amenities, important places, markers.

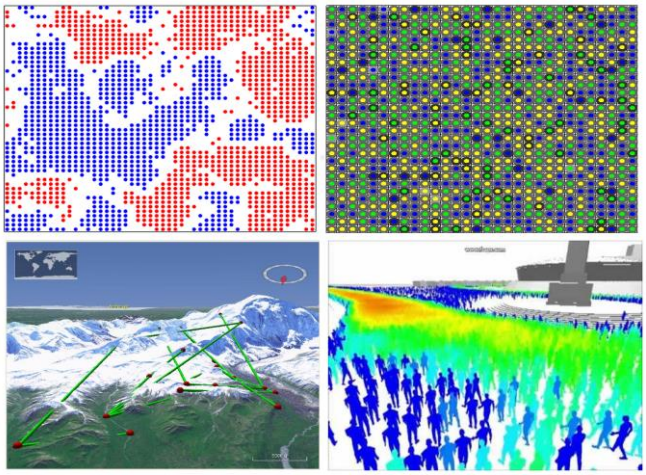

Fig. 1. From regular grid to complex GIS and architectural environment

The development of ABM frameworks, GIS and CAD software make possible agents to be disposed in environment which is very close to reality, From regular grid at the start of ABM development now it is possible to use complex GIS scenes or scenes imported from CAD files (Figure 1). Further, the new concept for GPU calculations implemented in some ABM applications permits use of several hundred thousand agents simultaneously.

5. Sources of GIS information

As an example for GIS – ABM interaction the GAMA Platform will be used. GAMA is a modelling and simulation development environment for building spatially explicit agent-based simulations.[5] GAMA is actively developed open source Java based data-driven model framework for running agent based models. It has its own model language GAML. The language has capabilities for automated creation of agents from data and specially from georeferenced data. Within GAMA platform it is possible to automatically create buildings and streets agents directly from GIS file.

GAMA uses Java bindings to popular and wildly used open source geographic library GDAL[6]. This gives possibilities to use all GDAL related software which has capabilities to run physical models of natural disaster like GRASS GIS, SAGA GIS and others.

GAMA has capabilities to import ESRI Shapefile formats as vector files (in all its varieties – point, line and polygon vectors). GAMA can utilize text format asc raster files. By importing the dataset related to shapefile GAMA and its language GAML is capable to import all vector geometries as type of agents – buildings, roads, bridges, etc.

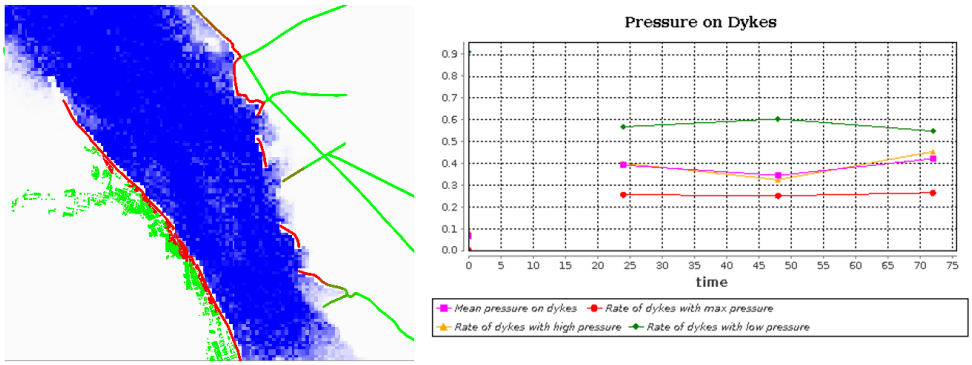

Fig. 2. Flood physical agent-based model (GAMA 1.7)

Importing asc raster file gives the Digital Elevation Model and information can be used to calculate specific values of variables in regard to position of agents. This approach can even be used for physical simulation of floods if the raster cells is treated as agents which can be flooded in certain water level as it is shown on Figure 2. If the environment information is enriched with shapefiles and infrastructure agents – like dykes and roads – the result of interaction can be observed as results of the model.

6. Global and Regional GIS Sources

The analysis of flood (or natural disaster) threads is a task that has to be done repeatedly within a region – an administrative region, a country or even bigger region. Execution of the task is a duty of regional or state administration. It is an expert type of duty – to work with many sources, geo formats and simulation procedures, on one hand. On the other hand, it is repetitive work that can become routine and boring for the experts.

In order to alleviate these contradicting duties it is a good opportunity to automate environment scene setup. The algorithm for automation will be given below after a small discussion on regional and global GIS systems as possible source of information.

In administrative or territorial organisation environment such as emergency planning agency (or units) it will be very ineffective to use separate shapefiles or raster files. Thus regional or global sources of vector and raster files are used as centralised geo information repositories. As an example the GISCO Information System of EUROSTAT can be used. GISCO provides raster files for the region of Europe[7]. Google Maps and OpenstreetMaps can be used as an example for global vector source information.

The existence of centralised vector or raster files repository is not an ultimate solution for the automation. Such repository become too big and useless if it is not accompanied by geo search and geo query capabilities.

Geo search is related to the geocoding capabilities – in general – it is the capability to find geo coordinates of the object (object is usually area or place) by its name. The next important element of automation is to query features within the region after it was found by its name. The features can be of different types – buildings, roads, industrial places, agricultural areas, etc.

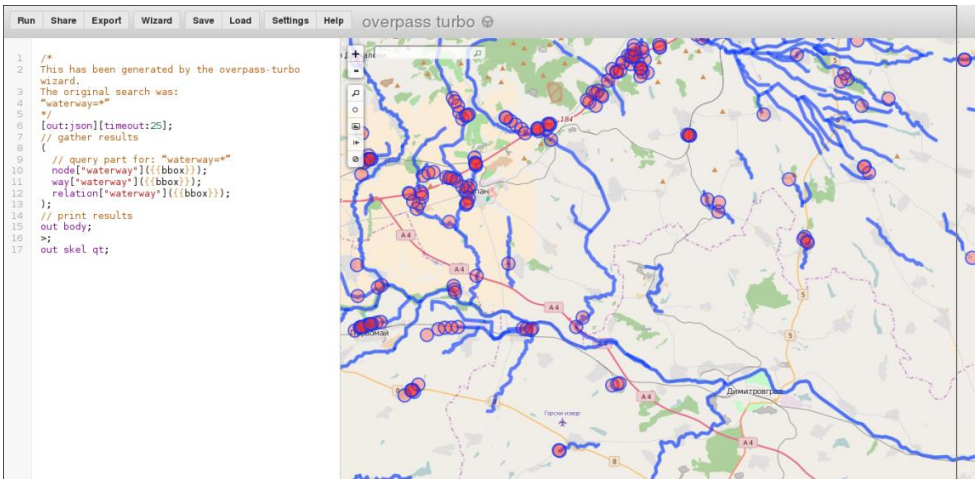

Fig. 3. Overpass Turbo visualisation of API quiery for waterways

In case of OpenStreetMap the geocoding capabilities are provided by the search engine Nominatim[8], and queries are maintained by the complex application of Overpass API[9]. The query within region (here it is called "bounding box" – bbox) for all kind of water ways and water sources can be setup as follows:

```
[out:json][timeout:25];
(
  node["waterway"]({{bbox}});
  way["waterway"]({{bbox}});
  relation["waterway"]({{bbox}});
);
out body;
>;
out skel qt;
```

The result of the query is shown on Figure 3 which represent selected waterways with Overpass Turbo – JavaScript application for visualisation of OpenStreetMap queries[10].

7. Possible automation

If we unite all consideration above we can provide two blocks of procedures that have top be sufficient to apply automation for scene setup for Agent Based Model simulations.

First block can be named **Global Sources Setup** and has to provide first prerequisite for automation – global and searchable GIS repository. This procedure has to be executed once.

```
\\ Setup vector files repository for the region
\\ Setup raster files repository for the region
\\ Provide geocoding capabilities and software
\\ Provide features query capabilities and application
(\\ Maintain and update -- according to changes during time)
```

The second block will be used for automation and will be repeated many times and can be called “Selected region setup”.

```
\\ Search by Name (or coordinates)
   search(Name) -> defining region (bbox);
   cut raster files within bbox;
   query vector sources by bbox;
\\ Filter for types:
   filter for(rivers, buildings, roads, barriers) \\ line and polygons;
\\ Create files:
   create shape files for: each type of data imported agents;
   create relief with .asc file;
   run physical flood model -> create .asc file for flooded area;
\\ Import all files in ABM Scenario
```

Such kind of automation is possible and if all sources prerequisites are implemented the ABM simulation can be utilized many times and the efforts needed for risk analysis will be significantly diminished.

8. Conclusion

Summarising, the automation of ABM scene setup is possible and even easy if central repository for geo information and files exists. Such repository can be provided as web service or file server. Decision what kind of repository to use is central for the type of automation that will be used.

Automation can save time and can provide more detailed plan for evacuation and for assessment of floods as a whole for all populated areas within a region. The weakness of this solution can be the absence or poor quality of information.

Acknowledgment

The authors express their gratitude to the Bulgarian National Science Fund for the partial financial support under the Grant № DFNI-I02/15 from 12.12.2014, titled "Information System for Integrated Risk Assessment from Natural Disasters".

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One Problem from Approximation Theory

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Abstract: We generalize and give the solution of one famous problem from the book Approximation of Functions by G. G. Lorentz [4. p. 52]

Keywords: Finite difference, moduli of smoothness, algebraic polynomials

1. Introduction

Theorems concerning equivalence between K functional and moduli of smoothness are a well known results in approximation theory (see [3]) . With $Dg = g^{(r)}$ and $X = L_p = L_p[a,b]$ with the usual L_p norm denoted by $\|.\|_p$ for $1 \le p < \infty$ or $X = C = C[a,b]$ with the uniform norm denoted by $\|.\|_\infty$ for $p = \infty$ the K-functional is of the form

$$K(f,t;X,Y,D) = \inf\left\{\|f-g\|_X + t\|Dg\|_X : g \in Y\right\}.$$

The classical moduli of smoothness are defined by

$$\omega^r(f,h)_p = \sup_{0<t\le h}\left\|\Delta_t^r f(x)\right\|_p \qquad r = 1,2,..., \qquad 0 \le h \le \frac{b-a}{r};$$

And the finite difference with a fixed step *t* is given by

$$\Delta_t^r f(x) = \begin{cases} \Delta_t^r f(x) = \sum_{k=0}^{r} (-1)^{r+k} \binom{r}{k} f(x+kt) & \text{if } x, a+rt \in [a,b] \\ 0, & \text{otherwise.} \end{cases}$$

The space AC_{loc}^k is given by

$AC_{loc}^k = AC_{loc}^k(a,b) = \left\{g : g', ..., g^{(k)} \in AC[c,d] \quad \forall a < c < d < b\right\}$, $AC[c,d]$ is the set of the absolutely continuous functions on $[c,d]$.

As already mentioned, the moduli $\omega^r(f,h)_p$ and $K(f,t^r;L_p,AC_{loc}^{r-1},D^r)$ are equivalent. For example Theorem 2.1.1 Chapter 2 in [2] (see also [1]) states that (in case when the weight function $\varphi \equiv 1$), there are positive constants C_1, C_2, such that for all $f \in L_p(a,b), 1 \le p \le \infty, \ 0 < h \le h_0$

$$C_1\omega^r(f,h)_p \le K(f,h^r;L_p,AC_{loc}^{r-1},D^r) \le C_2\ \omega^r(f,h)_p .$$

Here we present solution of the following

Problem. *Let* $f \in C[a,b]$. *Prove that* $\omega^r(f,h)=0$ *for some natural r and some real number h*>0 *if and only if* f *is a polynomial of degree r*-1.

2. Solution

If f is a polynomial of degree *r*-1, then obviously $\forall t>0$ - sufficiently small fixed number,

$\Delta_t f(x)$ is a polynomial of degree *r*-2, $\Delta_t^2 f(x)=\Delta_t(\Delta_t f)(x)$ is a polynomial of degree *r*-3, …, $\Delta_t^{r-1} f(x)=\Delta_t(\Delta_t^{r-2} f)(x)$ is a polynomial of degree 0, i.e. const.,

$\Delta_t^r f(x)=\Delta_t(\Delta_t^{r-1} f)(x)\equiv 0$, i.e. $\Delta_t^r f\equiv 0$ and then $\omega^r(f,h)=0$.

Let now $\omega^r(f,h)=0$ for some *h*>0. If

$K(f,h^r)=\inf\left\{\|f-g\|_{C[a,b]}+h^r\left\|g^{(r)}\right\|_{C[a,b]} : g\in AC_{loc}^r\right\}$ then

$C_1\omega^r(f,h)\le K(f,h^r)\le C_2\omega^r(f,h)$ for some positive constants C_1, C_2, i.e.

$K(f,h^r)\equiv 0$ for some *h*>0. Hence if *n* is sufficiently large natural number, then there exists a function $g=g_n$ such that

$$\|f-g\|\le\frac{1}{n} \quad \text{and} \quad \left\|g^{(r)}\right\|\le\frac{1}{n}, \tag{1}$$

where $g\in C^{r-1}[a,b]$, $g^{(r-1)}\in AC_{loc}[a,b]$ and all norms are sup – norms (in *C*[*a*, *b*] space). We obtain successively

$$g^{(r-1)}(x)=g^{(r-1)}(x_0)+\int_{x_0}^{x} g^{(r)}(s)ds,\ \forall x\in(a,b),$$

where $x_0\in(a,b)$ is a fixed number;

$$\left|g^{(r-1)}(x)-g^{(r-1)}(x_0)\right|=\left|\int_{x_0}^{x} g^{(r)}(s)ds\right|\le\left|\int_{x_0}^{x}\frac{1}{n}ds\right|=\left|\frac{x-x_0}{n}\right|\le\frac{b-a}{n},\ \text{i.e.}$$

$$\left|g^{(r-1)}(x)-g^{(r-1)}(x_0)\right|\le\frac{b-a}{n},\ \forall x\in(a,b). \tag{2}$$

Since $\int_{x_0}^{x}\left(g^{(r-1)}(s)-g^{(r-1)}(x_0)\right)ds=g^{(r-2)}(x)-g^{(r-2)}(x_0)-g^{(r-1)}(x_0)(x-x_0)$, from (2)

$$\left|g^{(r-2)}(x)-g^{(r-2)}(x_0)-g^{(r-1)}(x_0)(x-x_0)\right|$$

$$\leq\left|\int_{x_0}^{x}\left|g^{(r-1)}(s)-g^{(r-1)}(x_0)\right|ds\right|$$

$$\leq\left|\int_{x_0}^{x}\frac{b-a}{n}ds\right|=\left|\frac{b-a}{n}\right|\left|x-x_0\right|\leq\frac{(b-a)^2}{n},\quad\forall x\in(a,b).$$

(3)

If we put $x=s$ in (3) and integrate on $s\in(x_0,x)$ we obtain

$$\left|g^{(r-3)}(x)-g^{(r-3)}(x_0)-g^{(r-2)}(x_0)(x-x_0)-g^{(r-1)}(x_0)\frac{(x-x_0)^2}{2!}\right|\leq\frac{(b-a)^3}{n},\quad(4)$$

$\forall x\in(a,b)$. Thus one obtain by induction for any $l=1, 2, \ldots, r$,

$$\left|\begin{array}{l} g^{(r-l)}(x)-g^{(r-l)}(x_0)-g^{(r-l+1)}(x_0)(x-x_0)-g^{(r-l+2)}(x_0)\frac{(x-x_0)^2}{2!}-\ldots \\ -g^{(r-1)}(x_0)\frac{(x-x_0)^{l-1}}{(l-1)!}\end{array}\right|\leq\frac{(b-a)^l}{n},\quad\forall x\in(a,b).\quad(5)$$

Really, for $l=1, 2, 3$ inequality (5) coincides with (2), (3) and (4) respectively. If we integrate

$$g^{(r-l)}(s)-g^{(r-l)}(x_0)-g^{(r-l+1)}(x_0)(s-x_0)-g^{(r-l+2)}(x_0)\frac{(s-x_0)^2}{2!}-\ldots$$

$$-g^{(r-1)}(x_0)\frac{(s-x_0)^{l-1}}{(l-1)!}$$

on $s\in(x_0,x)$, we obtain the following estimate:

$$\left|\begin{array}{l} g^{(r-l-1)}(x)-g^{(r-l-1)}(x_0)-g^{(r-l)}(x_0)(x-x_0)-g^{(r-l+1)}(x_0)\frac{(x-x_0)^2}{2!}-\ldots \\ -g^{(r-1)}(x_0)\frac{(x-x_0)^l}{l!}\end{array}\right|\leq\left|\int_{x_0}^{x}\frac{(b-a)^l}{n}ds\right|\leq\frac{(b-a)^{l+1}}{n},\quad\forall x\in(a,b).$$

This inequality is of the type (5) with $l+1$ instead of l. Thus we prove (5) for $l=1, 2, \ldots, r$.

From (5) for $l=r$, we obtain:

$$\left| g(x)-\left(g(x_0)+g'(x_0)(x-x_0)+g''(x_0)\frac{(x-x_0)^2}{2!}+\ldots \right.\right.$$
$$\left.\left.+g^{(r-1)}(x_0)\frac{(x-x_0)^{r-1}}{(r-1)!}\right)\right| \le \frac{(b-a)^r}{n}, \quad \forall x\in(a,b). \tag{6}$$

If we denote the polynomial of degree r-1

$$P_{r-1,n}(x)=g(x_0)+g'(x_0)(x-x_0)+g''(x_0)\frac{(x-x_0)^2}{2!}+\ldots$$
$$+g^{(r-1)}(x_0)\frac{(x-x_0)^{r-1}}{(r-1)!},$$

which depends on n, since $g=g_n$, then from (6)

$$\left|g_n(x)-P_{r-1,n}(x)\right| \le \frac{(b-a)^r}{n}, \ \forall x\in(a,b). \tag{7}$$

Now from (7) and the first inequality of (1), $\forall x\in(a,b)$

$$\left|f(x)-P_{r-1,n}(x)\right| \le \left|f(x)-g_n(x)\right|+\left|g_n(x)-P_{r-1,n}(x)\right| \le \frac{1}{n}+\frac{(b-a)^r}{n}, \text{ i.e.}$$
$$\left|f(x)-P_{r-1,n}(x)\right| \le \frac{1+(b-a)^r}{n}, \ \forall x\in(a,b). \tag{8}$$

Since $\lim\limits_{n\to\infty}\frac{1+(b-a)^r}{n}=0$ and $f(x)\in C[a,b]$, then from (8) it follows that

$$\lim_{n\to\infty}\left\| f(x)-P_{r-1,n}(x)\right\|=0 \tag{9}$$

in sup - norm. Since the degree of all the polynomials $P_{r-1,n}(x)$ is no more than r-1, from (9) we will prove that $f(x)$ is also polynomial of degree no more than r-1.

Indeed, let $P_{r-1,n}(x)=a_0^{(n)}+a_1^{(n)}x+\ldots+a_{r-1}^{(n)}x^{r-1}$, where the coefficients $a_i^{(n)}, \quad i=0,1,\ldots,r-1$ depend on n and let $x_i\in(a,b), \quad i=1,2,\ldots,r$ be fixed numbers, such that

$$a<x_1<x_2<\ldots<x_r<b. \tag{10}$$

Then from (9),

$$a_0^{(n)} + a_1^{(n)} x_1 + ... + a_{r-1}^{(n)} x_1^{r-1} = f(x_1) + \varepsilon_1^{(n)},$$
$$a_0^{(n)} + a_1^{(n)} x_2 + ... + a_{r-1}^{(n)} x_2^{r-1} = f(x_2) + \varepsilon_2^{(n)},$$
.
.
.
$$a_0^{(n)} + a_1^{(n)} x_r + ... + a_{r-1}^{(n)} x_r^{r-1} = f(x_r) + \varepsilon_r^{(n)},$$

where

$$\lim_{n\to\infty} \varepsilon_i^{(n)} = 0, \ i=1,2,\ldots,r, \tag{11}$$

$\varepsilon_i^{(n)}$ are positive or negative numbers, close to 0. From (10),

$$\Delta = \begin{vmatrix} 1 & x_1 & x_1^2 & ... & x_1^{r-1} \\ 1 & x_2 & x_2^2 & ... & x_2^{r-1} \\ . & . & . & . & . \\ 1 & x_r & x_r^2 & ... & x_r^{r-1} \end{vmatrix} \neq 0$$ is not depending on n. Then

$$a_i^{(n)} = \frac{1}{\Delta} \begin{vmatrix} 1 & ... & x_1^{i-1} & f(x_1) + \varepsilon_1^{(n)} & x_1^{i+1} & ... & x_1^{r-1} \\ . & . & . & . & . & . & . \\ 1 & ... & x_r^{i-1} & f(x_r) + \varepsilon_r^{(n)} & x_r^{i+1} & ... & x_r^{r-1} \end{vmatrix}, \ i=0, 1, \ldots, r\text{-}1.$$

From (11) it is clear that there exists

$$\lim_{n\to\infty} a_i^{(n)} = a_i := \frac{1}{\Delta} \begin{vmatrix} 1 & ... & x_1^{i-1} & f(x_1) & x_1^{i+1} & ... & x_1^{r-1} \\ . & . & . & . & . & . & . \\ 1 & ... & x_r^{i-1} & f(x_r) & x_r^{i+1} & ... & x_r^{r-1} \end{vmatrix}, \ i=0, 1, \ldots, r\text{-}1. \tag{12}$$

Since the interval $[a, b]$ is bounded from (12) we obtain

$$\lim_{n\to\infty} \left(a_0^{(n)} + a_1^{(n)} x + ... + a_{r-1}^{(n)} x^{r-1} \right) = a_0 + a_1 x + ... + a_{r-1} x^{r-1} \tag{13}$$

in sup – norm. If $P_{r-1}(x) = a_0 + a_1 x + ... + a_{r-1} x^{r-1}$ from (9) and (13)

$$\lim_{n\to\infty} P_{r-1,n} = f \quad \text{and} \quad \lim_{n\to\infty} P_{r-1,n} = P_{r-1}$$

in sup – norm. From the uniqueness of the limit, it follows that

$$f(x) = P_{r-1}(x) = a_0 + a_1 x + \ldots + a_{r-1} x^{r-1},$$

i.e. $f(x)$ is a polynomial of degree no more than r-1. The proof is completed.

Remark. The last conclusion can be obtained**,** using that every finite linear subspace of a complex topological vector space is closed (see[5, Theorem 1.21].

We can formulate the following generalization:

Problem. *Let* $f \in C[a,b]$ *and for some natural r* $\omega^r(f,h) = o(h^r)$ *as* $h \to 0+$. *Then f is a polynomial of degree r*-1.

Proof. As in previous proof we use that moduli are equivalent to proper K – functional.

$$K(f,h^r) = \inf\left\{\|f-g\|_{C[a,b]} + h^r \left\|g^{(r)}\right\|_{C[a,b]} : g \in AC^r_{loc}\right\} \approx \omega^r(f,h) = o(h^r)$$

and putting $h = 1/n$, we obtain that

$$K(f,n^{-r}) = \inf\left\{\|f-g\|_{C[a,b]} + \frac{1}{n^r}\left\|g^{(r)}\right\|_{C[a,b]} : g \in AC^r_{loc}\right\} \approx o(n^{-r})$$

when $n \to \infty$. Then for any natural number n, there exists a function $g = g_n \in C[a,b]$ such that $g \in AC^r_{loc}$ and $\|f-g\|_{C[a,b]} = o(n^{-r})$ and $\frac{1}{n^r}\left\|g^{(r)}\right\| = o(n^{-r})$.

Then $\lim_{n\to\infty}\|f-g_n\|_{C[a,b]} = 0$ and $\lim_{n\to\infty}\left\|g_n^{(r)}\right\|_{C[a,b]} = 0$, which is analogous to the inequalities (1). As in previous proof, we conclude that $f(x)$ is a polynomial of degree no more than r-1.

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A Practical Aspect in Designing an Integrated Conjoint Analysis Module for Undergraduate classes

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Abstract: The paper reviews a Fink's model of an integrated course design and examines the issues of creating significant learning experiences for the students. As an experiential adoption of the model, the paper represents the outcomes of designing and running a Conjoint Analysis Module in an Undergraduate class during the academic 2014/15. Analyzing students' experiences, some critical break points during the learning process are outlined, and students' misunderstanding of the analysis implications is boldly regarded. That reveals a need of adjusting to the module structure a relevant simulation tool for doing conjoint analysis in terms in its practical embodiment by making business decisions.

Keywords: Conjoint analysis, marketing simulation, Undergraduates.

1. Introduction

Teaching is engaged with two closely related activities of designing: design of the course itself by making a number of decisions about the way the course will be taught, and design of the teacher-student interactions as an implementation of that course. The concept of the second – "teacher-student interaction" – is to be considered as a matter of lecturing, leading discussions, running labs, advising, communicating by email, etc. As the recent academic research confirms, in instructional designing the teacher, from one side, is claimed to design comprehensive but "amendable to learning" course content and to transmit knowledge (explicitly) and understanding (implicitly) through appropriate activities and interactions with the students. Students, from other side, assume an attitude to be open to instruction, although they could easily skip important structural elements of a given module design considering them as too theoretical and abstract. That often causes preconditions that some break points within the learning process to emerge. Increasingly, students evaluate the importance of a course design from a single perspective: whether the instructional design brings them about the appreciation of how the theoretical principles' output can be relevant in practice.

The purpose of this paper is to review some of the mentioned challenges both parties – the teacher and the students – *could* overcome in order to pursue learning goals set within a course. As a context, within which an attempt to overcome those challenges is made, a Conjoint Analysis Module is academically designed for Undergraduate classes on the grounds on the Fink's model of Integrated Course Design. Sequentially, a relevant simulation tool to the module design is adjusted as an opportunity to provide a highly interactive student experience that will foster understanding of how conjoint analysis is used for managerial decision-making.

2. Fink's Model of Designing Integrated Courses in Higher Education

An exemplary concept for Integrated Course Design elaborated by L. Dee Fink as a systematic process for designing courses is introduced here. The process embraces basic components of the instructional design itself, but it takes place by assembling those components into a relational, integrated model. The basic components in the model more or less are the same as those found in other models of instructional design [2, 4, 8]: analyzing situational factors, formulating learning goals, designing feedback and assessment procedures, and selecting teaching/learning activities. Under the Fink's model these components are revealed and emphasized into their interrelatedness.

The first component in the Fink's model of Integrated Course Design is to gather information about the *situational factors* (e.g., how many students are in the course, what kind of prior knowledge are the students bringing to the course about this subject, etc.). Should the information about the situational factors has been gathered, the first decision is to be about setting *learning goals,* or what the teacher wants students to get out of the course. There are two relevant approaches to this task: content-centered and learning-centered ones. Fink puts special stress on the second approach and extends it to a *significant leaning approach* by proposing taxonomy of it. The approach consists of six major types of significant learning: 1) getting foundational knowledge, 2) learning how to learn, 3) caring with developing new interests and values, 4) developing skills, including the ability to manage projects, 5) human dimension of learning about oneself and the others and 6) integration by connecting ideas, people. The taxonomy identifies significant kinds of learning that the teacher may want to set as important learning goals of his/her course. A determined feature of this particular taxonomy is that each kind of learning is an interactive one – the more teacher realistically includes, the more goals will support each other, and the more valuable student's learning will be [3].

The next decisions within applying the model need to be on the *feedback and assessment* where an inquiry about what students will do to demonstrate they have achieved the learning goals already set. The advantage of working on the feedback-and-assessment at this early stage of the course design is that when it becomes clear about what constitutes successful student performance, it is much easier to develop effective teaching/learning activities. Precisely then, appropriate *teaching/learning activities* are to be formulated. If there are significant learning goals and effective assessment procedures, it is most likely to incorporate Fink's active learning modus into the course design. And finally, the course design should be checked for internal *integration* to make sure that all the components are in alignment and support each other: whether the learning activities are consistent with all the learning goals, and whether the feedback and assessment activities are consistent with both the learning goals and the learning activities.

3. Designing and Exercising an Integrated Conjoint Analysis Module

Conjoint analysis has become one of the most commonly used quantitative market research methods both relevant for managerial decision making, and successfully adopted towards the academic purposes. It has been successfully employed across a wide variety of industries to quantify consumer preferences for products and services. As such, the conjoint analysis was been determined as a significant syllabus component of a Marketing Analyses Course designed for an Undergraduate class at a higher educational institution in Bulgaria

during the academic 2014/15. Purposefully, it was represented as Conjoint Analysis Module (integrated within a Marketing Analyses Course). It was adjusted on the grounds of the systematically developed Conjoint Analysis Toolkit within the Harvard Business Publishing. Recently upgraded, the Toolkit includes three custom-blended modules: a) Conjoint Analysis: Online Tutorial, b) Conjoint Analysis: A Do-It-Yourself Guide and c) Marketing Simulation: Using Conjoint Analysis for Business Decisions.

The first component, the Tutorial, provides students with an overview of the analysis, its key concepts, and several "try-it" exercises for hands-on learning. Once students complete the Tutorial, they should know the basics of the conjoint analysis – namely, what the conjoint analysis is, how it is conducted, who tends to use it, when and why it is applied.

From that perspective, a possible approach to assign the Conjoint Analysis: Online Tutorial to bold the learn-by-exercise experience is preferably after an introductory class lecture. In this approach the students, who have gained a good theoretic sense of what the method is about, can solidify their knowledge and later focus on their interactive tasks that allow them to experience many of the concepts first-hand. [6] In particular, the Tutorial gives students the opportunity to walk through the major steps involved, namely: conceiving, designing, implementing, and using a conjoint study. As part of the completing the Tutorial, students also have the opportunity of taking part in a conjoint study themselves – thus gaining a "respondent's perspective". [7]

Being presented to the Undergraduate students for the purposes of the Conjoint Analysis Module, the access to and the use of the Tutorial was optional. However, being given such an opportunity, students did not get used of its pedagogical capacity and value, and its usefulness by means of the interactive 'try-it" exercises. There were three particular reasons for that students signalized about after being surveyed at the end of the course. From 37 valid responses 47% preferred to be assigned the alternative course modules included in the current Marketing Analysis Course – Perceptual Mapping and SWOT Analysis, rather than selecting the Conjoint Analysis Module, ranging it as the most difficult option to be assigned for a final evaluation; 37% pinpointed that the content of the Tutorial is basically covered by the uploaded teaching materials and the students could independently obtain a good theoretical sense of the analysis; 14% claim that the access to the Tutorial was not for free but at the expenses of the student; for 2% the language of instruction was not the native one. Considering only the positive disposition to the Conjoint Analysis Module, the proportion of the student responses proves that the students consider the Tutorial as relevant but they still prefer to learn passively using the materials adjusted by the lecturer.

The second pedagogically structured component of the Toolkit – Conjoint Analysis: A Do-It-Yourself Guide [5] – was also used as a source of designing a Conjoint Analysis Module for the Undergraduate class because it provides practical guidelines for implementing and analyzing a conjoint study. Namely, it covers designing, conducting and analyzing activities of the conjoint analysis survey. In addition, several helpful Microsoft Excel spreadsheets are included to accompany the note and can be used as aids where referred to.

The Guide focuses on the standard format of ratings-based conjoint analysis, in which consumers are to be asked to provide independent ratings of various profiles, on a numeric scale. This format is convenient to administer, and it yields data that are easy to analyze using standard software such as Microsoft Excel. Applying that type of conjoint analysis entails the following six steps: 1) select product attributes, 2) select levels for these attributes, 3) create product profiles, 4) collect data, 5) estimate partworths, 6) derive insights and make predictions.

In practical aspect, the students, who selected the Conjoin Analysis Module, got involved with the analysis by applying the Guide, and by following the enclosed case. Even, they understand more about the concept of the conjoint analysis while they were applying it in individually chosen cases, given as an assignment for their final evaluation. The outcomes of that basic qualitative research [1] after examining and analyzing these assignments gave evidence that the ability to apply conjoint analysis can be evaluated as above the average. Moreover, the Guide proved to be teachable and student-friendly because there were excellent graded assignments of students with non-marketing background who also attended the Marketing Analyses Course and chose to accomplish Conjoint Analysis Module.

Almost all of the students' analyses submitted (20 analyses) were applied for a chosen tangible product [Table 1], and only one – for a service [Table 2].

Table 1. An example of a student's application of the Conjoint Analysis for a tangible product.

STEP DESCRIPTION	**TANGIBLE PRODUCT**			
	Mountain Bike			
Product attribute selection	Frame type	Frame material	Tire size *(in diameters)*	Price *(in BGN)*
Attribute's levels selection	Cross Country	Aluminum	26"	≤ 2 500
	Enduro	Carbon	27.5"	2500 – 5000
	Downhill	Mixed	29"	≥ 5000
Product profile creation	• 15 suggested designs • *Base product profile* {Cross Country; Carbon-made frame; Tire of 27,5"; Price - under 2500 lv.}			
Data collection and procession	• Survey: online conducted by Google Spreadsheet • Sample: 22 respondents targeted (experienced bike-riders, Bulgarian, men, aged between 19 – 25) • 20 valid responses received • 15 product profiles (observations) studied: each option is rated by selecting the number on the seven-point preference scale (1 is lowest, 7 is highest) • Best rated profile before the Regression analysis {Downhill; Mixed materials; Tires of 27,5"; up to 5000 lv.} = 4,95 (average value)			
Partworths estimation *(Utility)*	Intercept = 4,85; *Ideal product profile* {Enduro/Downhill; Mixed frame; Tire of 27,5"; up to 5000 lv.} U (Ideal Profile) = 6,75			
Insights derivation and predictions	Attribute importance: n.a. Predicting consumer choice between two alternatives: n.a.			

Students usually define 4 – 4, 5 attributes of a product and about 2,5 levels per attribute. Using the Experimental Profile Design of the product, based on Microsoft Excel sheet, they create optimal set of profiles – between 9 and 16 – corresponding to the number of attributes and their levels. A fault-finding question students arise after generating product profiles is about the criteria and the need of defining Base Product Profile. (This is the profile of the product that consumers are or could be already aware of, or that the firm can produce if other thing been equal.) About 50 per cent of the analyses were based on quick surveys with simple rating-based questionnaires conducted online by Google Sheet. The other half of the analysis imitated conducted survey by rehearsing various ratings of the generated profiles. Nevertheless, the prevailing part of them correctly applied the Regression Analysis needed, which help them to estimate the partworths and to evaluate the utility of an Ideal Product Profile, also required by the conjoint concept.

Table 2. An example of a student's application of the Conjoint Analysis for a service.

STEP DESCRIPTION	**SERVICE**				
	Postgraduate education				
Product attribute selection	Country of origin of the university	Language of instruction	Period of study	Rating	Price *(in €/year)*
Attribute's levels selection	Bulgaria	Bulgarian	1–2 years	Top 100	Free
	UK	English	≥ 2 years	Top 1000	≤ 4000
	Germany	German			≥ 4000
Product profile creation	• 9 suggested designs • *Base service profile* {University in Germany; Instruction in English; 1 year study; Between Top 100 ≤ 4000 €/year }				
Data collection and procession	• Survey: online conducted by Google Spreadsheet • Sample: 20 respondents targeted (graduating students, Bulgarian, aged between 21 – 24) • 20 valid responses received • 16 product profiles (observations) studied: each option is rated by selecting the number on the seven-point preference scale (1 is lowest, 7 is highest)				
Partworths estimation *(Utility)*	Intercept = 5,27 U (Ideal Profile): n.a.				
Insights derivation and predictions	Attribute importance: n.a. Predicting consumer between two alternatives: n.a.				

An obvious gap in applying the conjoint analysis appears during its last essential step of conduction, when insights should be derived and consumer choice between two alternatives should be predicted. What students actually did was to boost their efforts towards building the theoretical framework of the analysis. They succeeded in identifying and estimate the two poles of the designed options – the Base Product Profile and the Ideal Product Profile, but they realized it was prelude to the constructive application of the analysis. Finally, students confessed they oversighted the applicability of the Tutorial and the opportunity to become aware with the entire analysis, especially with its last critical phase of predicting customer choices of the product. They confirmed they understood the concept of the conjoint analysis, but they still missed the knowledge of its practical implication for managerial decision-making.

4. Adjusting a Relevant Simulation Tool in Doing Conjoint Analysis for Business Decisions

The concerns of the above uplift couple of methodical inconsistencies of the initial design of the Conjoint Analysis Module within the Marketing Analysis Course arise. Redefining the current *learning objectives* should bring an apparent induction about the core of the module. Setting the objective "ability to apply conjoint analysis for business decisions" should require a revision of the *module structure* in terms of the sequence of the

content provided. Then, the major issues should be identified and the proper array for introducing them to the students should be re-planned. Moreover, the initial ideas for the assignments or topics that would reflect the increasing complexity of the subject as students move from issue to issue should be reconsidered.

In that respect, the *instructional strategy* also should be revised. This requires some new activities to be set up. Students need to be given opportunities both to practice and to self-assess the quality of their performance. Obviously both the Online Tutorial and the Do-It-Yourself Guide can get students ready and prepared for later work. But although Undergraduate students can yield from the Tutorial and the Guide as instructional references, the need to practice the conjoint analysis from decision-making perspective still remains demanding. Formulated as a learning objective, it could be pursued by the third component of the comprehensive Conjoint Analysis Toolkit called *Marketing Simulation: Using Conjoint Analysis for Business Decisions*© [Fig. 1].

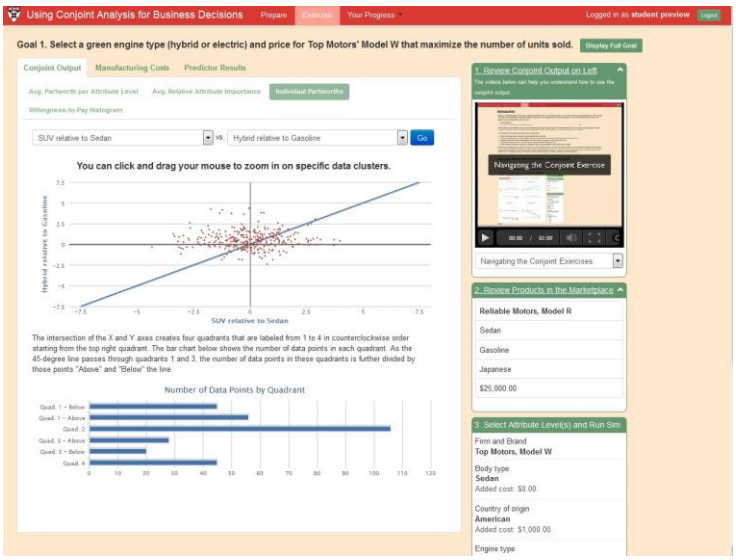


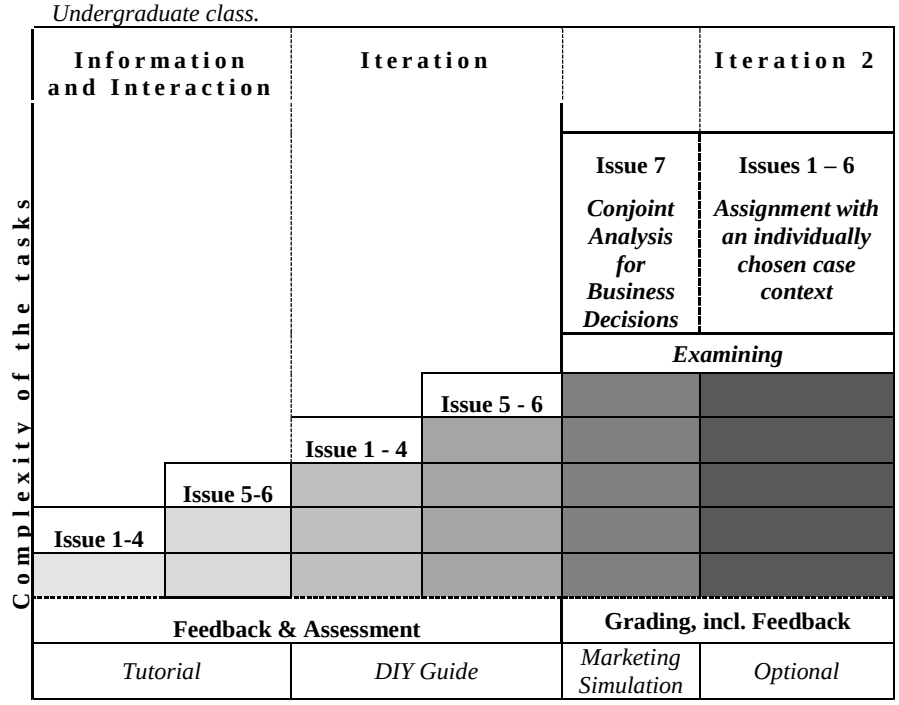
Fig. 1. Interface of the Marketing Simulation: Conjoint Analysis for Business Decisions.

The simulation is designed to reinforce student understanding and use the conjoint analysis as one of the most popular market research methods in academia and practice. Released in June 2015 its goal is to provide students with an appreciation of how conjoint analysis output can be relevant in practice, and to provide an interactive experience of using conjoint analysis for managerial decision-making. Delivered online, the simulation gives students exposure to key business concepts such as demand curves, segmentation, profit functions, competitive responses, vertical and horizontal differentiation, optimal pricing, niche vs. mass market strategies, product portfolio management, and brand equity. [7] In all cases, the link to conjoint analysis and its output is made explicit. It includes two scenarios: the Green Car exercise and the Over-the-Counter Cold and Flu Medicine exercise. Across these two scenarios, students work on a series of goals and face a host of competitive settings. In order to inform their decisions in each of the settings, students have access to the results of a conjoint analysis study. They can see these results in various ways and can run market simulations (e.g., what would demand in units or sales be for each product and at what price, simulated under various conditions).

After considering some of the situational factors of conducting the Conjoint Analysis Module in an Undergraduate class during the academic 2014/15, a revision of the experimented module design is being suggested. Taking into account (a) the specific context of the teaching-learning process, (b) the nature of the subject and (c) the characteristics of the examined class, the Fink's concept of aligning the learning objectives with an appropriate module structure and instructional strategy has been adjusted [Table 3]. The revision is based on an iterating procedure of repeating the conjoint analysis application with an increasing complexity of the assignments.

The first step called "Information and Interaction" stage is about to become aware with the concept of the conjoint analysis issue-by-issue (e.g. from sub-topic 1 to sub-topic 6), using the Conjoint Analysis Tutorial or some recommended readings. "Iteration" stage is a repetition of the analysis – again issue-by-issue (again from sub-topic 1 to sub-topic 6) – and it is designed to get students acquainted to the application of the conjoint analysis propped on "A Do-It-Yourself Guide".

Table 3. A revised structure of a Conjoint Analysis Module conducted and examined within an Undergraduate class.



At this stage the student's role is assumed to be, more or less, reflective into the teacher-student educational encounter, rather than proactive. "Iteration 2" stage would be an option for a final exam assignment and students themselves should choose the case to implicate into the conjoint analysis study. An alternative exam option would be conduction of the Conjoint Analysis: Marketing Simulation. In that case, students simultaneously will be instructed and be given proper feedback because of the learning-by-doing nature of the tool. But although that marketing simulation here is being charged with higher expectations, there is no history of how it has been exercised and perceived by the students so far. It is newly

released and the intentions about the possible student perceptions of learning-by-playing it remain hypothetical.

5. Conclusion

The purpose to design the iteration-based content structure of the Conjoint Analysis Module within a Marketing Analyses Course targeted for Undergraduates during the academic 2014/15 was to use the Fink's Significant Learning Concept into a concrete academic context and to be given relevant insights about the actual implications of that module. Built on the grounds of the Conjoint Analysis Toolkit©, systematically elaborated by Ofek and Toubia within Harvard Business School, the module gives promises to provide students with a significant learning groundwork by exercising the analysis. In that respect, the spinning *modus operandi* pursued is learning-by-doing. Practicing the conjoint analysis is then supported by an online-based tutorial and interactive tools.

A demanded practical aspect in designing a Conjoint Analysis Module for Undergraduates is mainly considered here as adjusting a simulation tool that reinforces student understanding and use of one of the most popular market research methods in academia and practice – conjoint analysis. The Marketing Simulation: Using Conjoint Analysis for Business Decisions© provides students with an appreciation of how conjoint analysis output can be relevant in practice, and to provide a highly interactive experience of using the analysis for managerial decision-making.

For that reason the described Conjoint Analysis Module for Undergraduates could be considered as a map for future qualitative in-class research of pursuing given academic outcomes.

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Heavy Traffic Analysis of Fluid Queue with *BMAP* Batch Fluid Arrivals

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Abstract: In this paper a *BMAP*-modulated fluid flow queuing model is considered. This is an extension of the conventional Markov modulated fluid flow model. In the conventional Markov modulated fluid queue, the buffer content process has a continuous sample path. This paper concerns a Markov modulated fluid queue whose buffer content process may have jumps Fluid arrives from outside according to the *BMAP* process and fluid level increases vertically at the arrival instances. The two types of fluids are governed by Markov chain with a finite space. The total buffer content is considered. The stationary joint distribution of the total buffer content and the background state is obtained under heavy traffic assumptions.

Keywords: Fluid queue, *BMAP* arrival of batches, heavy traffic limit theorem.

1. Introduction

The conventional fluid queue is an input-output system of fluid with a buffer. Suppose that input and output rates change according to a continuous-time Markov chain with a finite state space. This model is reffered as a Markov modulated fluid queue, and the Markov chain is called a background process. There are many applications for Markov modulated fluid queues. For instance, they are successfully applied to modern ATM systems , where the fluid flow is interpreted as a packet data stream which is proposed by ATM switches.

In this paper, we are interested in the situation that a fluid model has an extra input in addition to the conventional fluid flow. Thus, we extend the Markov modulated fluid queue in such a way that its input flow may have upward jumps which is determined by the background Markov chain. We assume that the amounts of jumps are independent. We reffer to such jumps as batch fluid arrivals. Most of the work in fluid queues deals with the steady-state distribution of the buffer content. See the survey paper by Kulkarni [1] for an extensive overview of the research in this area. Readers are advised to see Ahn and Ramaswami [2], Asmussen [3], Ramaswami [4], Takine [5] and references therein.

The system we are studing is the $BMAP/G/1$ fluid queue. Customers arrive according to the $BMAP$ (Batch Markovian Arrival process) and the server provides services at variable speeds according to the phases of $BMAP$ process. In [6] it is considered more complicated model of fluid queue. Using the Laplace-Stiltjes Transform of fluid level from [6] we find the limit distribution of fluid level under heavy traffic in steady state.

2. The model and some preliminary results

We consider a fluid queue with infinite buffer and two different inputs, a continuous and discontinuous fluid that instantaneously arrives at random times. We consider the total buffer contant. At first, let us introduce a background Markov chain and describe the fluid system by a stochastic process. We assume that the two inputs and processing are governed by a finite state Markov chain and distribution for batch sizes. The state of this markov chain is called a background state. We assume that the input of discontinuous fluid flow is defined by a $BMAP$ arrival of batches. The $BMAP$ process is defined by matrices

$$D_k = \left\| d_{i,j}(k) \right\|,\ 0 \le i, j \le K,\ k \ge 0.$$

The diagonal and off-diagonal elements of matrix D_0 are negative and nonnegative, respectively. The matrices $D_k, k \ge 1$ are nonnegative matrices. It is assumed that the matrix $Q = \sum_{k=0}^{\infty} D_k$ is infinitesimal matrix of continuous Markov chain, i.e. its raw sums are equal to zero. We assume that Q is irreducible chain with finite state space $S = \{0,1,2,\cdots,K\}, |S| = K+1, 1 \le K < \infty$, and it has a transition matrix Q. Thus, we introduce the background Markov chain for fluid queue. Since S is finite, there exists a stationary distribution for Markov chain with transition rate matrix Q, which is denoted by $K+1$ dimensional raw vector π, i.e. $\pi Q = 0, \pi e = 1,$ where e is a $K+1$-dimensional column vector whose components are equal to one. For each $i \in S,$ a number v_i is associated, which represents the net flow rate. That is, if the fluid buffer is not empty, its content changes with rate v_i under background state i. If $v_i > 0, v_i < 0$ or $v_i = 0$ then the fluid level respectively increases, decreases or is not changed. According to $BMAP$ arrival of fluid batches, the fluid level is increased instantaneously with the rate $d_{i,j}(k), 0 \le i, j \le K, k \ge 1,$ and random amount subject to distribution function $H^{*k}(x),$ where $H(x)$ is probability distribution function of positive random variable.

We denote

$$h_{k,1} = \int_0^{\infty} x dH^{*k}(x) = k h_1 \text{ and } h_{k,2} = \int_0^{\infty} x^2 dH^{*k}(x).$$

It is assumed that the batch amount is independent of everything else.

Buffer content process $X(t)$ is not a Markov process but two dimensional process $\gamma(t) = \{X(t), Z(t)\}$ is already a Markov process. The stationary distribution of $X(t)$ exists when $X(t)$ is stable , or

$$\pi(V + \sum_{k=1}^{\infty} k D_k h_1) e < 0, \quad (1)$$

where $V = diag(v_0, v_1, v_2, \cdots, v_K).$

We denote $\gamma(t)$ in the steady state by X and Z .For $i \in S$ and $x \geq 0$ denote $K+1-$ dimensional vector $F(x)$ as $F(x) = (F_0(x), F_1(x), \cdots, F_K(x))$,

where $F_i(x) = \lim_{t\to\infty} P\{X(t) \leq x, Z(t) = i\} = P(X \leq x, Z = i).$ (2)

The Laplace-Stiltjes Transform (LST) $\varphi(s)$ of stationary joint distribution of {X,Z} is found in [6], and

$$\varphi(s) = (\varphi_0(s), \varphi_1(s), \cdots, \varphi_K(s)) = sF(0)V(sV - D(h(s)))^{-1}, \quad (3)$$

where

$$F(0) = (F_0(0), F_1(0), \cdots, F_K(0)),\ \varphi_i(s) = \int_0^\infty e^{-sx} dF_i(x),\ D(h(s)) = \sum_{k=0}^{\infty} D_k h^k(s).$$

We need some preliminary results about continuous Markov chain. Let us consider Markov chain $Z(t)$ with matrix of transition rates $Q = \sum_{k=0}^{\infty} D_k$ and finite space $\{0,1,\cdots,K\}$. We will consider the set of linear algebraic equations

$$Qa = (\pi(V + \sum_{k=1}^{\infty} kD_k h_1)e)e - (V + \sum_{k=0}^{\infty} kD_k h_1)e, \quad (4)$$

with respect to unknowns $a_0, a_1, \cdots, a_K$. Since the stationary distribution $\pi = (\pi_0, \pi_1, \cdots, \pi_K)$ of $Z(t)$ is orthogonal to the right side of (4) the set of equations (4) have a solution. We will introduce the two matrices $A = \|q_{i,j}\|, 1 \leq i, j \leq K$ and R. The matrix r is defined as follows: the first raw and first column are equal to zero vectors and all other elements form the matrix A^{-1}.It is easy to show that the matrix QR looks as follows: the first column is zero vector, the first raw vector is equal to the vector $(0, -\frac{\pi_1}{\pi_0}, -\frac{\pi_2}{\pi_0}, \cdots, -\frac{\pi_K}{\pi_0})$, and the other elements form identity matrix. It is easy to show that for any vector $x = (x_0, x_1, \cdots, x_K)$ we have

$$xQR = x - x_0 \frac{\pi}{\pi_0}. \quad (5)$$

The solution to the set of equations (4) (for $a_0 = 0$) is

$$a = R[(\pi(V + \sum_{k=0}^{\infty} kD_k h_1)e)e - (V + \sum_{k=0}^{K} kD_k h_1)e]. \quad (6)$$

Further, we will suppose that

$D_k = \lambda D_k^0$ and $Q = \lambda \sum_{k=0}^{\infty} D_k^0 = \lambda Q^0$, where $Q^0 = \sum_{k=0}^{\infty} D_k^0$.

We will study the limit distribution of X in steady state under the condition that $\varepsilon \equiv \pi(V + \sum_{k=1}^{\infty} kD_k h_1)e \uparrow 0.$ In other words $\pi(V + \lambda \sum_{k=1}^{\infty} kD_k^0 h_1)e \uparrow 0,$ or $\lambda \uparrow \lambda_0 = -\frac{\pi V e}{\pi \sum_{k=1}^{\infty} kD_k^0 h_1 e}.$

Let us consider the case when $Q = Q^0 = \lambda_0 \sum_{k=0}^{\infty} D_k^0.$ Then the set of equations

$$Q^0 a^0 = -(V + \lambda_0 \sum_{k=1}^{\infty} kD_k^0 h_1)e. \quad (7)$$

is an analog to the equation (6). We denote by R_0 the analog to the matrix R for the set of equation $(7).$ The solution to the equation (7) (for $a_0^0 = 0$) is

$$(a_0^0, a_1^0, \cdots, a_K^0) = R_0(-(V + \lambda_0 \sum_{k=1}^{\infty} kD_k^0 h_1)e). \quad (8)$$

3. The Main Results

The purpose of this paper is to find the asymptotic behavior of the total fluid level X in steady-state under the heavy traffic conditions where $\varepsilon = \pi(V + \lambda \sum_{k=1}^{\infty} kD_k^0 h_1)e \uparrow 0,$ or when $\lambda \uparrow \lambda_0 = -\frac{\pi V e}{\pi \sum_{k=1}^{\infty} kD_k^0 h_1 e}.$ First of all in next theorem 1 we will find out the mean value of the fluid level in steady state.

Theorem 1. The mean fluid level in steady-state is given by the formula

$$EX = \frac{1}{-(V + \sum_{k=0}^{\infty} kD_k h_1)e}[\frac{\pi}{2} \sum_{k=0}^{\infty} D_k h_{k,2} + \pi(V + \sum_{k=0}^{\infty} kD_k h_1)a - F(0)Va], \quad (9)$$

where a is a solution to (6), and unknown probabilities $F_i(0), 0 \le i \le K$ satisfies the equation

$$F(0)Ve = \pi(V + \sum_{k=1}^{\infty} kD_k h_1)e. \quad (10)$$

and vector a is a solution to the set of equations $(5).$

Proof: Let us consider the stationary distribution of the fluid level and its LST $(3).$ $\varphi(s) = sF(0)V(sV - D(h(s)))^{-1}.$

After some algebraic manipulations we have the equation

$$\varphi(s)Q = \varphi(s)(sV + \sum_{k=0}^{\infty} D_k(1-h(s))) - sF(0)V \qquad (11)$$

Multiplying both sides of the equation (11) from the right by vector e we get

$$F(0)Ve = \varphi(s)(V + \sum_{k=0}^{\infty} D_k \frac{1-h^k(s)}{s})e. \qquad (12)$$

Putting here $s \to 0$ we have $F(0)Ve = \pi(V + \sum_{k=0}^{\infty} kD_k h_1)e$.

Instead of this, differentiating the equation (12) with respect to s at the point $s = 0$ we have

$$E(X_0, X_1, \cdots, X_K)(V + \sum_{k=0}^{\infty} kD_k h_1)e = -\frac{\pi}{2}\sum_{k=0}^{\infty} D_k h_{k,2}, \qquad (13)$$

since $\frac{d}{ds}(V + \sum_{k=1}^{\infty} D_k \frac{1-h^k(s)}{s})e = -\frac{1}{2}\sum_{k=1}^{\infty} D_k h_{k,2}e$ at point $s = 0.$ Now multiply both sides of (11) from the right by the vector a of solution to to the set of equations (4) we get

$$\varphi(s)Qa = s\varphi(s)(V + \sum_{k=0}^{\infty} D_k \frac{1-h^k(s)}{s})a - sF(0)Va.$$

Differentiating this equation with respect to s at the point $s = 0$ we have

$$E(X_0, X_1, \cdots, X_K)[(\pi(V + \sum_{k=0}^{\infty} kD_k h_1)e)e - (V + \sum_{k=0}^{\infty} kD_k h_1)e)] =$$

$$-\pi(V + \sum_{k=1}^{\infty} kD_k h_1)a + F(0)Va. \qquad (14)$$

Summing (13) and (14) we get the equation (9). Thus the theorem is proved.

From theorem 1 follows that the mean fluid level in steady-state depends on the system parameters as $h_1, h_{k,2}$, vectors $a, F(0)$ and matrices V,Q. Vector $F(0)$ is unknown but it vanishes when $\varepsilon \uparrow 0.$

Theorem 2.Under heavy traffic

$$-\pi(V + \sum_{k=0}^{\infty} kD_k h_1)e.EX = \frac{1}{2}\pi\lambda_0 \sum_{k=1}^{\infty} D_k^0 h_{k,2} + \pi(V + \lambda_0 \sum_{k=1}^{\infty} kD_k^0 h_1)a^0 + 0(1),$$

where a^0 is a solution to the set of equations (7).

Proof: Theorem (2) follows from theorem (1).

Theorem 3. Under heavy traffic

a) random variables X and Z are asymptotically independent;

b) the random variable $-\pi(V+\sum_{k=1}^{\infty} kD_k h_1)e \cdot X$ is asymptotically exponential with the mean $M = \pi[\frac{1}{2}\lambda_0 \sum_{k=o}^{\infty} D_k^0 h_{k,2} e + (V + \lambda_0 \sum_{k=0}^{\infty} kD_k^0 h_1)a^0]$.

Proof: We will consider equation (11). Multiplying both sides of (11) from the right by the column vector e and taking into account that $Qe = 0$ and $F(0)ve = \pi(V+\sum_{k=1}^{\infty} D_k h_1)e = \varepsilon$ we obtain

$$\varphi(s)[sV + \sum_{k=1}^{\infty} D_k(1-h^k(s))]e - \varepsilon s = 0. \quad (15)$$

Now, if we multiply both sides of (11) by the matrix R defined in Section two we get

$$\varphi(s)QR = (sV + \sum_{k=1}^{\infty} D_k(1-h^k(s)))R - sF(0)VR.$$

Using (5) from the last equation follows

$$\varphi(s) = \frac{\varphi_0(s)}{\pi_0}\pi + \varphi(s)[sV + \sum_{k=0}^{\infty} D_k(1-h^k(s))]R - sF(0)VR. \quad (16)$$

Substituting $\varphi(s)$ in (16) for $\varphi(s)$ in the right hand side of (16) we obtain

$$\varphi(s) = \varphi_0(s)\frac{\pi}{\pi_0}[I + [sV + \sum_{k=0}^{\infty} D_k(1-h^k(s))]R] + sY(s), \quad (17)$$

$$Y(s) = s\varphi(s)[[V + \sum_{k=0}^{\infty} D_k \frac{1-h^k(s)}{s}]R] - F(0)CR[I + [sV + \sum_{k=0}^{\infty} D_k(1-h^k(s))]R].$$

Substituting $\varphi(s)$ from (17) for $\varphi(s)$ in (15), we obtain

$$\frac{\varphi_0(s)}{\pi_0} = \frac{A(s)}{B_1(s)+B_2(s)}, \quad (18)$$

where, $A(s) = s\varepsilon - sY(s)[sV + \sum_{k=0}^{\infty} D_k(1-h^k(s))]e,$

$$B_1(s) = \pi[sV + \sum_{k=0}^{\infty} D_k(1-h^k(s))]e,$$

$$B_2(s) = \pi[sV + \sum_{k=0}^{\infty} D_k(1-h^k(s))]R[sV + \sum_{k=0}^{\infty} D_k(1-h^k(s))]e.$$

First, we find out that

$$\lim_{\varepsilon\uparrow 0}\frac{A(-\varepsilon s)}{\varepsilon^2 s}=\lim_{\varepsilon\uparrow 0}\frac{-\varepsilon^2 s+\varepsilon sY(-\varepsilon s)[-\varepsilon sV+\sum_{k=0}^{\infty}D_k(1-h^k(-\varepsilon s))]e}{\varepsilon^2 s}=-1. \qquad (19)$$

After some algebraic manipulations with $B_1(s)$ we have

$$B_1(s)=\pi[sV+\sum_{k=0}^{\infty}D_k(1-h^k(s)-h_{k,1}s)+\sum_{k=0}^{\infty}D_k kh_1 s]e=s\pi(V+\sum_{k=0}^{\infty}kD_k h_1)e+$$

$$\pi\sum_{k=0}^{\infty}D_k(1-h^k(s)-h_{k,1}s)e=s\varepsilon+\pi\sum_{k=0}^{\infty}D_k(1-h^k(s)-sh_{k,1})e.$$

Now, from the last equation we get

$$\lim_{\varepsilon\uparrow 0}\frac{B_1(-\varepsilon s)}{\varepsilon^2 s}=\lim_{\varepsilon\uparrow 0}\frac{-\varepsilon^2 s+\pi\dfrac{\varepsilon^2 s^2\sum_{k=0}^{\infty}D_k(1-h^k(-\varepsilon s)-h_{k,1}\cdot(-\varepsilon s))e}{\varepsilon^2 s^2}}{\varepsilon^2 s}=$$

$$=-1-\frac{\pi}{2}s\sum_{k=0}^{\infty}D_k h_{k,2}e. \qquad (20)$$

For $B_2(s)$, from (8) follows

$$\lim_{\varepsilon\uparrow 0}\frac{B_2(-\varepsilon s)}{\varepsilon^2 s}=\pi\frac{\varepsilon^2 s^2}{\varepsilon^2 s}[V+\sum_{k=0}^{\infty}D_k\frac{1-h^k(-\varepsilon s)}{-\varepsilon s}]R[V+\sum_{k=0}^{\infty}D_k\frac{1-h^k(-\varepsilon s)}{-\varepsilon s}]e=$$

$$=s\cdot\pi[V+\lambda_0\sum_{k=0}^{\infty}D_k^0 kh_1]R^0[V+\lambda_0\sum_{k=0}^{\infty}kD_k^0 h_1]e \qquad (21)$$

where, R^0 is an analog to R for the infinitesimal matrix $Q^0=\lambda_0 D^0$. From (7) and (21) follows

$$s\pi[V+\lambda_0\sum_{k=0}^{\infty}kD_k^0 h_1]R^0[V+\lambda_0\sum_{k=0}^{\infty}kD_k^0 h_1]e=-s\pi[V+\lambda_0\sum_{k=0}^{\infty}kD_k^0 h_1]a^0,$$

where a^0 is a solution to the set of equation (7).

Substituting $-\varepsilon s$ for s in (18) we get

$\lim_{\varepsilon\uparrow 0}\frac{\varphi_0(-\varepsilon s)}{\pi_0}=\frac{1}{1+Ms}$, where $M=\pi[\frac{1}{2}\lambda_0\sum_{k=0}^{\infty}D_k^0 h_{k,2}e+(V+\lambda_0\sum_{k=0}^{\infty}kD_k^0 h_1)a^0]$.

To conclude the proof it remains to note that

$$\lim_{\varepsilon\uparrow 0}\varphi(-\varepsilon s)=\lim_{\varepsilon\uparrow 0}\frac{\varphi_0(-\varepsilon s)}{\pi_0}\pi=\frac{\pi}{1+Ms}.$$

This complete the proof of the theorem.

4. Conclusion

The fluid queue with Markov modulated arrival and service rate have been extensively studied for the last time. In this paper we considered a modification of the classical fluid model, where in addition to the continuous changes, the buffer content can have instantaneous upward jumps. We studied the model introduced for the first time by Tzenova et all. in [6] in more common settings. We used the case when the input of batches is $BMAP$ process. We used the Laplace-Stiltjes Transform of the buffer level in the steady-state to determine its limit distribution under heavy traffic. The formula for the LST of fluid level contains vector function $Y(s)$ which is unknown but vanishes under heavy traffic conditions. This approach gives a direct proof of the heavy traffic limit theorem for the buffer level content and can be applied to more complex queueing systems as well.

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Reengineering of Business Process in Bulgaria's Small and Middle Business

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Abstract: The goal of this report is the research on the application of two types of reengineering methods (Clean State Reengineering and Technology Enabled Reengineering) in small and middle Bulgarian businesses. The differences and specifications, as well as the pros and cons of both of these types of reengineering have been listed here as well as the reasons behind choosing one of them. Research has been made on the firm's characteristics which were impactful for choosing one or the other method for reengineering.

Keywords: Reengineering methods, ERP system, business process

The number of small and middle businesses in Bulgaria in 2013 was over 300 thousand, which represents 99.8% of all the businesses, small businesses being those with 10-49 people staff, while middle businesses being 50-249 people staff. [1]

Big and small disproportions in the characteristics of small and middle businesses in Bulgaria are being saved. From a territorial aspect the most attractive region for the development of small and middle businesses continues to be the Southwestern region. On the other hand is the extremely low structural contribution from the Northwestern region, whose shares are between 2% and 5% of the different characteristics. [1]

The answer to the question if the economic crisis in the small and middle business sector has been overcome, cannot be one sided. In some sectors there are cases where the economic activity of year 2008 has been surpassed, while in others the drop continues. [1]

The investments for expanding and modernizing the production activity of goods and the provision of services, like the ones in ICT and in the business information systems will aid the increase of the competitiveness of SMEs.

Tools and technologies for reengineering

The ideas of Hammer about the reengineering process appeared before the tools of its realization, but with the advent of ERP systems during the 90s tools and resources for reengineering have been used included in them.

Reengineering „technology enabled"

For the implementation of technology enabled reengineering a certain technology is selected. For example if the selected technology is an ERP system, first the ERP system is chosen, and after that models, objects and processes (MOP) of the enterprise, of those who it can support. [2]

Advantages of reengineering „technology enabled"

• structures the reengineering efforts – For example, the ERP system provides

brochures, containing data on the types of activities that are being used and in what processes, how the objects should be structured, etc.

• explains the need of reengineering – The usage of an ERP system as a means for reengineering, as well as provides the "reason" for reengineering.

• creates better solutions – The system for resources planning of the enterprise could be used for making better decisions, when the team for development has limited experience. The good practices, contained in the ERP system, provide knowledge of the processes that can be implemented in order to minimize the effects of the lack of experience problem.

• limits the form of realization of the processes – The technology enabled reengineering limits the choice of form for the realization of the processes, mainly because the form of realization of the processes is chosen from a limited eligible number. The ERP system is designed to adapt to each set of forms. The selection from the set forms supports the processes that can interact with other processes, selected for use in the system.

• ensures that the chosen form of realization of processes will – If the process, conforming to the good practices is a part of the ERP system or other knowledge base with good practices, this is evidence that it actually works. The fact that the process is included in the good practices, usually means that an organization already successfully implemented it.

• ensures implementation, limited in time – The Implementation of the ERP is within a specific time period. Thus, many processes, provided by the ERP, could be implemented within a reasonable time frame.

• The software is available – When selecting the ERP system as a means for reengineering, there are guarantees that the software solution will be available.

Disadvantages

• The reengineering is limited to certain instruments used in the implementation.

• The reengineering is limited by the knowledge of the objects and processes, included in the tool.

• The development of the systems could be limited by the technologies.

• The chosen form of realization of the processes is accessible by other Enterprises.

• Doubts could arise: is this a technology implementation or reengineering?

• For some installations there might not be any good practices, which limits their use.

Reengineering "clean state"

In clean state reengineering the processes undergo reengineering to meet the requirements of the enterprise. When using this method there are no predetermined limitations. Ideally, the developers can create a system, optimal for the particular organization. In the case of using an ERP system, the present approach suggests consecutive reengineering, and after that selecting an ERP system. Thus, ERP adjusts accommodating the organization, in which the reengineering has been held, i.e. adjusts according to a model, resulted from clean state reengineering. [2]

Advantages

• The firms are not limited by specific instruments – The clean state reengineering is not limited by any single instrument. Thus, during clean state reengineering the whole range of instruments can be used. Since each tool for reengineering accumulates constraints and brings certain preferences, the usage of multiple tools may have significant advantages in comparison to the use of a single instrument.

• The firms can't be limited by the absence of good practices – As far as ERP systems can be used for a number of good practices, they are also limited by their database (DB) with

good practices. Companies with unique processes that create value, often ensure that they are not included in the number of processes that fall within the DB of the consultants or in the ERP systems. Thus, when the organization uses a DB with good practices, it may not include all the good practices.

• Future versions are not restricted by the technology – With time the processes are constantly evolving. If the form of realization for the process changes, this can lead to an "upgrade" with a future version of ERP.

• The firms can create unique forms of realization for the processes – In this method of reengineering, companies can create a new approach to solving the problem. This is particularly important in situation where the reengineering can provide a competitive advantage. For those companies, in which the technology is used as a competitive advantage, the clean state reengineering could provide an additional advantage. In carry out the clean state reengineering only the growing firm knows the form of realization of the processes.

• The reengineering process does not mix with deployment technology – Often one deployment of an ERP system is expensive and requires a lot of time. In some situations, these shortcomings arise not from the deployment of the ERP system, but because performing reengineering is also included here. When carrying out clean state reengineering, there is no doubt where the reengineering and where the technology implementations are.

• It can be the only way to create processes using new technologies – In some cases the processes should be included in the using of new technologies – for example, Internet, scanning of a bar code, scanning of QR code or use of RFID technology, when they become available. When using such technologies it might not be clear how the supporting processes will work in the new technologies. The clean state reengineering could be the only possible approach in such cases.

Disadvantages

• It might not turn out to be a structure that helps create a form of realization of the process.

• There are no rational grounds for reengineering.

• The processes could only be partially optimal.

• There is no restriction on the exit form of realization of the process.

• The chosen form of realization could turn out to be inadmissible.

• The process in the chosen form of realization may not work with the selected ERP system.

• Additional expenses could of time and money could be needed for the implementation of the chosen form of realization of the process.

• The use of multiple consultants is needed.

• The necessary ERP system may not be available.

Who can use the method clean state reengineering?

The answer depends on several factors, such as company size, volume of resources that can be invested in the development of the new processes, does the company have enough time to create the processes, degree of dependence on the technologies to create competitive advantages and are unique processes used.

Who can use the method of technology enabled reengineering?

The factors that we talked about above, can be used for determining which companies are obliged to decide on enabled reengineering. For example, companies who have limited

budgets and standard processes, which limit their capabilities and the need to conduct the larger clean state reengineering.

Conclusions

Businesses choose a method of reengineering corresponding to their needs and resources. The clean state method of reengineering is used by large companies that have big financial resources, have no time constraints and use unique processes as primary competitive advantage.

The usage of the enabled reengineering method is more typical for companies with limited budget, limited time, with relatively standard processes, such as small and middle businesses in Bulgaria. Thus, Bulgarian SMEs will have access to know-how, as described business processes, complying with the good world practices.

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Basics of Management for Cloud Computing Security

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Abstract: The main problem of this paper is acknowledgement of multiple level conflicts in security management in the clouds. The secondary problem that is observed is access and management of access in cloud environment. This article indicates connections between law, standards and policy. The main threats and defence mechanisms in cyber security related to the clouds are described. Thus this article represents a review of basics, which contains some analyses, and models for cloud security.

Keywords: Cloud computing, cloud security management, cyber security, cyber security management system

1. Introduction

The main **problem** of the management of cloud security that is discussed in this article is **managing access** for the data in the cloud. This is just one of the problems in managing the cloud security. The others will be just mentioned and they will be problems or subjects of the other articles of this series. As usual the author didn't take in mind the technical and technological aspects of this problem.

Cloud services are provided by over 100 companies. Cloud computing give the enterprises and end users many choices, how to operate in cyber space. This is the new standard for business continuity, engaging the clients in business process and culture of the company. This provides new security challenges to management of cyber security. Problems of cyber security get more "cloudy" when there are included a "cloud". For 2014-2015 year, over 40% of companies had a security problem with the cloud services.

2. Theoretical concept

There can be defined several *requirements to cyber security* in the cloud:

- Control cloud usage and usage of infrastructure;
- Manage data access;
- Protect cloud hardware and data;
- Monitoring of cloud security;
- Risk analyses and treat detection;
- Auditing and testing cyber security system (classical and cloud).

A **cloud infrastructure** is the collection of hardware and software that enables the five essential characteristics of cloud computing. The cloud infrastructure can be viewed as containing both a physical layer and an abstraction layer. The physical layer consists of the hardware resources that are necessary to support the cloud services being provided, and typically includes server, storage and network components. The abstraction layer consists of the software deployed across the physical layer, which manifests the essential cloud characteristics. Conceptually the abstraction layer sits above the physical layer.[1]

The *requirements to cyber security* have to be implemented in services of the cloud. There are three types of services provided by the cloud computing.

*Software as a Service (SaaS).*The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure. The applications are accessible from various client devices through either a thin client interface, such as a web browser (e.g., web-based email), or a program interface. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user-specific application configuration settings.[1]

Platform as a Service (PaaS). The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, libraries, services, and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly configuration settings for the application-hosting environment.[1]

*Infrastructure as a Service (IaaS).*The capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems, storage, and deployed applications; and possibly limited control of select networking components (e.g., host firewalls).[1]

The most **common usage** of the cloud technology is for several reasons. For enterprises it's *IaaS*and *PaaS*, which reduce the costs of building and maintaining their own infrastructure. Also when it's needed test or development environment in the cloud can be found already build one. Furthermore they can make a lot of savings with already build *SaaS* with personalized applications. The companies often use public and hybrid cloud in order to give access to more users to their developments and products. The cloud is often use as data storage, backup and/or disaster recovery.

Combination of security requirements and cloud services transforms cyber security practices.

3. Usage and access in the cloud

The cloud management depends of the nature of the clouds. They can be divided on 3 basic groups.

Private clouds- they are managed by concrete organization or person. The access of this type of clouds is managed too by the same organization or person. Practically, private cloud is a good solution for businesses with dynamic needs that require direct control over environment. This type of clouds present some of the features of the public clouds including self-service, resources on demand, chargeback and showback systems, 3Vs characteristics (volume, variety and velocity which are the three defining properties or dimensions of big data) etc. The main advantage of this type is the direct control made by organization over their data. They provide quick and easy data management, simply guidance, workloads, hosted services designed for a limited number of people. This cloud category attracts to organizations that have more trust and confidence in their internal IT departments than an outside unit. On-premise private cloud ensures standard security process, but it necessitates more operating costs for physical human resources. IT managers involve the data center into a private cloud' that offers many of the benefits of public clouds, but internally protected and managed. The externally hosted private clouds are also exclusively used by one organization, but are hosted by a third party specializing in cloud infrastructure. Externally hosted private

clouds are cheaper than On-premise private clouds. [2]

A private cloud's hardware is able to be stored on-site at an organization's property or sheltered in a datacenter. In some industries, such as finance, insurance and healthcare, a private cloud is preferred.Security in the cloud – is a business necessity. A private cloud offers the most control over security parameters because all security efforts are done in-house or are outsourced to managed security provider.[3] Cloud technology is the focus of many new potential threats and exploits, and presents new vulnerabilities that must be managed by organizations. The right exploiting of private cloud include detailed planning with respect of user permission, primary security control, control of access, storage security, locking down the individual virtual machine files, network monitoring, integration of virtual firewalls, implementation of detection systems etc. Using well organized security architecture and policies of a cloud infrastructure ensure and protect organization's assets.

*Public cloud*is a second type: In public cloud the computing infrastructure is hosted by the cloud vendor and according the vendor's premises. The customer has no visibility and control over where the computing infrastructure is hosted. The computing infrastructure is shared between any organizations.[4] They physical infrastructure is owned by and managed by the designated service provider and located within the provider's data centers. All customers share the same infrastructure pool with limited configuration, security protections, and availability variances [5].

The main advantages can be determined as follows:

- Usage of new trends, technologies and regular updates of public clouds. In comparison of private clouds, one organization is not be able to spent thousands of euro to acquire new hardware and software each year.
- Public clouds are more flexible regarding payment. The organizations pay only for used and needed services. Particular needs of each company are easily adapted by using this type of clouds.
- Public clouds allow cost-cutting in starting new projects, short term projects or projects with fixed period and budget.
- Often public providers buy latest security technology and this reflects of economies of scale
- Public clouds have more experience with hacking attacks, effective protection against them etc.
- Availability of quality human resource, security experts and security managers who are attracted by good salary and brand image.
- Credible cloud penetration testing

The third type is the *hybrid cloud*. This cloud takes all the vulnerabilities from the public and private clouds. For the client oriented companies this is the used type of cloud. Identity and access management is in big importance to cyber security for the services implemented in hybrid cloud.With this type clouds, service providers can utilize third party cloud providers in a full or partial way, thereby increasing the flexibility of computing. It is a helpful opportunity to respond and manage unexpected workload. Hybrid cloud gives to business a quick access to vast public cloud resources and to test new capabilities.In case when some organization is a part of highly regulated industry the hybrid cloud enables to house his critical applications and data in a physically separate private environment.

4. Managing data access

For example Google Cloud Identity & Access Management (IAM) lets administrators authorize who can take action on specific resources, giving you full control and visibility to

manage cloud resources centrally. For established enterprises with complex organizational structures, hundreds of workgroups and potentially many more projects, Cloud IAM provides a unified view into security policy across your entire organization, with built-in auditing to ease compliance processes.[6]

According to Michelle KimihiraGoing up the cloud continuum from on-premise to private to hybrid and then public cloud, IT's control and visibility into security policies decreases.[7]

There can be defined three main **problem**s in managing the cloud access:

- Place of access;
- Way of access;
- Quantity of cloud resources that can be accessed.

The new paradigm of cyber security told is that there always will be cyber security breach. In the past In the past, before the clouds, the main goal for cyber security management of access was to create maximum secure defence mechanisms. This mechanism worked in the known three ways – encryption, strength of the password and firewalls. In addition to that there are physical security mechanism that includes – guards, keys, biometrics. The new understanding of cyber security told us that the security measures don't matter. The goal is to limit the access to breached information. So there are controls for the quantity of information that can be reached from one account or user.

On August 31, 2014, a collection of almost 500 private pictures of various celebrities, mostly women, and with many containing nudity, were posted on the on websites and social networks Hackers take advantage of a security problem in the iCloud API which allowed them to make unlimited attempts at force breaking passwords.[8]

Over 60% of users of cloud services in private or hybrid clouds uses same password for every application. When we are talking about password over 80% of mobile devises keeps the information for password, a lot of them as plain text. According to this problems more than 19% of the active cloud accounts of people that leave their job, are still in use.[9]

Cyber thieves planted malware on cash registers at The Michaels stores across the USA, stealing more than 40 million credit and debit card numbers between Nov. 27 and Dec. 15, 2013. That malware was designed to siphon card data when customers swiped their cards at the cash register.[10].

Guardians of Peace claim to have over 100 Terabytes of data from Sony. To put that in scale, the largest hard drive size offered by Apple for its iMac range of desktop computers is one Terabyte. The Sony hackers claim to have 100 times that amount.

So far it's estimated that the Sony hackers have released around 235 Gigabytes of data. If their claims are to be believed, there's still a lot to come [11].

Cyber-attack against American bank JPMorgan Chase that is believed to have compromised data associated with over 83 million accounts – 76 million households (approximately two out of three households in the country) and 7 million small businesses.[12] Email, postal addresses, and phone numbers of account holders were obtained by hackers, by phishing attacks.

According to that examples there are several things that can be done to improve management of access to the cloud:

- Visualization of controls and specified control and auditing applications will help for control and monitoring of access in the cloud.
- The public clouds are often managed by third parties. The risk linked with this management has to be obtained automat.
- There has to be limited access to mobile device for the private clouds.

- Cloud identification and access have to maintain high level of automation when it became to authentication. The users get access only to the levels that are directly concerned with their job. The system administrators have to control default access to groups.
- The systems for authentication control and security has to automatically effects all the branches of the cloud that organization use.
- No access to cloud resources beyond the needed for the job, have to be granted.
- There have to be full history of authorization, access, usage of the infrastructure of the cloud.
- There are systems for duplicating data in the clouds. For system recovery that gives a big chances for maintaining the business process without losses. For access this grants more opportunities.
- The data security has to be standardized.
- The application access has to be standardized.
- There has to be security system between the data and application access.

5. Conclusion

In this article was made introduction in management of the security in the cloud computing. First there was explained the security requirements according to provided services. Secondary there was explained usage and access in the cloud. In the last part of the article was explained the problems with managing the access in the cloud. In the end there can be said that most of the companies provide identity and access management services.

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State of E-government in Bulgaria and Global Trends of E-governance

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Abstract: The paper reviews the state of Electronic government in Bulgaria compared to global trends in this area. It traces the development of Bulgarian E-government during the last years in details and gives an assessment of its effectiveness in practice at the moment. It's been used some concrete examples of other countries in which the digital government is imposed as a successful model of governance. On the basis of this research are prepared a range of suggestions and methods for improving the state of E-government in Bulgaria. In addition, the paper presents some expected results of their implementation.

Keywords: Electronic government, Bulgarian E-government, world trends in E-governance, improvement of Bulgarian E-government

1. Introduction

Electronic government is a contemporary and modern approach, which is applied actively in business and public administration. Legally, it is determined by the "E-Government Act", which is applied to people and organizations that respectively carry out public functions and provide public services.

According to the principles of e-governance, the consumer is placed in the center of administrative services. All of them must be provided effectively and efficiently. The administration is required to provide electronic access to public information in providing electronic services and making decisions. The state must improve the protection of citizens' rights in the electronic world by taking active steps to ensure trust and security.

The e-Government is a basic sector policy of e-governance. If it is effectively implemented, it can additionally contribute to reducing extreme poverty, improving the quality of life, safety, the environmental protection and the promotion of social inclusion and economic opportunities.

The benefits of e-Government are a lot. In e-Health, the quality of health services to the population is improved. The population has access to medical information and variety of health services via the Internet. At the electronic customs, various certificates (such as AEO, EUR.1), permits (for access to the TIR procedure, etc.) and also a certificate for the presence or absence of obligations for public state levies are electronically issued. For electronic public procurement the costs are reduced, for example – the amount of waste is reduced to provide better quality services at lower prices.

The main disadvantage in deploying e-Government is distrust of the society. Common reasons for this are computer illiteracy, lack of awareness and the negative attitude of those who are not interested in transparency and public access to information. E-Government is a very expensive project, which in the short term will not return, but in the long will be able to improve the quality of life. Another disadvantage is the security against cyber attacks.

2. State of Electronic government in Bulgaria

In 2002 and 2003 is planned the construction and development of basic structures and documents of e-Government. As a result, "Strategy for modernization of the public administration - from accession to integration", "E-Government Strategy," "Plan for the implementation of e-Government Strategy to 2005" and "Basic model for one-stop shop" are developed.

In addition, the Council of Ministers has established the Coordination Center for Information, Communication and Management Technologies (CCICMT) and the "Council of modernization of public administration" under the leadership of Deputy Prime Minister. The Council includes Working Group "Administrative services and e-Government" to coordinate the implementation of e-Government strategy.

During 2003 and 2005 the policy of e-government is concentrated into two main directions. One of them is to stimulate the creation of "critical mass" of applications and to acquire experience in both the developers of these applications and to their users. The main efforts are directed to develop and implement individual solutions in separate units of the ministries, agencies, regional and municipal administrations. The other is directed to implement some fundamental developments at the central level.

"E-Government Strategy" puts as one of its main purposes "Electronic delivery of qualitative, cost-effective and accessible administrative services to citizens and business." The providing of electronic services creates convenience for citizens and business, because reduces costs of performing, increases efficiency and minimizes corruption risk. Bulgarian Government is committed to the implementation of 20 indicative administrative services electronically - 12 for citizens and 8 for business. On November 2005 central departments have developed and provided a number of administrative services beyond 20 indicative ones. Also in 2005, the Council of Ministers ordered each agency to adopt rules for accepting and issuing documents electronically and signing them with an electronic signature.

The lack of sufficient political will and sequence in the efforts of the Bulgarian government in this direction lead to delays in the process. Therefore the first important result became reality on 1st October, 2007 – the foundation of a specialized government portal www.egov.bg

The lattest document, which specifies the actions and deadlines for working on e-governance, is the "Strategy for development of e-Government in Bulgaria 2014 - 2020".

Since 2003, in the UN survey are considered three components of e-Government, forming a common index for the development of e-Government (EGDI). The survey was made among 193 countries. Bulgaria is ranked in the first half of them. But this puts us last among the European countries, but between 2012 and 2014 is recorded a decline - from 60th place falls on 73rd. All these results show that Bulgaria still lags far behind the leading European countries in offering electronic services for citizens and businesses. It needs more expansion and improvement of the electronic services efficiency and better technological compatibility. Citizens and businesses do not have enough confidence yet in the electronic services, because of the fact that a significant part of the population is not qualified to work with more complex systems.

3. World trends in Electronic governance

The worldwide introduction of e-government begin to be seen more and more as an investment, reducing public expenses on administration and making services more user-friendly and accessible to citizens and businesses. In some countries, such as the UK,

Netherlands, Denmark, is placed particular emphasis on the effectiveness of implemented subsystems of e-government and their impact on reducing public expenses for administration.

Its development has become a priority in the administration of most leading economies. Worldwide a number of studies are periodically published on the status and trends of e-Government. The studies of United Nations present an opportunity to be made some main conclusions about the place of individual countries, their challenges in this field and some comparative analysis. The organization publishes the results from the reports. They might be used as a basis for comparison because they are organized periodically in the same manner. The general framework of a UN study on e-Government is based on the following principles:

- The E-Government research is considered as a mean to achieve the main purpose - development of all. It is a powerful tool which, if it is effectively implemented, could contribute significantly to reducing extreme poverty, improving environmental protection and promoting social inclusion and economic opportunities for all
- The research and its results must be placed in the context of the overall model and the level of development of each particular country.
- The focus of the research is on providing socio-economic conditions for the population and it is based on the understanding of the importance of e-Government for social inclusion.

The best implemented government portals provide multi-channel access to e-services of all government agencies, opportunities for payment of administrative services and online voting.

In the latest edition of the UN report on the state of e-government in the world "E-Government Survey 2014", entitled have been analyzed the performance of 190 countries. All of them are ranked according to their achievements in the index EGDI (E-government development index), as the place assigned to them is based on three components:

- online services;
- telecommunications infrastructure;
- human capital;

The UN global E-Government Report - 2014

Country	Region	2014 EGDI	2014 Rank	2012 Rank	Change in Rank (2012-2014)
Republic of Korea	Asia	0.9462	1	1	-
Australia	Oceania	0.9103	2	12	↑10
Singapore	Asia	0.9076	3	10	↑7
France	Europe	0.8938	4	6	↑2
Netherlands	Europe	0.8897	5	2	↓3
Japan	Asia	0.8874	6	18	↑12
United States of America	Americas	0.8748	7	5	↓2
United Kingdom	Europe	0.8695	8	3	↓5
New Zealand	Oceania	0.8644	9	13	↑4
Finland	Europe	0.8449	10	9	↓1
Canada	Americas	0.8418	11	11	-
Spain	Europe	0.8410	12	23	↑11
Norway	Europe	0.8357	13	8	↓5
Sweden	Europe	0.8225	14	7	↓7
Estonia	Europe	0.8180	15	20	↑5
Denmark	Europe	0.8162	16	4	12

Israel	Asia	0.8162	17	16	↓1
Bahrain	Asia	0.8089	18	36	↑18
Iceland	Europe	0.7970	19	22	↑3
Austria	Europe	0.7912	20	21	↑1
Germany	Europe	0.7864	21	17	↓4
Ireland	Europe	0.7810	22	34	↑12
Italy	Europe	0.7593	23	32	↑9
Luxembourg	Europe	0.7591	24	19	↓5
Belgium	Europe	0.7564	25	24	↓1
Very High EGDI Average		**0.8368**			
World Average		**0.4712**			

Distinctive features of the most successfully integrated e-government portals

The main trend identificated in previous editions of this study remains valid – to E-governance pass actively the countries with a high level of economic development. In the ranking of top 20 leaders in the development of e-government, in the first place is South Korea, which is largely expected. Following are the leading economies of Europe - the Netherlands, UK, Denmark and 5th place is for the United States. Among the new countries in the top 20 are Israel, Luxembourg and Liechtenstein, while their rating is higher than the estimates of the recognized leaders in e-government, such as Japan and Estonia.

Netherlands with the presence of "one window" provides communication with government departments in maximum comfort for the client. Moreover, the country has successfully implemented an electronic identifier for individuals and companies. The availability of broadband access is also highly appreciated by the experts of the UN.

Some significant improvements in the user interface and portal's work "DirectGov" as a single point of access to all information and services to the administration of the United Kingdom provided the country third place in the index. Special praise from UN experts earned the page "Do It Online", which lists all public services, forms, tools and operations provided by the government. E-service for job search "Jobcentre Plus" is also appreciated.

Denmark e-government portal represents a center for electronic transactions across the country, which connects the public administration, businesses and population of the country into a single network. The electronic invoices exchanged into this portal save 150 million euro per year to the citizens and 50 million euro to the business. Each Dane has a personal mail „E-Box", by which can receive letters from all government departments and companies in the country. Among the services at the portal of the Danish e-government are the opportunity for providing student loans, management of state pensions, the possibility of registration of income and marital status.

USA e-government is awarded by the experts of the UN as a portal providing a high degree of integration of all elements. Its excellent user interface and detailization allow the US citizens to find easily the necessary e-services at national or local level. The opportunities for consultation and search, the very good internal taxonomy and referral links, the many ways for communication with the administration and access to numerous databases define Usa.gov as one of the best sites for e-government in the world.

An interesting direction to development follows the e-government of Singapore - a traditional leader in the Asian region. In Singapore the main tendency is directed to increased use of „cloud technologies". For example, there is a cloud of communication between teachers. The portal of e-government provides the maximum possible range of options for online payments - from taxes to licenses and fines.

The major trend of 2014 is the e-government portals to become more transactional. Governments clearly understand the benefits of online payments. As a result, about 40% of the countries represented in the index in 2014 have introduced opportunities for electronic payment of taxes and fees. In 34 countries, citizens can pay and receive in government portal birth certificates, identity documents and licenses of motor vehicles. The experts of the UN note that most countries do not use many channels in the provision of e-services. Easy access to e-services through free Wi-Fi and mobile networks, as well as through partner commercial and public sites provides affluent countries the leading positions in index EGDI.

The concept of mobile government or M-government is successfully implemented in 33 countries till now, where citizens can pay services of the administration through mobile phones, and in 27 of them they receive sms messages from government officials. The UN analysts believe that the field of m-services in the near future will develop rapidly. Cellular communication networks increase the opportunities for access to public services for the elderly and for people with disabilities, people living in remote rural areas, also. Considering that the mobile phone is a basically subject to personal use, by which the public administration can provide different types of services to a particular citizen.

Three models of integrated e-government according to the level of development

I State of Korean E-Government

South Korea is a model of developed country in e-governance. It has actively pursued e-Government as a crucial means to make its government more competitive, by leveraging the world's best information and communications technology (IT) including broadband Internet. After laying the groundwork for e-Government, including the National Basic Information System (NBIS) computer networks in the 1980s and streamlining of applicable laws and institutions in the 1990s, the Korean government made the implementation of e-Government a major national agenda for the 2000s. As a result, e-Government has become firmly established in all areas of the Korean government. The Korean e-Government has produced visible results: both efficiency and transparency of administrative work have been significantly improved; administrative civil services have been greatly enhanced; and opportunities for people to participate in the policy-making process have been expanded. Accordingly, the effectiveness of the e-Government of Korea is widely acknowledged by the international community and various e-Government systems are being exported to foreign countries. The 2010 UN Global E-Government Survey shows that Korea ranked first among all the member countries, given the highest possible scores in the categories of Online Service Index and the e-Participation Index. Korea is now promoting e-Government that is focusing on utilization and convergence by consolidating services to maximize the convenience of users and implementing a seamless digital cooperation system connecting government departments and agencies, in order to improve the overall quality.

Korean e-Government Best Practices:

- Electronic Procurement Service (www.g2b.go.kr). All procurement procedures are handled online, and a single window of procurement is open to improve efficiency and transparency of public procurement.

- Electronic Customs Clearance Service (portal.customs.go.kr). Common use of information between logistics entities will be extended in order to improve and streamline export/import logistics business and processes as well as implementing a user-friendly batch logistics processing service.

- Internet Civil Services (www.egov.go.kr). People can use administrative services anytime, anywhere on the Internet.

- Comprehensive Tax Services (www.hometax.go.kr). Taxpayers can handle tax affairs online at home or work without visiting the tax office.

- Patent Service (www.kiporo.go.kr). All patent services, such as patent application and progress check, are provided online.

- Single Window for Business Support Services (www.g4b.go.kr) provide a wide range of information and services to support companies' business activities such as civil service information, policy information, and additional services via a single online window.

- On-nara Business Process System (BPS). The On-nara BPS is a new business process management system that has increased the efficiency and transparency of administration by handling, recording and managing in a standardized way all the business procedures of the government online.

- Shared Use of Administrative Information (www.share.go.kr). Civil service officers can process civil service requests by checking the administration network without requiring the applicant to submit required documents.

- National Computing & Information Agency (NCIA). Operate and manage all information systems of the government by integrating them into two data centers and provide non-interruptible administrative services by the best information technology and expertise.

- Every citizen can set the Korean e-government according to his/her personal needs and always have an access through mobile apps.

- Korea introduces new technologies (eg. distance learning) as well as in higher education and in secondary and even primary. Koreans use tablets and smart classrooms, which facilitates the access to learning.

II State of Estonian E-Government

Estonia is a model of quickly developing country in the field of e-government. The country began to plan digital government in 1997. Since 2005 all libraries, schools, universities, public buildings, parks and central areas of major cities have free Internet access. Everyone in the country can pay taxes and vote online, which reaches a high clarity and reduced corruption. It not only identifies the physical world, but also operates in the electronic environment, allowing people to have access to almost every electronic service (including banks, public transport, etc.). To date, no case of stolen personal information is known. There are no subscription fees for electronic signature. Estonia is one of the leaders in number of completed secondary education due to e-government.

Estonian E-government best practices:

- In electronic way can be accomplished purchase of any type.

- Almost any operation in Estonian e-Government happens with an ID card.

- Estonians have access to their e-government 24 hours a day, 7 days a week, allowing them to use about 700 administrative services from anywhere in the world.

- In the Estonian electronic government are also included police and systems to schools and health care. The automobile of every police officer is equipped with a computer, gps camera and has access to the Internet, as well as devices connected to a central server.

- There is no school without computer system. The easy communication saves a lot of costs of the educational system.

- If someone needs urgent help, his/her e-card can give the medical team access to his/her electronic health passport that contains all health information about the person. All medical facilities are connected, even pharmacies, where you can get a prescription with an ID card.

- Most of the notary services are also conducted on the Internet and all the necessary information as mortgages, paid taxes or criminal certificates are available online.

- Almost 100% of banking transactions in Estonia are carried out electronically. If someone wants to register a new company, in Estonia that would take about 18 minutes.

The financial incentive is essential for the success of e-Government in Estonia. The difference between online and offline prices is drastic. For example, the electronic tickets for public transport are around 30% cheaper than the paper ones. Banks also have eliminated most fees for online banking, remaining however fees for counter transactions. To ensure safe participation in the information society, Estonia has introduced electronic ID card chip that can be used to encrypt documents and to add an electronic signature. There are also optional replacement of the ID card – a mobile, which performs the same functions.

III State of Jordanian E-government

According to the recent UN report Jordan is among the countries with the least developed E-government, occupying 79th place in the world rankings with an index of 0.5167. The Asian country is trying to reach better levels of electronic services, starting some programs and projects. The information and communication technologies are developing rapidly, but more efforts are needed to their full improvement and optimal use. The Jordanian government offers a lot of business and technical services in support of the interaction between the public institutions and their customers through e-services. In the project of developing e-government are made serious investments over the past 10 years, seeking to transform the traditional delivery of services to more efficient and high quality services.

The unsuccessful attempts to be introduced and developed more efficient electronic services are a result of policy disadvantages in finance and business, infrastructure, data management, policy and legislation, education in terms of e-government.

Disadvantages in finance and business:
- Higher costs associated with registration and use of forms
- Errors and the introduction of redundant data at the time of use of registration
- Poor compatibility between corporate data held in different organizations

Disadvantages in infrastructure:
- Lack of local "feeder" networks
- The existence of four main government networks
- There is a little public interface and lack of Internet
- Few municipalities outside the capital are computerized

Disadvantages in data management:
- Lack of common standards for data
- Limited IT experience in public institutions
- Not all data is stored in electronic format

Disadvantages in policy and legislation:
- Legal obstacles to the recognition of electronic documents and signatures
- There is no law that allows electronic payment
- It is authorized the exchange of information electronically, but it is not actively encouraged under the law
- Legal obstacles for the submission of documents in electronic form within the ministry

Disadvantages in education:

- Lack of Internet access to homes
- Many citizens, government and business sectors remain unaware of what exactly the E-government is and how to benefit from it
- Low literacy of citizens in terms of computer skills

Some arrangements are being taken to deal with the weaknesses of e-government in Jordan. Therefore, the action plans are aimed at different institutions and private sectors. Also it required greater effort and activity on the part of society for the successful implementation of e-governance in Jordan.

4. Methods for improving the state of Electronic government in Bulgaria

Bulgaria is on 73rd place out of 193 countries in the index for development of e-government - EGDI. This ranking is worse than the previous one in 2012, when the country was ranked on 60th place. A reason for concern is the fact that the overall assessment of the country is decreased from 0.6132 for 2012 to 0.5421 for 2014.

The assessments for Bulgaria according to the three indicators comprising the index are as follows:

- online services - 0, 2362;
- telecommunications infrastructure - 0.5941;
- human capital - 0.7960;

In comparative terms with other countries in the ranking is necessary to emphasize on the following:

- This value (0.5421) is the lower limit for the group of countries with high index;
- On the value of the index Bulgaria ranks last among European countries;
- The value of Bulgaria is slightly above average for the European Union - 0.73;
- The value of Bulgaria is below the average of European countries - 0.6936;

Bulgaria is a developing country in the field of e-governance. Compared with countries in the world it ranks in the middle. The Government of Bulgaria have to consider several basic steps in the development of its e-government portal. Some of them are:

- to inform in details the population for benefits from the use of e-government;
- to provide a basis for the development of e-government, and train staff to build it;
- to develop their ideas consistently, not chaotic;
- to consult the opinion of the population and businesses about the innovations in the e-Government portal.

The last step for developing of Bulgarian e-government is a referendum on "For or against electronic voting" which held on 10th October 2015. Its results show that population wants electronic voting to be introduced. The conditions for successful referendum in the Republic of Bulgaria are:

- Participation in it should take no fewer votes than in previous elections.
- More than a half have to respond affirmatively.
- To vote at least 20% of the population.

The Bulgarian population failed to meet the first condition for its 35% activity, but the second indicator shows cleary to 70% answered the question with "yes." Therefore, everything depends on the government. It has 3 months to decide whether to introduce electronic voting or not.

Concrete suggestions for improving the state of Bulgarian e-government

- Making of a unified information environment in the public administration. This will lead to a leveling of the information environment in the departments of a technological level.

Coordination of decisions in the field of information technology will lead to a compatibility of systems of individual agencies. There will be a consistency in terms, nomenclatures and classifiers.

- Establishment of the National ATM1 Public Administration Network which will lead to an integrated optical communication network between ministries and departments.

- A good organization and recruitment of qualified experts in the development of information structure will allow an effective development and implementation of modern information technologies.

- The availability of computer equipment must be a priority in public administration, but for now it falls behind.

- Application of uniform standards and statutory regulations in all administrative structures which governing the administrative services.

- The functions of administrative structures must be precisely defined to match the specific requirements for electronic government. The existing vertical structure of the management model make the relationship between the administration and citizens or businesses difficult, which should be removed after the introduction of functions.

5. Conclusion

The electronic government is seen as an important part for the process of modernization of public administration in Bulgaria. It is committed to provide modern and efficient governance by means of modern information technologies in order to meet the needs of the citizens and businesses at any time and at any place. To achieve good results the e-government should be developed and updated according to the respective needs and requirements of the citizens. One of the effective ways is to borrow techniques and methods from the leading countries in the field of E-governance. This report presents other specific methods for improving the state of e-government. In realizing the defined proposals and examples is expected to increase the index for the development of e-government (EGDI) in the country which is the main purpose of the strategy for e-governance.

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Economic Benefits of Information as a Commodity in the New Economy

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Abstract: This research report aims to examine the economic benefits generated by the information as a commodity in the new economy. Scientific interest of the new economy connects with the emergence of digital information and in particular with the hardware and software associated with it. The digitization of information, its exchange and multiplication can contribute to the reduction of marginal costs or to almost zero values of the above mentioned. It is concluded that the global expansion of the economy is realized on the web with the establishment of virtual markets. Particular attention is paid to the function of the new economy, where information is reproduced and distributed in emergency low marginal costs without loss of quality. The latter is possible thanks to the digitization of information which facilitates its widespread and rapid dissemination. An information classification is made and the specific characteristics of the information are differentiated. Special emphasis is placed on individual price cost of information as a commodity, calculated based on choices made with or without the presence of information.

Keywords: Information, marginal costs, new economy, economic benefits.

1. Introduction

The "new economy" is associated with two not necessarily compatible issues. First, in the application of macroeconomic concepts, new economy requires new analytical tools. In this report, the existing macroeconomic toolkit seeks theories with which to control the economy related to digitized information. For this purpose we must introduce a distinction between commodity information, information goods and information infrastructure. This allows the implementation of macroeconomic theories in different market structures and their implications for the welfare of the new economy. Relation commodity-information likely aims to facilitate coordination issues and thus raise public welfare. To be able to fully exploit this potential, there are concerns about the reliability of the information and the credibility of the buyers and sellers that need to be addressed. Relation goods-information, on the other hand, bears characteristics similar to natural monopolies. The same statement applies to aspects of the relation information-infrastructure. There is a trend in the market in both categories to be kept under control by the government, so that the global potential of the new economy of wealth could be materialized.

2. New economy and information

Globally, there is strong interest in what is usually called "new economy". It connects to the economy, which refers to digital information and related hardware and software. The good thing in the new economy is a result of the digitization of information, its exchange and multiplication can be equated to zero marginal cost. On this basis, more and more people

connect to the global network. This allows very quick and cheap way to transport information. The economic significance of these developments is important and growing. The strong expansion of the economy thrives on the Internet, where on the virtual markets the supply and demand are meeting each other. As a result, the old physical markets are replaced with a continuous and high speed. On the other hand, many new online markets appear. The Internet is increasingly responsible for added value that is reflected in the value of the companies involved in the trade of information on stock exchanges worldwide.

There are two essential and important things that are written about the new economy. First, the approach to the understanding of issues related to the new economy is often macroeconomic. This means that the effects on macroeconomic variables such as national product, price level and employment are taken into account. National product and employment will rise for long periods of time without any inflation [1].

Secondly, the understanding that the new economy requires a rethinking of economic theory is imposed. It is claimed that the old economic laws are no longer applied. In their place new and current economic realities appear. Demand is not linked to prices, while supply often does. Since the traditional economic laws are no longer applied, speaking of a "new economy" that it is justified.

In a certain sense, these two ideas are contradictory. If someone believes that the old theory cannot rationalize the new economy, then nobody can support optimism about the effects of new welfare economics based on old theories and measurements. In other words: optimism, based on statistics, macroeconomics reveals faith in the applicability of this theory.

Therefore it is important to find a theoretical structure that can be used to redefine the problems of the "new economy". Traditionally known scientific knowledge, such as the existence of a compromise between unemployment and inflation, as it presented in the Phillips curve or measurement methods based on prices, inflation indices, are less solid and reliable in an economy in which information flows lead to reduce average costs [2]. The latter corresponds to the paradox of the national product in heaven and hell. In heaven, there is no shortage. All products are available in abundance. Therefore all prices and hence national product are zero. In Hell, on the other hand, there is a need for energy in order to keep the temperature high enough. Moreover, everything is scarce and prices are high. As a consequence, the national product is significant. Traditional macroeconomics should not measure preference to hell to paradise. Is it not possible to use the concept developed in the economic theory to consider how to effectively allocate limited resources in an attempt to shed light on the new economy? Discipline in which the issue of allocation leads to the development of advanced models is microeconomics.

The core industries in the new information economy are characterized by imperfect competition, asymmetric information or external effects. Consequently, in many circumstances well-designed microeconomic policies, in the form of competition policies, technology policies or combinations of these, have the potential of generating welfare improvements and promoting social efficiency [3].

Based on the structure of economies, and the behaviour of consumers and producers therein generate microeconomic implications for social welfare. The latter is sequentially defined a concept which is not open to a macro measurement of the problems mentioned above. Microeconomic theory seems particularly suitable for producing reports on the new economy. At its early development, the role of information in the public understanding was primarily in microeconomics. The concept of Adam Smith's "invisible hand" in competitive markets is essentially concerns about the spread of sufficient information by market prices in such a way that individual optimal solutions are also socially optimal. Microeconomics

seems well prepared to deal with the issues of information. However, this is the use of limited resources for alternative purposes, based on which the theory concludes that the scarcity is the one who determines the prices of goods and that they guide the invisible hand.

Still, digitized information can be reproduced and transported without loss of quality and marginal costs almost equal to zero. This seems able to challenge the concept of scarcity. However, unrestrained preparation of information leads to a new type of scarcity: the time needed to select, personalize and consume information. Furthermore, there is an artificial way to make information scarce by granting intellectual property rights.

And another potential source of shortage is in media on the level of "information infrastructure". In this report, some of the consequences that large-scale movement of digitized information can lead to changes in the structure of supply and demand, as well as in competitive processes and social welfare, are explored.

Research on the economics of digitization studies how markets change when digitization leads to reproduction at zero cost and an abundance of digital data. Digital technology has led to a rapid decline in the cost of storage, computation, and transmission of data. As a consequence, economic activity is increasingly digital. The transformative nature of digital technology has implications for understanding economic activity, for consumer behavior, for competitive strategy, for new firm formation, and for determining policy. Research on the economics of digitization is distinguished by an emphasis on how digital technology and digital data interact with market outcomes. Specifically, economic settings transformed by digital data tend to have very low marginal costs of production and distribution, as well as lower transactions costs and market frictions, thereby raising numerous questions and issues [4].

The central aspect of the new economy is its function, whereby information is reproduced and distributed emergency low marginal costs without loss of quality. The latter is possible because the form of information, which is determined by the new telecommunication-networks with Internet connections. The term "information" is used for anything that can be digitized. This is the digitization of information which facilitates its widespread and rapid dissemination. Although digitization is not always entirely feasible - after all, the digital signal is only a discrete approximation of a similar signal. Any information, regardless of its daily application may be digitized for practical purposes.

3. Information classification

In order to reveal the influence of the information on the manner in which decisions are taken, it is useful to be classified. The first and most elementary distinction is between pure and instrumental information. Pure information that must be distinguished from its carrier and it is information from a direct source of utility or information that is used directly as an input factor in the production process. An example of user information such as a movie is good, but is not considering cinema. Example of information as a production factor is the word processing program, but without CD-ROM, which it works to. Pure information is a commodity and therefore is characterized as any other goods of content, time and place of availability and current status [5].

We refer to pure information as information commodity. Instrumental information, by contrast, is about things that provide a direct benefit or serve in production. This attitude is a "commodity-information", such as information about some movie plays at a particular time in a particular theater or information about the presence of a certain type of production factors. Relation "goods-information" ("commodity-information") in microeconomic literature as a whole represents a probability distribution on the set of possible states. In case of full relation "goods-information", there is not uncertainty and distribution is possible in

many countries worldwide. In case of incomplete "commodity-information", individuals base their decisions on incorrect distribution. The new terms "commodity-information " generally leads to an update of this distribution.

When information products are a direct source of utility themselves, the "commodity-information" specifies the selection of individuals of any goods that provide utility. It has little value in itself, but generates value in regard the opportunity to make a choice. "Commodity-information" serves to take a better understanding on the movie, make focus on the information of the main products in time for the show.

Also, the information that producers receive for their behaviour and preferences of the act of buying, customers is inherently "commodity-information". Commodity-information is information on the elements of the vector of goods, including information goods. The information is often available in both of these forms. The trailer of a movie is both information good (as is often fun read) and "commodity-information" as leads to optimization of consumer choice. One element of the "commodity-information" that attracts research and scientific interest in the economic literature is the price of a commodity.

In parallel with this problem area is whether the information is commodity or not. In this context, it is important to note the difference between the interpretations of the same type of "commodity-information" from different individuals. Faced with a large amount of identical information, different individuals can generate such expectations. Yet, on the basis of the same signals from the outside world, different individuals may form different expectations [6]. The implicit value of the information can lead to the trading of "commodity-information" as a commodity. Information about what movie where is projected is generally offered free of charge. Another prominent example of its commercial character is the information needed by buyers and sellers of houses, when trying to find their location. Trade in that product, which consists of commodity information provides broker agents their salaries.

Although the information can be analyzed separately from its physical carrier, but to be useful, it must be stored, for example on DVD, paper or in the human minds. The combination of information and carrier become common product standard item in its economic sense. An example is again information good "movie", shown in a cinema [5]. As the number of seats in the cinema is limited, an appropriate price can make the goods sought. Also, the information printed in the magazine consumer is connected with paper that they need to acquire. Marketable goods information acquire the characteristics of traditional products and are characterized by content, time and place of availability.

Improvement of relation "information-infrastructure" is interesting because it creates equality between the importance of information and media (carrier). Cheaper transportation of information makes the availability of information smaller problem. For manufacturers this means that traditionally important element on which is built monopoly power disappears. Moreover, technological progress leads to the emergence of new applications that were previously impossible or have been too expensive.

4. Specific characteristics of information

Technological improvements that facilitate commerce can reduce transaction costs, provide more information to participants, boost access to a wider array of products, lead to efficiency gains, as well as result in welfare improvements for the entire economy [7]. Both the production and dissemination of information are significantly different from those of natural products. This was recognized in the early 60's by Kenneth Arrow. He observed that the production of new information generally requires high fixed costs that are absorbed to a great extent once they are made. Writing a book, for example, requires a special effort of the

writer. Once this procedure is performed, reproduction copy of the book is easy and can be performed at relatively low marginal cost [8]. Such is the case with the books since he invented the art of printing through computer software. In this case, the marginal costs (MC), necessary for the preparation of the information are zero.

This asymmetry between fixed (FC) and marginal cost (MC) causes a number of important issues, because copying is a simple process and once produced information is disseminated quickly and easily. As a result, it is doubtful whether someone is ready to make the initial investment in the production of new information. Ultimately, there is a real opportunity that the investment cannot be bought back [9]. The consequences are even more catastrophic when taking into account the public good such information. Naturally, this is the basis of intellectual property rights.

Therefore, information can be passed from one individual to the next. It expresses the characteristics of the information recorded by Arrow. In most cases these features are equally true, as well as for "commodity-information" and for information goods. That is why trade of information usually includes its multiplication, which results that information is a commodity for which there is not necessarily rivalry.

5. Conclusion

We consider that the information is dominant part of the new economy, that why it is very important to manage it in effective way. It is necessary to differentiate the "commodity-information" as data and information products. The flow of the two types of information is building infrastructure. Regarding the characteristics of this two type of information as a goods, they are offer to market. In reason of their advantages, they become competition key. Today they are offer to monopolistic market, granted by the intellectual property rights. To generate economic benefits from information is crucial to well understand its inherent characteristics as a commodity, manage it effectively, knowing the state of modern markets.

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New Solution of a Problem from Group A of the NSOM, 2015 and One Famous Problem from Approximation Theory

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Abstract: The paper is dedicated to the National Student Olympiad in Mathematics, held in Sunny Beach resort, May 29 – 31, 2015. New ideas to the solutions of the problems concerning approximation theory are considered.

Keywords: NSOM 2015, finite difference, rank of the matrix, moduli of smoothness

1. Introduction

The National University Students Olympiad in Mathematics (NSOM) is a mathematical competition among university students of BA and MA programs.

The National University Students Olympiad in Mathematics with international participation (NSOM 2015) took place May 29 - 31, 2015 at Sunny Beach, Bulgaria. Host institution of the Olympiad was the University of Architecture, Civil Engineering and Geodesy (UACEG), Sofia. The contestants from Group A study – mathematics, informatics and computer science. The Conspect of Group A includes the following themes:

1. Vector algebra and applications to geometry.
2. Straight line and plane equations.
3. Quadratic forms. Equations of curves and second degree surfaces.
4. Matrices, determinants, systems of linear equations.
5. Finite dimensional linear spaces. Euclidean spaces.
6. Linear operators: eigenvalues and eigenvectors, diagonalization and applications.
7. Polynomials with integer, real and complex coefficients.
8. Groups, rings, fields.
9. Functions of one real variable: continuity, differentiability, basic theorems of differential
calculus.
10. Indefinite, definite, improper integrals and applications.
11. Parameter-dependent integrals.
12. Number sequences and series. Sequences and series of functions.

Detailed information about the regulation of NSOM is published at http://nsom2015.heliohost.org/nsom15.html, where one can find the author's solutions of the problems. Here we present second solution, different from author's of the following

Problem

Let $A=(a_{k,l})$ be a $n\times n$, $n\geq 2$ matrix with elements $a_{k,l}=(k-l)^3$. Find the rank of the matrix.

The solution is given in section 3.

2. Preliminaries

In this section we recall some basic facts about finite difference which will be needed in the sequel. We consider the first finite difference with step *t*,

$$\Delta_t f(x) = f(x+t) - f(x).$$

We put

$$\omega(f,h) = \max_{\substack{x,t \\ |t|\le h}} |f(x+t) - f(x).|$$

The function $\omega(f,h)$ is called the *modulus of continuity* of f and is defined for $0 \le h \le b-a$ when $f \in C[a,b].$

The finite difference of order r =1,2, … , with step t $\Delta_t^r f(x)$ are defined by induction. If $f(x)$ is defined on $A=[a,b]$ then

$$\Delta_t^1 f(x) = \Delta_t f(x); \quad \Delta_t^r f(x) = \Delta_t \Delta_t^{r-1} f(x).$$

One proves by induction:

$$\Delta_t^r f(x) = \sum_{k=0}^{r} (-1)^{r+k} \binom{r}{k} f(x+kt).$$

Indeed we have

$$\Delta_t^r f(x) = \Delta_t \Delta_t^{r-1} f(x) = \Delta_t \left(\sum_{k=0}^{r-1} (-1)^{k+r-1} \binom{r-1}{k} f(x+kt) \right)$$

$$= \sum_{k=0}^{r-1} (-1)^{k+r-1} \binom{r-1}{k} f(x+(k+1)t) - \sum_{k=0}^{r-1} (-1)^{k+r-1} \binom{r-1}{k} f(x+kt)$$

$$= f(x+rt) - \left(\binom{r-1}{r-2} + \binom{r-1}{r-1} \right) f(x+(r-1)t) +$$

$$+ \left(\binom{r-1}{r-3} + \binom{r-1}{r-2} \right) f(x+(r-2)t)$$

$$+ \ldots + (-1)^r f(x) = f(x+rt) - \binom{r}{r-1} f(x+(r-1)t)$$

$$+ \binom{r}{r-2} f(x+(r-2)t) + \ldots + (-1)^r f(x) = \sum_{k=0}^{r+k} (-1)^{r+k} \binom{r}{k} f(x+kt).$$

We used the identity $\binom{r-1}{l-1}+\binom{r-1}{l}=\binom{r}{l}$.

Another useful formula is valid for functions f, which have absolutely continuous derivative $f^{(r-1)}$ ($f^{(r-1)}$ is an indefinite integral of $f^{(r)}$):

$$\Delta_t^r f(x)=\int_0^t\dots\int_0^t f^{(r)}(x+y_1+\dots+y_r)dy_1\dots dy_r. \qquad (1)$$

This formula is obvious for $r=1$ and is proved by induction on r in the general case.

From (1) we obtain that the finite difference of order $r+1$ of algebraic polynomials of degree r are equal to 0.

If $f\in C[a,b]$ the *moduli of of smoothness* of f are defined by

$$\omega^r(f,h)=\max_{\substack{x,t\\|t|\le h}}\left|\Delta_t^r f(x)\right| \qquad r=1,2,\dots, \qquad 0\le h\le\frac{b-a}{r};$$

$\omega^1(f,h)$ is the modulus of continuity $\omega(f,h)$. As a function of h, $\omega^r(f,h)$ is continuous, increasing, and satisfies $\omega^r(f,0)=0.$

After these preliminary remarks we explain the solution of the problem.

3. Solution

As $(k-l)^3$ is an algebraic polynomial of degree 3 on k, when l is fixed we have

$$\Delta_1^4\left((k-l)^3\right)=0.$$

More precisely

$$\begin{aligned}&\Delta_1^4\left((k-l)^3\right)\\&=(k-l)^3-4(k-l+1)^3+6(k-l+2)^3-4(k-l+3)^3+(k-l+4)^3\\&=a_{k,l}-4a_{k+1,l}+6a_{k+2,l}-4a_{k+3,l}+a_{k+4,l}=0.\end{aligned}$$

Thus if A_k is the k - th vector row of $A=(a_{k,l})$ we conclude that

$$A_{k+4}=4A_{k+3}-6A_{k+2}+4A_{k+1}-A_k, \quad k=1,2,\dots,n-4.$$

We obtain that each of the vector row $A_5,A_6,\dots,A_n$ is a linear combination of $A_1,A_2,,A_3$ and A_4. Therefore for $A=(a_{k,l})$ the rank of the matrix $r(A)\le 4.$ Since

$$\Delta_4 = \left|a_{k,l}\right|_{k,l=1}^{4} = \begin{vmatrix} (1-1)^3 & (1-2)^3 & (1-3)^3 & (1-4)^3 \\ (2-1)^3 & (2-2)^3 & (2-3)^3 & (2-4)^3 \\ (3-1)^3 & (3-2)^3 & (3-3)^3 & (3-4)^3 \\ (4-1)^3 & (4-2)^3 & (4-3)^3 & (4-4)^3 \end{vmatrix}$$

$$= \begin{vmatrix} 0 & -1 & -8 & -27 \\ 1 & 0 & -1 & -8 \\ 8 & 1 & 0 & -1 \\ 27 & 8 & 1 & 0 \end{vmatrix} = 1296 \neq 0$$

we obtain that the vectors row A_1, A_2, A_3 and A_4 are linearly independent and the rank of the matrix $r(A) \geq 4.$ Hence $r(A) = 4$ for $n \geq 4.$

When $n = 2$ $A = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$, $\det(A) = 1 \neq 0$ and $r(A) = 2.$

For $n = 3$ $A = \begin{pmatrix} 0 & -1 & -8 \\ 1 & 0 & -1 \\ 8 & 1 & 0 \end{pmatrix}$, $\det(A) = 0$ and $r(A) = 2.$

Thus the rank of the matrix A, $r(A) = 4$ for $n \geq 4$ and $r(A) = 2$ for $n = 2, 3.$

4. One problem from the book Approximation of Functions by G.G. Lorentz

Problem [4, p.52] Prove that a function $f \in C[a,b]$ is linear if and only if $\omega^2(f,h) = 0$ for some $h > 0.$

Solution 1. If $f \in C[a,b]$ is linear from (1) and the definition of the modulus is obvious that $\omega^2(f,h) = 0$. Let $\omega^2(f,h) = 0$ for some $h > 0$ and $f \in C[a,b]$. We shall prove that $f \in C[a,b]$ is linear. By assumption as $\omega^2(f,h) = 0$ with $0 < t \leq h$ and $x,\ x + 2h \in [a,b]$ we have

$$f(x+2t) - 2f(x+t) + f(x) = 0. \tag{2}$$

By (2)

$$f(x+2t) - f(x+t) = f(x+t) - f(x). \tag{3}$$

On the other hand

$$\big(f(x+2t) - f(x+t)\big) + \big(f(x+t) - f(x)\big) = f(x+2t) - f(x).$$

Hence

$$f(x+2t)-f(x+t)=f(x+t)-f(x)=\frac{1}{2}\big(f(x+2t)-f(x)\big). \qquad (4)$$

We split each of the intervals $[x,x+2t]\in[a,b]$, $[x+2t,x+4t]\in[a,b]$ into two parts. Now we have 5 points $(x+jt)\in[a,b]$ $j=0,1,2,3,4.$ We use (4) with $0<2t\le h$ and $x,\ x+2h\in[a,b]$ to write

$$f(x+4t)-f(x+2t)=f(x+2t)-f(x)=\frac{1}{2}\big(f(x+4t)-f(x)\big) \qquad (5)$$

We can write by (4) and (5)

$$f(x+2t)-f(x+t)=f(x+t)-f(x)$$
$$=\frac{1}{2}\big(f(x+2t)-f(x)\big)=\frac{1}{4}\big(f(x+4t)-f(x)\big).$$

Similarly

$$f(x+4t)-f(x+3t)=f(x+3t)-f(x+2t)$$
$$=\frac{1}{2}\big(f(x+4t)-f(x+2t)\big)=\frac{1}{4}\big(f(x+4t)-f(x)\big).$$

Hence

$$f(x+t)-f(x)$$
$$=f(x+2t)-f(x+t)=f(x+3t)-f(x+2t)=f(x+4t)-f(x+3t)$$
$$=\frac{1}{4}\big(f(x+4t)-f(x)\big)$$

Repeating this process l times we obtain 2^l+1 points $(x+jt)\in[a,b]$ $j=0,1,2,...,2^l$ for which with $0<2^{l-1}t\le h$ and $x,x+2h\in[a,b]$ we have

$$f(x+jt)-f(x+(j-1)t)=\frac{1}{2^l}(f(x+2^lt)-f(x)),\quad j=1,2,...,,2^l. \qquad (6)$$

By summation of several successive equality (6) we obtain

$$f(x+jt)-f(x+it)=\frac{j-i}{2^l}\,(f(x+2^lt)-f(x)) \quad \text{for } 0\le i<j\le 2^l. \qquad (7)$$

Let now x_0 and y_0 be arbitrary two points with $x\le x_0<y_0\le x+2^lt,$ $2^{l-1}t\in(0,h]$ and $x,x+2h\in[a,b].$ We select

$$x_{0l}=x+it \text{ and } y_{0l}=x+jt \qquad (8)$$

(i and j are integers $0\le i<j\le 2^l$) in such a way that

$$|x_{0l}-x_0|<t \quad \text{and} \quad |y_{0l}-y_0|<t \qquad t\in\left(0,\frac{h}{2^{l-1}}\right]. \qquad (9)$$

As $f \in C[a,b]$ is continuous $\forall \varepsilon > 0\ \exists\ L$ sufficiently large integer such that for $l > L$ is satisfied

$$\left| \frac{f(y_0) - f(x_0)}{y_0 - x_0} - \frac{f(y_{0l}) - f(x_{0l})}{y_{0l} - x_{0l}} \right| < \varepsilon ,$$

because of $t \in \left(0, \frac{h}{2^{l-1}}\right]$ and (9) we have

$$\lim_{l\to\infty} x_{0l} = x_0 \text{ and } \lim_{l\to\infty} y_{0l} = y_0 .$$

I. e. we derive

$$\lim_{l\to\infty} \frac{f(y_{0l}) - f(x_{0l})}{y_{0l} - x_{0l}} = \frac{f(y_0) - f(x_0)}{y_0 - x_0} .$$

Because of (7) and (8) we have

$$\frac{f(y_{0l}) - f(x_{0l})}{y_{0l} - x_{0l}} = \frac{f(x + jt) - f(x + it)}{(x + jt) - (x + it)} = \frac{f(x + 2^l t) - f(x)}{(x + 2^l t) - x} .$$

If we assume that $y = x + 2^l t$ is fixed we derive

$$\frac{f(y_0) - f(x_0)}{y_0 - x_0} = \frac{f(y) - f(x)}{y - x} ,$$

where $x \le x_0 < y_0 \le y \le x + 2h$. If we choose $x = a',\ y = b'$, where $[a', b']$ is an arbitrary interval with length *h*, we obtain

$$\frac{f(y_0) - f(x_0)}{y_0 - x_0} = \frac{f(b') - f(a')}{b' - a'}$$

for every two points x_0, y_0 with $a' \le x_0 < y_0 \le b'$. Therefore f is differentiable for any $x_0 \in (a', b')$: $b' - a' = 2h$ and

$$f'(x_0) = \lim_{y_0 \to x_0} \frac{f(y_0) - f(x_0)}{y_0 - x_0} = \frac{f(b') - f(a')}{b' - a'} .$$

Hence $f(x) = \frac{f(a' + 2h) - f(a')}{2h} x + c$ for $x \in (a', a' + 2h)$, i.e. f is a linear function in each interval $(a', a' + 2h)$ and arbitrary $a' \in [a, b - 2h]$. Since $f \in C[a,b]$ f is a linear function $\forall x \in [a,b]$.

Solution 2. Theorems concerning equivalence between K functional and moduli of smoothness are a well known results in approximation theory (see [3]) . With $Dg = g^{(r)}$ and $X = L_p = L_p[a,b]$ with the usual L_p norm denoted by $\|.\|_p$ for $1 \le p < \infty$ or $X = C = C[a,b]$ with the uniform norm denoted by $\|.\|_\infty$ for $p = \infty$ the K-functional is of the form

$$K(f,t;X,Y,D) = \inf\left\{\|f-g\|_X + t\|Dg\|_X : g \in Y\right\}.$$

The classical moduli of smoothness are defined by

$$\omega^r(f,h)_p = \sup_{0<t\le h}\left\|\Delta_t^r f(x)\right\|_p \qquad r = 1,2,..., \qquad 0 \le h \le \frac{b-a}{r};$$

And the finite difference with a fixed step *t* is given by

$$\Delta_t^r f(x) = \begin{cases} \Delta_t^r f(x) = \sum_{k=0}^{r} (-1)^{r+k} \binom{r}{k} f(x+kt) & \text{if } x, x+rt \in [a,b] \\ 0, & \text{otherwise.} \end{cases}$$

The space AC_{loc}^k is given by $AC_{loc}^k = AC_{loc}^k(a,b) = \left\{g : g', ..., g^{(k)} \in AC[c,d] \quad \forall a < c < d < b\right\}$, $AC[c,d]$ is the set of the absolutely continuous functions on $[c,d]$.

As already mentioned, the moduli $\omega^r(f,h)_p$ and $K(f,t^r;L_p,AC_{loc}^{r-1},D^r)$ are equivalent. For example Theorem 2.1.1 Chapter 2 in [2] (see also [1]) states that (in case when the weight function $\varphi \equiv 1$), there are positive constants C_1, C_2, such that for all $f \in L_p(a,b), 1 \le p \le \infty,\ 0 < h \le h_0$

$$C_1\omega^r(f,h)_p \le K(f,h^r;L_p,AC_{loc}^{r-1},D^r) \le C_2\ \omega^r(f,h)_p .$$

By assumption $\omega^2(f,h) = \max_{\substack{x,t \\ |t|\le h}} \left|\Delta_t^2 f(x)\right| = 0$ for some $h > 0$ and $f \in C[a,b]$ hence the K - functional is also zero.

$$K(f,h^2;L_p,AC_{loc}^1,D^2) = \inf\left\{\|f-g\|_{C[a,b]} + h^2\|g''\|_{C[a,b]} : g \in AC_{loc}^1\right\} = 0.$$

Let choose $g \in AC_{loc}^1$:

$$\|f-g\| \le \frac{\varepsilon_0}{2} \text{ and } \|g''\| \le \frac{\varepsilon_0}{2}. \qquad (10)$$

As $g'(x) = g'(x_0) + \int_{x_0}^{x} g''(t)dt$, $x_0 \in (a,b)$, $x \in (a,b)$ using (10) we have

$$\left| \int_{x_0}^{x} g''(t)dt \right| \le \int_{x_0}^{x} \frac{\varepsilon_0}{2} dt = \frac{\varepsilon_0}{2}(x - x_0) \le \frac{\varepsilon_0 (b-a)}{2}.$$

Then $|g'(x) - g'(x_0)| \le \frac{\varepsilon_0 (b-a)}{2}$ for $x \in (a,b)$. Also for $x \in (a,b)$,

$$g(x) = g(x_0) + \int_{x_0}^{x} g'(t)dt = g(x_0) + \int_{x_0}^{x} [g'(x_0) + (g'(t) - g'(x_0))]dt =$$

$$= g(x_0) + g'(x_0)(x - x_0) + \int_{x_0}^{x} (g'(t) - g'(x_0))dt.$$

Now we obtain

$$\left| g(x) - g(x_0) - g'(x_0)(x - x_0) = \left| \int_{x_0}^{x} (g'(t) - g'(x_0))dt \right| \le \left| \int_{x_0}^{x} \frac{\varepsilon_0 (b-a)}{2} dt \right| \right.$$

$$\le \frac{\varepsilon_0 (b-a)^2}{2}, \; x \in (a,b) \tag{11}$$

Then from (10) and (11) we conclude that for $x \in (a,b)$,

$$\begin{aligned} &|f(x) - (g(x_0) + g'(x_0)(x - x_0))| \\ &\le |f(x) - g(x)| + |g(x) - (g(x_0) + g'(x_0)(x - x_0))| \\ &\le \frac{\varepsilon_0}{2} + \frac{\varepsilon_0 (b-a)^2}{2}. \end{aligned} \tag{12}$$

Let $\varepsilon > 0$ be arbitrary and choose $\varepsilon_0 > 0$ such that $\frac{\varepsilon_0}{2} + \frac{\varepsilon_0 (b-a)^2}{2} < \varepsilon$. Using (12), with this choice one has

$$|f(x) - (g(x_0) + g'(x_0)(x - x_0))| < \varepsilon, \; x \in (a,b).$$

Therefore there exists a sequence of linear functions $A_n x + B_n$ such that $\lim_{n\to\infty} |f(x) - (A_n x + B_n)| = 0 \quad \forall x \in [a,b]$, i. e. $\lim_{n\to\infty} (A_n x + B_n) = f(x)$ in sup – norm. Taking fixed point x_1 and x_2 such, that $a < x_1 < x_2 < b$ it follows that the

sequences $\{A_n x_1 + B_n\}_{n=1}^{\infty}$ and $\{A_n x_2 + B_n\}_{n=1}^{\infty}$ are converged and then $\{(x_2 - x_1)A_n\}_{n=1}^{\infty}$ is converged. Since x_1 and x_2 are fixed number and $x_2 - x_1 \neq 0$ we obtain that $\{A_n\}_{n=1}^{\infty}$ is converged and then $\{B_n\}_{n=1}^{\infty}$ is converged also as $n \to \infty$. Let $\lim_{n\to\infty} A_n = A$ and $\lim_{n\to\infty} B_n = B$. Since the interval [*a*, *b*] is bounded, it follows that

$$\lim_{n\to\infty}(A_n x + B_n) = Ax + B \text{ in sup – norm.}$$

Since $\lim_{n\to\infty}(A_n x + B_n)$ in sup – norm is unique, we conclude, that $f(x) = Ax + B$, i.e. $f(x)$ is a polynomial of degree no more than 2.

Remark. The last conclusion can be obtained using that every finite linear subspace of a complex topological vector space is closed (see[5, Theorem 1.21]).

Solution

Without loss of generality we can asume that $f \in C[0,1]$, i.e. *a*=0 and *b*=1. For any natural number *n* the Bernstein operator is defined by

$$B_n(f;x) = \sum_{k=0}^{n} \binom{n}{k} x^k (1-x)^{n-k} f\left(\frac{k}{n}\right), \quad x \in [0,1].$$

Theorem 3.2 of Popoviciu [1935] in Chapter 10 in [1] states that the following inequality is valid

$$|f(x) - B_n(f;x)| \le C\omega^2\left(f, \sqrt{X/n}\right), \ x \in [0,1]$$

with some constant *C*>0, where $X = x(1-x)$. In particular when *n*=1,

$$|f(x) - B_1(f;x)| \le C\omega^2(f, 1/2), \ x \in [0,1].$$

But from properties of the moduli [1, p.45, (7.7)],

$\omega^2(f, 1/2) = \omega^2\left(f, N.\frac{1}{2N}\right) \le N^2\omega^2\left(f, \frac{1}{2N}\right) = 0$ for sufficiently large natural number *N*. Then $\omega^2(f, 1/2) = 0$ and $|f(x) - B_1(f;x)| = 0$, i.e.

$f(x) = B_1(f;x) = f(0)(1-x) + f(1)x = (f(1) - f(0))x + f(0), \ x \in [0,1]$ is a linear function.

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Manufacturing Execution Systems (MES) and Manufacturing Intelligence (MI) Solutions - Outline Current Trends in Manufacturing Analytics

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Abstract: MES (Manufacturing execution systems) track and document the transformation of raw materials through finished goods. The term Manufacturing Intelligence (MI) is described in the literature as "the synthesis of three key elements – manufacturing performance, business intelligence and real-time information". The paper reviews existing MES (Manufacturing execution systems) and Manufacturing Intelligence solutions to outline current trends in manufacturing analytics. This research is necessary to establish a solid ground for development of Manufacturing Business Intelligence and Self-Service capabilities.

Keywords: Manufacturing intelligence, MES (Manufacturing execution systems), Plant Intelligence, Analysis of manufacturing systems data

1. Introduction

MES (Manufacturing execution systems) track and document the transformation of raw materials through finished goods. The term Manufacturing Intelligence (MI) is described in the literature as "the synthesis of three key elements – manufacturing performance, business intelligence and real-time information". The review of existing MES (Manufacturing execution systems) and Manufacturing Intelligence solutions is important to establish a solid ground for development of Manufacturing Business Intelligence and Self-Service capabilities. Following the lean principles the visualization and functionality of MI solutions can be always improved. However, first must be clear what are the needs and trends and what solutions exist on the market.

2. Manufacturing execution system (MES) definition

A manufacturing execution system (MES) is a control system for managing and monitoring work-in-process on a factory floor.

A MES keeps track of all manufacturing information in real time, receiving up-to-the-minute data from robots, machine monitors and employees.

The idea of MES might be seen as an intermediate step between, on the one hand, an *Enterprise Resource Planning (ERP*) system, and a *Supervisory Control and Data Acquisition (SCADA)* or *process control system* on the other [4]

3. Manufacturing intelligence definition

According to [1] the manufacturing equivalent of Business Intelligence is Manufacturing Intelligence (MI). MI expands the concepts of traditional studies by looking across multiple dimensions of production information to discover correlations not seen in

normal engineering analysis. MI focuses on products, inventory, WIP, production schedules, production performance, yields, waste, and costs. MI can be implemented to augment the Six Sigma and other improvement projects.

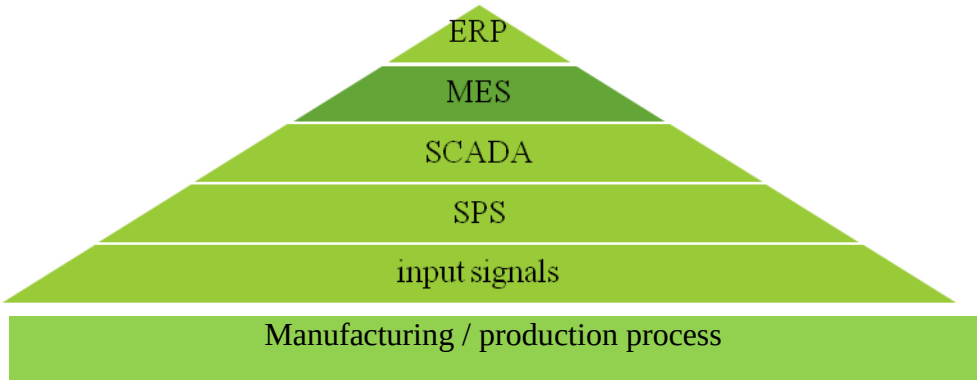

Fig. 1. MES in the automation pyramid [3]

According to [2] the majority of recently published material on manufacturing intelligence (also referred to as 'Enterprise Manufacturing Intelligence' (22, 23) is technical or sales material (24, 25). This literature focuses on what functionality specific MI products have without providing a coherent description of the purpose or scope of MI.

Manufacturing Intelligence is the synthesis of the key elements (manufacturing performance, business intelligence, and real-time information) required for global manufacturers to compete in the current business environment. Manufacturing Intelligence is the next generation of decision support capabilities for global manufacturers. [2]

4. MES and Manufacturing Intelligence Solutions

According to [5] MES is comprised of a relatively mature group of applications designed to manage production workflow from beginning to end, operation by operation. These applications generate work instructions for operators, ensure the right materials are available, and communicate operator and setpoint instructions to factory systems. As specific tasks are performed, outputs and results are measured against parameters for quality, cycle time, and throughput. MES have evolved over time to become mission critical systems that maintain the bill of process, 'as built' bill of material, and full product genealogy. MES delivers the largest dividends to those companies that build complex discrete products.

Alternatively, manufacturing intelligence solutions are relatively new entrants to the market. They were not designed to manage mission critical production processes, but rather provide visibility into selected tasks and pieces of equipment. Web portals provide direct access, enabling operators to monitor production and managers to manage by exception remotely. Manufacturing intelligence solutions are generally driven from existing ERP systems to provide visibility into plant floor operations.

As a real-time visibility and analytics tool, manufacturing intelligence solutions rely on collecting data directly from plant floor equipment to build data models that aggregate and deliver information to decision makers throughout the manufacturing enterprise. [5]

- Best in Class respondents are more likely to have mature KPI programs and are building linkages across the global manufacturing enterprise. [5]
- Key technologies such as MES, manufacturing intelligence, and business analytics will play an increasingly important role in enabling the global manufacturing enterprise. [5]
- The number of MES implementations is expected to double (35% - 71%) within 2 years additional more than one third will integrate these solutions into supply chain functions. [5]
- Manufacturing intelligence solutions will enable companies to continuously improve operations and fuel innovation. [5]

5. Manufacturing metrics

Delivering KPIs and **real-time** results to operators, managers, and executives is a top technology priority for the majority of manufacturers that participated in the *Global Manufacturing: MES and Beyond Benchmark Report* study. [5]

Real – Time KPI Monitoring				
Emerging Technology	Technology project in progr ess	Technology up and running > 1 year	**Technology planned in the future**	No plans for this technology
Real-time KPI monitoring (w/MES)	18%	23%	**39%**	21%
Real-time KPI monitoring (w/mfg intell)	9%	9%	**29%**	53%
Real-time KPI monitoring (w/SCADA)	14%	15%	**27%**	44%

Fig. 2. Real-Time KPI Monitoring [5]

Companies that have been reporting against KPIs for five years or more are likely to have achieved Best in Class status today. At least one third more Best in Class companies have monitored scrap or yield, factory throughput, and manufacturing cycle time for the past five or more years than their poorer performing counterparts. Figure 3 also shows a performance disparity between those companies that have been monitoring time-to-market (an important cross-functional metric) for several years (50% of Best in Class versus 13% of the others).

Figure 5 shows that Best in Class companies are much further along in the development of metrics programs that span multiple locations than their lower performing counterparts. For instance, Best in Class companies are five time more likely to be monitoring OEE, workforce performance, or manufacturing cycle time across facilities than their poorer performing competitors. Additionally, order-to-delivery cycle time, scrap or

yield, and factory throughput are being monitored enterprise-wide 3 and 4 times more frequently by Best in Class companies. [5]

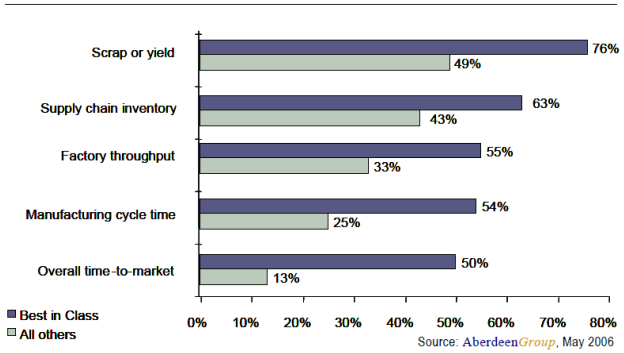

Fig. 3 Mature Manufacturing Metrics (5+ years) [5]

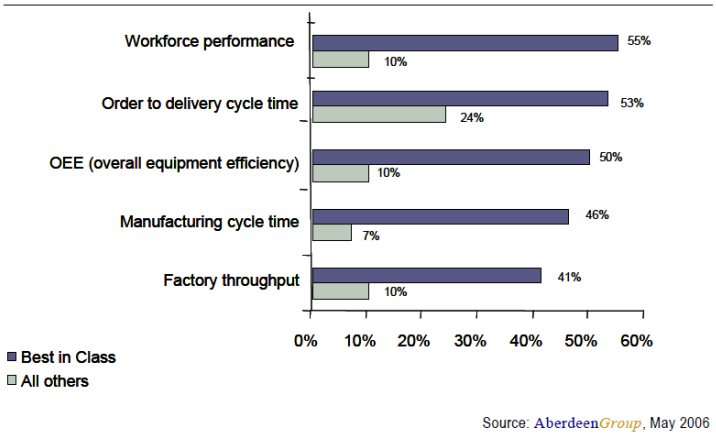

Fig. 4. Corporate-Driven Manufacturing Metrics [5]

6. Visualization and functionality analysis

There are many different MI applications on the market. Overall, they have similar functionalities [6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21]. Some report functionalities are custom development, some other use QlikView BI software, and the third group is using other BI platforms. Below on Figure 5 you can see layouts of some manufacturing intelligence solutions. For the needs of this research are reviewed different software solutions like: InfoBatch, Factory MES Analytics, Wonderware QI Analyst, IQMS, SIMATIC IT, Tableau applications, QlikView applications, SAS applications.

7. Conclusion

Is there a link between Manufacturing execution systems (MES) and Manufacturing Intelligence (MI) solutions and the best in class manufacturers? What are the current trends in manufacturing analytics? The answers to this questions are given in the paper.

The overall conclusion is that best in class manufacturing companies are monitoring some of the most important KPIs by using MI solutions. The process of data collection, transformation and analysis is automated and in most cases real-time or near real-time. There are many software vendors and solutions which are offering different MI functionalities. However, the author of this paper see an opportunity new data models, visualization and report functionalities to be designed and developed to provide better user experience which will support the continues plant improvements.

Subject of future work is to design concepts regarding reports visualization and functionality.

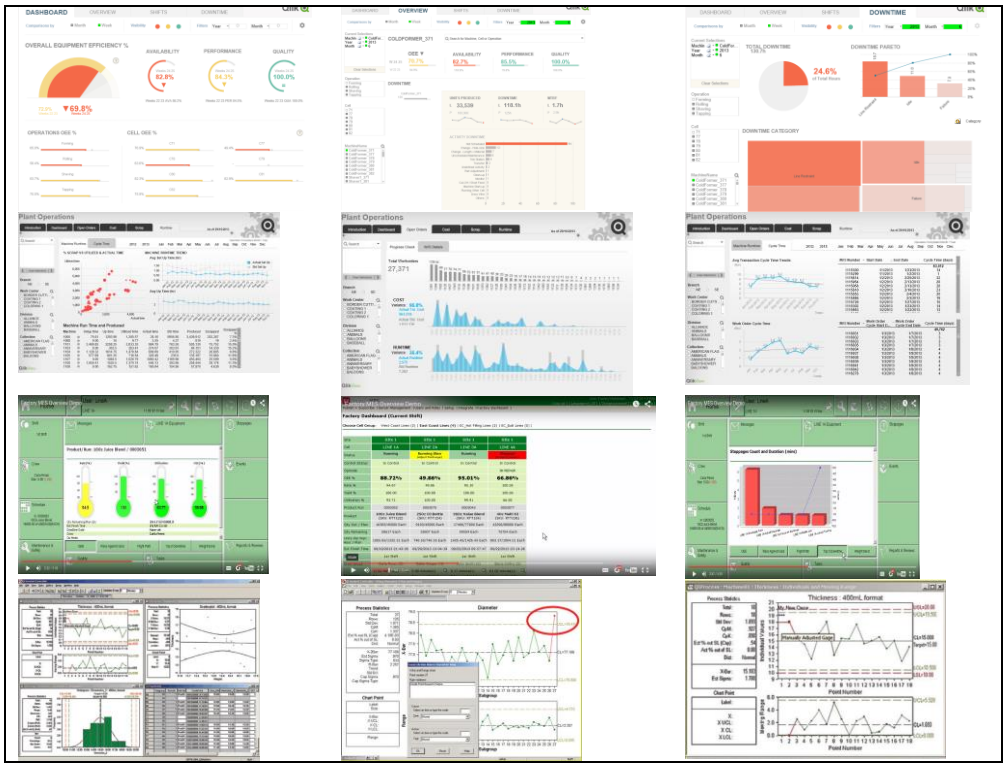

Fig. 5. MI applications [6-21]

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Lean Manufacturing and Performance Measurement – Improve Manufacturing Performance

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Abstract: One of the lean principals is to "create lean value by doing the job right and by doing the right job". To understand whether a plant is following this principle a lot of analysis is required. This brings up the question "Which are the right KPIs and how to calculate them right?" This paper will outline some of the most important lean principles and KPIs for manufacturing operations management.

Keywords: Manufacturing intelligence, Plant Intelligence, Analysis of manufacturing execution (MES) systems data, Key Performance Indicators (KPI), Manufacturing Operations Management

1. Introduction

Lean thinking is the dynamic, knowledge-driven and customer-focused process through which all people in a defined enterprise continuously eliminate waste with the goal of creating value. [3]In order to find out what needs to be improved, the overall picture in a plant can be monitored and analyzed. Plants measure their performance using different methods and criteria. They use performance metrics or measures. There are numerous possible metrics for each business activity. The information technology and business intelligence tools in particular are supporting this process by automating the collection of business data, integration of the data across multiple dimensions, analysis of the data, and presentation of the results [1].

2. Definition of Lean Manufacturing – key principles

John Krafcik, a graduate student at MIT's Sloan School of Management and a researcher in the International Motor Vehicle Program (IMVP), was the first to use the term lean production system. In his master's thesis he highlighted that lean production uses less of everything compared with mass production – less human effort in the factory, less manufacturing space, less investment in tools, and fewer engineering hours to develop a new product. This makes it possible to produce a greater variety of higher-quality products in less time. [3, 5]

The Lean Manufacturing key principles are listed below:

a. Customer-Focused

Customer needs and expectations act as a pull upon enterprise activities, from product design and manufacturing to after-market customer support. [3]

b. Reorganization of workforce effort to support improvement projects

Mass production presumes that innovation and improvement will come from a relatively small group of experts, with the rest of the workforce considered primarily as

interchangeable cogs in the production and design machines and as a cost. A key feature of lean thinking involves appreciating the entire workforce, the suppliers, and others as sources of knowledge, information and insight regarding the elimination of waste and the creation of value. [3]

c. Waste and Wasteful activities elimination

All forms of waste must be eliminated; these include overproduction, work-in-process inventories and extra steps in accomplishing a task. Eliminating waste is important not just to cut costs, but also to improve quality, safety and responsiveness to changing market requirements. **Lean is not a 'speedup' to work harder, but a deliberate approach taken to 'work smarter'**. [3]

Waste (muda in Japan) types list:

- **Overproduction and excess inventory** – producing parts at the beginning of a process when no need has been created at the far end of the process
- **Waiting** (downtime) – any idle time produced when two independent processes are not completely synchronized
- **Transportation –** the movement of a part from one machine to another or from one location to another
- **Processing and unnecessary motion –** the time and energy wasted by repeatedly inspecting, adding to inventory, and storing raw material as it moves between locations.
- **Defective products –** products produced that need rework or additional inspection to be certified

Fig. 6. Remove waste to reduce cost [4]

d. Continuous improvement

A key principle is that the improvement effort should be constant. Nobody can judge whether we can or cannot improve significantly a process or result. We always should assume that we can improve the processes and overall results. Therefore, improvement projects has to be always organized to create efficient processes and quality products.

Lean perfection means striving for continuous improvement with no judgment about how long it might take, or how much effort must be expended. The goals of lean manufacturing are:

- high quality
- low cost
- short cycle times
- flexibility
- continues efforts to drive waste out of the organization
- value being defined by the customer
    - Waste is anything a customer is not willing to pay for.
    - Value is anything the customer is willing to pay for.

To improve the overall plant performance some of the important questions which can be asked are:

How does an organization determine product value? Has a value stream analysis been conducted properly? What happens? Who touches the parts? How are parts transformed?

How are steps sequenced? What nonvalue-added steps can be removed from the value stream? Are we doing the job right? Are we doing the right job?

3. DMAIC Improvement Process

Lean Six Sigma methodology combines process speed with quality, which can enable manufacturing companies to continuously innovate, improve, and measure subsequent improvements for profitability globally. DMAIC is a data-driven quality strategy used to improve processes. It is an integral part of a Six Sigma initiative, but in general can be implemented as a standalone quality improvement procedure or as part of other process improvement initiatives such as lean.

Phase		Goal	Milestones		
			1	2	3
1	**Define**	Establish focus	Identify problematic output	Review output history	Describe output process
2	**Measure**	Create baseline	Evaluate process efficiency	Qualify measurement system	Establish output capability
3	**Analyze**	Discover causes	Diagnose output variation	Identify possible causes	Isolate critical factors
4	**Improve**	Devise solution	Examine factor effects	Optimize factor settings	Prescribe factor tolerances
5	**Control**	Sustain benefits	Verify solution repeatability	Ensure process stability	Monitor output capability

Fig. 7. Tabular representation of the DMAIC goals and related milestone activities [7]

Figure 2 illustrates the DMAIC methodology and its phase wise milestones. Through this strategy, it is possible to improve almost anything because we reduce the problem to its deterministic root. In other words, we apply the fundamental transfer equation: Y=f (X). In the transfer equation, Y is the outcome and X represents all of the essential inputs, and f is the ways and means (process) by which the critical inputs (x's) affect the output (Y). For any given problem-centric situation, we must define, measure, and analyze the critical Y and then improve and control the critical x's. [6]

On Figure 3 are listed the DIMAC tools which can support the improvement process.

The DMAIC cycle provides a systematic five-phase approach: (1) define—the target of this phase is a clear description of the problem as well as identification of the target and scope for the improvement area or improvement initiative; (2) measure - the target of this phase is data collection according to customer requirements, (3) analyze - the target of this phase is identification and verification of assumed root causes, (4) improve — the target of this phase is to find and implement solutions that address the root causes, and (5) control— the target of this phase is to track whether the new process has been sustainably implemented. [6]

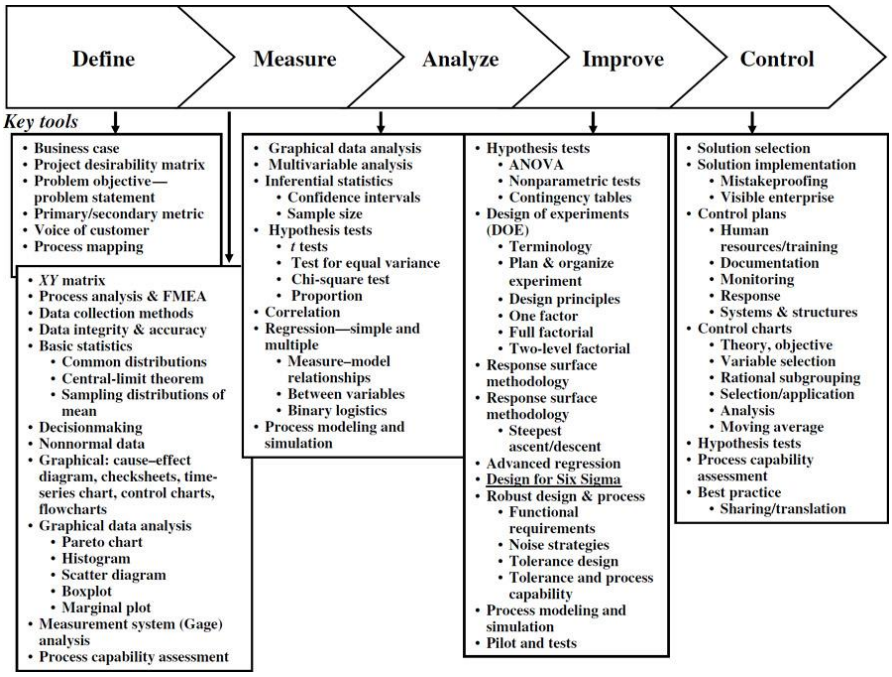

Fig. 8. DIMAC Key tools

4. Performance measurement

Performance measurement is the process of gathering data to see whether an organization's business results are meeting operational and strategic goals. Organizations use performance metrics, or measures, for monitoring. There are numerous possible metrics for each business activity. Only some metrics are Key Performance Indicators (KPI) but all KPIs are metrics.

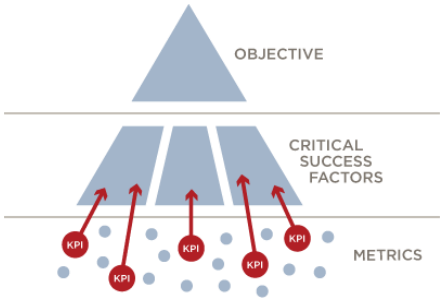

Fig. 9. Metrics and Key Performance Indicators

All **metrics** reflect performance in one way or another
There are three main types of performance measures **[2]**

- Key **result** indicators (**KRIs**) tell you **how you have done in a perspective**
- Performance indicators (**PIs**) **tell you what to do**
- **KPIs** tell you what to do **to increase performance dramatically**

Some sample metrics by business activity are listed below:

- Production
  - Number of units manufactured within a specific time period
  - Number of items shipped on time
  - Machine changeover time
- Quality
  - Product yield (ratio of products that passed inspection to total number of products started into production)
  - Defect rates of a key process
- Financial
  - Revenues
  - Expenses
  - Profitability
- Internal
  - Process quality
  - Cycle times

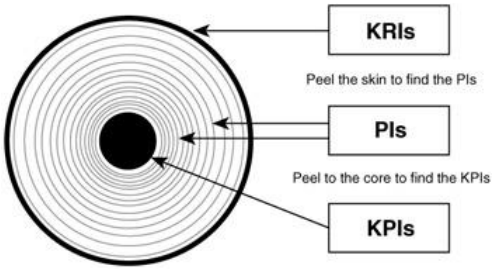

Fig. 10. Types of performance measures [2]

5. Key performance indicators for manufacturing operations

Which are the right metrics and how to calculate them right?

Some of the most important KPIs are described in standard ISO 22400-2:2014 *Automation systems and integration – Key performance indicators (KPIs) for manufacturing operations management*.

KPIs are defined as quantifiable and strategic measurements that reflect an enterprise's critical success factors. KPIs are very important for understanding and improving manufacturing performance, both from the lean manufacturing perspective of eliminating waste and from the corporate perspective of achieving strategic goals. [8]

Apart from the standard ISO 22400-2:2014 some additional KPIs are mentioned in Six Sigma literature related to:

- Statistical Process Control (SPC) in Six Sigma
- Basic Statistics and Graphical Methods for Six Sigma
- Performance metrics for Six Sigma
- Process Capability for Six Sigma
- Cycle Time Reduction and Kaizen in Six Sigma
- Root Cause Analysis and Waste Elimination in Six Sigma

a. Quality items for discrete manufacturing

There are many items which is worth to collect data and monitor. Some of them are listed below:

Good part; Inspected part; Upper specification limit; Lower specification limit; Planned busy time; Planned run time per item; Actual personnel work time; Actual unit busy time; Actual personnel attendance time; Actual production time; Actual unit delay time; Actual unit setup time; Actual unit processing time; Actual unit busy time; Actual order execution time; Time between failures; Time to repair; Time to failure; Failure event count; Corrective maintenance time; Preventive maintenance time; Scrap quantity; Planned scrap quantity; Good quantity; Rework quantity; Produced quantity;

b. KPIs for discrete manufacturing

Once we collected data and prepared the necessary data items we can use them as data elements in order to calculate different KPIs. Below are some of the most important KPIs Key performance indicators for manufacturing operations management [8, 9, 10, 11, 12, 13]:

Metric	**Formula**
Allocation efficiency	Actual unit busy time/ Planned busy time
Allocation ratio	Actual unit busy time/ Actual order execution time
Availability	Actual production time / Planned busy time
Changeover loss ratio	total changeover downtime/planned production time×100
Cost of poor quality	Actual cost - Minimum cost
Critical process capability index (Cpk)	$C_{pku} = (USL - \bar{\bar{x}}) / (3 * \hat{\sigma})$; $C_{pkl} = (\bar{\bar{x}} - LSL) / (3 * \hat{\sigma})$ $C_{pk} = \text{Min}(C_{pku}, C_{pkl})$
Defects per million opportunities	(Number of defects/(No. of units)(No. of defect opportunities/unit))*1 000 000 or (Number of defects in a sample/Total defect opportunities in the sample)*1 000 000
Defects per unit	Number of defects observed in period /Number of units

	inspected in period
Downtime loss ratio	total downtime/planned production time×100
Effectiveness	Planned run time per item * Produced quantity / Actual production time
First time yield	units with no defects / the total number of units inspected*100
Machine capability index	(Upper specification limit-Lower specification limit)/(6*sigma)
Mean time between failures	(total time between failures)/(number of failures)
Mean time to repair	(total time in repair)/(number of failures)
Overall equipment effectiveness index	Availability*Effectiveness*Quality ratio
Performance ratio	(quantity produced*standard cycle time)/(total uptime)
Process capability index (Cp)	(Upper specification limit- Lower specification limit)/6 sigma
Production process ratio	sum(Actual unit busy time)/ Actual order execution time
Quality ratio	Good quantity/ Produced quantity
Rework ratio	Rework quantity/ Produced quantity
Right first time	number of good units produced / the number of total units going into the process
Rolled throughput yield	multiply the first time yield for each process by each other to get the value of your rolled throughput yield
Scrap ratio	Scrap quantity/ Produced quantity
Speed loss	(standard cycle time)/(actual cycle duration)
Technical availability	total uptime/total elapsed time×100
Technical efficiency	Actual production time/(Actual production time+ Actual unit delay time)
Throughput rate	Produced quantity/ Actual order execution time
Total effective equipment performance	technical availability*performance ratio*quality ratio
Utilization efficiency	Actual production time/ Actual unit busy time
Worker efficiency	Actual personnel work time/ Actual personnel attendance time

If a plant is 6 sigma this means that the following results are achieved:
Cp>= 2.0, Cpk >= 1.5, DPMO <=3.4

6. Conclusion

The lean manufacturing key principals, Lean Six Sigma methodology and tools enable the plants to improve dramatically their performance without affecting the quality. There are numerous key performance indicators which can be monitored to facilitate the continuous improvement process. Future research work is to further develop business

intelligence application for manufacturing operations management which could enable the plants to visually monitor the ongoing manufacturing processes and activities.

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Mathematical Epidemiology

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Abstract: This paper aims to compare two different approaches in mathematical epidemiology continuous and agent based models. We consider the specifics of the continuous SIR model and create an agent based version of it in order to outline the key strengths and weaknesses in the two different types of models.

Keywords: Epidemiology, Agent based models, SIR model

1. Introduction

The dynamics of many systems in biological, natural and social sciences is modeling with ordinary differential equations (ODEs) [2-4, 9, 11, 12]. The dynamic theory has become an essential tool of analysis particularly since computer has become commonly available. Important fields of mathematical modeling are nonlinear ODEs [6-8], partial differential equations (PDEs) and dynamics with delay [13, 17, 22-24], which have also been applied to different fields of social sciences, population dynamics and medicine [14-16, 18-21].

Epidemiology studies the spread of different infectious diseases. Due to the nature of this study its hard and often impossible to conduct control experiments. That is why mathematical models are very useful in our attempts to understand the infectious diseases. These models allow us to analyze and even predict the outcome of different outbreaks before they even occur.

In our paper we consider two different approaches toward the SIR model. The standard continuous version which relays on a system of differential equations and an agent based version that uses a computer simulation to predict the outcome of an epidemic. We solve and analyze them in order to understand their specifics and their differences.

2. The Idea of the SIR Model

In SIR model we explore a scenario where a small group of infected individuals is introduced to a population of healthy but susceptible to the disease individuals. Assuming that the population is a constant we divide the population in three different classes S, I and R.

- The S class is called Susceptible consist of healthy people that are susceptible to the disease.
- The I class is called Infected are the infected individuals that could spread the disease on contact with members of the class S.
- The R class is called Removed contain individuals that once were infected but are either isolated, cured and have gained permanent immunity or are dead. The main property of the individuals in this class is that they cannot spread the disease.

Using the presumption that the population is a constant, if we denote the total size of the population with N then we find the following equation:

$$N = S + I + R \qquad (1)$$

In order to be able to devise the population in these three classes we have to make the assumption that the diseases we consider have only two possible outcomes. Either the infected individuals will be cured and will gain a permanent immunity or they will die.

The purpose of the SIR model is to investigate the dynamics between the three classes and to enable us to predict the amount of individuals in each of the three classes for every moment of our epidemic.

3. Continuous Model

a. The Mathematical Model

The continuous model tries to describe the dynamics between the three classes with a system of differential equations. In order to construct this system, we have to make some additional assumptions. We have to presume that every two individuals from the population have the same chance to make a contact and every contact between a susceptible and infected person have the same probability of spreading the disease. Another important assumption is that individuals move from class I to class R at a constant rate. Using this assumption, we construct the following system.

Let's denote the amount of individuals in each of the classes S, I and R in respect of the time by $S(t), I(t)$ *and* $R(t)$ *for* $t \in [0, T]$ then our system is:

$$\begin{aligned} \frac{dS(t)}{dt} &= -aS(t)I(t), \\ \frac{dI(t)}{dt} &= aS(t)I(t) - bI(t), \\ \frac{dR(t)}{dt} &= bI(t). \end{aligned} \qquad (2)$$

Where a is called the coefficient of infectivity and represents the probability of an infected person transmitting the disease to a susceptible individual on a single contact. This parameter depends mainly on the specifics of the disease that we consider. The parameter b is a constant for which is true that $\frac{1}{b}$ is equal to the average time that an individual spend in the class I and is determined both by the specifics of the disease and our ability to fight it.

b. Mathematical Analysis of the Continuous Model

The continuous model provides us with an explicit system of ODE that we can directly analyze. This is a good thing because it provides us with a way to gain understanding about the inner dynamics of every disease that we will model. For example, let's consider the second equation from system (2). We can see that:

$$\frac{dI(t)}{dt} = aS(t)I(t) - bI(t) = I(t)a\left(S(t) - \frac{b}{a}\right) \qquad (3)$$

It is evident from the equation above that if for some t_0 , $S(t_0) = \frac{b}{a}$ then it is true that $\frac{dI(t_0)}{dt} = 0$ which means that $I(t)$ reach a local extremum. In our case the extremum is a maximum, because by definition if there is an epidemic the number of the infected people, at the start of the epidemic, will grow. That means that for $t > t_0, \frac{dI(t)}{dt} < 0$. In other words, at the moment t_0 the epidemic will reach it's limit and will start to decline until eventually burns out.

Equation (3) also tell us if there will be an epidemic at all. There are two possible scenarios:

a.) If $S(0) \leq \frac{b}{a}$, the number of infected individuals will not increase and there will be no epidemic.

b.) If $S(0) > \frac{b}{a}$, the number of infected individuals will grow until the moment t_0 when it will reach it's maximum and will start to decline until the end of the epidemic.

If $S(0) > \frac{b}{a}$, we can see how many individuals will be affected by the epidemic through solving the following equation:

Let's denote by $S(\infty)$ the number of susceptible people at the end of the epidemic ($I(\infty) = 0$) then using system (2) and equations (1) and (3) we get the following equation:

$$\log\frac{S(0)}{S(\infty)} = \frac{aS(0)}{b}\left(1 - \frac{S(0)}{N}\right)$$

The total number of people affected by the disease will be $R(\infty) = N - S(\infty)$.

c. Numerical Experiments

i. Numerical Solution

Solving system (2) can be of a great benefit to us by allowing us to better understand the spreading of the epidemic. One way to do that is the Euler's method. The idea behind this method is simple:

Let's consider the following Cauchy problem:

$$\frac{dU(t)}{dt} = f\big(U(t)\big), t \in (t_0, T]$$

where $U: R \to R^n$ *and* $f: R^n \to R^n$.

We introduce the following mesh:

$$\omega = \left\{t_0 + i\tau, i = 0,1,2,\dots,n, n = \frac{T-t_0}{\tau}\right\}.$$

We denote the numerical solution of U in the point $t_i \in \omega$ with $y_i := U(t_i),\ for\ i = 0,1,2,\dots,n.$ Using the following approximation of $\frac{dU(t)}{dt}$:

$$\frac{dU(t)}{dt} = \frac{U(t+\tau) - U(t)}{\tau}$$

we get this equation for the value of the numerical solution in two consecutive point:

$$\frac{y_{i+1} - y_i}{\tau} = f(y_i).$$

This is equivalent to:

$$y_{i+1} = y_i + \tau f(y_i)\ for\ \forall i = 0,1,2,\dots,n-1.$$

Using this idea, we construct the following numerical scheme which gives us the numerical solution of our model:

$$S(t+1) = -\tau aI(t)S(t) + S(t),$$
$$I(t+1) = \tau aI(t)S(t) - \tau bI(t) + I(t),$$
$$R(t+1) = \tau bI(t) + R(t),$$

for i=0,1,2,…,n-1 where if we consider an epidemic for a period of T days, then $n = \frac{T}{\tau}$ and $t_0 = 0$.

Now let's see how well our model describes a real epidemic. We will consider influenza epidemic data for a boys' boarding school [10] where S(0) =762, I(0) =1 and R(0)

=0. We also know that for this particular case a= 0.00218 and b= 0.44036 using the Euler's method we get the following result. We will examine this epidemic for a period of fifteen days, see figure 1.

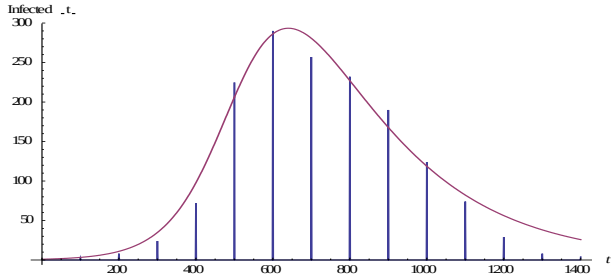

Fig. 1. Model's prediction is represented by the seemingly continues curve and the experimental data is represented with the vertical lines.

ii. Parametric Sensitivity

It is important issue for our model to know how sensitive it is in respect of it's parameters a and b. The main reason is that if we have this knowledge we will be able to better predict future epidemics in the context of improving health care and ever changing diseases. The answer we porpoise is this:

Let's say for example that we want to see how our model react to a change in the infectivity of the diseases. Let's denote the numerical solution of system (2) with some known initial conditions and values for parameters a and b. With $S^a{}_{initial}(t)$, $I^a{}_{initial}(t)$ u $R^a{}_{initial}(t)$ and denote the numerical solution for the same data but for a value of the infectivity coefficient a= $a_{changed}$ with $S^a{}_{changed}(t), I^a{}_{changed}(t)$ u $R^a{}_{changed}(t)$. We will evaluate the sensitivity of the model by evaluating the following differences:

$$S^a{}_{difference} = \frac{S^a{}_{changed}(t) - S^a{}_{initial}(t)}{a_{changed} - a_{initial}},$$

$$I^a{}_{difference} = \frac{I^a{}_{changed}(t) - I^a{}_{initial}(t)}{a_{changed} - a_{initial}},$$

$$R^a{}_{difference} = \frac{R^a{}_{changed}(t) - R^a{}_{initial}(t)}{a_{changed} - a_{initial}},$$

$for\ t \in [0, T]$

Now lets consider the example from chapter 3.3.1. In figure 2 we can see what will happen to the differences if we introduce the following change $a_{changed} - a_{initial} = 0.0000001$.

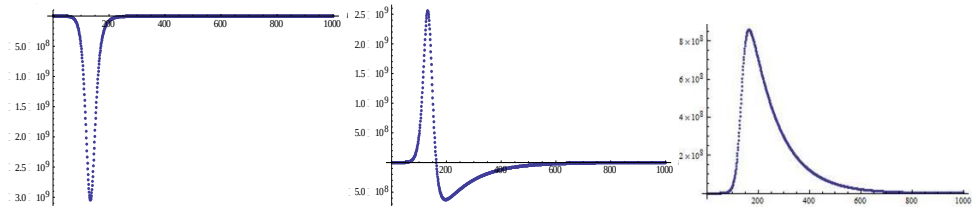

Fig. 2.

a) $S^a{}_{difference}$ *b)* $I^a{}_{difference}$ *c)* $R^a{}_{difference}$

iii. Parametric identification

Another very interesting question is if we can guess the value of some of the parameters using only raw data which is the values of the three classes S, I and R for some amount of consecutive time periods. This could give us useful information about the diseases and about our own ability to deal with it. We were able to construct an algorithm that finds one of the parameters a and b if we know the other one and the raw data for this epidemic. For example, let us be searching for the parameter b if we have a=0.00218 and the raw data from example 3.3.1.

First we have to define a function that will show us the difference between the raw data and a numerical solution of system (2) solved for a given pair of parameters a= a' and b= b'. We will call that function the Error function and will denote it with $Err(a', b')$: $R^2 \to R$. We define that function in the following way:

With $I_{real}[t]$ we will be denoting the raw data and with $I^{(a,b)}{}_{solution}[t]$ we will denote the numerical solution of system (2) for parameters (a', b'). We will define the Error function as:

$$Err(a', b') := \frac{1}{n}\sum_{1}^{n}\left(\frac{|I_{real}[t] - I^{(a',b')}{}_{solution}[t]|}{I^{(a',b')}{}_{solution}[t]}\right)$$

Where n is the number of days for which we will consider the epidemic. The idea of our algorithm is:

Let ε be an acceptable value for the Error function that we have defined. We will start from some initial guess for the parameter b - b_{guess} which is smaller than the real value of b. We will define a temporary variable b_{temp}. The algorithm is:

1. $\alpha = 1$.
2. $b_{temp} = b_{guess}$+0.001α.
3. If $Err(a, b_{guess}) < Err(a, b_{temp})$:
   $\alpha = \frac{\alpha}{2}$,
   $b_{temp} = b_{guess}$+0.001α,
   go to point 3.
4. b_{temp}=b_{guess}.
5. *If* $Err(a, b_{temp}) < \varepsilon$ we stop the algorithm,
   else if $Err(a, b_{temp}) > \varepsilon$ go to point 1.

Let's consider the example from 3.3.1 with ε =0.12 then our algorithm gives us b=0.496 and the real value of the b e equal to 0.44036. It is possible to find both of the parameter using only the raw data. In our opinion it can be achieved by ARSTI method. Use of this method for a similar to ours systems of ODE can be seen in [5].

4. The Agent based model

a. Agent based version of the SIR model

i. Definition of agent based models

Agent based model (ABM) is a computer simulation of interactions between number of autonomous agents in a defined environment. These models allow us to re-create and predict patterns in the relations between the agents themselves and between the agents and

the environment. ABM require a lot of computational power but can incorporated many details about both the environment and the agents.

ii. Implementation of our agent based model

In our research we try to re-create the spread of an epidemic in a population by creating an agent based version of the SIR continuous model. In order to achieve better computation time, we implement our model in a C++ environment. In our model the agents are the people in the population. Each individual is defined as an object from a class and possess the following variables:

- Infected – a bool type variable that shows if a person is currently infected by the disease and if he is able to spread it.
- Immunity – an integer type variable that denote the level of resistance an individual have toward the disease. The maximum value of this variable means that the individual have full immunity against the disease. In our case this is only possible if the individual has been infected.
- Days spent in infected state – integer type variable that keep track of the time that an individual spend in infected state.

Using the first two variables we can divide the population into the three classes from the SIR model. The Susceptible class we be populated by individuals with infected variables equal to false and without full immunity. If an individual has an infected variable equal to true and full immunity than he will be part of the Infected class and if he has infected variable equal to false and full immunity, he will be considered to be from the class Removed.

We define the relations between the agents in our simulation by a two dimensional matrix of integers called the adjacency matrix. For each individual there is a row in the matrix that describes the intensity of the contact between him and the other members of the population. For example, if the intensity of the contact between two agents is zero that means that they won't make a contact.

The environment in which the agents interact in our case will be the disease and we will define it by the following variables

- Infectivity – the probability that a contact with normal intensity between an infected individual and a susceptible individual with normal immunity will lead to infecting the susceptible agent. This parameter depends only on the specifics of the disease we consider.
- Average amount of days before removal – this variable denotes the average amount of time that individual spend in infected state before going to the removed state. This environmental variable depends both on the specifics of the disease and our ability to fight the epidemic (health care for example).
- Days for the simulation – denotes the number of days for which we will run the simulation.

Our simulation will be divided in Days for the simulation number of days. Each day every two agent will make a contact according to the adjacency matrix. If the contact is between a susceptible and infected individual a function called Infection will be called. This function will take into consideration the immunity of the susceptible person, the intensity of the contact and the infectivity of the disease and with the help of random number generator will decide if the susceptible individual will be infected. If the susceptible agent is infected his immunity variable will be set to full immunity. For the random generator we use the GNU scientific library. At the end of each day for every individual in the population, a function named pass a day will be called. This function will increase the Days spent in the

infected state variable for every member of the class Infected and will transfer any infected individual with a Days spent in infected state variable bigger than Average amount of days before removal environmental variable in the Removed class. The result of the simulation will be three arrays that will hold the size of each of the three classes S, I and R for each of the days in which we examine the epidemic. Now let's consider the example from chapter 3.3.1.

We have a population of 762 susceptible individuals and we introduce one infected agent. The infectivity of the disease will be 0.00218 and the Average amount of days before removal will be equal to two (for this implementation an integer number is required). Due to the lack of more detailed information about the students we will assume that every two students have a normal intensity of the contact between each other and every susceptible student have a normal immunity. We run the simulation and the result can be seen in Fig. 3.

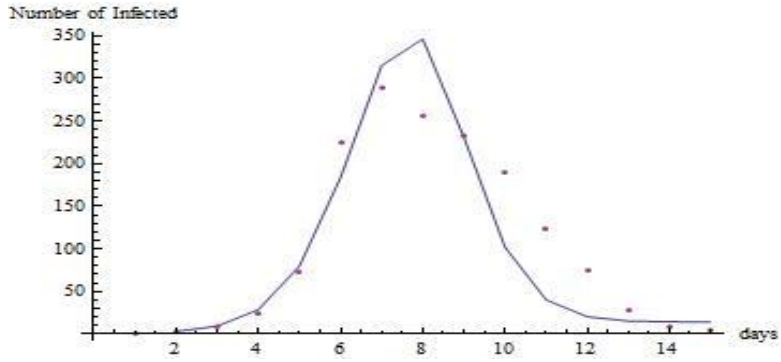

Fig. 3. The isolated points are the real data and the connected ones, is our prediction.

b. Experiments

i. The stability of the results

In the infected function we used a random number generator and due to the fact that for most of the diseases the three classes grow and decline exponentially we get very different results from running the simulation several times. Due to this inconsistency in the results we cannot make any accurate predictions about patterns in our model. For example, the average of the mean absolute deviations of the number of the infected individuals for each of the days, calculated for a single simulation is 70.8293 (the average taken for 10 data points). The way we deal with this issue by conducting many simulations and taking the average of the results. A block of n simulations for some positive integer n, we call a n simulation. We found the following correlation between number of simulation and the consistency of the results shown in table 1.

Table 1. Average of 10 data points.

Number of simulation	The average of the mean absolute deviations of the infected individuals for each of the days
1	70.8293
10	18.5345
100	6.61648

300	1.62901
1000	1.54794

In respect of this data and taking into account the computational power available to us, we decided that the 300_simulation yields consistent enough results and we will be using it for further research.

ii. Parametric sensitivity

As in the continuous model it is important to know how the result of a n_simulation will change in response to a change in one of the environmental variables. We propose a solution similar to the one used for the continuous model:

For example, we will consider a change in the Infectivity variable. Let's denote the result from a n_simulation with Infectivity=$\text{Infectivity}_{\text{initial}}$ by $S_{initial}(t), I_{initial}(t)\ and\ R_{initial}(t)\ for\ t = 1, \dots, \text{Days for the simulation}$ and the result from a n_simulation with Infectivity=$\text{Infectivity}_{\text{changed}}$ by $S_{changed}(t), I_{changed}(t)\ and\ R_{changed}(t)\ for\ t = 1, \dots, \text{Days for the simulation}$.

Then we will define $S_{difference}(t), I_{difference}(t)\ and\ R_{difference}(t)\ for\ t = 1, \dots, \text{Days for the simulation}$ as:

$$S_{difference}(t) = \frac{S_{changed}(t) - S_{initial}(t)}{\text{Infectivity}_{changed} - \text{Infectivity}_{initial}}$$

$$I_{difference}(t) = \frac{I_{changed}(t) - I_{initial}(t)}{\text{Infectivity}_{changed} - \text{Infectivity}_{initial}}$$

$$R_{difference}(t) = \frac{R_{changed}(t) - R_{initial}(t)}{\text{Infectivity}_{changed} - \text{Infectivity}_{initial}}$$

$$for\ t = 1, \dots, \text{Days for the simulation}$$

If we use the same environmental variables used in the example from chapter 4.1.2 and introduce a change equal to $\text{Infectivity}_{changed} - \text{Infectivity}_{initial} = 0.0000001$ we get the following result for the difference in the number of Infected individuals:

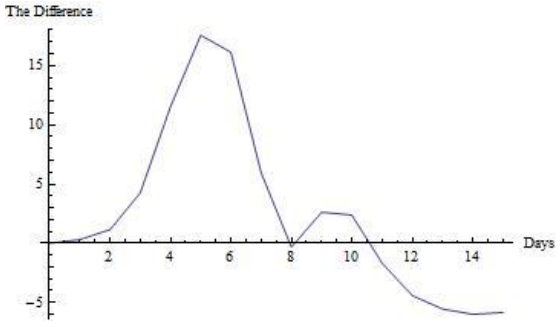

Fig. 4. The value of $I_{difference}(t)\ for\ t = 1,2,\dots,15$.

5. Conclusion

In conclusion, the continuous model compiles much faster and provide us with an explicit system of ODE which gives us much more freedom in analyzing the main mechanics of the diseases. The SIR continuous model enable us to make fast predictions about the outcome of a certain epidemic. This proves very useful when we analyze the epidemic. For example, our parametric identification heavily depends on the ability of our model to hastily provide us with experimental profile of the disease for different values of the parameters a and b. But it is also true that this kind of models require a lot of assumptions and fail to accommodate the specific of the population which results in more inaccurate predictions. The agent based model is slower to compile and we cannot make any meaningful analysis before the compilation is complete. On the other hand, it gives us freedom to change almost any variable we want and even add a new one. It is able to better describe the specifics of the population that we are considering and provide us with more exact prediction tools. Our opinion is that the continuous models do a better job in analyzing the main pattern in an epidemic but the ABM are better for making accurate predictions about the outbreak. Another comparison between the continuous SIR model and an agent based model can be seen in [1].

Acknowledgment

The authors of this article would like to thank to Project INERA/FP7-REGPOT-2012-2013-1 NMP (Research and Innovation Capacity Strengthening of ISSP-BAS in Multifunctional Nanostructures).

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Implementing Persistent Connections on the Web through SignalR Hubs

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Abstract: Only two years after standardization of WebSocket protocol Microsoft has announced the first release of SignalR and the software developers have quickly started to adopt this new technology in their projects. Always cumbersome to implement in the past web applications with persistent connections are now prone for rapid development with this library. At the top level of abstraction of persistent connections lay SignalR Hubs. In this paper we outline the evolution of the HTTP persistent connections from the developers' perspective and the unique characteristics of SignalR hubs compared to the other implementations.

Keywords. Real-time web applications, SignalR Hubs, Persistent Connection.

1. Introduction

Users do not like to wait for web pages taking long time to retrieve and the web latency continues to be a researched problem. Web latency can be caused by many reasons i.e. processing timespan from servers, client slowness, bandwidth, and native weakness of the underlying communications protocols. Nevertheless there is a strong tendency of replacing desktop applications with web based ones, while keeping the user experience with identical look and feel. There is a whole new branch of applications called real-time web applications in which delivering data real-time is crucial.

Real-time applications are basically subject to a soft or hard constraints. Depending on the business needs the software needs to complete its execution in a particular timeframe. If this time constraint is strict the software is hard real-time if not is soft real-time. Although real-time software has been around for a while the term real-time web software is new and is related to the concept of real-time delivery of content to clients as it is available. The real-time web applications should be considered as soft real-time applications because the delivery of data from the server to its clients should happen in a short period of time - for less than a second.

Real-time web applications now are very popular, but more than a decade development of underlying technology was needed [1]. Microsoft bundled real-time features as part of its ASP.NET stack call it SignalR [2, 3]. SignalR applications uses persistent connections to do full duplex communication. Always cumbersome to implement in the past, web applications with persistent connections are now prone for rapid development with this library.

In this paper we will present SignalR hubs as an abstraction over Persistent Connections as a way to build real-time web applications.

2. Persistent Connections

A persistent connection is a communication channel between the server and the client that is kept open. The channel is provided by one of the following transport options which implies the feeling that connection is always persistent:

- Long Polling
- Forever Frame
- Server-Sent Events
- WebSockets

To the user a Persistent Connection implies being connected at all times, but it goes through different phases like: connecting, maintaining, disconnecting. All these phases go through sub phases.

For a Persistent Connection, the connecting phase goes through the following steps:

1. The client sends a handshake request to the server
2. Server returns response to the client about the handshake request with all the possible transport options
3. The client chooses the best transport option
4. The client sends a connect request to the server with the selected transport option
5. Once the server has accepted the connect request, the persistent connection is made.

Steps to maintain the connection are:

1. Send data from server to the client
2. Send data from client to the server
3. Send keep-alive packets
4. Reconnect after time out.

Steps to close the connection include:

1. Client sends a stop command to the server and closes the connection, when the connection is not needed any more.
2. When the server receives a stop command it cleans the connection.

Historically persistent connections have been exploited for more than a decade. The most popular implementation that provide persistent connections before WebSockets is known as Comet [1] or reverse-AJAX. Comet usually used techniques such as XHR Streaming and HTTP Long-Polling. Unfortunately Comet never got standardized. All the implementations before WebSockets actually use at least two connections for both directions of communication. Additional problems arise with cross-origin resource sharing (CORS) [4].

Persistent connections does not necessarily lead to reduction of web latency, but in general they can address inefficient use of multiple concurrent connections. When a developer builds a real-time web application he'd need to take address of all the aforementioned steps before even start writing any business logic. Using SignalR hubs lets developers go through all the connecting, maintaining and disconnecting phases out of the box. They allow developers to stay focused on the business logic of the application, instead of investing time in details.

3. SignalR Hubs

Building a real-time web application is a complicated task especially if you were to start building the whole framework from scratch. SignalR hubs provide an abstraction where

WebSockets are used or emulated. Implementation actually can fall back to the only available transport mechanisms (see Figure 1).

SignalR set of server-side and client APIs for web developers to simplify this task. SignalR allows developers to do Rapid Application Development in the field of real-time applications.

SignalR offers 2 kind of APIs:

- High-level APIs known as Hubs
- Low level APIs called persistent connections

Hubs provide an abstraction on the top of persistent connection. They provide two libraries to developers:

Server-side libraries – They gives opportunities to build server-side methods which can be called by clients as well as mechanism to call some methods defined on the client side from the server methods.

Client-side libraries – These libraries allow developers to implement client-side methods that can be called by server methods as well as mechanism to call server-side methods.

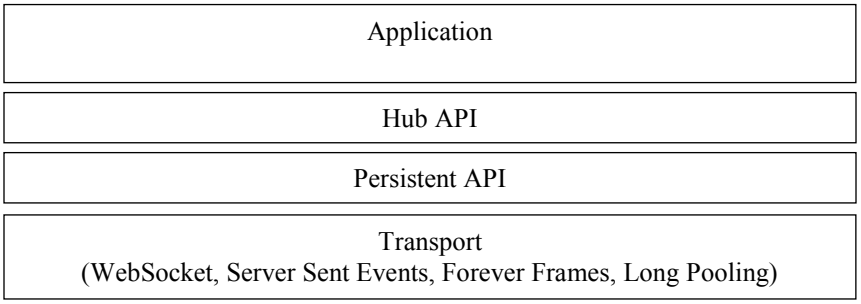

Fig. 1. SignalR API structure

SignalR has a client-server architecture and one server component can serve a multiple clients. Making requests from client to the server is a common operation but making a call from server to a particular client is not (see Figure 2.).

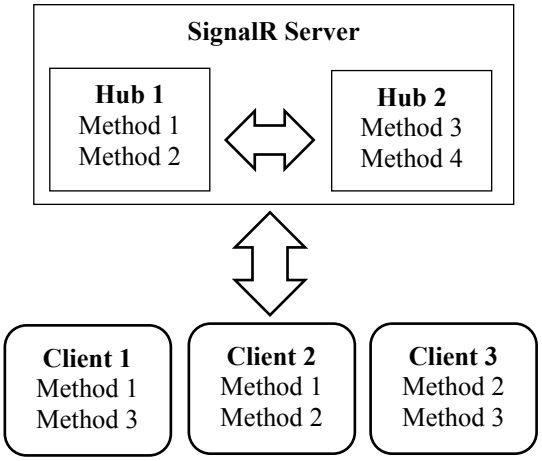

Fig. 2. General Hub structure

Traditional HTTP connection is disconnected one but SignalR is based on the Persistent connection paradigm. Persistent connections are opened for a long time [5]. During this time frame SignalR hub can push content to the clients. Hubs simplify the process of working with client-based methods from the server and server-side methods from the client. SignalR hubs also provide options for clients' segregations. Communication between hubs is also possible.

4. Case study

There is a wide range of modern real-time web applications. From online web-based games, through dashboards and simulations systems all they rely on persistent connections. The case study will present a simple SignalR Hub implementation. Every Hub application consists three parts:

- Server-side Hub implementation
- Client-side implementation
- Mapper

Hub is a .NET class that derives from Microsoft.Aspnet.SignalR.Hub base class which implements a bunch of methods. Below is source snippet which is the server-side implementation of the hub.

```
public class MyHub : Hub {
    public void SendData() {
        var data = MyService.GetData();
        Clients.All.displayData(data);
    }
}
```

Hub has one public method called SendData which uses the Clients object to send data to all its clients.

Client-side implementation which we will present is an HTML page.

```
<!DOCTYPE html>
<html xmlns="http://www.w3.org/1999/xhtml">
      <head><title>SignalRHub client</title></head>
      <body>
          <script src="Scripts/jquery-1.10.2.min.js"></script>
          <script src="Scripts/jquery.signalR-2.0.js"></script>
          <script src="/signalr/hubs" type="text/javascript"></script>
          <script type="text/javascript">
              $(function () {
                  var hubConnection = $.connection.MyHub;

                  hubConnection.client.displayData=function(data){
                      $("#dataContainer").append(data + "<br/>");
                  };
                  $.connection.hub.start().done(function (){
                      $("#btnGetData").click(function () {
                          hubConnection.server.SendData();
                      })
```

```
                    });
                });
            </script>
            <div id="dataContainer">
            </div>
            <input type="button" id="btnGetData" value="Get Data" />
        </body>
</html>
```

The source above implements three important functionalities:

- Establishes connection to the server
- Creates a client function called displayData which accepts the content from the server and visualize it.
- Calls the server-side function which sends the client data

The last part of the SignalR Hub implementation is the mapper which maps hubs during the Startup of the application. In this class you need to implement a method called Configuration.

```
public class Startup {
    public void Configuration(IAppBuilder app) {
        app.MapHubs();
    }
}
```

5. Conclusion

SignalR applications are not based on the traditional HTTP connections which may be disconnected but to persistent connection paradigm. Persistent connections remain open for a long period of time during which the server can send content to its clients.

Building real-time application is a pretty complicated task especially if you build the whole framework from scratch. SignalR hubs are high-level implementation of Persistent connection and allows developers to do rapid application development in the field of real-time applications.

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Exploring the Results from the Integration of Multimedia in Teaching Math in Elementary School

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Abstract: In today's electronic internet world, web services, cyber technology, electronic communications sites for virtual learning and educational portals there is an increasing need of adequate education. In the 21st century, multimedia is an important mechanism in education which contributes the integration of ICT in other school subjects. Its potential is in motivating students, presenting the learning content in attractive way. This paper presents the results of integrating multimedia presentations in mathematics education.

Keywords: Multimedia, mathematics education, effectiveness of learning process.

1. Introduction

Firstly, there is a need of clarification of what multimedia is. The English word multimedia (multi - very, media - thus, money) has two main meanings (Oxford Dictionary):

1. (in computing) the use of sound, pictures and film in addition to text on a screen.
2. (in teaching and art) the use of several different ways of giving information or several different materials.

The Encyclopedia Britannica gives the following definition of multimedia:"Any computer-delivered electronic system that allows the user to control, combine, and manipulate different types of media, such as text, sound, video, computer graphics, and animation. Interactive multimedia integrates computer, memory storage, digital (binary) data, telephone, television, and other information technologies. Their most common applications include training programs, video games, electronic encyclopedias, and travel guides. Interactive multimedia shift the user's role from observer to participant and are considered the next generation of electronic information systems. " (Encyclopedia Britannica).

Todorov's definition of multimedia is: "The combination of more than one media, a kind of multidimensional medium for presenting information objects. Adding sound or interactivity to product information is sometimes enough for it to be classified as multimedia. Multimedia is an informational product that combines two or more of the following elements: text information, graphics (static illustrations), interactivity (the ability to determine the temp and the posledovatelnost action by the user), sound (speech, music), animation, digital video (moving picture)." (Todorov, 2004).

According to Richard Meyer - founder of the theory of multimedia learning, many people learn better from words and pictures than just words, this represents the so-called two-way perception of information, which is much more stable. Studies show that students prefer visual information that helps them better understand the text. It has been shown that the presentation of visual information together with additional information through different channels does not always easy for understanding and perception.

2. Description of the survey

For the purpose of the survey is used presentation software (MS PowerPoint), for several reasons:

- The application meets the requirements of free software. Every computer in school has this application software;
- No need additional training for teachers, because they already work with this type of application, and have qualification courses for teachers, which is enshrined in national strategies and programs for the integration of ICT in Bulgarian schools;
- In the multimedia presentation can easily integrate components to foster two-channel perception of information. It can also provide interactivity;
- The ability to change the presentations for their own needs. Can quite easily be removed and add components and even whole slides to complicate or lighten its contents;
- Need of minimum resources

There are 18 educational multimedia presentations related to mathematics education, as they help study was to establish the possibilities of integration of multimedia in teaching math in elementary school in order to increase the effectiveness of the learning process.

This study was performed in one academic year. There have performed experimental lessons with 161 students, divided into experimental and control groups as follows - the experimental group (using multimedia) - 83 students control group (traditional training) - 78 students. One of the most common ways to evaluate the results of students in school is the test examination. This form is impersonal, contain precise and clear criteria of evaluation is rapid for implementation and verification. To determine of the input and output level of the knowledge of students have used two tests.

3. Results

Using a pre-established instruments were collected and processed empirical data resulting from this study. These data are presented in graphical form for each class separately based on the results of the input and output knowledge level of the control and the experimental group.

The stages are:
Entry Level - 1
Output Level – 2

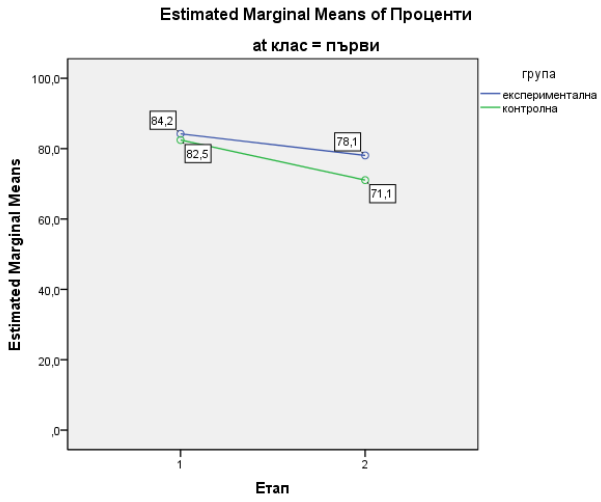
Clearly, the results obtained for the experimental group at the end of the period decreased by 6.1 percent compared to the beginning and the results obtained for the control group decreased by 11.4% at the end of the experiment from the beginning. Overall the success rate is decreased. From here we can conclude that the use of multimedia in teaching math in first grade gives an advantage over traditional training.

From the chart it can see that the results obtained for the experimental group at the end of the period increased by 22.2% compared to the beginning and the results of the control group increased by 9.1% at the end of the experiment against the beginning. That is a positive result. We can conclude that the use of multimedia in teaching mathematics in second grade has an advantage over traditional learning methods.

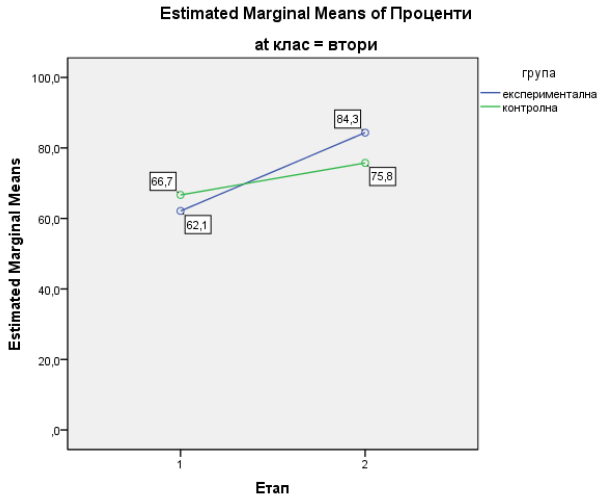
As in second grade again we have an amendment for the experimental group, at the end of the period increased by 23.3% compared to the beginning and the results of the control group increased by 7.9% at the end of the experiment compared against the

beginning. Here again we can report the positive result, and it is better than the second grade. We can conclude again as in second grade, that the use of multimedia in teaching mathematics in third grade has an advantage over the traditional learning methods.

First grade diagram 1

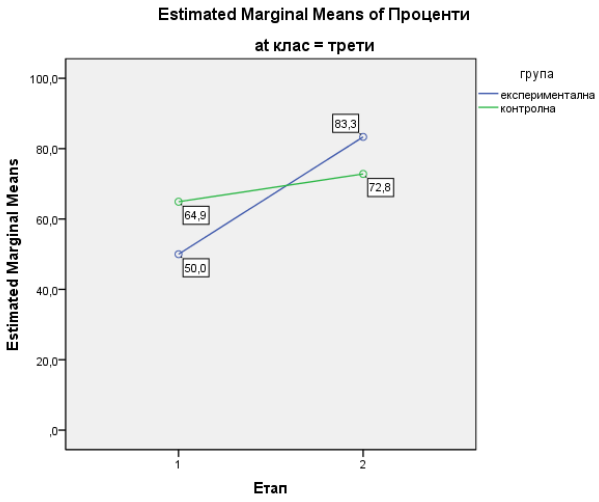


Second class diagram 2

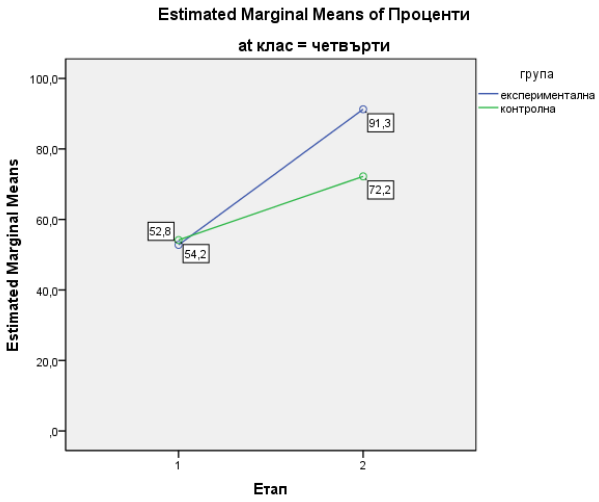


In fourth grade the change of the results, obtained for the experimental group at the end of the period increased by 38.5% compared to the beginning and the results of the control group increased by 18% at the end of the experiment against the beginning. These data give us an even better result, which means that the use of multimedia in teaching mathematics in fourth grade has even greater advantage over the previous discussed classes.

Third class diagram 3



Fourth grade diagram 4



4. Conclusion

In conclusion, the data obtained from the pedagogical experiment show that the students from the experimental group significantly improved their performance compared to students in the control group. The positive trend of integrating multimedia in learning related to mathematics education increases with classes, i.e. the effect is greater in the fourth grade compared with the effect in the first grade.

Mathematical Modeling of the Dynamics of Economic Systems with Time-Delay

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Abstract. Many processes in economy are described by the system of ordinary differential equations. Such models are effective in the study of the evolution of economic systems over long periods of time. We know that delay the introduction of information into dynamic models change their properties. Widely known are specific economic models (model of business cycles Goodwin, Kaldorian macro dynamic model augumented with Kaleckian investments lag and oligopoly model Cournot), illustrating that with delays more complex dynamics can occur. In this article we will show that these two models (without delay) generate the same dynamics, if the delay is small enough. However, this is not true if the delay is greater. The theoretical conclusions are illustrated with well-known economic model Dimitrova-Vitanov, which introduce a time delay.

Keywords. Evolution of economic systems, economic agents, Dimitrova – Vitanov model, time delays.

1. Introduction

Applications of differential equations are now made in modeling many areas of science. A differential equation expresses the rate of change of the current state as a function of the current state. The dynamic theory has become an essential tool of economic analysis particularly since computer has become commonly available. Others important fields of mathematical economy are partial differential equations, stochastic processes and dynamics with delay, which have also been applied to different fields of economics, social sciences population dynamics and medicine [8, 13-26].

It has been shown by many authors that the introduction of information delay into the dynamic models changes their properties. In this paper we will first show that these two types of models (with and without delay) generate the same dynamics if the delay is sufficiently small. This is, however, not true if the delay becomes large. The theoretical findings are illustrated by known model of Dimitrova-Vitanov.

In this paper we discuss a system of interacting economical systems for the cases with and without time delay. In the first case a description of the system we use already known models of type Dimitrova – Vitanov [1 – 4, 9 - 12]. These models describe the phenomena of competition and adaptation two essential features of complex systems. Economic agents compete for resources and this competition often leads to significant changes in the environmental conditions. The agents react to changes by a greater or lesser adaptation. Those who adapt better, have better chances of survival. Clearly, it is important to model both processes simultaneously. In the model of Volterra rate of growth and the rate of interaction are constants. But the change in the number of members of the agent systems leads to a change in the number of meetings between them. This can lead to a change in the

ratios of increase of the number of members of the economic agent and the coefficients of the interaction. This is a manifestation of adaptation to changing environmental conditions. In this model summarizes a number of classic models, such as the models of type Volterra.

The system of model equations for this case [9 - 11] is a system of ordinary differential equations. When there and introduce a time delays in these model equations, the resulting system describes the delay at the respective economic processes.

2. The Model of Dimitrova-Vitanov

As we noted above in papers [2, 4, 9-11] Dimitrova and Vitanov have been studied and solved numerically (in various suitably selected values of the parameters) the following systems ordinary equations:

$$\frac{dN_i}{dt} = r_i^0 N_i \left[1 - \sum_{j=1}^{n} (\alpha_{ij}^0 - r_i) N_j - \sum_{j=1}^{n} \sum_{l=1}^{n} \alpha_{ij}^0 (\alpha_{ijl} + r_{il}) N_j N_l - \sum_{j=1}^{n} \sum_{k=1}^{n} \sum_{l=1}^{n} \alpha_{ij}^0 r_{ik} \alpha_{ijl} N_j N_k N_l \right],$$

where r_i is the growth ratio of the i-th agent system and α_{ij} is the interaction coefficient measuring to what extent the growth of the i-th agent system is influenced by the j-th. We agent system assume, that both coefficients are density dependent and that they depend on the density of the members of the agent systems in the following manner:

$$r_i = r_i^0 \left[1 + \sum_{k=1}^{n} r_{ik} N_k \right], \tag{1}$$

$$\alpha_{ij} = \alpha_{ij}^0 \left[1 + \sum_{k=1}^{n} \alpha_{ijk} N_k \right]. \tag{2}$$

If we lay:

$$r_i^0 = f_i^0,$$
$$r_i^0 \alpha_{ij}^0 = -f_{ij} - b_{ij}^0,$$
$$r_i^0 \alpha_{ij}^0 (\alpha_{ijk} + r_{ik}) = -b_{ijk},$$
$$r_i^0 \alpha_{ji}^0 r_{ik} \alpha_{ijl} = 0,$$

we get:

$$\frac{dN_i}{dt} = N_i \left[f_i^0 + \sum_{j=1}^{n} (f_{ij} + b_{ij}^0) N_j + \sum_{j,k=1}^{n} b_{ijk} N_j N_k \right]. \tag{3}$$

With such indications entered the system is converted to the system discussed in Arneodo et al. [5 - 7], and additional members, caused by adaptation effects.

3. The Model with Time Delay

The equations with time delay are a generalization of ordinary differential equations. In the study of real systems with after-effect in quality of output an approximation it is assumed that the delay is kept constant. Such consideration represents a kind of step forward compared to the "ideal" process, which is obtained assuming that "tripping" is not derived instantaneously. In other cases, such an assumption describes a process of partial approximation. Mostly complete analysis shows that in rare cases important to real systems, the continued depends not so much of the time, but also by themselves requested features, as well as their derivatives. In some cases, naturally implies that this dependence does not a

determinant.

Let us now introduce the constant time delay $\tau > 0$ in the system. Thus we obtain a system of ordinary differential equations with time delay:

$$\frac{dN_i(t)}{dt} = N_i(t-\tau)\left[f_i^{\,0} + \sum_{j=1}^{n}(f_{ij} + b_{ij}^0)N_j(t-\tau) + \sum_{j,k=1}^{n} b_{ijk}N_j(t-\tau)N_k(t-\tau)\right]. \quad (4)$$

If we assume that the solution is smooth a sufficiently for the right side of the equations of the system we use in degrees of decomposition τ:

$$\dot{N}_i(t) = F_i(t-\tau) \quad (5)$$

$$F_i(t-\tau) = F_i(t) - \tau.\dot{F}_i + ... + (-1)^n \frac{\tau^n}{n!}\overset{(n)}{F}_i + ..., \quad (6)$$

where: $\dot{F}_i = \sum_{j=1}^{n}\frac{\partial F_i}{\partial N_j}\dot{N}_j$, $\ddot{F}_i = \sum_{j,k=1}^{n}\frac{\partial^2 F_i}{\partial N_j \partial N_k}\dot{N}_j\dot{N}_k + \sum_{j=1}^{n}\frac{\partial F_i}{\partial N_j}\ddot{N}_j$. (7)

Then we can discuss solutions to a system as:

$$N_i(t) = \sum_{\alpha=0}^{\infty}(-1)^\alpha \frac{\tau^\alpha}{\alpha!}N_i^\alpha(t), \quad (8)$$

where $N_i^\alpha(t)$ are functions that must be determined by the terms equate to the same degree of τ. Note that $\alpha > 0$ these functions are N_i^0 solutions of linear systems of equations without delay. In $\alpha = 0$ we get that the functions are solutions of the initial system, but already without time delay. To find the functions $N_i^\alpha(t)$ you can use and appropriate given initial conditions.

4. Concluding remarks

In this paper, we received a nonlinear model of the dynamics of interacting economic and social systems with time delay. Thus the model discussed in previous section can be applied in other areas - for example, problems related to long-term forecasts in the economy, in the social sciences and in many other areas of science and technology, which are constantly growing.

Note that the model (4) generalizes many of the existing models, taking into account:

- the model takes into account not only the current situation but will take account of the past system;
- model accounting for the influence of environment on the growth rates;
- model accounting for the influence of the environment on the coefficients of the interaction among the agent systems;
- models accounting for the influence of the environment both on the growth rates and the coefficients of interactions among the agent systems.

For the above reasons described model is promising for future research in the field of economics and social sciences.

Acknowledgment

The authors of this article would like to thank to Project INERA/FP7-REGPOT-2012-

2013-1 NMP (Research and Innovation Capacity Strengthening of ISSP-BAS in Multifunctional Nanostructures).

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Architecture of the Client-server Information System and Cloud-based Information System

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Abstract: The paper reviews architecture outlines as the general characteristics of the information system and it influences on all stages of information system developing. It is very important to determine the architecture of the information system in advance, because does not exist "best" architecture. Each organization needs of proper architecture. There are some differences between the architecture of cloud-based information systems and client-server systems, so it is important to know their characteristics, to select the most appropriate architecture for a particular information system, depending on its requirements.

Keywords: Information system architecture, client-server architecture, cloud-based architecture.

1. Architecture of the client-server information system

Client-Server model of the data processing has following characteristics:

• Data processing is performed by one component (one application, one software module, etc.).

• components are shared by the users all the time.

• All resources are available.

• The software works through the implementation of one process.

• Communication between components is done through the exchange of messages or entire objects.

Characteristics of the client:

• submits applications;

• waits response;

• connects to a small number of servers simultaneously;

• active part of the client-server connection, usually initiate communication;

• interacts with end users through a graphical user interface.

Characteristics of the server:

• waits queries from customers;

• receives requests, processes them and then sends answer;

• receives requests from large number of customers;

• passivity, waits for requests from the client;

• does not communicate directly with the end user.

Depending on the functions of the information system, servers could be application servers and data servers.

The application server maintains business logic. Business logic is a bridge between the user and the data. This tier based on user queries, extracts the necessary information from the database, processes it, upon a specific rules and submit it to the user interface. This is

done by applying formal procedures and business rules upon data.

At this level there are two parts. The first part includes a relatively stable business rules and the second includes a set of frequently updated processing procedures related to the database. The second part can be encapsulated into components that are physically separated from the modules that perform basic business rules.

On the application server tier could has two levels - business rules (Business Rules Tier) and data access (Data Access Tier), which maintaine respectively user interface and data tier.

Data serves keep databases. A typical three tier client-server application has the following architecture (fig.1)

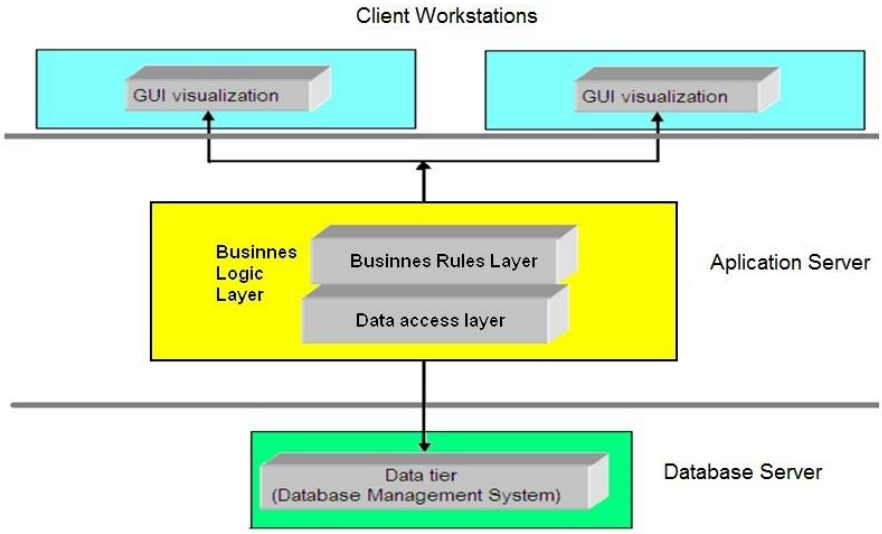

Fig.1. Three tier client-server architecture

The architecture of the web-based client-server applications, has some specific features (Fig. 2).

First of all, it includes a web server, such as Microsoft Internet Information Service (IIS) or Apache.

Second, the user interface of the client workstation is realized via a standard browser such as Microsoft Internet Explorer (IE), Mozilla FireFox, Opera and others.

Third, the functional limitations of the browsers require the separation of the tier of User Interface on two subtiers:

• Subtier of the visualization (GUI visualization) implemented by the browser. This subtier, includes minimal processing, written in the scripting language executable by the browser and user interface visualization.

• Subtier of the management (GUI management), implemented by the web server with the languages as ASP (Active Service Pages), JSP (Java Service Pages), PHP.

2. Architecture of the Cloud Based Information System

The architecture of cloud-based information system depends on the data processing. Cloud-based information systems are distributed systems. A distributed system consists of a collection of autonomous computers connected to the network and middleware software that

enables computers to coordinate their activities and share system resources, so that users perceive the system as a single, integrated computing tool.

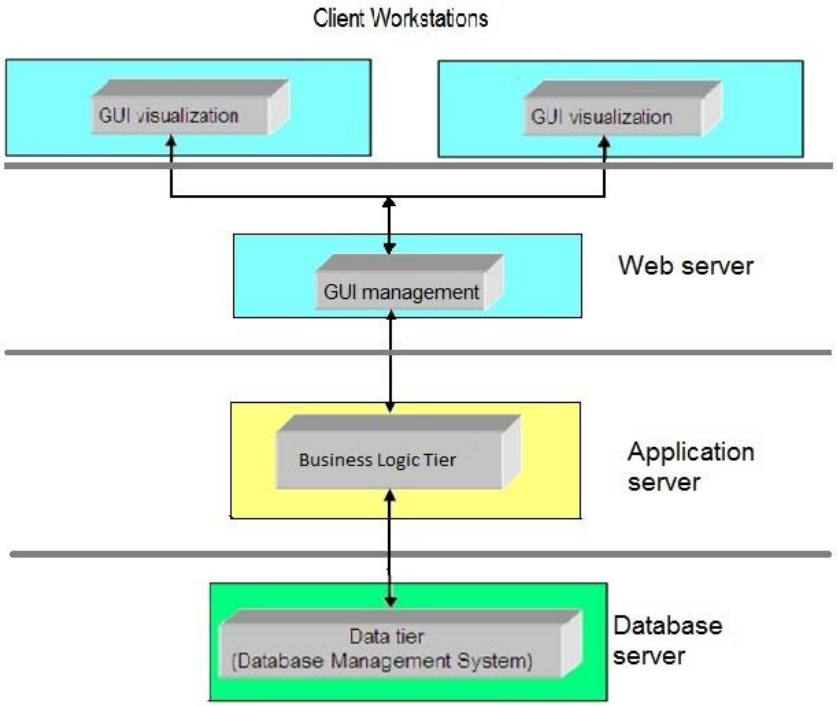

Fig.2. Architecture of the web-based client-server applications

Architecture of the distributed data processing information systems could be client-server, but in could be organized as the cloud based - through the integrated data center, where multiple servers are aggregated (Fig.3).

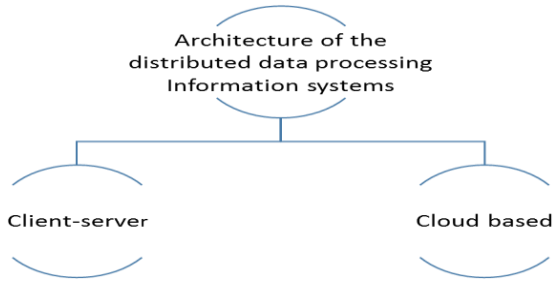

Fig.3

Characteristics of the distributed system generally are:
• It consists of multiple autonomous components
• The components are shared by the users
• The resources may not be available at any time
• The software works through the implementation of concurrent processes on different

processors.

A distributed database, which is stored in more than one physical location, is usually found in very large corporations that require immediate, fast access to data at multiple sites. There are two ways to structure distributed databases:

1. Partition a central database so that each remote processor has the necessary data to serve its local area.

2. Replicate the central database at all remote locations.

For the cloud information systems, as distributed systems is valid transactional approach. Typical of this approach is that it guarantees the isolation of concurrent transactions to the database.

If two transactions are executed simultaneously by two client apications on the same data, the transactional approach ensures that one transaction always will be executed after the other, and there will be no interaction between them.

Transactional approach drastically change the style of programming in the tier the of business logic in the cloud-based systems. The task is divided into subtasks, which are parts of the application that will run in parallel. Cloud application includes modules that perform tasks in parallel. Each client's tasks is handled consistently, but while one module works for subtask of one client, the next module works for another client. In this methodology, there is a possibility of inconsistency of the data. The main question that developer must answer is whether the system could persist of the inconsistency of the data. The level of the tolerance of the system to the consistency of the data, depends on the task that end users solve with the application - if the application is for online shopping, viewing photos, listening audio, watching video files, this is acceptable.

Cloud based information systems have their components with specific functions.

The first component is the client application – it may be a web browser or any program that uses the same protocols as the browser and its job is to send requests to the cloud-based services and to receive answers from them. These questions and answers are usually carried out through a web page.

The second component is the network itself that moves data. Physically it is a complex of routers, DNS servers and servers to manage different protocols.

The third component is the cloud data center and information system itself based on the cloud. The cloud has a complex architecture. Data center seeks to control the routing of the data from the client's computer to the entry point in the cloud and after analyzing the data, to forward them to the entry point of the specific server. This server in communication with the other servers, builds the response that would be send to the client computer. So the application is a client to a specific server from the cloud, and this server in the turn, is a client for other servers and services.

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Personalized Education through Big Data – Approaches and Applications

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Abstract: Big Data is the new trend in personalization. It provides powerful tools that enhance educational services. The great variety of data concerning individuals has to be carefully selected, correctly collected and appropriately processed. The key element here is to extract relevant information in order to make deep analysis and accurate predictions about students' development. Based on these predictions and through personalized recommendations a more effective learning process can be achieved. This is important not only for lecturers, tutors, and mentors but also for the students' self-assessment. The paper discusses different approaches implementing Big Data concept in the educational field.

Keywords: Big Data, Education, Personalization, Learning Analytics.

1. Introduction

Recently our society has become largely knowledge driven and is facing unprecedented challenges – it is required for everyone to constantly acquire quickly new skills, academic staff to be engaged in new learning approaches, not to use only predominantly well-known instructional methods (lecturing or assigning tasks to passive students). The new Big Data tools allow for collecting, processing and analyzing huge amounts of education data and thus to offer significant information and meaningful tools to all education-related stakeholders – both from macro point of view (administrators and employers) and from micro point of view (students, tutors and even parents). As a result, instructional methods based on learning Big Data analytics will allow transformation of education to more data driven decision making and enable educational paradigm shift where students are put at the center. Thus a real personalization comes true.

2. Educational Big Data

Nowadays, in the digital age Big Data has become a significant part of each area of our society. For many years data has been used to drive the development. In educational practice the potential of Big Data and learning analytics can influence the way the learning process is carrying out [1]. Accumulated data of many types from many sources and in many contexts has the power to change the learning process itself by providing tools for personalization.

The data collected can be classified by different criteria: objects that are characterized; sources of origin; manner and form of extraction; time period it relates to; purpose; activity that assists; variability of information, etc.

Structured or unstructured educational data are generated from many heterogeneous sources. Both traditional and diverse ICT-based education forms produce formal structured real/ non real – time private and public educational data. It is easy to extract larger volume of

data during the interaction of students with e-learning platforms. Personal data that are stored in students' profiles ranges from personal information to learning achievements, from social behavior to various risk indicators. The data comprises basic individual (biographical) and academic information – learning style and psychological type; training experience and study achievements; qualifications and skills, etc. Public data concern demographic and administrative issues – environmental factors and local specifics; institution type; curriculum, courses and study programs; faculty and teachers-students ratio; academic degrees and majors. Public data serves for policy development, results assessments, intervention planning, group modeling, etc. Private data are used for individual modeling, thus customizing the outlined educational policies to a personalized learning path for each student by enabling curriculum adaptation, different teaching approaches, and flexible pace of learning. As a result, students are provided with the opportunity to learn according to their preferences, interests and experiences. Informal data, usually unstructured, also influences personalization and are harvested from social networks, mobile apps, education-related forums, newsgroups, blogs, vlogs, chats, learning games etc.

Table 1 Data classification

Classification category		
Information carrier	Traditional, Paper	Digital files
Presentation form	Digital	Graphical
Time conditions	Real time	Non-real time
Structure form	Structured	Unstructured
Acquisition form	Formal	Informal
Privacy	Private	Public
Purpose	Personalization	Statistics

From other point of view, the education related information for each student, extracted from e-learning systems can be regarded as general and personal data. The first one is relevant for the whole educational process: curriculum, plans and programs, courses, learning resources, teachers-students ratio, data about educational institutes (formal/ informal, public/ private) etc. Personal data itself concerns the education of each particular individual: initial personal information, obligatory psychological and pedagogical characterization, individual specifics, subjects studied, courses completed, curricula, competitions acquired, achievements, external evaluations, test and exam results etc.

Other type of educational data concerns learning resources stored in data warehouses and public repositories, which are created, annotated, and modified by educational professionals. Digital records for all components of educational process and students' profiles are also regularly created and updated. Furthermore, e-learning systems generate data reports to faculty and authorities. Extraction and processing of such huge amount of heterogeneous information is an extremely tough job that is carried out with Big Data tools based on complex mathematical and statistical approaches, data mining and learning analytics [2]. Thus students' progress can be easily tracked and students at risk of falling behind or dropping out can be identified. The tremendous value of gathered data is appreciated for personalizing the learning approaches and resources.

3. Big Data Analytics in Education

Big Data learning analytics methods are used for large educational data sets management in order to extract and process significant information for entire learning process and to reveal various statistics, multilateral relation and dependences. Most often used approaches are closely related to data mining, predictive modelling, etc. and depend on the set goals [2]. For example, structure discovery is performed through domain-, cluster-, and factor-analysis, while in order to detect patterns and identify relationships between or within data sets correlation and association rules or causal data mining are used. Intrinsic characteristics of subjects in educational domain can be explored through modeling and neural networks. Predictions about students' academic achievements and career readiness are based on classification, regression, density distribution estimation [1, 3].

Big Data analytics in education has various forms and reflects multitude of factors, depending on: type and sources of the gathered data, set objectives, academic users (tutors, students, etc.). We consider analytics in education context related to students' performance on three different levels: institutional, group and individual [3].

At the institutional level (government, university and faculty) analytics comprises development of educational strategies and setting policies, decision-making and learning process management. The information about the educational programs and courses is detailed, while that about the learners is summarized. Much of the data are public, formal and structured and come from institutions' administrative educational systems and student registration systems.

At the group level analytics generalize students' performance. It is focused on providing better service delivery, discovering learning models and trends, identifying areas in need of improvement, achieving measurable indicators, matching students to a proper program or offering career readiness assessment and employment. Most of this statistical information is gathered from e-learning systems and concerns students' engagements in courses and activities. On this level, personal and informal information is also taken into account in order to propose the best professional development.

At the individual level analytics are used for extracting essential information, detecting patterns, creating pedagogical approaches based on practical results, assessing intervention's impact, identifying students at risk of failing, etc. This information includes all types of data. It comes mainly from log-files by tracking students' activities in the learning management systems (snapshots of students' actions): learning resources read, assignments completed, individual students' contributions in forums and discussions. At this level, students' modelling based on data from personal profiles (preferred learning style, pace of learning, learning difficulties and specifics) has a significant impact for achieving improvement by offering personalized recommendations.

Learning analytics bring insight into the students' learning process, classify them according to different attributes and characteristics (achievement rates, psychology types, learning abilities, etc.), and provide overview of students' success and failures [4]. In general it outlines the effectiveness of different pedagogical strategies and approaches. Big Data can also be used for individual student's modeling in order to provide personalized education to groups with similar learning styles, preferences or difficulties.

4. Big Data Application in Educational Context

Every day the educational area generates a huge amount of heterogeneous data that has diverse origins - traditional and innovative. The latter comes mainly from e-learning systems, which allow collecting wide variety of specific data regarding not only the learning

process as a whole but the individual students' performance by tracking their behavior. This information comprises log-data, interactions within the e-learning platforms, usage of learning resources, cooperation between users and faculty, participations in education forums, thematic groups etc. All these data are at a hand, but their multifaceted value cannot always be fully assessed. They have to be retrieved, sorted and analyzed in order to extract meaningful information and thus to get valuable knowledge. To acquire intelligible and comprehensible meaning a sophisticated processing has to be done. Big Data and learning analytics provide tools for resolving such complex tasks. As a result, a useful insight on the whole learning process can be obtained and policies both on institutional and individual level can be drawn. In this manner an adaptive, efficient and attractive education is achieved where personalization is a significant part.

We represent our point of view about Big Data application in educational framework on Figure 1. It shows a complete picture of data collection, processing, distribution and utilization. Subsequently the educational data is subject to mathematical analysis. On the one hand data are statistically processed in order to be summarized and generalized so that educational programs and policies can be outlined and arranged. On the other hand, sophisticated Big Data techniques are applied to discover patterns and develop models and thus to grasp the factors for successful performance or arising problems and to propose relevant ways to overcome them, i.e. allow improvement and personalization of educational approaches. In particular, educational Big Data analyses enable identification of the most used or recommended learning courses and resources; assessment of their usefulness. They also reveal time distribution of learning activities, relative difficulty degree of tests and exams, preferred student's learning style and other important parameters of learning process that can be examined. Furthermore, the acquired knowledge from these analyses provides a valuable feedback for tutors, learning resource authors and students by giving the overall perspective on the whole process and therefore ensuring data-driven decision-making. Thus problems and specific "stumbling blocks" can be identified and appropriate interventions can be made – alternative learning resources or methods, personalized help, etc. could be provided.

Initially, a student's profile is created along with registration in e-learning system and very simple student's model is built [5]. It comprises student's individual data and reflects the educational path and learning progress. The profile includes a priori information as well as real time collected data, e. g. "snapshots" arising from on-going interactions with e-learning platform. The students' profiles are compared and summaries and trends are outlined. Also, by combining the data from profiles and Big Data analytics on individual level each student can be modeled and his/ her performance can be predicted [6]. Such utilization of learning related databases for building predictive models is critically important for making education more effective. Thus various key indicators for the learning process of individuals can be revealed – learning pace, utilized learning methods and resources, preferences about resource parameters (design, structure, level of difficulty, etc.); necessity of course or curriculum change; other specific requirements for adaptation (dyslexic, visual/ hearing impaired, etc.). All these factors are at the base of providing personalized educational services and can help students not to become disengaged.

Gathering the information about students' real-time actions is based on data mining – e-learning platform harvests data by tracking all kinds of learning activities and records these data in students' profile:

- *students' logs in the system*: identification, log-in time, IP address, etc.
- *students' learning activities:* access time, viewed/ read resources, resource visiting log, participation in group discussions, forums, chats, etc.

- *detailed problem solving snapshots:* number of times and time taken to perform individual tests, hints and help used, assessment results, etc.
- *students' logouts from the system*: gives duration of learning.

The main part of the collected real-time information about students' actions consists of enormous quantity of web- and text- data that is not easy to understand, so it needs to be pre-processed in order to extract features, detect trends, make clusters, outline exceptions, etc.

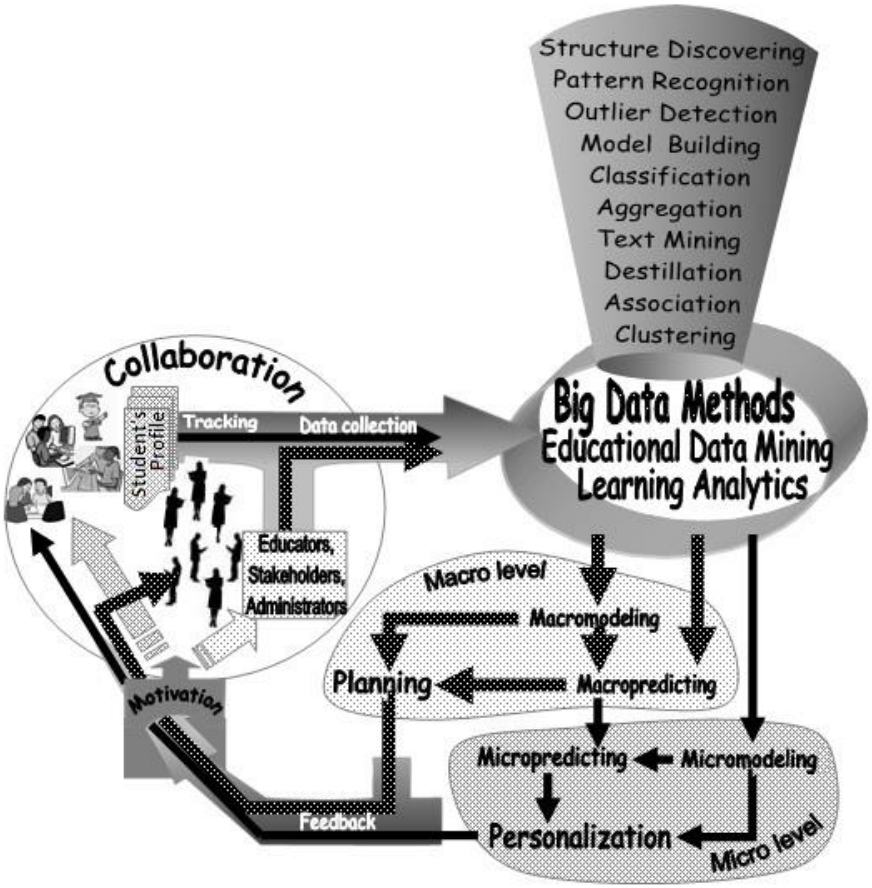

Fig. 1. Educational Big Data cycle

Big Data analytics contribute to deep understanding of the educational process in micro and macro context [3]. The data of all students are collected and processed in many different manners according to the predefined goals and various parameters: level of knowledge, skills, motivation, satisfaction and attitudes towards learning process, pace of learning, learning style and preferences, learning environment and resource's usage, demographics, etc. The powerful Big Data mathematical instruments use various approaches to reveal the significant features, to make predictions and to support decision making, in macro level that affect the learning process as a whole. These analyses help to interpret the existing information and to acquire new knowledge about the process of teaching and learning. By examination of students' behavioral patterns exceptional talented or in risk

students can be identified and appropriate actions to be taken. As a result, the education is enhanced and improved. Most often several methods are implemented simultaneously – quantitative and case analysis, sequence analysis, multivariate adaptive regression splines, decision trees, neural networks.

All the derived conclusions are used for making education policies on the macro level and developing personalized learning resources, plans and adapted pedagogical approaches based on the individual data analysis on the micro level.

At the end some considerations should be taken into account – the variety and volume of collected data and their power to enhance education continue to grow, but critical challenges still exist. The most important ones are data security, reliability and privacy, which have to be properly assessed. These essential issues require an adequate policy for data collection and usage in order to better manage educational Big Data.

5. Conclusion

This paper describes some applications of Big Data analytics approaches to education that have the potential to dramatically enhance the way of teaching for every student. Recent intelligent ICTs and modern functional rich educational frameworks allow capturing much more data concerning learning process than ever before. Processing of these immense quantities of data with Big Data tools based on data mining, learning analytics, etc. extend our ability to understand the immanent value of such increasingly large and heterogeneous educational data. These data are then analyzed to derive important knowledge about learning process and thus to make reason-based real-time decisions in order to provide personalized education.

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System Modelling & Experimental Assessment of IoT Cybethreats in Future Smart Homes

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Abstract: The paper outlines a modelling approach for assessing future cyberthreats, resulting from implementation of multiple IoT devices in future smart home environment. A combination of experts' beliefs, users' questionnaire based surveys results and literature data for multiple smart homes inhabitants' necessities and potential cyber threats hackers' activities is encompassed in a system model, using specialized software environment. Additional results' assessment is finally performed via probabilistic validation.

Keywords: IoT, future smart homes, cyberthreats, system modelling, probabilistic assessment

1. Introduction

Modern society has changed significantly in the last two decades and the ever emerging innovations continue to change man, environment and society. The majority of the changes come from the shift of the technologies – from analog to digital. They have led to the formation of the Digital Age – our modern times, where business, government, education, health, entertainment and all other aspects of human life have embraced and even rely on digital technologies. The mass impact of the Digital Age started with the universal introduction of personal computers, mobile/cell phones and Internet and nowadays the overwhelming amount of data and information in the world is created, transmitted and stored in a digital form [1]. The wide use of computing and communication led to lower prices and smaller sizes of digital and communication devices. This in turn led to more and more applications, where digital technology can be employed. So came the present situation, that in addition to personal computers connected to Internet and mobile phones, many objects (or so called "things"), used by humans, became digitalized. Those "things" became capable of creating, collecting, storing or/and processing digital data. In such manner the term Internet of Things (IoT) emerged [2]. IoT is one of the big and very hot ideas of the present [3]. It is in fact a concept, where devices and objects embedded with sensors, electronics and software form a network, capable to collect and transfer data. IoT can and is being applied to any human activity and in any field of human presence. One of the most popular areas of application is at home – there IoT is used to form smart home environment. This environment allows house owners to monitor and control any appliances and system of the house, as well as performing overall supervision of the entire home.

Critical and essential to the functioning of IoT and smart homes in particular are the sensors and RFID (Radio-frequency identification) devices. There is a great variety of sensors – for temperature, humidity, gas, motion, vibration, pressure, etc. They function

together with RFID (which is regarded as the basis of IoT), which can identify and track object, to which they are attached. In such manner the house and its parameters can be under the monitor and control of its owner.

2. Main Concerns for IoT & Smart Homes

According to a research, which analyses more than 750 publications in the area of IoT [4], the most frequently representative keywords in the subjects and structure is "IoT security". In its 2014 comprehensive IoT forecast, Gartner identifies security as the first challenge in this field [5]. One of the main reasons for that is that IoT is a heterogeneous system, integrating various devices, services and protocols between them.

Other issues, which are of vital importance for IoT are the sensor networks, RFIDs, communication channels and protocols, Internet and cloud computing, etc.

Undoubtedly, being area of application of IoT, smart homes (or smart houses) also share the same concerts as listed above, with security topping the list. It is even more important, as home is a special place for people, where privacy is of upmost importance.

The smart homes' products could be generalized in three categories, aggregated in Table 1:

- Sensors and smart devices of limited digital capacity;
- Higher capacity devices;
- Fully intelligent digital devices and services, processing data and information.

The fact that the existing devices and services are highly heterogeneous (appliances vary from light bulbs, thermostats and gas detectors to washing machines, fridges, TVs, surveillance equipment, smart phones, computers and networks) shows that many players in the field of home appliances must be able to make their products interact with other objects and products, being capable of mutual exchange of data and information.

Devices must be also easily and securely identified, authenticated and authorized for setting in particular function/action. This is a serious challenge to implement on such a scale.

At the same time, one must not forget another existing issue in Internet – the security of communications and cloud services, as smart homes can be controlled/monitored remotely via Internet and mobile phones.

This in turn makes it very important for researchers and developers to be able to model and assess all mentioned above cyberthreats in order to preserve the overall home security. Smart home security is needed because people have private data and privacy concerns in their home most than anywhere in their life.

More detailed future cyberthreats assessment will be presented, using both system modelling and results probabilistic assessment.

3. Cyberthreats Exploration

The implementation of this stage is benefitting from the ideas, proposed in [6], but is mainly addressing the smart homes with IoTs problem space system modeling and exploration (3.1) and further results probabilistic assessment (3.2).

We found this idea, being comprehensive enough for extending the mixed reality polygon approach [7], but in a more comprehensive context from IoTs perspective future threats specifics understanding.

3.1. System Modelling

This stage was organized following the positive successful experience, based on the General Systems Theory [8] and Vester's dynamic generalization [9] for multiple cyberthreats exploration [6].

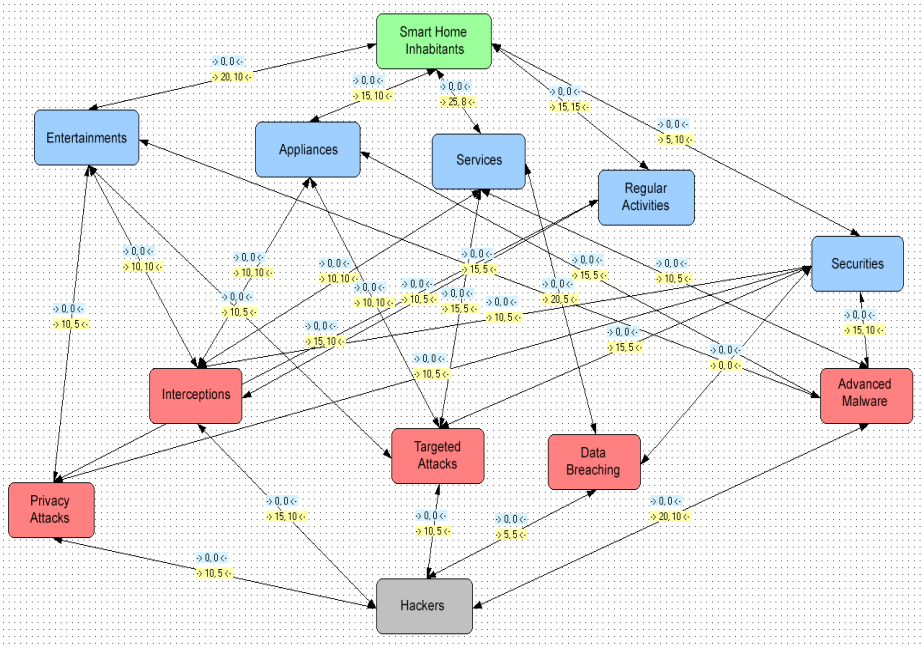
Table 1. Devices and services in smart homes.

IOTS	EXAMPLES	FUNCTION	CAPABILITIES	VULNERABILITY
Sensors and limited capacity devices	Temperature, light, humidity, gas and other sensors and detectors/devices, cameras, appliances (washing machine, fridge, etc.), RFIDs	Presenting data and information on the environment and real-time events in the house	Small memory and very limited processing power	Malfunctioning, power or battery problems, in few cases of some appliances – unauthorized access
Higher capacity devices	Home WiFi network, sensor network, routers and gateways for home networks, smart TVs, SIM, GPS and GPRS modules	Communication of data and information gathered by sensors and other devices, partial processing of data	Memory storage capable of storing and running bigger and complex programs, controllers and processors for running communication protocols	Tapping and tampering communications and devices inside the home and the communication to/from the house
Fully intelligent digital devices and services	Home servers, including device managers, cloud services, tablets and smart phones	Process, controls and take decisions on various processes and conditions, alerts home owners	Possessing an OS of some kind, big memory, computing and communication capabilities	Unauthorized remote access and gaining control and command of devices and systems

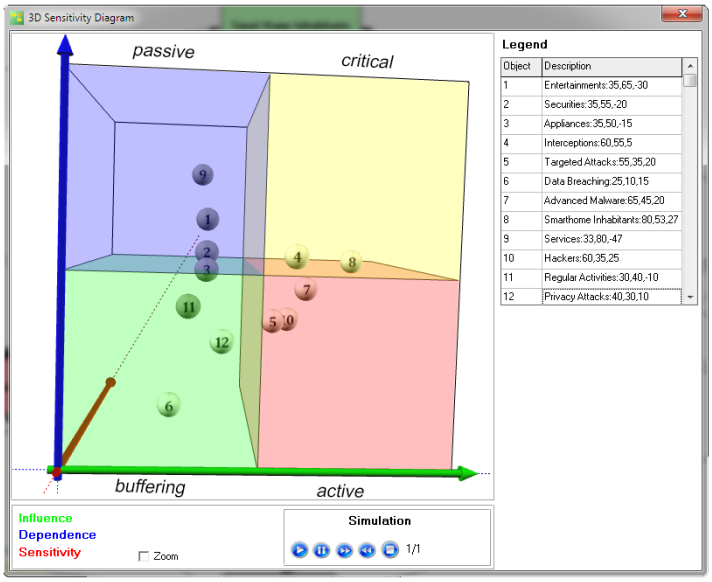
The modelling in itself was performed using I-SCIP-SA software environment [10]. A graphical interpretation of Chen's 'E-R' paradigm [11], describing elements as related entities in the model, is accomplished. All relations (uni- or bi- directional) are weighted and time dependent (times equal to 0, concern static models, whilst – arrays of time values with certain functional – dynamic ones). Graphically, entities are marked with labeled rectangle or circle and relations, with arrows, labeled for both weight (yellow) and time (blue). Model assessment is based on experts' beliefs (sensors data is also applicable in certain dynamic situations, see e.g. [7]) for the relations weight and their time trends, implemented into three dimensional Sensitivity Diagram (SD), using: influence (x), dependence, (y) and sensitivity (z) values. SD is providing four-sector entities classification (in accordance with x, y, z values): green – 'buffering', red – 'active', blue – 'passive' and yellow – 'critical'.

Additional, 'active' (white, positive z values) and 'passive' (grey, negative z values) reassessment for each of the entities in a certain sector is also accomplished. This is also marked with elements' sensitivity evaluation towards the z axis. All entities from the model are visualized in SD with indexed balls.

A practical modelling implementation of smart homes with IoTs multithread model in I-SCIP-SA environment, organized around 'Smart Home Inhabitants' aggregated necessities ('Entertainments', 'Appliances', 'Services', 'Regular Activities' and 'Securities') and 'Hackers' attacks, expected evolution ('Privacy Attacks', 'Interceptions', 'Targeted Attacks', 'Data Breaching' and 'Advanced Malware'), using initial data from [12], some tailoring following the industrial beliefs [13] and questionnaire based results [14] is provided in Figure 1.



a)



b)

Fig. 1. Smart homes multi threats model (a) and resulting sensitivity diagram (b).

The resulting model SD (see Figure 1b) is defining the following classification: critical: 'Interceptions' – '4' and 'Smart home Inhabitants'; active: 'Targeted Attacks' – '5', 'Hackers' – 10 and 'Advanced Malware' – '7'; passive: 'Entertainments' – '1', 'Securities' – '2', 'Appliance' – '3', 'Services' – '9'; buffering: 'Data Breaching' – '6', 'Regular Activities' – '11' and 'Privacy Attacks' – '12'.

As these future threats analysis for smart homes is based on experts' beliefs, users' opinions and literature data, providing initial static classification (that could evolve in multiple dynamic scenarios [15]), further results probabilistic assessment is accomplished.

a. Results Probabilistic Assessment

As the identified cyberthreats from 3.1 are concerning future trends prognosis, this process could be considered from multiple perspectives, involving the human factor within mixed reality smart home polygon and different IoT gadgets [7]. Whilst, this approach is comprehensive enough, but at the same time – rather complex and multiple resource consuming, a more simplified initial one, is presented here, following some recent industrial experience [13]. A combination of selected system analysis entities and Beta probability distribution, implementing experts' beliefs for a priori assessment is initially used. These are further validated through agent-based cyberattacks probabilistic validation via simulation in Matlab R2011b environment, providing a posteriori simulated probabilities, assessing hypothetical evolution scenarios.

Three cyber threats entities, resulting from the system analysis (see Figure 1b), have been selected, following also other surveys results [14], [16] for further exploration: 'Interceptions', 'Privacy Attacks' and 'Advanced Malware' (see Figure 2 - Figure 4).

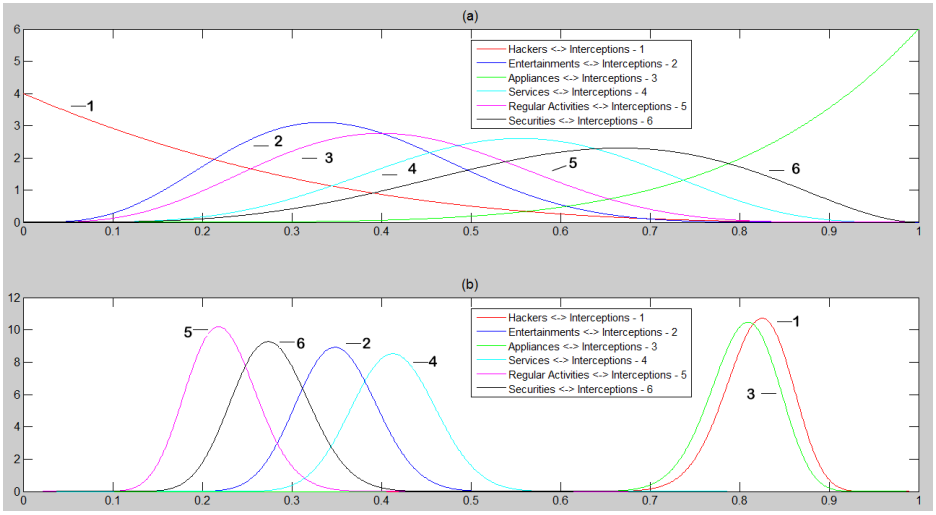


Fig. 2. 'Interceptions' probability assessments: before (a) and after (b) the simulation.

The obtained simulation results assessments demonstrate some useful findings, concerning trends dynamic probabilistic changes. The 'Interceptions' negative influence to smart home 'Appliances' is confirmed, whilst a contradictory one, for 'Interceptions' and 'Hackers', is found (see Figure 2). The 'Entertainments' prioritization is clearly distinguished towards 'Regular Activities', concerning 'Privacy Attacks' (see Figure 3). Finally, 'Advanced Malware' effect is prioritized for smart home 'Services' and 'Appliances' (see Figure 4).

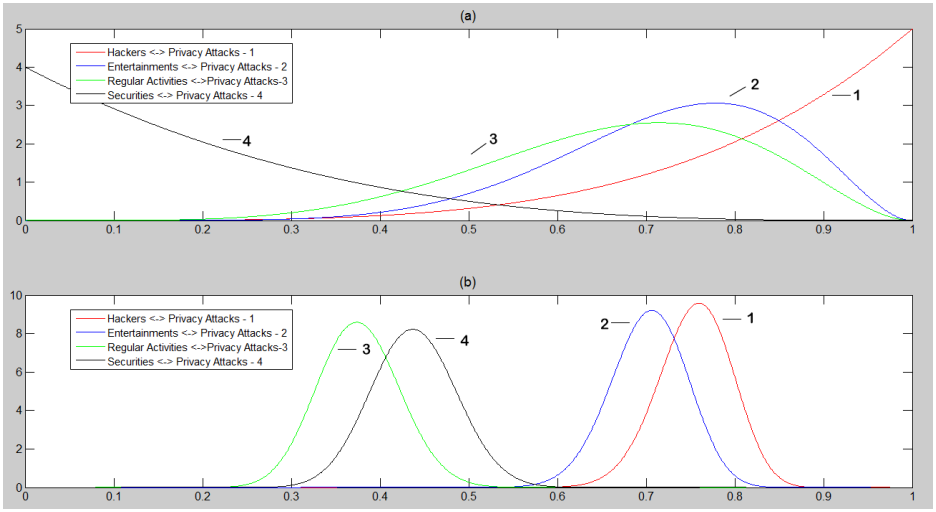


Fig. 3. 'Privacy Attacks' probability assessments: before (a) and after (b) the simulation.

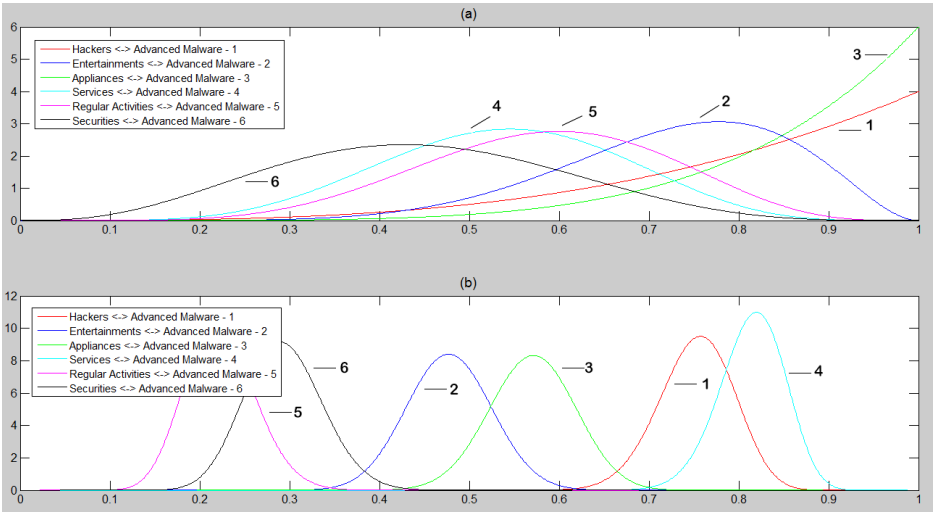


Fig. 4. 'Advanced Malware' probability assessments: before (a) and after (b) the simulation.

4. Conclusion

Proper understanding of digital technologies evolution is defining a rather comprehensive task for meeting the new security challenges. The presented approach for system modelling and probabilistic assessment encompassing experts' beliefs, users' questionnaire based surveys, literature data and machine simulation is providing a good useful added value to the security problem exploration.

Further, mixed reality polygon integration with IoT gadgets data is an expected progressive step. This will incorporate both multiple human factor response and environment monitoring within the assessment, providing a more reliable future cyberthreats identification and countering.

Acknowledgement

This study is partially supported by 'Creation of platforms for application studies in Internet of Things', UNWE Grant 1-5/2015. Additional gratitude for the technological support is given to 'A Feasibility Study on Cyber Threats Identification and their Relationship with Users' Behavioural Dynamics in Future Smart Homes', Research Grant 'Funding of Fundamental & Applied Scientific Research in Priority Fields', Bulgarian Science Fund, Ministry of Education Youth and Science, 2012-2016, DFNI-T01/4, www.smarthomesbg.com

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New Opportunities for a Query Performance Analysis in MS SQL Server 2016 Using the Query Store

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Abstract: The query performance is a very important issue in every Database Management System. There are many tools for collecting and analyzing information for the execution of the queries. In Microsoft SQL Server 2016 a new tool will be added - Query Store. This paper aims to present the capacity of this tool, compare it with other similar tools, and suggest options for using it in the analysis of the performance of the queries.

Keywords: query performance, performance analysis, Query Store

1. Introduction

The Query Store is a new feature, which is added in the Microsoft SQL Server 2016. Everyone who has dealt with the query performance analysis is familiar with the tools that Microsoft SQL Server provides. Starting from Microsoft SQL Server 2005, many execution-related Dynamic Management Objects (Views, Functions, and Procedures) became available, such as:

- sys.dm_exec_query_stats,
- sys.dm_exec_sql_text, and
- sys.dm_exec_query_plan.

These DMO's are used as a source of information about the execution of queries. In previous papers I have already discussed the capabilities of some other tools like Data Collector [1] and Extended Events [2].

The main goals of this paper are to present the capabilities of Query Store, compare it with other similar tools, and suggest options for using this tool in the query performance analysis.

2. What is Query Store?

The SQL Server Query Store feature automatically captures a history of queries, plans and runtime statistics, and retains it for a future analysis. It separates data by time windows, allowing users to see database usage patterns and find out when query plan changes happened on the server [3]. The Query Store collects data about every query that has been executed by the server. Information is divided in two main categories:

- execution plan information, and
- execution statistics information.

Each query in general is associated with multiple execution plans. The history of these execution plans is stored in the **plan store**. Each query execution generates multiple statistics which are stored in the **runtime stats store**.

The architecture of the Query Store is presented in Figure 1.

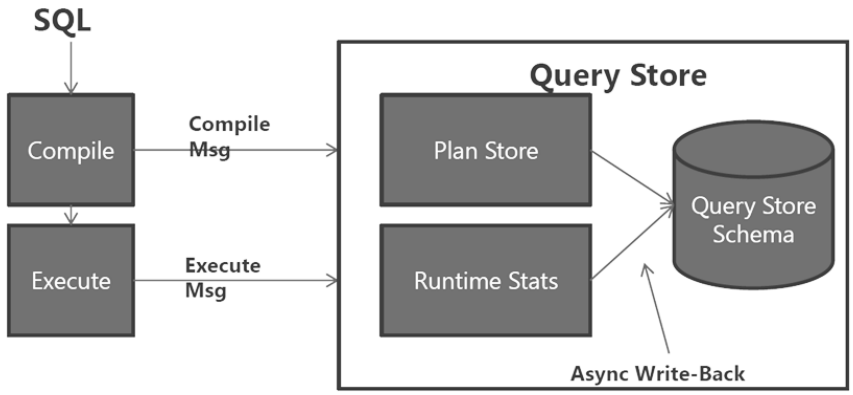

Fig. 11. Query Store Architecture [4]

When a query gets submitted against a database that has the Query Store enabled, the compiled query Execution Plan is written to the Query Store Plan Store and the runtime information of the query is recorded in the Runtime Stats Store [5]. The collected information is stored in memory and then is written asynchronously to the disk, depending on the specified interval, or when there is a memory pressure on the system.

3. Enabling and Configuring Query Store

The Query Store is not active for a new database until it is not enabled using the Microsoft SQL Server Management Studio or the SQL statement ALTER DATABASE.

Using the Management Studio, Query Store can be enabled by selecting **Properties**, **Database Properties** and then in the **Query Store** page selecting **True** for the **Enable** option.

Using the SQL statement, Query Store can be enabled by executing:

ALTER DATABASE <database name> SET QUERY_STORE = ON;

The Query Store can be configured by using the Management Studio or the SQL statement, for example:

```
ALTER DATABASE <database name>
SET QUERY_STORE (
   OPERATION_MODE = READ_WRITE,
   CLEANUP_POLICY =
   (STALE_QUERY_THRESHOLD_DAYS = 365),
   DATA_FLUSH_INTERVAL_SECONDS = 600,
   MAX_STORAGE_SIZE_MB = 100,
   INTERVAL_LENGTH_MINUTES = 60,
   SIZE_BASED_CLEANUP_MODE = AUTO,
   QUERY_CAPTURE_MODE = AUTO
   MAX_PLANS_PER_QUERY = 1000);
```

Information about current settings can be obtained from Query Store Catalog View sys.database_query_store_options:

```
SELECT * FROM sys.database_query_store_options;
```

All configuration options can be seen in Table 1.

Table 1. Query Store configuration options

Option	Description
OPERATION_MODE	Can be READ_WRITE or READ_ONLY.
CLEANUP_POLICY	Configures the STALE_QUERY_THRESHOLD_DAYS argument to specify the number of days to retain data in the query store.
DATA_FLUSH_INTERVAL_SECONDS	Determines the frequency at which data written to the query store is persisted to disk. Data collected by the query store is asynchronously written to the disk.
MAX_STORAGE_SIZE_MB	Configures the maximum size of the query store. If the data in the query store hits the limit, the query store changes the state to read-only and stops collecting new data.
INTERVAL_LENGTH_MINUTES	Determines the time interval at which runtime execution statistics data is aggregated into the query store. The runtime execution statistics are aggregated over a fixed time window.
SIZE_BASED_CLEANUP_MODE	Controls whether the cleanup process will be automatically activated when total amount of data gets close to maximum.
QUERY_CAPTURE_MODE	Designates if the Query Store captures all queries, or relevant queries based on execution count and resource consumption, or stops adding new queries and just tracks current queries.
MAX_PLANS_PER_QUERY	An integer representing the maximum number of plans maintained for each query.

4. Query Store Related Views, Functions, and Procedures

The Query Store can be viewed and managed through the several views, functions and stored procedures.

The system function **sys.fn_stmt_sql_handle_from_sql_stmt** is used to obtain the SQL handle for a specified SQL statement.

Stored information about queries, query plans and runtime statistics can be accessed using Query Store catalog views. There are seven catalog views which are briefly presented in Table 2.

Some aspects of the Query Store can be managed through stored procedures. There are six Query Store stored procedures, presented in Table 3.

5. Using Query Store in the Query Performance Analysis

As mentioned above, Query Store stores information about all executed queries, their execution plans and runtime statistics. This information is available through the Query Store catalog views. At first glance, this is not something radically new because there was DMO's providing similar information in the previous versions of Microsoft SQL Server. However, the Dynamic Management Views retrieve information from procedure cache, where only the

last execution plans are stored. Plans also get evicted from the cache when the server restarts or due to memory pressure. Given that the Query Store retains multiple execution plans per query, it can help diagnose performance problems that are related to plan changes.

Table 2. Query Store Catalog Views

View name	*Description*
sys.database_query_store_options	Returns the Query Store options for this database.
sys.query_context_settings	Contains information about the semantics affecting context settings associated with a query.
sys.query_store_plan	Contains information about each execution plan associated with a query.
sys.query_store_query	Contains information about the query and its associated overall aggregated runtime execution statistics.
sys.query_store_query_text	Contains the text and the SQL handle of the query.
sys.query_store_runtime_stats	Contains information about the runtime execution statistics information for the query.
sys.query_store_runtime_stats_interval	Contains information about the start and end time of each interval over which runtime statistics information for a query has been collected.

Table 3. Query Store Stored Procedures

Procedure name	**Description**
sp_query_store_flush_db	Flushes the in-memory portion of the Query Store data to disk.
sp_query_store_force_plan	Enables forcing a particular plan for a particular query.
sp_query_store_remove_plan	Removes a single plan from the query store.
sp_query_store_remove_query	Removes the query, as well as all associated plans and runtime stats from the query store.
sp_query_store_reset_exec_stats	Clears the runtime statistics for a specific query plan from the query store.
sp_query_store_unforce_plan	Enables unforcing a particular plan for a particular query.

Since the Query Store keeps history of execution plans and runtime statistics throughout query executions, there are many possibilities for query performance analysis. The Query Store can be used to:

- Determine the number of times a query was executed;
- Identify top queries by execution time, memory consumption, etc.;

- Easily find a plan performance regression;
- Audit the history of query plans for a given query;
- Analyze the resource (CPU, I/O, and Memory) usage for a particular database.

The number of executions for each query can be found, for example, using this statement:

```
SELECT q.query_id, qt.query_text_id, qt.query_sql_text, SUM(rs.count_executions)
FROM sys.query_store_query_text AS qt
JOIN sys.query_store_query AS q ON qt.query_text_id = q.query_text_id
JOIN sys.query_store_plan AS p ON q.query_id = p.query_id
JOIN sys.query_store_runtime_stats AS rs ON p.plan_id = rs.plan_id
GROUP BY q.query_id, qt.query_text_id, qt.query_sql_text
ORDER BY total_execution_count DESC;
```

The top 10 queries with the longest average execution time can be found using this statement:

```
SELECT TOP 10 q.query_id, qt.query_sql_text, rs.avg_duration
FROM sys.query_store_query_text AS qt
JOIN sys.query_store_query AS q ON qt.query_text_id = q.query_text_id
JOIN sys.query_store_plan AS p ON q.query_id = p.query_id
JOIN sys.query_store_runtime_stats AS rs ON p.plan_id = rs.plan_id
ORDER BY rs.avg_duration DESC;
```

The top 10 queries that had the biggest average physical IO reads, with corresponding average row count can be found using this statement:

```
SELECT TOP 10   q.query_id, qt.query_sql_text, rs.avg_physical_io_reads,
                rs.avg_rowcount
FROM sys.query_store_query_text AS qt
JOIN sys.query_store_query AS q ON qt.query_text_id = q.query_text_id
JOIN sys.query_store_plan AS p ON q.query_id = p.query_id
JOIN sys.query_store_runtime_stats AS rs ON p.plan_id = rs.plan_id
ORDER BY rs.avg_physical_io_reads DESC;
```

The Query Store goes further by giving an opportunity to direct the query processor to use one of the stored execution plans for a query. This is referred to as plan forcing. Data changes all the time, so the Query Optimizer might generate a different plan for the same query. Sometimes the new plan is less efficient than some of the previous plans. Plan forcing can resolve a query performance regression caused by a plan change.

The Query Store can be accessed also through Microsoft SQL Server Management Studio. In the structure of the database with enabled Query Store there is a section named **Query Store**. This section contains several reports, presenting information from the Query Store:

- Regressed Queries;
- Overall Resource Consumption;
- Top Resource Consuming Queries;
- Tracked Queries.

As a conclusion, the Query Store has the following advantages:

- The Query Store is integrated in Microsoft SQL Server;
- The Query Store stores the information permanently on disk;

- The query execution plan can be forced in order to resolve a query performance regression;

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Information System for Detecting Heterogeneities During Multi-dimensional Data Mart Integration

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Abstract: The problem of integrating autonomously developed data marts can arise when an organization needs to merge data resides in independently developed data marts in order to make a better decision in a given situation. During this integration several categories of heterogeneities can arise because of the complexity in the multidimensional data model. In order to detect these heterogeneities semi-automatically, an information system is built. This paper proposes and explains the architecture and implementation of a system, which can identify possible heterogeneities between the elements of integrated multi-dimensional data marts. The first section of the paper presents the literature overview on the topic. Then the proposed information system is explained.

Keywords: Data warehouse, data marts, integration heterogeneities, multidimensional metadata.

1. Introduction

A data mart consolidates data required for decision-making by various users (for example, Sales Department) [1]. One of the main phases of a data mart lifecycle is the dimensional modeling, where the conceptual and logical model are built [2]. The result of dimensional modeling is the multi-dimensional data model (MDM) of the data mart, which can be materialized by different OLAP – ROLAP, MOLAP, and HOLAP. The multidimensional model (MDM) on which the concept of DW and DM are based is comprised of three basic constructive elements: the facts which are analyzed, the dimensions (coordinates of the fact) and the measures which allow for the quantitative evaluation of the facts [3]. The multi-dimensional data model is semantically richer than the traditional ER data model, based on the fact that MDM consists of two different conceptual entities – dimension and facts. This leads to much more complex integration of two data marts.

One problem that needs to be solved in many practical cases is the integration of data marts that have been developed and operated independently. In many cases, data which resides in multiple and independently developed data sources are needed for decision-making. For example, if several KPI from different DM are to be compared or new KPI defined (by the KPIs residing in several different DMs), two possible choices arise – building a new DM or integrating the existing ones. Building a new DM is a costly and time consuming task. Therefore, it would be better if there were mechanisms for integration of the existing DMs. Another case where DM integration is needed is in mergers and acquisitions of different companies. In this case, for example, one company acquires another company and the DMs in the acquired company should be integrated into the DW of the acquiring company. Here the same possible choices as in the previous case are available.

For the integration purposes the data marts should be based on common dimensions and facts, but in many cases different departments of one company develop their own data marts and their integration becomes a difficult task. The difficulties come out of the heterogeneities of the MDM elements and can be classified as dimension and fact heterogeneities from a semantic point of view. The dimension heterogeneities occur when the dimension schema structures, dimension members or the naming of semantically related dimensions have semantic discrepancies. The fact heterogeneities occur when the measures in different data marts are in different names, values (inconsistent measures), formats or even different scale. Some work has been done on the problem of resolving these heterogeneities occurring in data mart integration [4, 5, 6, 7]. Some of the authors [4, 5, 6] are proposing information systems for automating the process for data mart integration. The main part of data marts integration is resolution and identification of the possible heterogeneities. To the best of our knowledge there are no proposals for an information system which automatically or semi-automatically detects and identifies possible heterogeneities between the integrated data marts. The author in [8] proposes a methodology for heterogeneities detection consisting of 4 methods. A conceptual architecture of a system for heterogeneities detection is proposed in [9].

The goal of this paper is to propose and define an information system for heterogeneities detection during the multi-dimensional data mart integration, based on the work in [8, 9, 10].

The rest of the paper is organized as follows: Section 2 introduces the architecture components of the proposed system and their implementation. In Section 3 the metadata repository is presented and explained. Finally in section 4, some conclusions and future work are inferred.

2. Architecture Components of the System

The main goal of the proposed information system introduced in this paper is to provide a systematic and summarized information about the presence or absence of different types of heterogeneities among data marts elements, prior to their integration.

The information system has three main components:

1. The integrated data marts
2. The application, which actually does the work separated in three parts – “Metadata Extractor Engine”, “Metadata Repository” and “Heterogeneity Detector Engine”
3. Graphical User Interface (GUI) which presents the results

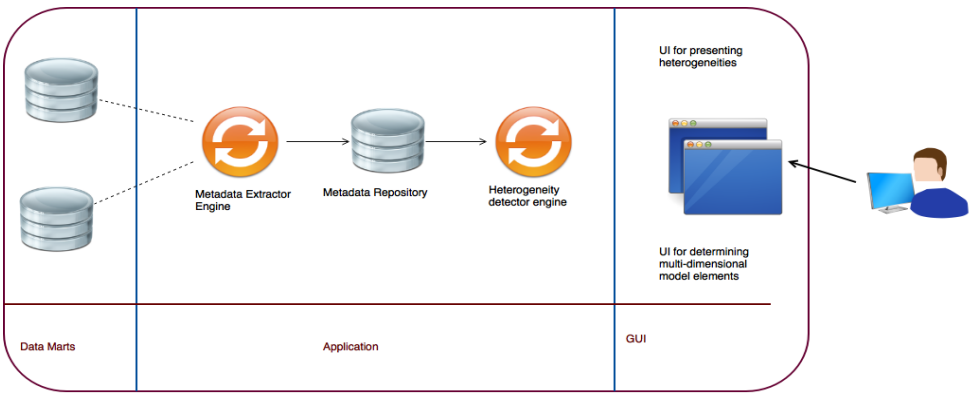

Fig. 12. Information system architecture

The first components of the system for detecting heterogeneities are the data marts, which are going to be integrated. These data marts stand as a data source for our system and are implemented as relational databases of star or snowflake schemas.

The next component of the architecture is the so-called "Metadata Extractor Engine". This architecture component enables the extraction of metadata required for heterogeneities detection and loading it to the next component "Metadata Repository".

The "Metadata Repository" serves as a container for the data describing and defining the elements of a data mart. This data is required for further comparison and processing in order to enable the detection of the possible heterogeneities between the integrated data marts.

The "Heterogeneity Detector Engine" processes the data in the "Metadata Repository" and detects the presence or absence of heterogeneities between the data marts. This component is based and implements the logic defined in [8].

The last component of the system is the GUI, which presents the results produced by the application.

2.1. Metadata Extractor Engine

The "Metadata Extractor Engine" architecture component plays a significant role as it collects system and user data about the integrated data marts. The goal of this component is to collect data about:

- Dimensional attributes within the dimension schema and their characteristics and properties
- Non-dimensional attributes within the dimension schema and their properties and characteristics
- Dimensional attributes within the fact schema
- Measures from the fact schema

A set of programming methods were developed in order to implement the logic defined in the proposed formal algorithms in [8].

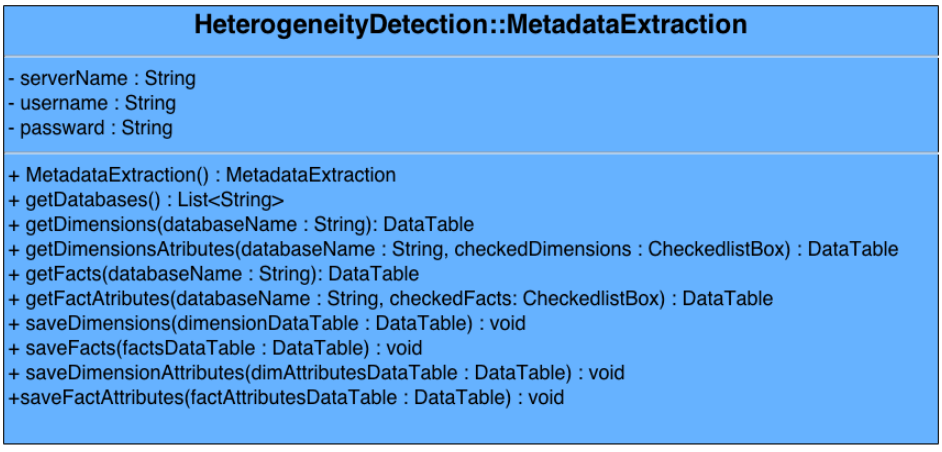

Fig. 13. Metadata Extractor methods

The methods getDatabases(), getDimensions(), getDimensionsAttributes(), getFacts()

and getFactAttributes() fully implement the logic defined in [8]. The remaining methods load the next component, the "Metadata Repository".

2.2. Metadata Repository

The Metadata Repository aims to provide a suitable form for storing the multi-dimensional schema elements. In order to achieve that an ER data model is developed (fig. 3) [10]. The metadata repository is composed of 5 entities:

1. Dimensions
2. DimensionAttributes
3. DimensionAttributesType
4. Facts
5. FactAttributes

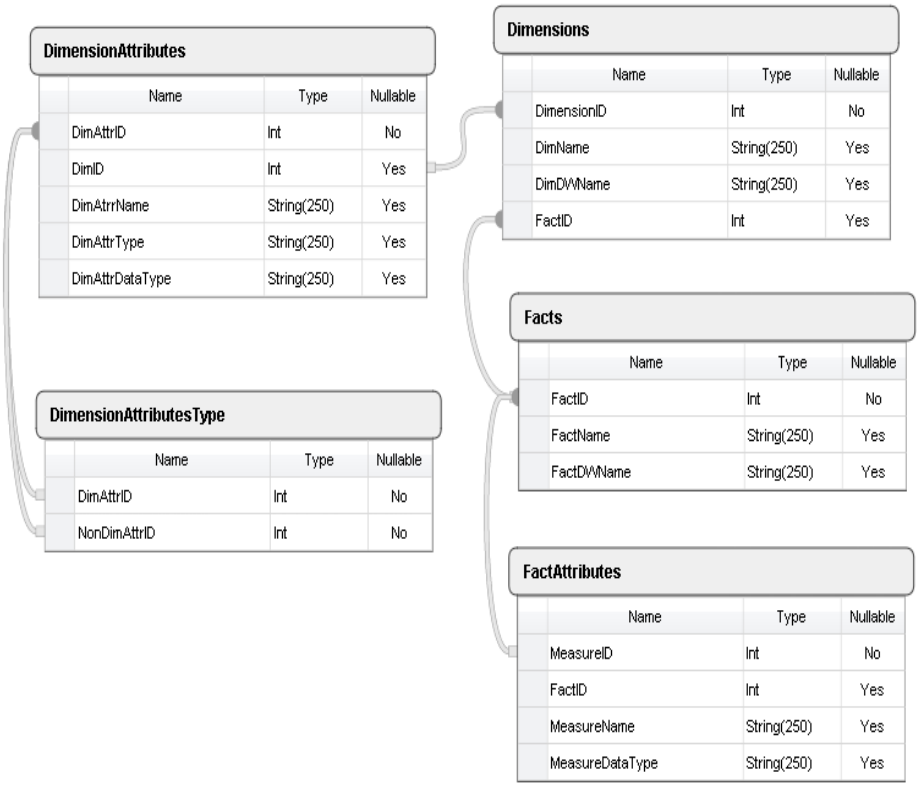

Fig. 14. Metadata Repository schema

The dimension-specific characteristics and properties which should be taken into account during the realization of the metadata repository are:

- Every dimension has a name and a relationship to some fact table, as well as belonging to exactly one data mart.
- Every dimension is composed of two attributes types –dimensional and non-dimensional attributes. The dimension hierarchy is composed of dimensional attributes. The non-dimensional attributes additionally describe some dimensional attribute. Every attribute has its own domain described as its data type.

- One dimensional attribute may have many non-dimensional attributes, while one non-dimensional attribute can describe only one dimensional attribute.

On the other hand, the fact table's specific characteristics and properties should be taken into account. They can be summarized as:

- Each fact table has a name and a belonging to a data mart.
- A fact table is composed of dimensional attributes and measures. Dimensional attributes correspond to the base level of the associated dimension. Each attribute has a corresponding domain described as a type of data

2.3. Heterogeneity Detector Engine

The implementation of the "Heterogeneity Detector Engine" consists of a set of programing methods (fig. 4). These methods are also based on the logic implemented in [8].

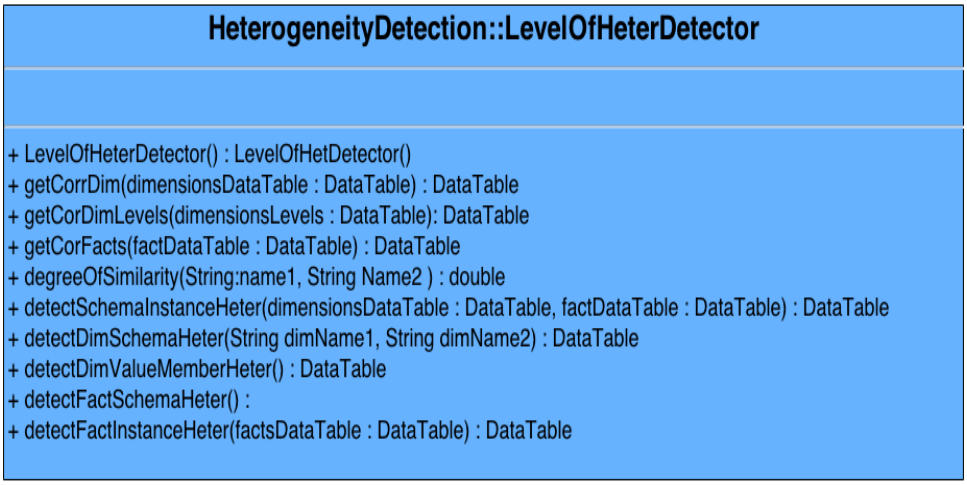

Fig. 15. Heterogeneities detector engine methods

The methods getCorrDim(), getCorDimLevels(), getCorFact(), degreeOfSimilarity() process the data in "Metadata Repository" and by applying rules (defined in [8]) extract the corresponding multidimensional data marts elements. The remaining methods compare the extracted and corresponding elements in order to detect different levels of heterogeneities.

3. Conclusion

The problem of integration of data marts has been observed, mainly focusing on resolving the possible heterogeneities rather than their detection prior to the integration itself.

This paper presents an information system for early detection of possible heterogeneities during the integration of autonomously and independently developed data marts. The early detection of heterogeneities is an imperative step that must be taken before undertaking a data mart integration solution and is an effective tool for the prevention of numerous errors and misunderstandings.

Acknowledgment

The authors express their gratitude to the Bulgarian National Science Fund for the partial financial support under the Grant № DFNI-I02/15 from 12.12.2014, titled "Information System for Integrated Risk Assessment from Natural Disasters".

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Methods for Cloud Services Integration with Educational Social Networks

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Abstract: The educational social networks in the higher education are an innovative approach for increasing the engagement of the participants in the learning process. Custom on-premises implementations have shown to be an effective technological solution. At the same time software-as-a-service solutions (for example, web-based office applications, file sharing, real-time collaborative applications, etc.) allow for a higher level of interactivity of the courses. Different software methods for interface and data integration of such cloud services into an existing educational social network at the University of National and World Economy have been implemented and evaluated.

Keywords: Educational social network, cloud services, integration.

1. Introduction

Social networking sites have a significant impact on both the personal and the professional life [1], the scientific community [2] and other specific areas. An important part of the social networking space are the Enterprise social networks – social environments aimed at improving the communication workflows in the enterprise. The integration with the existing software systems is considered a key to a better adoption and improved productivity of the employees [3]. An Educational social network is a type of online social network which provides either an end-user software product or a platform and framework for enhancing the learning process for all of the participants in a given formal or informal educational environment [4, 5, 6]. For example, in the higher education, such a system might be an engaging way to promote some desired activities among the students, including, but not limited to: teamwork; professional communication; sharing knowledge and experience; aggregation and evaluation of information sources; presentation of the individual skills; discussions; construction of knowledge. The most significant difference from a traditional e-learning system is the workflow – it is not focused around the content itself but the connections between the participants or between the participants and the content, formed actively or passively during the interaction with the Educational social network. Thus the goal of an Educational social network is not to replace the existing e-learning solutions with a better alternative, but to give the students and the lecturers an additional environment, consisting of familiar tools and behavioral patterns focused around sharing information with multiple groups of people.

In order to achieve the educational goals of such a system, we need state of the art toolset for each part of the process. Developing such tools is infeasible due to the required resources. Also, most of these tools are readily available as cloud services and have application programming interfaces for the purpose of integration with other systems. This leads to the idea of using existing software-as-a-service solutions as an integral part of the

workflow of the Educational social network at the University of National and World Economy.

2. Educational Social Networks and Cloud Services

Depending on the specific cloud service there might be different possible points of integration with the Educational social network [7, 8]. The expected types of educational activities are the primary criteria to select the cloud services for integration. For example, a course in Economics might benefit from a collaborative environment for document writing, spreadsheets and presentations (like Microsoft Office365, Google Drive, Zoho), while for a Programming course we might need a version control system (like GitHub, Visual Studio Online).

The most basic collaboration features in the cloud that might be relevant for most courses in a university are:

- Real-time communication;
- File sharing;
- Office applications – for word processing, spreadsheets, presentations;
- Group calendars – for planning and better organization within the teams;
- Sharing content with the professor;
- Capabilities for reviewing and commenting on the contents.

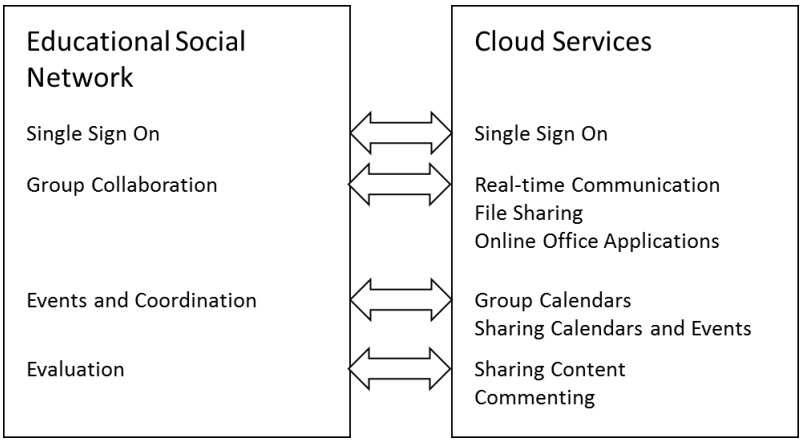

Fig. 16: Integration targets for educational social networks and cloud services in the context of a non-specific course.

3. Implementation

As all of the students at the University of National and World Economy have Microsoft Office 365 accounts, the choice of this cloud service for our integration purposes seems appropriate. The chosen approach is to build a web service using Microsoft ASP.NET WebAPI, which allows us to use a managed library for the access to the Office 365 API. Then this service will be called by the Educational social network in order to send and retrieve relevant data for its context.

There are two levels on which the integration has been implemented – data and interface. On the data level, the Educational social network passes information about the

students and the professors and retrieves data about their cloud accounts. Then if the professor has created a team for a course project, the ESN invokes the operation of creating a SharePoint team site in the cloud. Then the ESN requests information about the shared items in the team site. On the user interface side, the ESN requests a URL, which opens a specific shared item in its default editor in the cloud – for example, a Word file gets opened in Microsoft Word Online for editing and reviewing purposes.

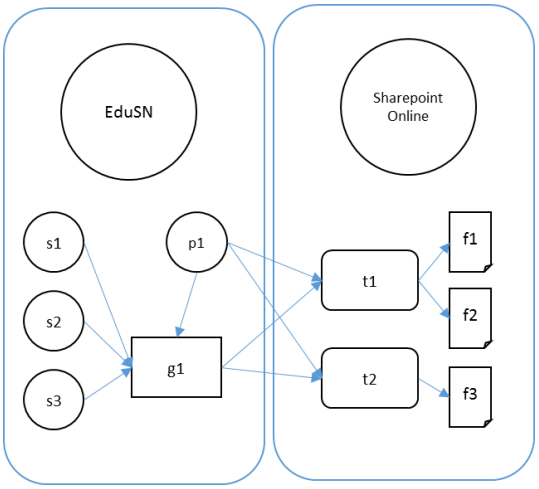

Fig. 17. Integration flow - s1 to s3 are students, participating in a group g1 with professor p1. In the SharePoint Online environment, the professor has created two team sites for the group where different students can work simultaneously in the cloud.

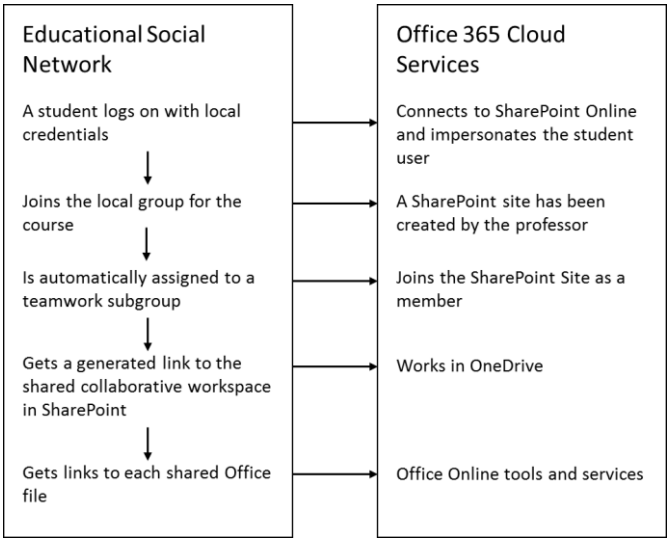

Fig. 18. The flow that has been implemented in this case

After a successful login by the student or the professor, we can use their cloud e-mail address to perform operations on their behalf. The group in the Educational social network is created based on the administrative separation of the students. The professor who is associated with a certain group can create as many project teams as they like. Each team can consist of multiple students from the group. Creating the team inside the Educational social network triggers the creation of a SharePoint team site in the cloud.

The process starts with opening a tenant administration context and supplying the credentials of an administrative account. Then the team site creation properties are defined based on a given template. The process waits in a loop while the site is getting generated as it takes from few seconds to a few minutes.

From this point on, the student is a member of one or many team sites in the cloud. The shared files are placed in a "Shared Documents" folder on the team site. A new client context is instantiated to retrieve the list of the shared files and their unique numbers (used later to invoke the online editors).

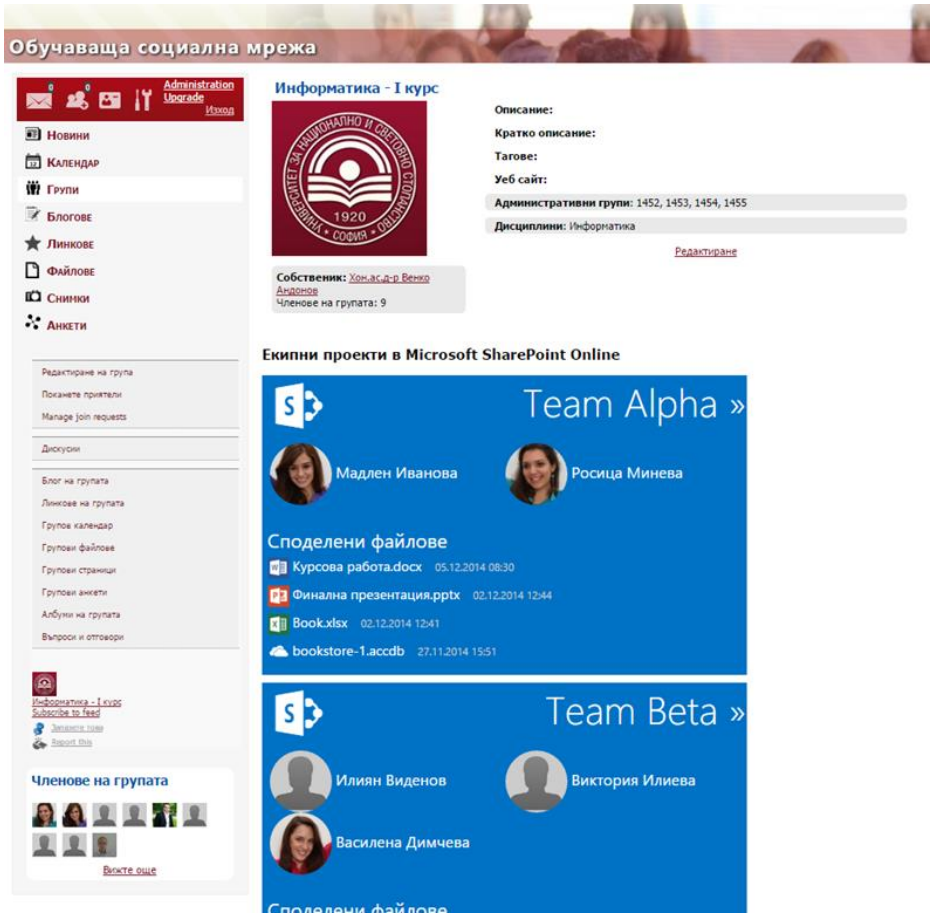

Fig. 19. Screenshot of the Microsoft SharePoint Online integration inside the educational social network of UNWE

4. Conclusions

The integration between an educational social network and different cloud-based services is a promising method to achieve higher levels of interactivity at low development costs. Each service has its own development specifics which might limit the number of services in a given educational social network.

The integration method described here attempts to use the strengths of the cloud service directly into the usual educational flow within the educational social network. This integration achieves a complete end-to-end collaborative solution for students and professors depending on their preferences and learning goals.

The development of a web service as an intermediary between the Educational social network and any cloud service allows for the development of independent modules for different services. Then the participants in the Educational social network would be able to pick any specific set of services matching their contents and ideas.

Acknowledgment

The authors express their gratitude to the Bulgarian National Science Fund for the partial financial support under the Grant № DFNI-I02/15 from 12.12.2014, titled "Information System for Integrated Risk Assessment from Natural Disasters".

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Design of Subsystem „Registration of Queries for Monitoring, Forecasting and Optimization“

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Abstract: This report is a result of current and previous research of systems' performance and more specifically the focus is on the database productivity in a system. The database is considered a part of the entire business information system. This report proposes a subsystem „Registration of queries for monitoring, forecasting and optimization“ that is a part of a business information system for performance management of a database based on business intelligence technologies.

Keywords: Database, database monitoring, database administration, database performance, performance forecast.

1. Introduction

Previous researches present an entire concept for management of database performance [1, 2, 3]. The idea covers tasks and concepts that are very similar to those of business intelligent systems - data collection, storage history, producing new values based on the accumulated history, forecast. The previous papers take the idea of the architecture of business intelligent systems and develop it further to serve the idea of future forecasted environment. It is important to have a tool for database performance management in order to identify potential risk areas for improvement. The author has developed a prototype system for database performance management based on the overall concept.

This paper proposes a design of subsystem „Registration of queries for monitoring, forecasting and optimization“, that is a part of this prototype.

2. Concept of the subsystem

This part of the system is designed to work with the common properties of the database that will be monitored. This component system should also allow the user – database administrator to specify business problems, represented in the system, using large queries, which the organization needs to optimize and monitor. The user should also be able to set critical thresholds for execution time of the queries.

The so-called “execution steps” briefly describe the main functionality of the component subsystem “Registration of queries”. The sequence of steps involved in this subsystem is shown in figure 1. These are seven steps that require intervention of database administrator:

- Creating stored procedures for generating storage structures for statistical data about the work of the database depending on different servers. Analysis of tables and views, which hold or access statistical data for the different database management systems respectively. Creating stored procedures corresponding to a selected server or database management system.

- Collection and management of data for generating a specific data warehouse. This step is designed to include collecting of data necessary for creating a specific data warehouse in a prepared in advance universal storage structure. The data warehouse, which will be generated, is defined as specific, because it is created according to some specific properties such as the database server, which is used for the database and some others. Each database management system stores statistical data for the work of each database in various structures. These structures are usually tables that differ not based on the databases, but based on the server and the database management system, on which they are stored and used.

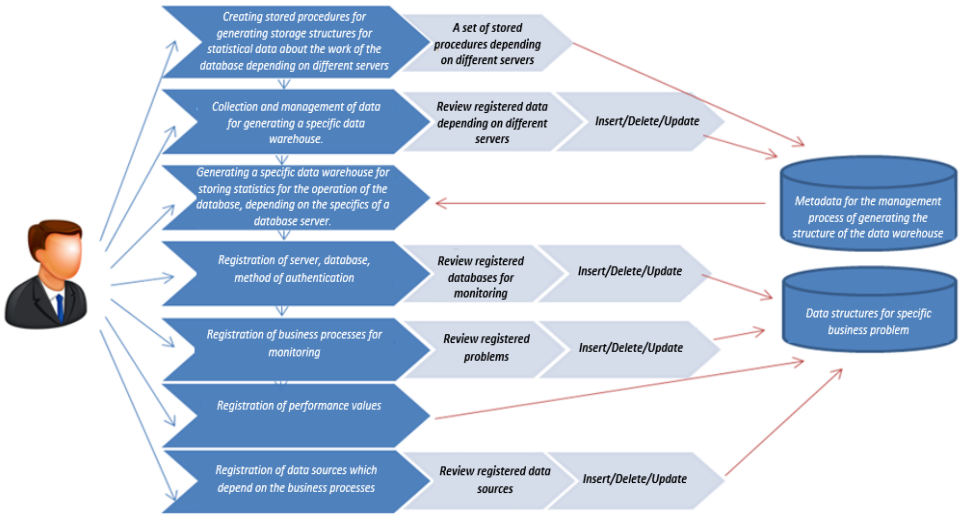

Fig. 20. Sequence of steps in the subsystem „Registration of queries for monitoring, forecasting and optimization"

- Generating a specific data warehouse for storing statistics for the operation of the database, depending on the specifics of a database server. On this step the data warehouse is generated according to the data for the database, collected during the first two steps.

- Registration of server, database, method of authentication. This step includes collecting information for the name of the server of the database which will be monitored as well as the name of the database. Another important thing is to choose a way of identification for the server– windows or sql user.

- Registration of business processes for monitoring. The suggested subsystem equalizes the registration of a business problem with registration of a critical for the business in terms of query execution time.

- Registration of data sources which depend on the business processes. For research purposes there should be registered different data sources, which participate in the studied business process, in order to monitor, forecast and detect potential problems with the database performance depending on the given business process.

- Registration of performance values. The database administrator is responsible for determining critical thresholds for the execution time of a given query and in this way the process will be monitored according to its optimal values.

3. Design of the subsystem

This section describes the screens' design of subsystem "Registration of queries for monitoring, forecasting and optimization" of the created prototype.

3.1. Page „Settings“

The page "Settings" is split in two parts with panels. The first part shows with which database it is working currently in the application and also if there are changes in the current database. In the second panel, the database administrator can enter settings for connecting to a database, server type, server, database name, authentication method and appropriate username and password, a description of the database and register it for monitoring. For convenience, loading the installed servers and visualizing them in a drop-down list, is developed. Accordingly, when selecting an instance of server, the databases that are on the server also are loading in a drop-down list (Fig.2.).

After the part with database registration, all registered databases for monitoring, are visualized in control GridView. Editing and deleting the data of registered databases for monitoring, is also available.

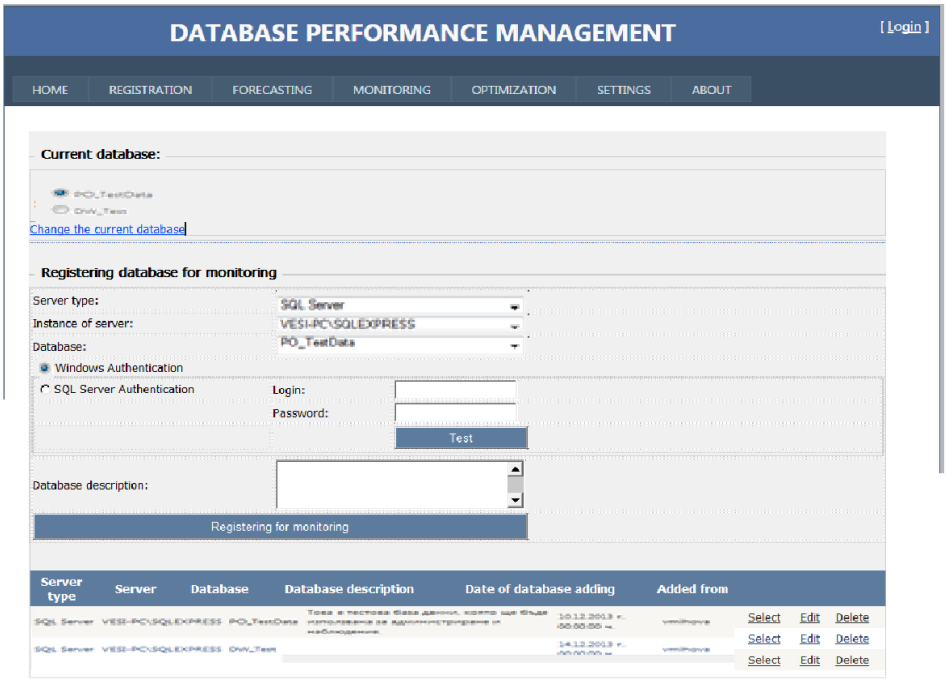

Fig. 21. Page „Settings “

3.2. Page„ Registration“

3.2.1. Registration of business processes for monitoring

On this page registration of business processes for monitoring, is developed. In this prototype it is accepted that the business process is associated with a large query in the database. In a panel with textboxes, it is entering data for business process monitoring and

inserting the data in the database by clicking the button. The fields' information is displayed in labels controls (Fig. 3.).

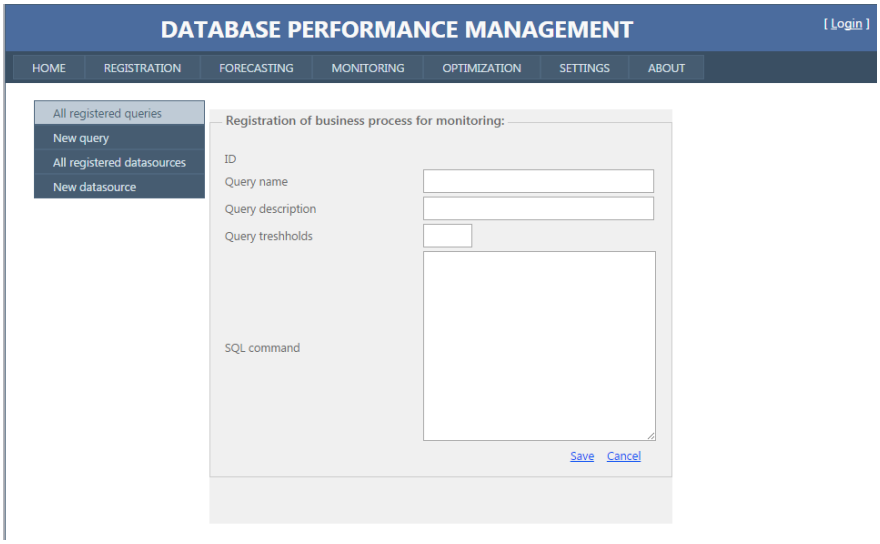

Fig. 22. Registration of business processes for monitoring

3.2.2. Update a business process

The forms for entering and editing queries are made with same visualization for user-friendliness of the system. The page is split in two panels – a panel for the query's data and a panel for the data sources which depend on the query. There is a form for entering and editing data sources as well as a list of all data sources (Fig.4.).

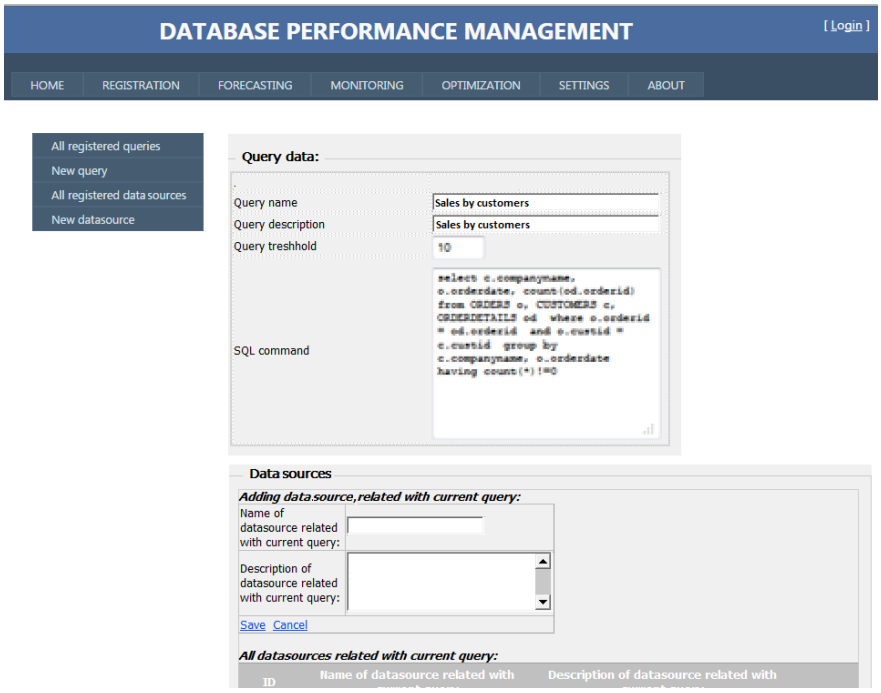

Fig. 23. Update a business process

3.2.3. Review of registered business processes

On this page there is a list of all registered business processes, visualized with GridView control. This list provides an opportunity for sorting all elements through the header of the list. The list also provides query editing (Fig. 5.).

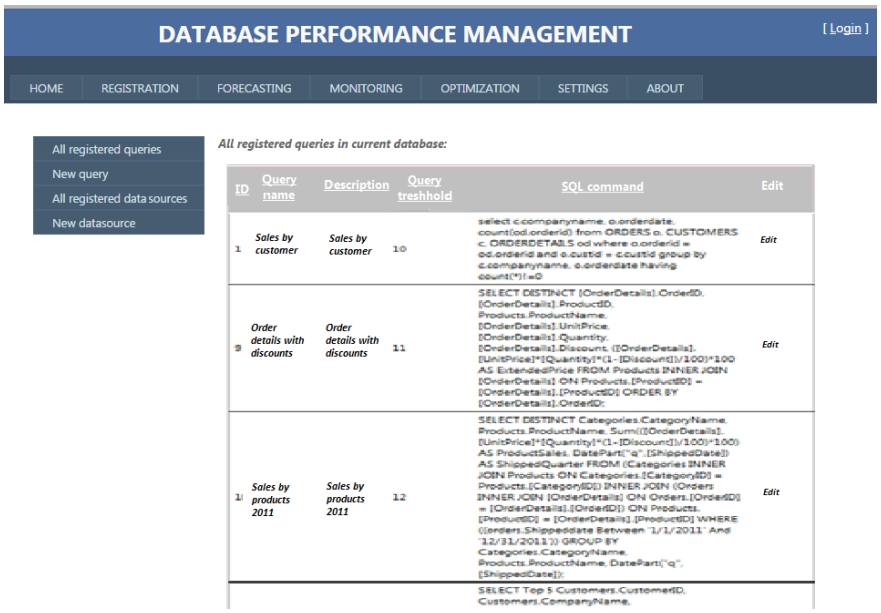

Fig. 24. Review of registered business processes

3.2.4. Registration of data sources which depend on the business processes

On this page, there is a list of all registered data sources, visualized with GridView control again. The list displays data for data sources such as number, field and description; the queries which are associated with the data source are also visualized. This list provides an opportunity for sorting all elements through the header of the list. The list also provides data source editing and deleting (Fig.6.).

Fig. 25. Review data sources which depend on the business processes

4. Conclusion

In summary, this paper presents design and concept of the subsystem „Registration of queries for monitoring, forecasting and optimization“ of a business information system for performance management of the business applications.

It is important to have a tool for database performance management in order to identify potential risk areas for improvement. The author has developed a prototype system for database performance management, based on the example of sql server databases but the architecture of the system allows management database performance of different servers.

For future development, the author will analyze tables and views, which hold or access statistical data for the different database management systems respectively create stored procedures for generating storage structures for statistical data about the work of the database based on the example of different servers.

Acknowledgment

The authors express their gratitude to the Bulgarian National Science Fund for the partial financial support under the Grant № DFNI-I02/15 from 12.12.2014, titled "Information System for Integrated Risk Assessment from Natural Disasters".

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Design of subsystem „Forecasting database performance“

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Abstract: This report is a result of current and previous research for systems' performance and more specifically the focus is on forecasting database performance. This report proposes subsystem „Forecasting database performance“ that is a part of a business information system for performance management of a database based on business intelligence technologies.

Keywords: Database, database monitoring, database administration, database performance, performance forecast.

1. Introduction

Previous researches present an entire concept for management of database performance [1, 2, 3]. The idea covers tasks and concepts that are very similar to those of business intelligent systems - data collection, storage history, producing new values based on the accumulated history, forecast. The previous papers take the architecture of business intelligent systems and develop it further to serve the idea of future forecasted environment. The author has developed a prototype system for database performance management based on the overall concept which includes four subsystems:

- Subsystem “Registration of queries for monitoring, forecasting and optimization”,
- Subsystem “Forecasting database performance”,
- Subsystem “Monitoring the current and the future state of the registered queries”,
- Subsystem „Database performance optimization“.

This paper proposes the design of the second subsystem „Forecasting database performance“, part of this prototype.

2. Concept of the subsystem

This component system is the heart of the system. This basic aim is to collect data for the working of the system, based on the previous subsystems' results for specific business problems. This subsystem requires use of statistical methods to forecast values and to measure the relation between specific variables.

The sequence of steps involved in this subsystem is shown in figure 1. These are seven steps that are managed from inputted data in subsystem „Registration of queries for monitoring, forecasting and optimization“. The intervention of a database administrator in this subsystem is minimal. In this part, he is required to set automatic procedures for periodically collecting and generating statistics and forecasting statistics for execution time of query, database objects and also for correlation coefficients and their forecasting values. After that the database administrator only starts the procedures.

- Collecting statistics for execution time of queries;

Each relational database management system provides information about execution time of all queries in the database, but this data is for the current moment, there is no accumulation of values for more moments. The subsystem offers to perform collection of statistics in order to be able to accumulate historical information about specific database objects.

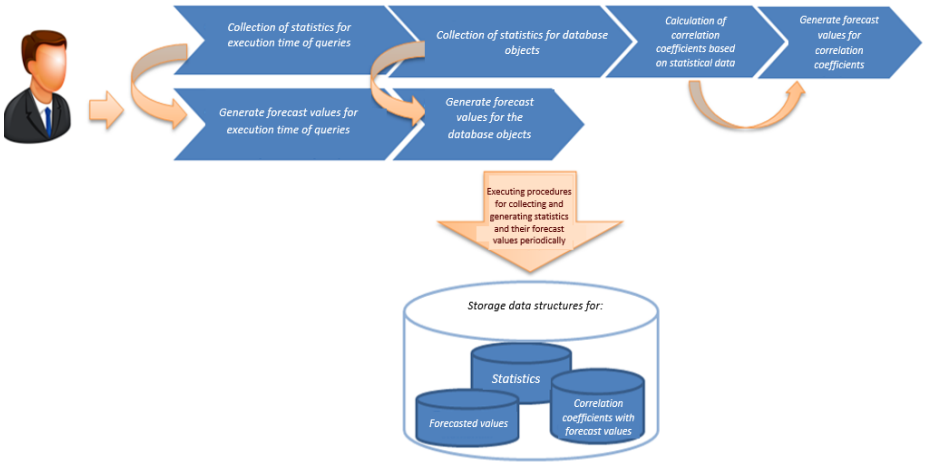

Fig. 26. Sequence of steps in the subsystem "Forecasting database performance"

- Generate forecast values for execution time of queries;

We can forecast values for execution time of queries, based on gathered historical information. In this step, the database administrator is allowed to manually start forecasting values for execution time of queries by specifying the period of forecasting.

- Collecting statistics for database objects;

This step includes processes of collecting information about database objects, which includes the volume of data, relations with another tables and many other information which may contains dependencies. The logic behind is the same as in step "Collecting statistics for execution time of queries". Again it is necessary periodical collecting statistical information in a particular moment because database systems can display data only in particular period but it is necessary to gather more information for forecasting.

- Generate forecast values for the database objects;

This step is intended to forecast values for quantitative dimensions of objects such as forecasting the number of rows in a table that is involved in a query. Again it is developed with statistical methods. The administrator can manually start forecasting the values of the monitored objects by specifying what the period of forecasting is.

- Calculation of correlation coefficients based on statistical data;

On this step of the current subsystem, there is a tracking how the dependency changes over time - how the number of rows of an object affects the execution time of a business problem.

- Generate forecast values for correlation coefficients.

Again with statistical methods forecasting for calculated values of correlation coefficients is available.

Further, the administrator is provided with the option to manually start forecasting the

values of correlation coefficients, indicating what the period to forecast is.

- Periodic collection and generation of statistics and their forecast values, calculating the correlation coefficients and generating forecast values for correlation coefficients.

In this step of the subsystem, the database administrators is supposed to set up automatic procedures that collect data periodically for registered objects and business problems, which will be monitored in the system. Besides, automatic procedures for generating forecast values and calculating correlation coefficients are provided.

3. Design of the Subsystem

In this section will describe the design of subsystem of the prototype "Forecasting database performance".

This part of the system is based on the proposed concept of the subsystem with relational database system MS SQL Server and programming language T-SQL. Initiation of the steps, described in the concept, is managed by an asp application that unites all subsystems.

This subsystem can be developed by different tools and technologies such as data mining, statistical packages, MS Excel, stored procedures, etc. For the present study the author choses to work with stored procedures, and to use statistical methods for forecasting, detecting dependencies and calculating the correlation coefficients. In this prototype the monitored and administered database are chosen to be based on SQL Server, which means that the structures for collecting statistics, forecasting and calculating correlation coefficients are for SQL Server databases.

For the realization of this subsystem there is a set of stored procedures developed for storing the current state of execution time of queries and number of rows of tables in the database. There is also a set of store procedures for calculating forecasting values of execution time and number of rows. And last, there are procedures for calculating the coefficients of correlation and forecasting values of correlation coefficients.

There are automatic procedures for periodic collecting and generating of statistics and forecast values, calculating the correlation coefficients and generating forecast values for correlation coefficients.

Actually the results of this subsystem can be viewed from another subsystem, but there is a page in the asp application to start all these procedures with the view on Fig. 27.

4. Conclusion

In summary, in this paper design and concept of subsystem „Forecasting database performance“ of a business information system for performance management of the business applications are presented. The subsystem contains the following sequence of steps in order to achieve its goals:

- Generate forecast values for execution time of queries;
- Collecting statistics for execution time of queries;
- Collecting statistics for database objects;
- Generate forecast values for the database objects;
- Calculation of correlation coefficients based on statistical data;
- Generate forecast values for correlation coefficients.

- Periodic collection and generation of statistics and their forecast values, calculating the correlation coefficients and generating forecast values for correlation coefficients.

It is important to have a tool for database performance management to identify potential risk areas for improvement.

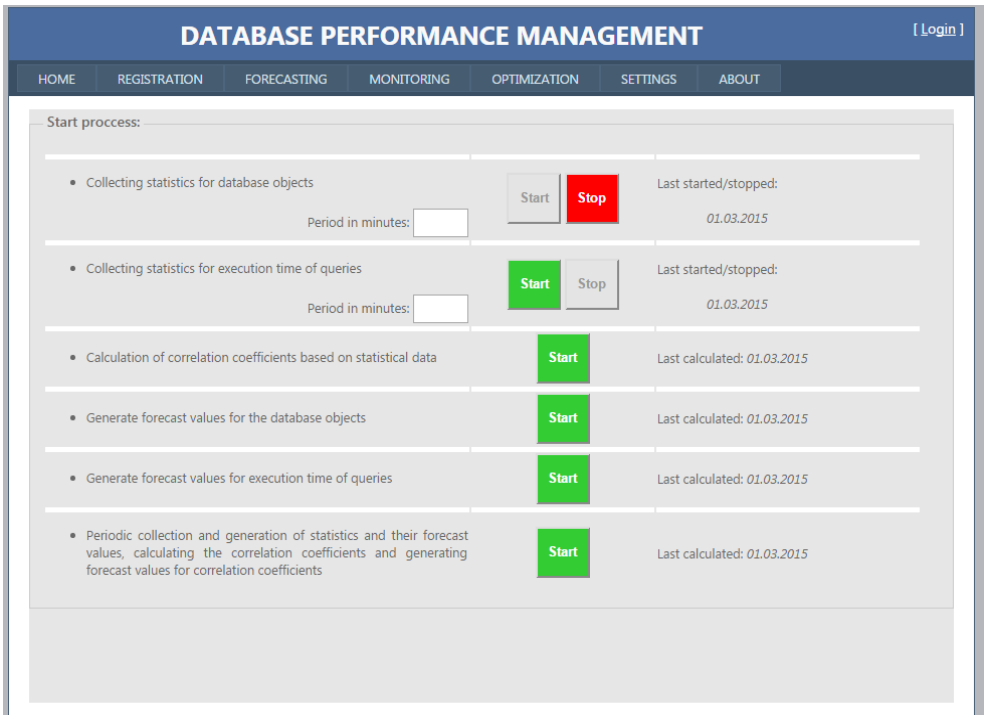

Fig. 28. Page from subsystem „Forecasting database performance“.

Acknowledgment

The authors express their gratitude to the Bulgarian National Science Fund for the partial financial support under the Grant № DFNI-I02/15 from 12.12.2014, titled "Information System for Integrated Risk Assessment from Natural Disasters".

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Rational Portfolio Investment Based on Consumer's Preferences as Optimal Stochastic Control

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Abstract: In the paper is demonstrated a system engineering value driven approach within determination of portfolio investment policy. The principles of rationality and market efficiency lead to modern portfolio theory and to the Black–Scholes theory for option valuation. In the paper the financial market is modeled by Black-Scholes stochastic differential equation and the rational portfolio solutions in risk are specified based on the individual consumers' preferences represented as utility objective function.

Keywords: Preferences, Utility, Optimal Portfolio, Hamilton-Jacobi-Bellman equation, Blak-Scoles model, financial market

1. Introduction

The principles of rationality and market efficiency lead to modern portfolio theory, and to the Black–Scholes theory for option valuation. Financial economic formally considers investment under certainty and uncertainty (risk) and hence contributes to determine rational (even optimal) financial business strategy. Financial econometrics is the branch of financial economics that uses econometric techniques to parameterize the relationships suggested. Arrive to econometrics we inevitably run into the notion of utility.

Utility theory is one of the popular methodologies in Multi-Attribute Decision Making. The Utility theory permits development of complex models in which human participation is reflected analytically starting from marginal information as human preferences. In fact the Utility theory permits mathematical inclusion of the decision maker in the mathematical modeling and mathematical descriptions of complex processes with human participations [3, 4, 6].

In the paper is demonstrated a system engineering value driven approach within determination of the investment policy in a continuous-time financial market modeled by a stochastic differential equation [10]. The problem consists in determination of investment policy which represents the amount invested in a risky asset at any moment of the financial process. The investment policy solution represents the optimal portfolio allocation determined as optimal stochastic control at any moment.

2. Mathematical Formulations

According to social-cognitive theories, people's strategies are guided both by internal expectations about their own capabilities of getting results, and by external feedback [3, 6]. Probability theory, stochastic programming and stochastic optimization and utility theory address decision making under these conditions [3, 6 7, 10]. The mathematical description or modeling on such a fundamental level requires basic mathematical terms and their gradual

elaboration to more complex and specific terms like value and utility functions, operators on mathematically structured sets as well, and equivalency of these descriptions. In the financial market is modeled by Black-Scholes stochastic differential equation.

Black-Scholes Model and Objective Function

Consider a non-risky asset S^0 and risky one S. Following the sources [10] the Black-Scholes stochastic differential equation is given by:

$$dS_t^0 = S_t^0 r dt \quad and \quad dS_t = S_t \mu dt + \sigma dW_t .$$

In this paper r, μ and σ are constants (in the paper: $r = 0.03$, $\mu = 0.05$ and $\sigma = 0.3$) and W is a one dimensional Brownian motion. By X_t we denote the state space vector of the controlled time continuous financial market. The investment policy is defined by a progressively adapted process $\pi=\{\pi_t, t\in[0,T]\}$ where π_t represents (defines) the amount (X_t π_t) ($\pi_t \in[0,1]$) invested in the risky process at time t. The remaining wealth (X_t - π_t X_t) at the same time moment t is invested in the non-risky process. The time period T is 50 weeks. The dynamic of the liquidation value X_t of a self-financing strategy satisfies is given by the SDE:

$$dX_t^{\pi} = \pi_t X_t^{\pi} \frac{dS_t}{S_t} dt + (X_t^{\pi} - \pi_t X_t^{\pi}) \frac{dS_t^0}{S_t^0} =$$

$$= (rX_t^{\pi} + (\mu - r)\pi_t X_t^{\pi}) + \sigma \pi_t X_t^{\pi} dW_t .$$

It is obvious that in these conditions and parameters is true $E\int_0^T (\pi_t X_t^{\pi})^2 dt < \infty$. Here E denote mathematical expectation defined in the initial filtered probability space (Ω, F, F, P) with canonical filtration F=$\{F_t, t \geq 0\}$ of the Brownian motion defined over the probability space (Ω, F, P). More precisely, E denotes the mathematical expectation over the probability space (Ω, F, P). The objective of the investor (decision maker-DM) is to choose the control (the amount π_t invested in the risky process) so as to maximize the expected utility of his terminal wealth at moment T, i.e: $V(t,x) := \sup_{\pi\in[0,1]} E[U(X_T^{t,x,\pi})]$, where $X^{t,x,\pi}$ is the solution of the controlled stochastic differential equation with initial condition (initial wealth) x at time t [10]. For the liquidation value it is supposed that if the state space vector is zero in a moment t then it remains zero until the end T ($X_T^{t,x,\pi} = 0$).

We assume that the outcome set X is a two-attribute product set V×W, with generic element x= (v, w). The sets V and W are attribute sets where V designates the first attribute-the amount π_t, (X_t π_t, $\pi_t \in[0,1]$) invested in the risky process and W designates the second attribute, the quantity of money in BGN's.

When the utility function over the consequences is known, it is very easy to exploit it using a computer. However, in practice, the effective construction of function raises numerous problems. Indeed, al-though the construction of single-attribute utility functions is generally quite easy, that of multiattribute utility functions is usually very hard to perform due to the cognitive limitations of decision makers [1, 5, 6, 14]. Hence, the usual requirement is that they be decomposable as a simple combination of single-attribute more easily constructed utility functions [6]. The aggregation of the two attributes in a multiattribute utility function needs investigation of the *Utility independence* in between the risky

investment and the quantity of money [6]. We mark as $(v, w_1)£(v, w_2)$ the lottery $<(v, w_1), (v, w_2),\alpha>$: α is the probability of the appearance of the alternative (v, w_1), and $(1-\alpha)$ - the probability of the appearance of the alternative (v, w_2). The probability α (subjective or objective) describes the uncertainty with one investment event £ [9, 14]. It is said that the second attribute w is utility independent if:

$$(v, w_1) £ (v, w_2) \succ (v, w_3) £ (v, w_4) \Leftrightarrow (v', w_1) £ (v', w_2) \succ (v', w_3) £ (v', w_4),$$

for all $v, v' \in V$ and for all $w_1, w_2, w_3, w_4 \in W$.

That is, preferences on W do not depend on the particular deterministic level at which $v \in V$ is fixed. A convenient implication of preferential independence is that changing v does not affect rank-ordering in W. The following theorem describes a well known result [6].

Theorem 1*:* Assume that the image of the function $F(w) \rightarrow U(v, w)$ is an interval for all v, where U(v, w) is the two attribute utility function. Then w is utility independent if and only if

$U(v, w) = f(v)p(w) + g(v)$ for some functions f, p, g with f positive.

Let W be relevant over a range w^o to w^* and V over a range v^o to v^* and assume that $U(v, w^*)>U(v, w^o)$ for all v and $U(v^*,w)>U(v^o, w)$ for all w. We may write this independency condition as: $U(v, w) = U(v, w^o)+ [U(v, w^*)-U(v, w^o)] U(v^o, w)$.

We suppose that the preferences over the set W (the amount X_t at any moment t - quantity of money) do not depend on the particular deterministic level at which the risky investment π_t ($v \in V$) is fixed on at any moment t. In other words, we suppose that the preferences associated with the quantity of BGN's (set W) are utility independent from the level of risky investment π (set V). For description of the objective function is needed evaluation of the single-attribute utility functions $U(v, w^*)$, $U(v, w^o)$ and $U(v^o, w)$ following the conclusions of the theorem. This multiattribute utility is relevant with the decision maker's preferences and permits optimal control design of the investment process in agreement with the intuition and the empirical knowledge of the of the decision maker.

Value, Utility and Polynomial Utility Approximation

The value based decision making in this paper is in the framework of the axiomatic decision making, but realize the prescriptive decision making approach [4, 7, 8]. The preference relation in the ordering scale (x is preferable to y) is denoted by ($x \succ y$). A "value" function is a function u(.) for which it is fulfilled [4, 6]:

$$((x, y) \in X^2, x \succ y) \Leftrightarrow (u(x)>u(y)).$$

We cannot talk about distance between the different alternatives. Here only ordinal evaluations within different mathematical processing of the information may be used. If with the ordering of the alternatives we can evaluate the distance between them we can talk about interval scale [4, 8]. For these scales the distances between the alternatives have the meaning of real numbers. The transition from one interval scale to another is achieved with affine transformation: $x = ay + b, (x, y) \in X^2, a > 0, b \in R.$ Among these types of scales is also the measurement of the utility function through the so called "lottery approach" [6, 9, 11]. Let X be the set of alternatives ($X \subseteq R^m$). The DM's preferences over X are expressed by ($\succ$). The *"indifference"* relation ($\approx$) is based on ($\succ$) and is defined by $((x \approx y) \Leftrightarrow \neg((x \succ y) \vee (x \prec y)))$. Let P is a convex set of probability distributions over X. A utility function $u(.)$ will be any function for which the following is fulfilled [4, 6, 8]:

$(p \succ q , (p,q) \in P^2) \Leftrightarrow (\int u(.)dp > \int u(.)dq)$.

The interpretation of the above formula is that the integral of the utility function $u(.)$ is a measure with respect to the comparison of the probability distributions p and q defined over X. The notation ($\succ$) expresses the preferences of DM over P including those over X (single point distribution, $X \subseteq P$). The presumption of existence of a utility function u(.) leads to the existence of:

Asymmetry $(x \succ y) \Rightarrow (\neg(x \succ y))$,

Transitivity $(x \succ y) \wedge (y \succ z) \Rightarrow (x \succ z)$,

and Transitivity of the "indifference" relation ($\approx$).

There are quite different utility evaluation methods that are based prevailingly on the "lottery" approach (gambling approach). A "lottery" is called every discrete probability distribution over X. We mark as $<x,y,\alpha>$ the lottery: α is the probability of the appearance of the alternative x and $(1-\alpha)$ - the probability of the alternative y. The most used evaluation approach is the following assessment: $z \approx <x,y,\alpha>$, where $(x,y,z) \in X^3$, $(x \succ z \succ y)$ and $\alpha \in [0,1]$ [6, 11]. Starting from the gambling approach for the definitions and the presentation of the expert's preferences we use the following sets:

$A_{u^*}=\{(\alpha,x,y,z)/(\alpha u^*(x)+(1-\alpha)u^*(y))>u^*(z)\}$,

$B_{u^*}=\{(\alpha,x,y,z)/(\alpha u^*(x)+(1-\alpha)u^*(y))> u^*(z)\}$.

In the formula above the notation $u^*(.)$ is the DM's empirical utility assessment. Through stochastic recurrent algorithms we approximate functions recognizing the above two sets [7]. The proposed assessment process is machine-learning based on the DM's preferences. The machine learning is a probabilistic pattern recognition because $(A_{u^*} \cap B_{u^*} \neq \varnothing)$ and the utility evaluation is a stochastic approximation with noise (uncertainty) elimination. The following presents the evaluation procedure. *The DM compares the "lottery" $<x,y,\alpha>$ with the simple alternative z, $z \in Z$ ("better-$\succ$", $f(x,y,z,\alpha)=1$", "worse-$\prec$", $f(x,y,z,\alpha)=(-1)$" or "can't answer or equivalent- $\sim$", $f(x,y,z,\alpha)=0$", $f(.)$ denotes the qualitative DM's answer). This determines a learning point $((x,y,z,\alpha), f(x,y,z,\alpha))$. The following recurrent stochastic algorithm constructs the utility polynomial approximation* $u(x)=\sum_i c_i \Phi_i(x)$:

$$c_i^{n+1} = c_i^{n} + \gamma_n \left[f(t^{n+1}) - \overline{(c^n, \Psi(t^{n+1}))} \right] \Psi_i(t^{n+1}),$$

$$\sum_n \gamma_n = +\infty, \sum_n \gamma_n^2 < +\infty, \forall n, \gamma_n > 0 .$$

In the formula are used the following notations (based on A_u): $t=(x,y,z,\alpha)$, $\psi_i(t)=\psi_i(x,y,z,\alpha) = \alpha\Phi_i(x)+(1-\alpha)\Phi_i(y)-\Phi_i(z)$, where $(\Phi_i(x))$ is a family of polynomials. The line above the scalar product $\bar{v} = \overline{(c^n, \Psi(t))}$ means: ($\bar{v} = 1$), if ($v>1$), ($\bar{v} = -1$) if ($v<-1$) and ($\bar{v} = v$) if ($-1<v<1$). The coefficients c_i^n take part in the polynomial presentation

$g^n(x) = \sum_{i=1}^{n} c_i^n \Phi_i(x)$ and $(c^n, \Psi(t)) = \alpha g^n(x) + (1-\alpha) g^n(y) - g^n(z) = G^n(x,y,z,\alpha)$ is a scalar product. The learning points are set with a pseudo random sequence.

The mathematical procedure describes the following assessment process: The expert relates intuitively the "learning point" (x,y,z,α) to the set A_{u^*} with probability $D_1(x,y,z,\alpha)$ or to the set B_{u^*} with probability $D_2(x,y,z,\alpha)$. The probabilities $D_1(x,y,z,\alpha)$ and $D_2(x,y,z,\alpha)$ are mathematical expectation of $f(.)$ over A_{u^*} and B_{u^*} respectively, ($D_1(x,y,z,\alpha)$=M($f/x,y,z,\alpha$)) if (M($f/x,y,z,\alpha$)>0), ($D_2(x,y,z,\alpha)$=(-)M($f/\ x,y,z,\alpha$)) if (M($f/x,y,z,\alpha$)<0). Let D'(x,y,z,α) is the random value: D'(x,y,z,α)=$D_1(x,y,z,\alpha)$ if (M($f/x,y,z,\alpha$)>0); D'(x,y,z,α)=(-$D_2(x,y,z,\alpha)$) if (M($f/x,y,z,\alpha$)<0); D'(x,y,z,α)=0 if (M($f/x,y,z,\alpha$)=0). We approximate D'(x,y,z,α) by a function of the type G(x,y,z,α)=(αg(x)+(1-α)g(y)-g(z)), where $g(x) = \sum_i c_i \Phi_i(x)$. The coefficients c_i^n take part in the approximation of yhe function G(x,y,z,α):

$$G^n(x,y,z,\alpha) = (c^n, \Psi(t)) = \alpha g^n(x) + (1-\alpha) g^n(y) - g^n(z), \quad g^n(x) = \sum_{i=1}^{N} c_i^n \Phi_i(x).$$

The function $G^n(x,y,z,\alpha)$ is positive over A_{u^*} and negative over B_{u^*} depending on the degree of approximation of D'(x,y,z,α). The function $g^n(x)$ is the approximation of the utility function u(.).

The single-attribute utility functions U(v, w^*), U(v, w^o) and U(v^o, w) are evaluated by the proposed stochastic recurrent algorithm and the utility function is shown in figure 1.

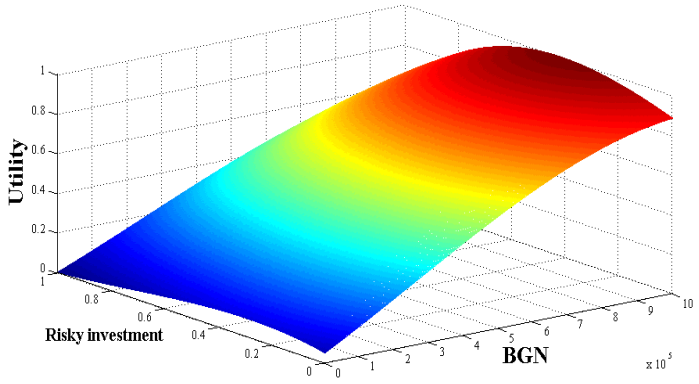

Figure 1

We underline that it is supposed that the preferences over the amount X_t (quantity of money) at any moment t do not depend on the particular deterministic level at which the risky investment π_t is fixed on at the same moment t. In other words, we suppose that the preferences associated with the quantity of BGN's (set W) are utility independent from the level of risky investment π (set V).

3. Black-Scholes Model and Optimal Portfolio Allocation

We recall the stochastic Black-Scholes model:

$$dX_t^{\pi} = (rX_t^{\pi} + (\mu - r)\pi_t X_t^{\pi}) + \sigma\pi_t X_t^{\pi} dW_t .$$

Here r, μ and σ are constants (in the paper: r=0.03, μ=0.05 and σ=0.3) and W is a one dimensional Brownian motion [10]. By X_t we denote the state space vector of the controlled dynamic process. The investment policy is defined by a progressively adapted process $\pi=\{\pi_t, t\in[0,T]\}$ where π_t represents (defines) the amount (X_t, π_t) ($\pi_t \in[0,1]$) invested in the risky asset at time t. The remaining wealth (X_t - π_t X_t) at the same moment t is invested in the non-risky asset. The time period T is 50 weeks. The liquidation value of a self-financing strategy satisfies the following stochastic differential equation:

$$dX_t^{\pi} = \pi_t X_t^{\pi} \frac{dS_t}{S_t} dt + (X_t^{\pi} - \pi_t X_t^{\pi}) \frac{dS_t^0}{S_t^0} = (rX_t^{\pi} + (\mu - r)\pi_t X_t^{\pi}) + \sigma\pi_t X_t^{\pi} dW_t.$$

The numeric solution could be obtained by the Kushner-Dupuis scheme method for example [13]. In this paper is choosing a different approach exposed in the monograph [12]. Following the presentations in [10, 12] and passing through generalized solution of the Black-Scholes stochastic differential equation we found a polynomial approximations of the Hamilton-Jacobi-Bellman (HJB) function w(t, X) and of the control manifold π(t,X). We show them in figures 2 and 3.

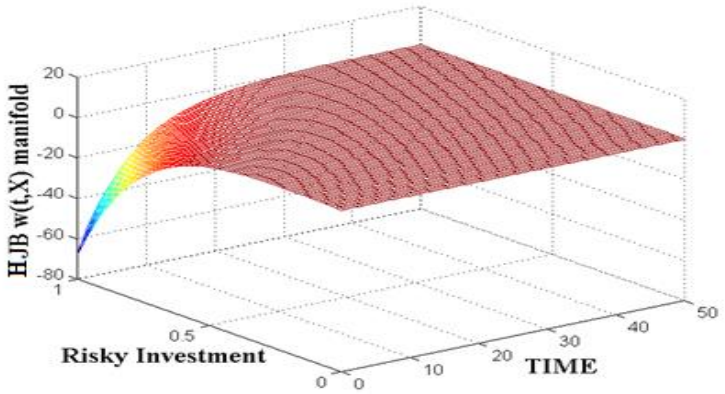

Figure 2

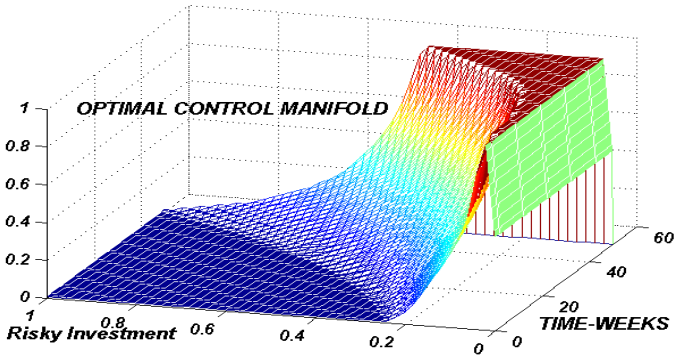

Figure 3

The stochastic process is started in 30 different initial points; from 1000 BGN's to 30000 BGN's. In the next figure 4 are shown the processes with optimal stochastic control.

In figure 5 is shown one sample of optimal control solutions. This figure shows not only quantitatively the optimal control investment but permits deduction of an investment business strategy in agreement with the decision maker's preferences. From the exposed in figure 5 follows that if the initial amount is between 1000 BGN's and 10000 BGN's is recommended to invest the entire initial wealth in the risky investment. If the initial wealth is between 25000 BGN's and 30000 BGN's it is advisable to start with the non-risky investment and after the 30 or 40 weeks to invest a part in the risky-investment.

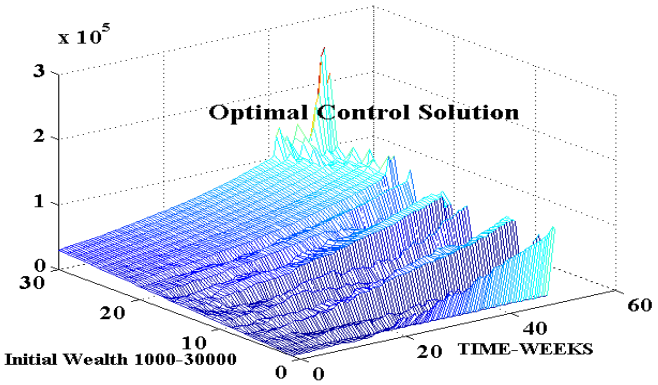

Figure 4

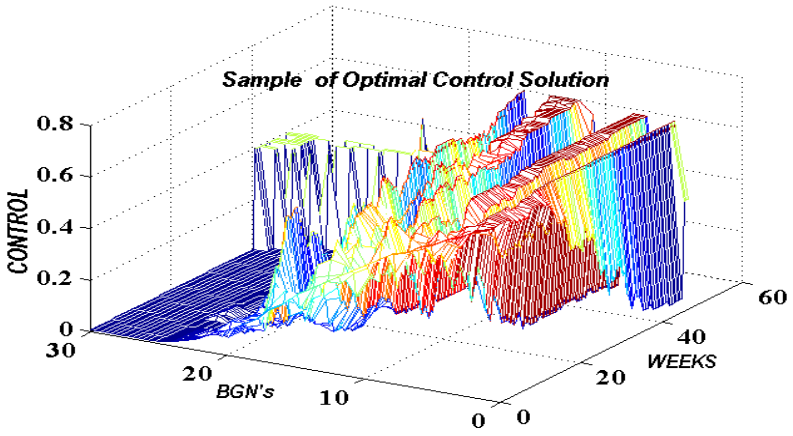

Figure 5

We emphasize that this is true only for the concrete process parameters and for the concrete Utility function.

4. Conclusions

In the paper is demonstrated a system engineering value driven approach within the problem of determination of the optimal portfolio allocation modeled with dynamic as Black-Scholes stochastic differential equation. The Black-Scholes optimal portfolio solutions are specified on the individual consumers' preferences. The optimal control permits deduction of an investment business strategy in agreement with the decision maker's preferences.

The mathematical formulations presented here could serve as basis of tools development. These value evaluation leads to the development of preferences-based decision support in machine learning environments and iterative control design in complex problems.

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Opportunities for Using Information Technologies in the Training of Students from Education and Qualification Degree "Master" – Distant Learning in the Discipline "Economic Analysis"

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Abstract: With the development of globalization processes in all fields of economic life and of modern information and communication technologies at the beginning of the 21st century, new, and to some extent, different needs of the higher education specialists' training occur. In compliance with the Common European higher Education Area Qualification Framework and the National Qualification Framework of the Republic of Bulgaria, the modern specialist with higher education, holder of education and qualification degree "Master", should have the relevant knowledge, skills and competences in the field of his/her education. This makes the issue of the application of information technologies for the needs of training of students from education and qualification degree "Master" – distant learning, very topical. This report highlights the distant learning in the discipline "Economic Analysis" for the students from education and qualification degree "Master" considered as a system of interrelated components. This report studies the opportunities and the guidelines for using information technologies in the process of students' training when applying the methodology of the economic analysis of the industrial enterprise's business. The objective is to achieve a complex model for analysis of the enterprises' business and status, based on the modern information and communication technologies.

Keywords: Education, degree "Master", distant learning, economic analysis, information technologies, opportunities.

1. Introduction

The distant form of study is an organization of the study process where the student and the lecturers are always at different places, but are not always separated in time. The distance between them is overcome by the use of technical means and the opportunities provided by the modern information and communication technologies. Audio, video, computer and communication technologies and means are commonly used.

In the conditions of market economy, competition, globalization, acceleration of social life, emergence of new professions, mobility of people and needs to make optional solutions in constantly changing environment, new requirements are established to the specialist with higher economic education who study and obtain education and qualification "Master".

The "Economic Analysis" is an important discipline studied by the students for Master's degree in a distant form of training, major "Accountancy and Control". According to the newest developments, new knowledge, skill and competence content is established that should be mastered and further extended by the students of EQD "Master" in the field of

accountancy and economic analysis of the business of the independent economic subjects in the country.

The purpose is to provide students with systemized specific knowledge about the economic analysis methodology of the entire business of the company (innovation, marketing, investment, principal, trade and financial), of the dynamics and static's of the enterprise in the conditions of market economy. Methodologies for analysis of enterprise's revenues, efficiency of resource use, expenses, financial results, financial position and financial stability take central place in the study. The study content focuses on the practical application of the methods for analysis and evaluation of the impact of different factors by separate objects and aspects of the enterprise's business.

2. Student's knowledge, skills and competences in economic analysis

Knowledge may comprise mastering, understanding and rationalizing of theoretical works of the economic analysis in terms of important science-metric categories, such as subject matter, object, method, methodology, technique, etc., by establishing opportunities for developing and defending students' own opinions. Based on the above, the higher education specialist should develop his/her own ideology on the issues of economic analysis theory and to seek ways for their solution. Thus, students have the objective opportunity to interpret the knowledge they have obtained in the field of economic analysis of the business practice in the country by improving the existing or by introducing new practices that are adequate to the fast changing conditions.

By studying the discipline "Economic Analysis", the students of EQD "Master" – distant study, will obtain principal knowledge about the system of analysis and evaluation indicators of the volume, product range structure, quality and competitive power of offered products, rhythm of production and sales, use and efficiency of resource use (fixed tangible assets, tangible resources and work power), revenue, expenses, financial results, financial position, financial stability and efficiency of the enterprise's business. They will obtain knowledge for different methods and models for analysis of the dynamics of indicators, for analysis and evaluation of the factors' impact on the changes in the values of efficiency indicators characterizing different aspects of the entire business of the enterprise.

Skills may be defined as a set of principal cognitive skills and portable skills. Portable skills comprise the abilities of the higher economic education specialist for: planning, analysis and evaluation of the business, of the financial results and of the efficiency; contacts with different counterparties; team work; presentation of different aspects of business; use of advance information and communication technologies, including mastering of new program languages and techniques; identifying problem areas in the enterprise's business and management, as well as problem solving; project management, etc.

By studying the discipline "Economic Analysis", the students of EQD "Master" – distant study, will obtain cognitive skills about the elements of the analysis method and will thus be able to define the impact of direct factors on the behavior and on the change of indicators characterizing the efficiency of resource use, revenue, expenses, financial results, financial position, financial stability and profitability of the enterprise. Students will gains portable skills to present topical issues of the economic issues in the business practice, to work in a team when identifying and solving problems, to master, apply and improve information technologies for economic analysis of the entire business of the enterprise, to establish information and corporate culture, to have new vision for the issues in terms of the protection and restoration of environment, etc.

The competences of the higher economic education specialist may be defined as a system of elements with objective interrelations and dependencies existing among them.

First of all, these are competences in professional aspect, i.e. the competences in the respective field the higher education specialist has studied in and has obtained EQD "Master". Secondly, this is the ability for self-definition of objectives and tasks that should be solved either in specific business situations, or in general for the entire development of the enterprise, according to its mission, vision and strategy. Thirdly, this is the competence and the responsibility of the higher education specialist to make managerial and business decisions for the efficient management of the enterprise. Fourthly, the higher education specialist should creatively give a meaning to the issues within his/her of field of education and to propose ways to solve them.

The European Reference Framework sets out the following key competences: communication in the mother tongue; communication in foreign languages; mathematical competence; basic competences in theory of science; competences in the field of information and communication technologies; competences in numeric and information; digital competences; learning to learn.

The study of the discipline "Economic Analysis" by the students of EQD "Master" – distant study ensures the following competences.

Firstly, the students in major "Accountancy and Control" will acquire professional competences for: collection, processing and interpreting incoming information required for the needs and purposes of the economic analysis; solving complex business problems in business practice; integration of knowledge and sources of information, etc. Secondly, the students will gain competences for being independent and responsible: independent leadership and management of economic analysis teams; creative solving of practical and applied problems and making correct and justified decisions for the development of business in operating and strategic perspective. Thirdly, the students will learn how to learn, for example, for identifying the needs of new knowledge in economic analysis and their mastering and application in the business practice in timely manner. Fourthly, students will obtain communicational and social competences, for example for clear, understandable and accessible expression of their own views, formulations and judgments on different problems of the economic analysis methodology by different objects of the analysis content, as well as abilities to solve problems in real business.

The distant study in the discipline "Economic Analysis" for the students of EQD "Master", major "Accountancy and Control" should look for a balance between knowledge, skills and competences. Here we should clearly distinguish between knowledge, skills and competences of higher economic education specialists holders of Master's degree from the holders of Bachelor's degree, including in the disciplines "Economic Analysis", "Financial and Business Analysis", "Financial and Economic Analysis", and "Business Analysis.

3. Requirements for the distant study in the discipline "Economic Analysis" for students of EQD "Master", major "Accountancy and Control"

In general, we consider the requirements for the distant study as a system of elements among which specific interrelations objectively exist. We consider the very process of study in economic analysis as a specific system for preparation of the students in the field of analysis theory and practice. For ensuring the normal course of this process, the respective conditions (factors) are required. In particular, we consider these conditions as a system of elements for ensuring high quality training of the students. These elements mean to provide

the study process with: fixed tangible and intangible assets; study documents; training materials and resources, and staff.

To ensure the required fix tangible and intangible assets for the study process means to use appropriate rooms for providing consultations in the field of economic analysis and to ensure opportunities to use appropriate software for analysis of different objects of the analysis content.

The provision of study documents [1,a.39,p.2] approved by the academic council upon the joint proposal of the main teaching unit and the Distant Study Centre, comprises the following components: obligatory study documents; list of the team carrying out and providing the study; information about the organization of access to the information resources; list of technical and communication means; system of examination and evaluation, including means for control and transparency of examination procedures; system for study quality control.

The provision of the study process with training materials and resources for self-preparation of the students in the discipline "Economic Analysis" should ensure not less than 75% of its study content. Training materials and resources should be developed in compliance with the specific features of the economic analysis as a science, managerial function and practical and applied activity. They are developed according to a methodology that corresponds to the specificity of the major "Accountancy and Control".

With view of information and technological provision of the study process, training materials and resources may be classified in four groups:

- Training and methodological materials on hard copy or their digital versions;
- Multimedia and interactive training materials disseminated on electronic carriers, magnetic and optic disks, audio- and video equipment;
- Training materials and modules for training and evaluation shared on specialized servers with guaranteed high-speed internet access;
- Training materials and resources for self-preparation shares in internet based system for distant training, with guaranteed high-speed internet access, where the organization and carrying out the distant study are also supported, as well as an integrated personal database, curriculums and virtual training materials, assignments and tests.

When organizing and carrying out the distant form of study for obtaining education and qualification degree "Master", not less than 70% of training materials and resources for self-preparation at third and/or fourth technological level should be ensured.

The provision of staff for the study process comprises academic and lecture staff, administrators who are responsible for the technological and logistic support of the program, the interactive student-lecturer connection and the procedures for carrying out examinations; technical staff responsible for the support of the technical equipment and for ensuring flawless communication between the parties.

4. Distant study in the discipline "Economic Analysis" for students of EQD "Master", major "Accountancy and Control"

The organization of the study process in the discipline "Economic Analysis" for students of EQD "Master", major "Accounting and Control" – distant study, should be considered as a system that may encompass the following elements: academic and lecture staff; curriculum; synopsis and training materials.

The academic and lecture staff in this discipline should have high qualification in the field of theory of economic analysis, the practical application of the analysis methodologies, and should be able to work with advance information and communication technologies.

The themes comprised in the curriculum for this discipline should not repeat the material studied by the students of EQD "Bachelor". These are the students who have studied the disciplines "Financial and Business Analysis", "Financial and Economic Analysis", "Business Analysis" during their Bachelor's program.

A questionnaire (synopsis) should be developed for this discipline, according to the content of the curriculum. The questionnaire should be uploaded on the distant study website.

In the process of study in the discipline "Economic Analysis" for the students of EQD "Master" – distant study, specialized platforms with specific training resources, textbooks and training materials should be used. Textbooks and training materials for distant students are the principal and single training mean. They should focus on the important and significant issues of the discipline "Economic Analysis". Different themes should outline the respective knowledge to be obtained by the students on the topics of the discipline's study content. Textbooks and training materials should demonstrate only well proven and practical and applied analysis methodologies by avoiding the quotations of different author's opinions and statements on discussion matters, as well as academic disputes, for example about the types of economic analysis. The content should follow the logic of learning and should ensure opportunities for mastering the study material by the distant students. The materials on different topics included in the study content of this discipline should be distributed rationally in time, with view of the possibility for its understanding and learning. Textbooks and training materials may contain references to different links related to the study content of the discipline "Economic Analysis", which allow obtaining additional information on different topics. Furthermore, textbooks and training materials should comprise all required materials for solving additional assignments, for example tests, case studies, preparation of paper works, etc. Textbooks and training materials may be on hardcopy or in electronic version. The digital textbook in the discipline "Economic Analysis" allows working in the electronic training system (Moodle), with options to publish ongoing individual home assignments, to form groups by interests; to perform assignments in a team; to bring topics for discussion, to propose practical causes for solution, to organize business games, etc.

The system of elements describing and characterizing the distant study in the discipline "Economic Analysis" for EQD "Master" may further comprise the following elements:

- Quality of study in the discipline;
- Information basis and communications for self-work of the students;
- Contact seminars (consultations);
- Online "student-lecturer" connection. Feedback between lecturer and student.
- Self-preparation of students;
- Evaluating students' knowledge. Opportunities for "real time" examinations and distant examinations;
- Bibliography of the course.

5. Conclusion

The reform of the Bulgarian higher education system starts with the introduction of the three-level education and qualification structure. The modernization of the higher education should follow the development trends in the European Union member states, and the country should be guided by the strategic documents adopted within the frames of the Bologna process, the Europe 2020 Strategy and the national Program for Development "Bulgaria 2020". The modernization of the higher education in the country encompasses the function of the knowledge triangle, and namely the connection between higher education, research and innovations for attaining high achievements and sustainable development of the national economy and regions in the country. The achieving of these ambitious goals is directly related to the use of advance information and communication technologies in the study process for students – economists in the discipline "Economic Analysis" – Master's degree.

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Electronic Administrative Services

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Abstract: The paper addresses the issues for the development of e-government services nationally and globally. The paper examines some basic principles of the study of e-government, according to the methodology of the United Nations. There are comparatives analysis of the rates of development of electronic services in Bulgaria and neighboring countries. They compare the average for Eastern Europe and the world. Finally, conclusions and recommendations are formulated.

Keywords: Electronic administrative services, public administration, e-government.

1. Introduction

This paper addresses the issues of development of e-government services. Tray is made against the background of a global trend for full computerization of management. In the literature there is no uniformity regarding the definition of the content of the concepts of "e-services" and "administrative services provided electronically". Therefore, the research approach is to define the basic concepts used. On this basis, we perform comparative analysis of the achieved level of development of electronic services in Bulgaria and other neighboring countries. We also perform a comparison with the average for Europe and the world.

2. Electronic administrative services

Developments in computerization in the Republic of Bulgaria and the world necessitated the introduction of administrative services with electronic access. They are the administrative services provided to citizens and organizations by public administrations, which can be requested and provided remotely by using electronic means. In literature there are different opinions on the content of the concepts of e-services and administrative services with electronic access and administrative services provided electronically. For the purposes of this study will be used e-services, the three concepts are considered equivalent. Administrative authorities shall provide all services electronically within their powers. Key players in this process are the service provider and the recipient. Provider of electronic administrative services is an administrative authority exercising public functions and provides electronic services to citizens and organizations within their competence and the provisions of law. They disclosed their services in a clear and accessible way, at any time should be accessible status of the service. The providers of electronic administrative services may not refuse acceptance of electronic documents issued and signed as required, and to refuse electronic documents and provision of electronic administrative services. Recipient of electronic administrative services is a national organization that uses electronic administrative services. Kirilov put the basic principle of such a communication line between the full electronic and scanned documents [1].

In terms of e-government services, their suppliers are required to collect, than process and provide personal data as necessary for the provision of electronic services. All the technical requirements for providing access to electronic administrative services and policies used graphics and other interfaces are published on a dedicated portal. [4]

3. Assessment of e-government services

Questions to assess the level of development of e-government services are complex. According to some authors it is a serious question of how it would be appropriate to search for information on the Internet. This can be used as a basis for establishing methodologies for evaluating electronic services. Similar methodological aspects can be found in the study of Milev in 2014, where he is offering an appropriate technological solution [2]. On the other side United Nations periodically publish results of studies on its website. [3] These tests can be used as a benchmark because, as organized periodically by the same methodology as the latest data are for 2014 general framework of a UN study on e-government and e-services based on the following principles (Fig. 1):

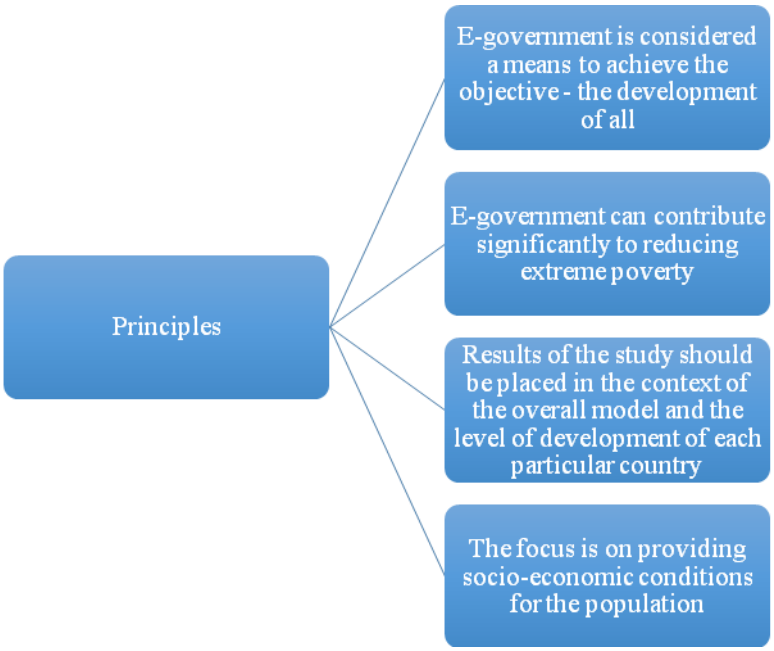

Fig. 1 Basic principles

From a methodological standpoint, the study considers three aspects (components) of e-government. They form the so-called conceptual framework and these components remain constant through all the years, reflecting trends, best practices and innovative approaches that individual countries use to address common challenges of sustainable development. The components are:

- Index for the development of electronic services;
- Index for the development of telecommunications infrastructure;
- Index of human capital.

The methodology defines the overall index for the development of e-government (denoted in the study with EGDI - e-government development index). The distribution of the weights of the three components in the final index for the development of e-government is evenly - 1/3 (Fig. 2).

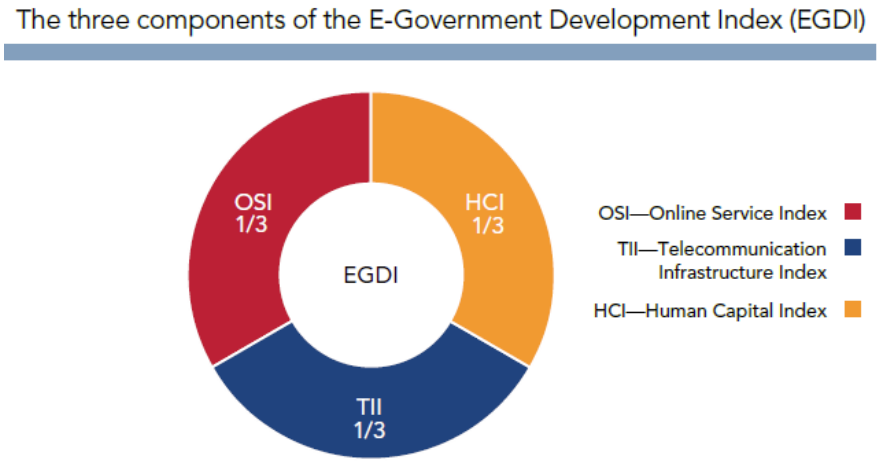

Fig. 2 Total index for the development of e-government [3]

According to the UN methodology in Fig. 3 shows the index values for the development of e-government (EGDI) for 2012 and 2014 for the Republic of Bulgaria and the three neighboring countries (Greece, Serbia and Romania).

Country	Rank 2012	Rank 2014	EGDI 2014	Rank Change
Greece	37	34	0.7118	+3
Romania	62	64	0.5632	-2
Serbia	51	69	0.5472	-18
Bulgaria	60	73	0.5421	-13

Fig. 3 Comparative analysis of the values of EGDI

As seen from the data values for Bulgaria lag significantly behind those of Romania and Greece. In 2012, Bulgaria was on the 60th place in the world by 2014 has stalled to 73rd place. The change in Romania and insignificant, but Greece has advanced with three places. Data for Serbia are similar to those for Bulgaria, although it is ahead in the ranking.

Fig. 4 is represented graphically in the comparative analysis. It can be concluded that all four countries have comparable values of the index above the world average.

The data show a negative trend of e-government in Bulgaria, especially considering the average for Eastern Europe (Fig. 5).

Fig. 6 shows the values for 2014 of the three constituent components of the overall index.

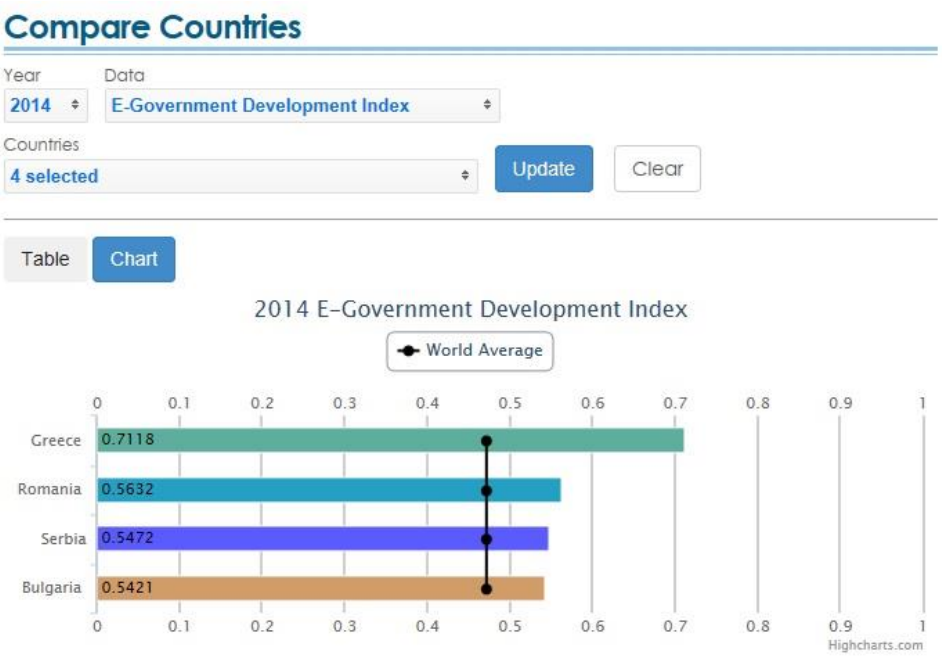

Fig. 4 A graphical representations of the values of EGDI

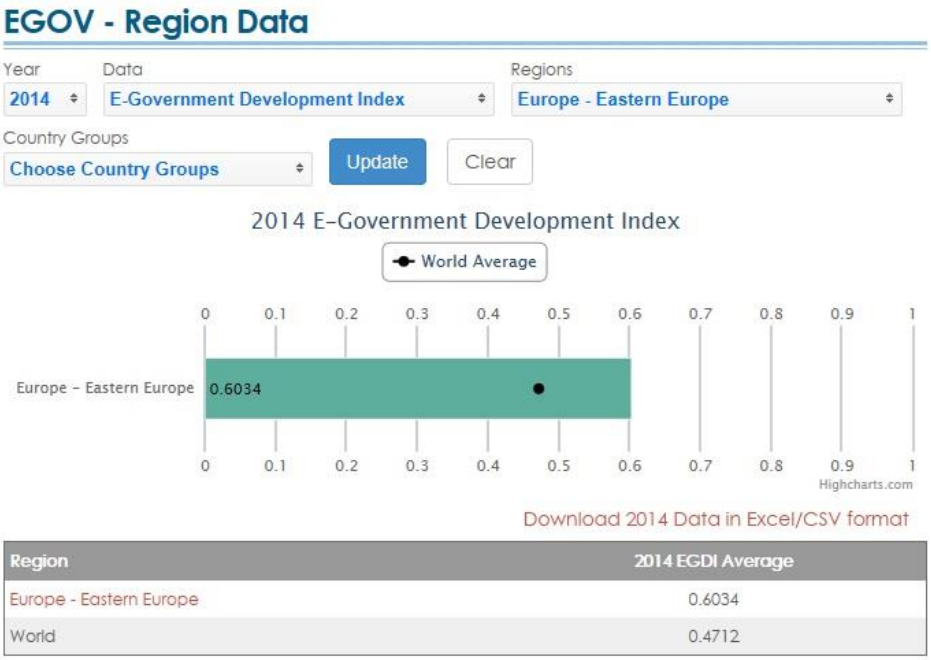

Fig. 5 Averages for Eastern Europe in 2014

Fig. 6 Values for 2014 of the three constituent components of the overall index

As can be seen only for two years from 2012 to 2014 Bulgaria has fallen behind c1 3 places in the world ranking with a total value of index 0.5421 for 2014. Very low values are observed for the index, which reflects the participation of citizens in governance. Its value for 2014 is 0.2549 (122 place in the world ranking.)

In view of this research interest is the analysis of the development of the values of the three constituent components of the overall index. In this analysis, special emphasis should be placed on the index for the development of electronic services (Fig. 7).

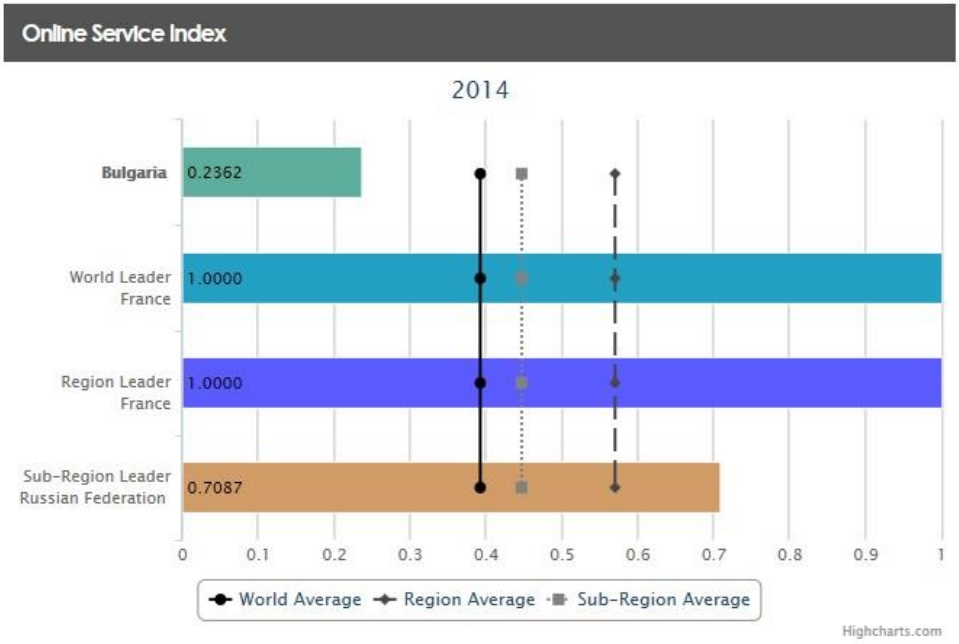

Fig. 7 Values of OSI for 2014

As seen from the data value for Bulgaria is 0.2362. The value of world leader France is 1.0000 and it is 0.7087 for the Russian Federation. The value of Bulgaria lags far behind the world average, the surveyed region and sub-region.

4. Conclusion

Finally, it should be noted that analyzes made in this paper show a significant delay in the development of electronic and particularly of e-government services in the country in recent years. The index value for the development of electronic services has decreased from 0.4902 in 2012 to 0.2362 in 2014, which means nearly twice deterioration of electronic services in Bulgaria for the last two years. The index value for the development of telecommunication infrastructure has increased from 0.5006 in 2012 to 0.5941 in 2014. The index value of human capital decreased from 0.8486 in 2012 to 0.7960 in 2014. These data indicate a serious challenge to the development of e-governance in the country and will likely lag outlines the development trend in the coming years. It is necessary to take measures on strengthening the role of electronic services in the management and accelerate the pace of the computerization of state and local government.

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Opportunities for Measuring the Effectiveness of Public e-services

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Abstract: The paper addresses the issues of public e-services and the measurement of their effectiveness. This is made with a view to seeking models and methodologies to measure the effectiveness of the different stages of development and deployment of services. The paper proposes a specific methodology, which consists of 15 indicators. Finally conclusions are formulated.

Keywords: Public electronic services, public administration, e-government.

1. Introduction

This paper addresses the issues of effectiveness of public electronic services. In the literature there is no uniformity regarding the definition of the content of the terms "public electronic services" and "efficiency". Therefore, the research approach is to define the basic concepts used. On this basis it is a proposal for a system of indicators and their weights for measuring effectiveness. The results of development can find specific practical application in terms of various public electronic services.

2. Nature of public e-services

According to some authors electronic services affect the ability of civil servants to apply modern technology to different social groups. An important indicator of this process is the introduction of electronic services in the activities of citizens. Measuring its progress can be made through e-participation index evaluation in dealing with routine administrative activities of citizens [12]. In world literature and strategic documents extensively deals with the development of effective and high-quality electronic services. Some authors pay particular attention to the stages of development and introduction of electronic e-government services at national level and at the municipal level [1]. Other authors focus on electronic services in terms of providing public information [2]. In various documents and analyzes the European Commission states that there are increased expectations of society to service providers in terms of replacing the concept of service-oriented administration with service-oriented customers (users). Services should be more integrated across institutions, including those abroad. This represents a fundamental transformation in the way services are constructed. The benefits to society are, however, significant: better services, more reliable delivery, much faster, with less effort [11]. In the present study we support the concept that need of change in thinking on e-governance in the field of electronic design services is focused entirely on the needs of consumers. This approach is not yet fully accepted in Europe, along with that individual governments should be utilized more fully the benefits of e-government, which requires the implementation of a new generation of electronic services [11]. Analyzes, based on these and other sources [6], [10] show the need to define the

content of the concepts of e-services and public electronic services. This is necessary because of the objective need of creating a concept for operation and maintenance of primary data controller that collects data on citizens or organizations once and ensure their storage (single medium). Similar views correspond in unison and with the entered basic principle in national law, that persons who carry out public functions (as well as administrative bodies) may require citizens and organizations presentation or demonstration of already collected or generated data, are required them together automatically by the primary administrator of the data. The literature on public electronic services and services created in e-government are widely discussed. In this regard, some authors reveal the difference between informative and transactional e-services [7], [9]. According to these sources for information services are those that have a one-way communication from a public organization to service users. A large part of electronic services such as in this study supports the idea that in modern practice there is more self-conscious and objective need "two-way communication" [3] between citizens and businesses on the one hand and public organizations on the other. In this regard, some authors define services based on two-way communication as e-services [6].

In view of the tasks of this paper, we should place a topic of discussion nature that characterizes an aspect of the definition of public e-service, namely changes in internal workflows. In support of this we may indicate some research authors in the direction that it is important work re-design when developing e-government systems and e-services [4]. So, to become one e-service a public electronic service, it should delivery except by a public body is an essential characteristic were previously working reengineering business processes in the organization. This way it will be able to respond more fully to the information needs and the needs of citizens and businesses. In the public sector there are entities that provide electronic services that are administrative in nature, but are subject to the characteristics of administrative e-services and the rules for their application and receiving the response. The similar services in this paper are defined as public electronic services. It can be considered that this concept is more general than the concept of e-services and presents it in a broad sense, including by presenting services and other public sector entities.

In this context we can define the following basic characteristics of electronic public services, namely:

- ID of the public organization providing service;
- Name of the public organization providing service;
- ID of the public electronic service;
- Name of public electronic services;
- Use of public electronic services;
- Status of the electronic service;
- Website or another communication channel for public access to electronic services;
- Unique identifier of the application for access to the public electronic services;
- A list of unique identifiers of possible responses and denials.

These and other characteristics can be used for various analyzes on the possibilities for designing, implementing and measuring the effectiveness of public electronic services.

3. Effectiveness of public e-services

In literature there are many relevant research challenges definitions of efficiency. A similar definition of efficiency of e-government services is given in Australian audit report of

2005. According to this source it means efficient use of financial, human, physical and information resources so that results have been achieved maximum to any given set of input resources [5]. With discussion character can be defined staged from the same source highlights in carrying out assessment of the efficiency of electronic services, namely organizations providing electronic services to carry out periodic measurement of effectiveness, to collect sufficient quantity and quality information about the process and use the information collected to improve their work. Interest in this paper is the view of some authors on the identified aspirations of the government to provide more quality and efficient electronic services, thereby increasing the confidence of citizens. This paper supports the perception that it is necessary multicomponent assessment of the effectiveness of electronic services, which can use different regular research on the problems of the United Nations. It periodically publishes results [8]. These tests can be used as a benchmark as to be organized on the same methodology as the latest data are for 2014.

4. Opportunities for measuring effectiveness

Defined dimensions of public electronic services, namely business process reengineering, technical and software provision of public electronic service and training of service users give reason to develop and propose a system of indicators to assess performance. The proposed system comprises 15 indicators for assessment method was chosen method of scores. Weightings indicators are expertly defined by their values and recommended values for the transformation of qualitative data into quantitative are given in Table 1.

Table 1 Indicators for measuring effectiveness

№	Indicator's name	Weight
1	What are specialists in the organization responsible for the development and implementation of public e-services?	0,08
2	What significance for the organization is the introduction of electronic public services?	0,09
3	How to assess the impact of proposed public e-services?	0,07
4	What indicators for assessing the level of information technology and electronic services offered public use?	0,07
5	Is there an analysis of the organization's core business processes leading to initiatives to develop new electronic services?	0,06
6	How many documents are issued daily average in the organization?	0,07
7	What is the percentage of effective documents issued on the basis of the submitted electronic applications and inquiries?	0,06

8	How many electronic applications to provide services to receive daily?	0,07
9	How many employees are involved in the organization average in a business process?	0,06
10	How many types of documents involved in core business processes flowing in the organization?	0,05
11	How documented business processes?	0,06
12	What experience in the organization of employees who maintain public electronic services?	0,07
13	What are the working skills of users of electronic services?	0,07
14	What is the qualification of the users of public e-services?	0,06
15	What is the experience of managers in development and implementation of public e-services?	0,06

5. Conclusion

Finally, it should be noted that research on the effectiveness is quite a complicated process. On the one hand in the literature and practice, there is no unity on the methods of its measurement. On the other hand the implementation of measures to increase the efficiency of public electronic services is very important. The report is an attempt to define a system of indicators and their weights with which it is possible to examine the effectiveness of electronic services. This is the basis for the creation of adapted and better public electronic services.

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Opportunities for Extracting Web Content in a Structured Way

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Abstract. The paper examines conceptual features of the way information is stored on the web. Emphasis is placed on the opportunities for the extraction of this web content in a structured way. For this purpose in the paper are suggested some specific to object-oriented concepts techniques in order to analyze the content before extracting. This paper presents such a model and highlights its potential benefits.

Keywords. Internet, site structure, web crawler.

1. Introduction

In today's virtual world, there are millions of websites with much different information. Even if we imagine that all the information on web sites is the same, then surely it would have been presented to them in different ways, from a structural point of view. The reasons for the differences in the presentation of information can be varied. On one hand, the website could have a specific design. On the other hand there is always the possibility of a single design to be implemented differently on the client web language from the respective developers of sites. In many cases there are mistakes in the structuring of information on various web sites, probably as a result of accidental errors committed by those developers. Most modern web browsers have the tools to correct these errors in order to better visualize the web content. The aim of this study is to find an approach that web content can be extracted and analyzed in a structured way, despite differences in visualization and the existence of mistakes in structuring websites.

2. Extracting web content

The paper focuses on the concept for structured information. In this sense, the concept is different from the one where machines search for information on the web such as Google, Bing, etc. Presumably search engines index all content on client websites. The purpose of this study is to extract specific information from a web page in a structured way. Such an approach can be successfully applied in the development of new electronic services in state and local government [1]. Retrieving web content is a technological issue. Many aspects in the implementation and management of software are theoretically covered in various publications of authors who work on the subject [2]. The standard scheme for retrieving web content is illustrated in Fig. 1.

In the language of the client presentation web content description of a document goes through special units called labels or tags. By labels we can form different parts of the text such as titles, quotes, tabs, links, etc. For the purposes of our study, the extraction of information must be adequately combined with proper analysis. In this way it would be possible to enable the existence of the extracted content in a structured way. For the purpose

of the study this content is in the form of web publications. There are many different web portals with publications with their distinctive designs and ways of presenting information. Information unit in this case is the publication with its attributes. These details usually present authors of the publication, date of the publication on the website, photo or galleries of photos, etc., but every publication should be characterized by title and text. The purpose of our module for analyzing and retrieving of web content consists essentially in recognizing individual elements of a publication, so that subsequently they may be indexed and processed separately. The working algorithm of the model in the study of object-oriented approach is represented graphically in Fig. 2.

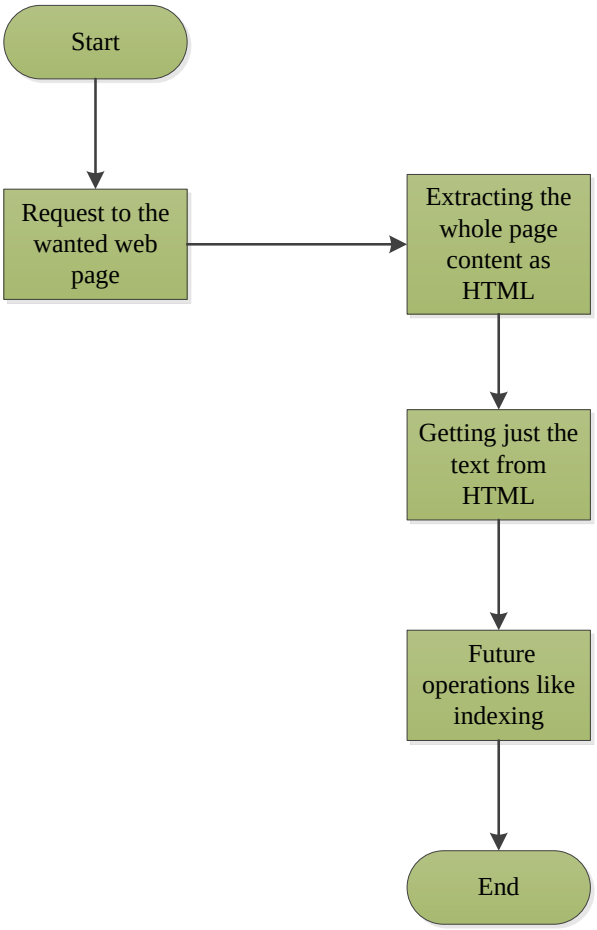

Fig. 1 Extracting web content

Extremely important feature of this model is that it does not know in advance the web addresses (links) on the pages with publications. For this reason the initial starting point is always the main page of the website. The next item that interests us is the location of the menu categories of publications. The categorization itself is not a focus of this paper. What is important for us is the correct differentiation of information structures. Walking along the algorithm in Fig. 2 we come to the extraction of web contents, which forms a given

publication. The ways in which these contents could be presented in their HTML form are many and this is why we actually need a specific approach. Based on the presented algorithm we should have a system that implements a base functionality that is common to all detail pages with publications.

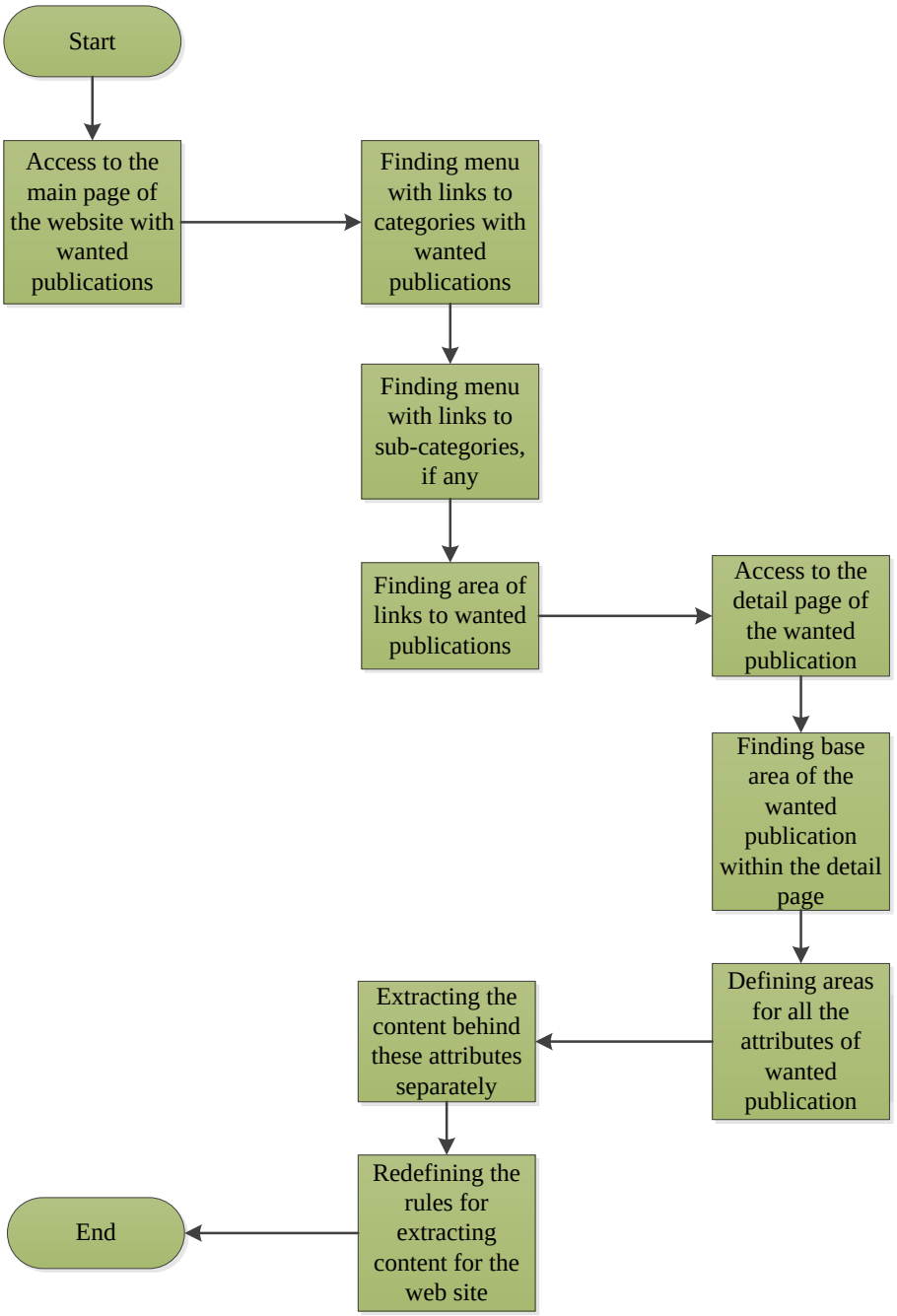

Fig. 2 Extracting web content in object-oriented way

This implementation, however, provides methods to tune the specific web content for each component separately extracted. The use of these methods is not mandatory. In many cases, the basic realization itself will be sufficient to properly interpret the HTML code in the desired structure. Additional functionality will be used when there is a need for correcting errors in incorrectly structured HTML, clearing any tags code, removing redundant fragments statements from HTML, ignoring JavaScript.

3. Conclusion

Considered approach is defined as object-oriented, because of the potential to redefine the way of extracting the resulting text from Web content specific to object-oriented platforms that use techniques of succession. One such model is characterized by the following potential advantages:

- Opportunities to extract information from different sources defined in a general way;
- Single programming rules for behavior analysis of web content that is reused for different web design structures;
- Methods to redefine the different areas of web pages for specific treatment of HTML fragments;
- Recognition capabilities of different types of data through common and predefined criteria.

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Challenges in Determining the Similarity of Online Publications

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Abstract: The paper examines the basic principles of indexing web publications. The idea of this paper is linked to the existence of a database containing web publications. This database is used by media monitoring solutions for displaying wanted information. Client part of this type of solutions should be implemented using web based interfaces. Users of this type of solutions should be able to monitor the web publications in the database in real time. The module for related publications presented in this paper makes it possible for the users to see proposals for such related publications for any given publication considered. The paper examines the algorithm by which this module works and highlights some of the advantages in its implementation.

Keywords: Internet, media monitoring, related publications.

1. Introduction

In modern web space there are numerous examples of web portals, where the choice of specific publication from the user is followed by the display of a list of suggestions for similar publications on the portal. It is logical to assume that conversion module for determining those related publications is governed by different algorithms. Each of these algorithms should be described in a certain standardized way – beginning of the algorithm, a list of actions with publications and results of the implementation of the algorithm. This is a widely used approach for the description of electronic services. In studies of some authors they even speak for a standardized description of electronic services [1]. Such an approach is also useful and it is described by other authors in aspect of verification of public projects [2]. It is also a serious issue the association of each instance of standardized descriptions of the publications according to the relevant group in real time.

2. Architecture of server-side application for determining the similarity of publications

The actual determination of the similarity of the publications is usually associated with the prior drafting of so called dictionary illustrated in Fig. 1.

After receiving the publication in the system, it is analyzed and extracted so called keywords from the content. These should be the words of the text that are relevant for the purposes of given publication. Therefore, it seems appropriate in advance to have a dictionary of words that is not possible to be keywords within the system. Such words should be the pronouns, prepositions, adverbs and other specific parts of speech.

The creation of the dictionary is schematically represented by Fig. 2 as a principle scheme for indexing documents. Extracted keywords are checked in the dictionary. If they are already there, we should only associate theme for this given publication. Otherwise, we

should add to the dictionary any new entry for each keyword that is not yet part of the dictionary. There is also opportunity to prioritize the word for publication on the basis of some criterion, such as frequency in it. This would be important if we want to be more accurate in determination of related publications later. Of course, there is a realization in which the keywords are defined as such only when they have a minimum number of presence in the publication and we can assume that each keyword has equal weight to specific publication.

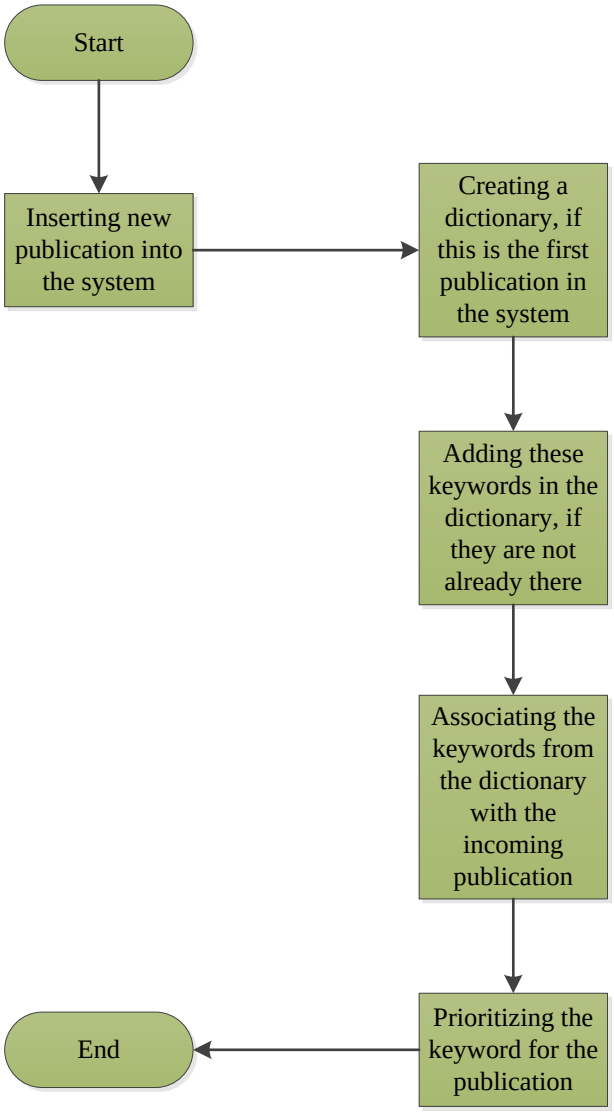

Fig. 1 Framework of basic dictionary

According to this paper, for a relatively adequate definition of related publications, it would be appropriate to use a hybrid algorithm, which has a dictionary of words, but implements also the ability to prioritize keywords in real time. The module for determining related publications for this study represents a java based server-side application. Its principal operating schema is illustrated by Fig. 3. The object of this example is a media monitoring system with web-based client part that provides lists with publications, stored within the system. The choice of a publication from the web part of the system goes to the java-based application server that functions as a local service. It takes care of the identification of other publications within the system, which can be determined as similar to the chosen one. In this sense, if there is a publication A, which according to our algorithm is similar to publication B within the system, it does not mean that publication B has to be similar to publication A.

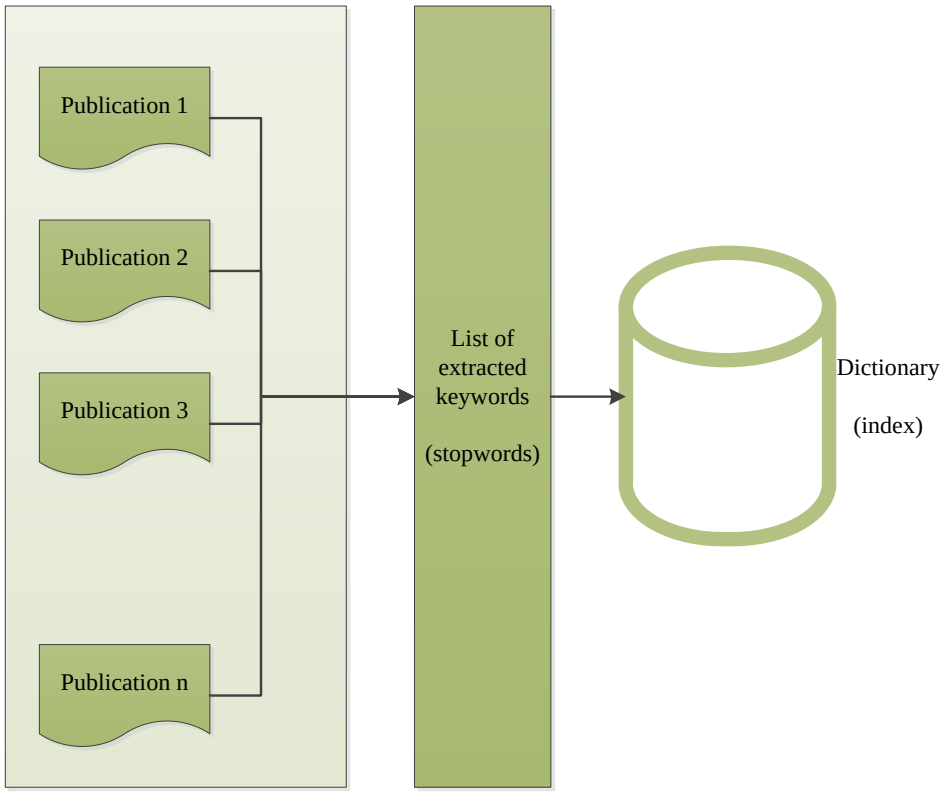

Fig. 2 Creation of dictionary

In general, the algorithm for determining the similarity originally extracts keywords from the publications, ignoring a list of words that cannot be considered as keywords. Based on how often these words appear in a publication, we are able to determine their importance. Of course, we should set the minimum number of repetitions of a word for it to be considered as a potential keyword.

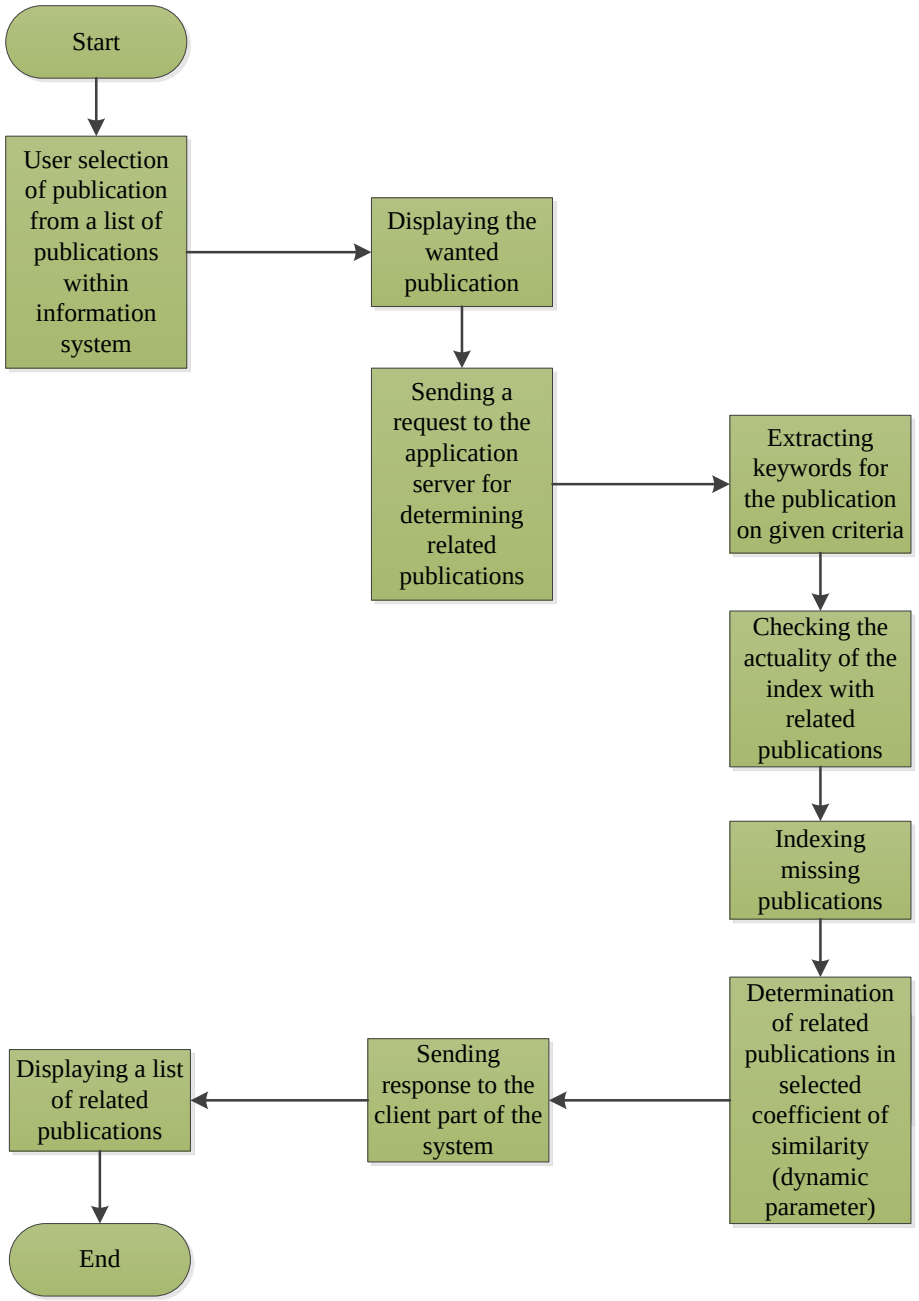

Fig. 3 Algorithm for determining the similarity of online publications

We should also determine the maximum number of keywords. It is logical to assume that one or two keywords in a given publication will lead to a large number of similar publications, where these words are found. Therefore, according to this study, the optimal number of keywords is rather four or five. We should determine the minimum length of a

word for it to be considered as a keyword. The index for supporting the determination of related publications in this example accepts as a condition that two publications would be similar on entering the system within 24 hours.

Each of mentioned parameters for determining the similarity of online publications can receive value from the client part of the system and application server takes this value into account in determining the related publications – a key advantage of this algorithm, which is possible due to the existence of the index in real time.

3. Conclusion

The idea of the existence of such a real-time index realizes the following advantages:

- From a conceptual standpoint the module for determining the related publications works as an independent system algorithm encapsulated in a separate server application, which does not disturb the work of the client part of the system;
- Extraction of keywords of selected publication is a real time process, which means that prioritization of specific words in the publication is a matter of tuning the system and is not connected with the change of any source code;
- Determination of related publication in real time means that at the time of consideration, the module for determining the related publications can verify whether the system has received new data and if so, promptly indexing this data before the decision which publications are similar to the current one;
- Each of the existing parameters for determining the similarity of the publications can receive value from the client part of the system and application server takes these parameters into account in determining the related publications.

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Information Problems in Carrying out the Financial Audit of European Projects

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Abstract: Conducting financial audits is a complex and demanding task. In recent years, increasingly emphasizes the role of information and software solutions in the audit process. The main objective of the paper is to disclose the information problems of the processes of verification and financial audit. This is done based on the experience of the project "Student practices". Finally we formulate conclusions and recommendations.

Keywords: Information technologies, Electronic verification, Information problems in carrying out the financial audit.

1. Introduction

Project BG051PO001 - 3.3.07-0002 "Students practice" [3] focuses on practical training of students in real working environment. Its ultimate objective is to increase the percentage of students employed on a permanent contract. For the period 21.06.2013 – 31.12.2015 University of National and World Economy [4] has concluded the contract of 4564 students for practical training and verified their costs electronically.

2. Technology of electronic verification and financial audit

Financial audit and verification of expenses are directly related to information problem for the computerization of the archives of public institutions. This implies the existence of a secure means of identification of electronic documents, their veracity and relevance of content [1]. Furthermore, it is necessary to provide the technical means by which to implement information security within the integrated environment for exchange of electronic documents. To make it possible to carry out verification of costs incurred and financial audit, it is necessary to ensure full compliance of the data (Fig. 1).

Electronic verification and financial audit of expenditure on public projects (Student's practices) is based on the following principles:

- Full compliance of expenditure with existing regulations;
- Correspondence between underlying and reported costs;
- Correspondence between electronic and scanned paper documents;
- Correspondence between students and completed reports of mentors;
- Correspondence between the cost for students and the cost for their mentors and academic tutors.

The main roles of the participants in the process of financial audit are (Fig. 2):

- Expert financial - accounting services;
- Expert in scanning and uploading system scanned financial documents;

- Verifier;
- Financial auditor.

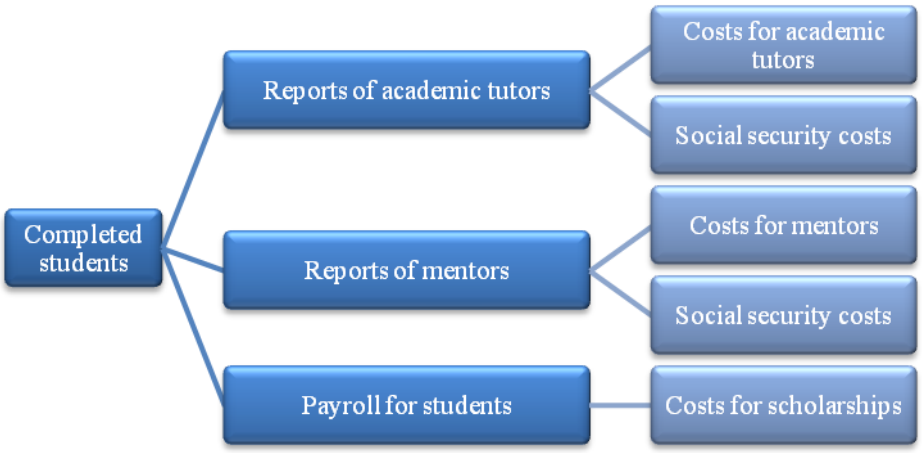

Fig. 1 Correspondence between the cost for students and the cost for their mentors and academic tutors

Fig. 2 Roles of participants

In a specially developed system of Ministry of education it is conducted a two-stage verification of costs incurred by the accounting firm of experts and the managing authority.

Then there is a realized sample of some of the project costs, undergoing financial audit (Fig. 3).

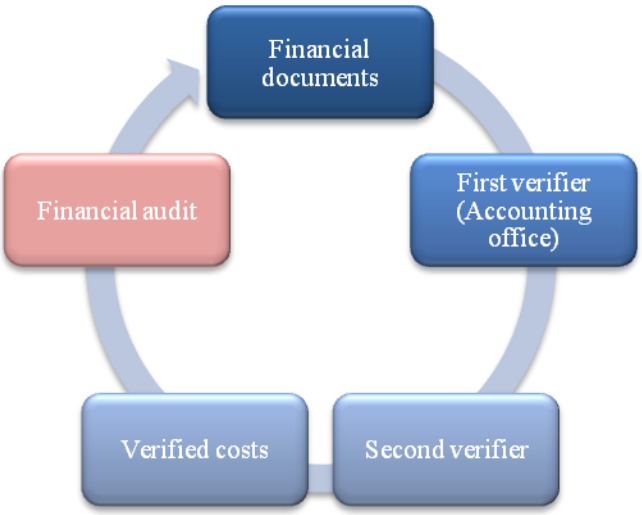

Fig. 3 Verification and financial audit

Guidelines on conducting the financial audit are:

- Identify of the characteristics of the audited organization;
- Description of the contract for the project;
- Analysis of the characteristics of administrative acts, which are defined project participants and technological obligations and responsibilities;
- Obligations of participants with type of posts and remuneration;
- Verifying of the hours reported by the experts and the project budget;
- Documents on the basis of which any award of activities of experts;
- The procedure by which we check active student rights;
- How to document the actions taken during the inspection?
- The procedure by which we check the relevance of bank accounts;
- The procedure by which we provide scholarships and remuneration;
- The availability of the reports of all stakeholders (students, mentors, tutors and academic experts) electronic and paper;
- Proof of the publicity measures;
- Descriptions of advances and interim payments;
- Percentage of total amount received from the indicative budget;
- Any cost of the action, there is against supporting documents?
- The costs meet all the following conditions: are legal; actually incurred; associated with the implementation of project activities; reflected in the accounting and tax records of the university?

3. Information problems in carrying out the financial audit

A result of the analysis may state the following information problems in the financial audit of expenditure on public projects (Fig. 4):

- The need to use specialized audit software;
- Existence of a procedure for the integration of audit software with the main software project;
- Ability to automatically extract data from major software project;
- Adequacy of generated reports against audit policy;
- Effective use of the Internet search, including search in web forums, to perform financial audits [2].

Fig. 4 Information problems

4. Conclusion

We can draw the following conclusions and recommendations:

- It is constantly to adapt procedures for conducting financial audits against the particularities of the various projects;
- Conducting financial audits are accompanied by serious IT problems;
- Their resolve is key to the success of the inspections;
- It should be recommended to more widespread use of specialized audit software.

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The Challenge – Systems with Open Business Logic

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Abstract: This paper discusses the problems of the business logic of software applications. Problems in this area can be defined as classic. The main arguments for this are to clarify the role and importance of the programming team working on software application. The paper gives some possible solutions to the questions reviewed. Finally, conclusions and recommendations are drawn.

Keywords: Business application, business logic, software architecture.

1. Introduction

This paper attempts to examine the causes and consequences of loss of functionality of software. To develop research problem we are going to point out the need to analyze the system with classic three-tier architecture (Fig. 1).

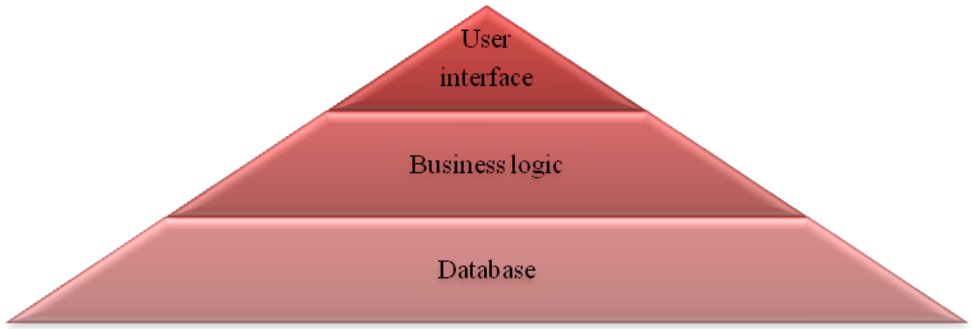

Fig. 1 Classic three-tier architecture

The functionality of the three layers is different. Layer database manages data. Business logic includes a set of software modules that perform the conversion of data into effective information according to the rules of the subject area. The user interface presents the resulting information in a convenient form for the user. Various reports and management information are displayed on this layer.

2. Creation of business logic

The implementation of such systems is common practice. In recent years, three-tier architecture has evolved in the architecture of web applications. This is especially true in the creation of national and large systems, such as some of the subsystems of e-government [1].

The creation of the business logic layer (desktop and web systems) is usually approached by a preliminary study and design (Fig. 2).

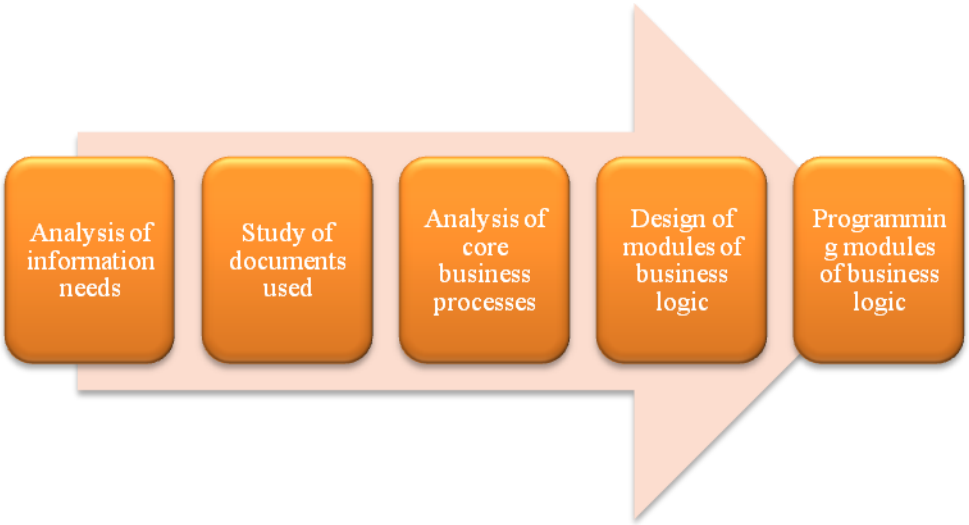

Fig. 2 Creation of business logic

At the beginning of the process we start with an analysis of information needs. In some cases, users are not able to completely define them at this stage. Then we carry out a study of the documents used in the different stages of the process. This allows an analysis of core business processes in the subject field. The fourth step is the design of modules of business logic. Then we perform the actual programming. At the stage of design and programming some authors develop specific search algorithms to improve the quality of the resulting information [2].

3. Requirements to business logic

With regard to the purpose of the present study we may indicate the following requirements to business logic:

- Accuracy - represents exactly the requirements of the subject area;
- Completeness - presents all analyzed requirements;
- Expandability - business logic chance to develop in the future;
- Ability to create various reports;
- Opportunities to use specialized algorithms to quickly find and retrieve information;
- Lack of information gaps and more.

These and other requirements are related to the need for the user to be able at any moment of time to access the needed information.

4. Problems in creating the business logic

Problems in creating the business logic can be classified in the following groups of problems that occur in the systems with a similar three-layer architecture (Fig. 3):

- Business logic does not comply with the requirements of the subject area;
- User can't generate the required reports;
- Strong dependence of reference of the intervention of an administrator;
- Bad expandability options;
- Possibility of information gaps and more.

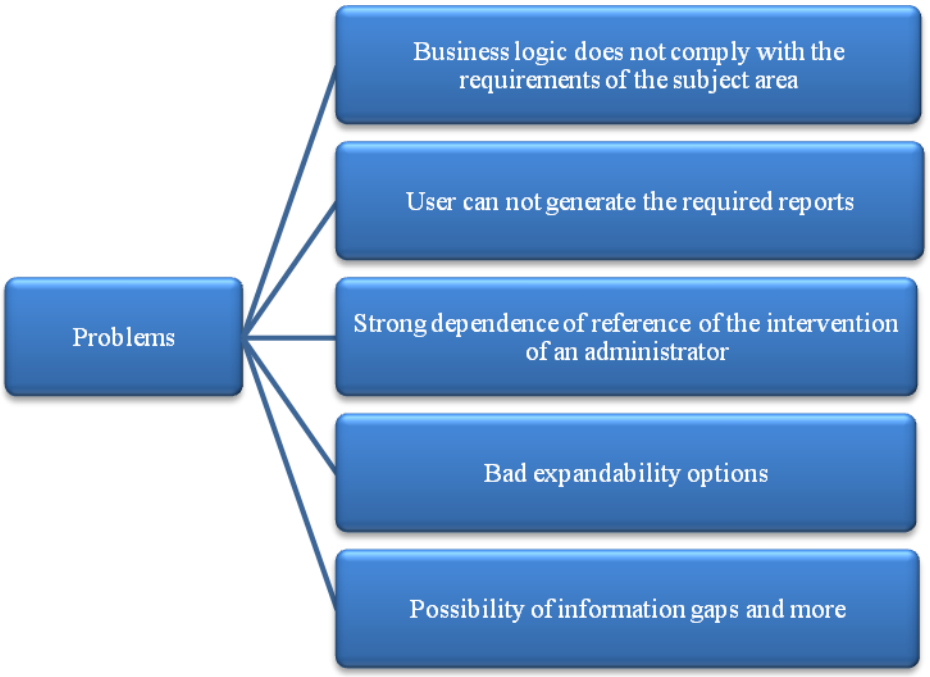

Fig. 3 Business logic problems

Each of the several problems can find a specific solution to improve the efficiency of the system.

5. Possible solutions

Possible solutions to these problems can be drawn in the following several aspects:

- There is a serious need of study of the requirements of the subject area. We should examine the documents used, the participants and their roles and actions carried out;
- Even before the design and creation of a system we should perform a study on the necessary effective reference. For subject areas in which the statements are dynamic, its structure should be envisaged and realized report generator. Its functionality should imply its use by users of the system who take management decisions;
- For a number of systems there is a strong dependence of effective actions by reference to the system administrator. This is a negative phenomenon in the absence of administrator users can not enjoy the performance of entered data (Fig. 4);
- Providing opportunities for easy refills with new modules of business logic;

- Providing mechanisms for filling information gaps and more.

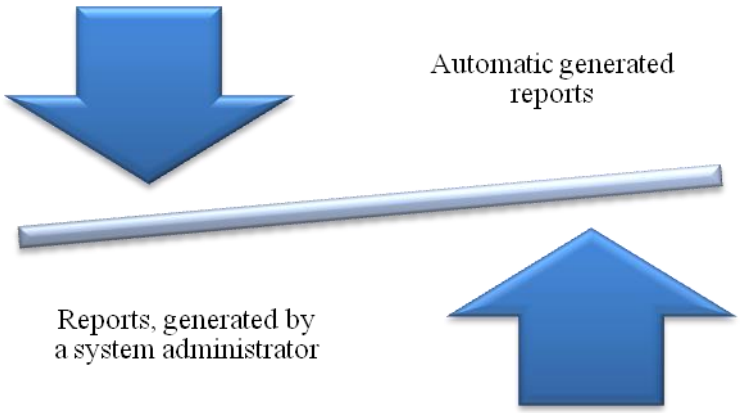

Fig. 4 Need to complete in modules of business logic

6. Conclusion

Finally, it should be noted that certain types of web-based systems users do not receive a clear possibility for generating various inquiries. The intervention of the system administrator is a complex, time-consuming and creates dependence. In this type of system users have to manually create effective information. The paper sets out the main information problems and their causes. Finally, we made some recommendations and conclusions.

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Accounting Forecasting and Reporting on the Effects of Natural Disasters

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Abstract: This report highlights the role, functions and the specific accounting rules applicable to the forecasting and management of natural disasters by the business. The author proposes a model of management program in case of disasters and failures that is developed on the basis of the information obtained from the enterprise's accounting system and the risk management capacities for model development. With the help of a case study the report illustrates the accounting approaches for reporting the effects of occurred natural disasters. The rules for evaluation and recognition of key property items of the enterprise pursuant to the most widely and globally used accounting standards – IFRS, are presented.

Keywords: Accounting, Reporting, Risk management, Natural disasters

1. Introduction

This report presents a review and analysis of natural disasters. **The subject of the study** comprises the accounting forecasting of potential expenses and losses of assets and resources of the business, cost evaluation and reporting of further negative effects of natural disasters from accounting point of view. **The objective** of the study is to identify the role, functions and accounting approaches applied by the business for forecasting and reporting of consequences from natural disasters.

The main study thesis is to prove that except information, control and analytical function, accounting also has **forecasting functions**, which is used for the development of business forecasts and risk management strategies in terms of disasters and failures. At enterprise level, the financial reporting and control are considered the smallest constituents of the natural disasters management systems. They are the fundament on which emergency situations management should be developed within the frames of the respective national economy even on regional and international level.

Accounting is examined in the broadest possible aspect as an information and control system, which is part of the overall management system of the enterprise. On one hand, the accounting system ensures high quality information for the achieved results, the financial and property position of the enterprises from all sectors (business, non-profit, public) of the economy, and on the other hand, it allows the managers and officers to plan and forecast the required manners and means for managing the expenses incurred due to the occurrence of emergency situations and natural disasters. These are floods, storms, fires, volcano eruptions, landslides, avalanches, earthquakes, etc., which are beyond man's control. Disasters and failures cause significant human and material losses, impede investments and production, affect the principal or supplementary business activities, destroy connections with principal suppliers of raw materials and materials, as well as with key clients and business partners.

2. Role of accounting for forecasting and preventive management of natural disasters

The role of accounting in the process of planning and prevention of the enterprise against natural disasters is to ensure reliable and appropriate information about natural disasters, which have affected the enterprise in the past, about carried out actions, about the expense amounts and their efficiency for the management of disasters and failures. The availability of such kind of information is extremely useful and allows managers to undertake adequate preventive measures and actions for mitigating the negative consequences of future occurrence of natural disasters.

Perspectively orientated risk management should be prepared and should develop long-term investment policy combined with appropriate policy for resource allocation. Such policy of the managers should be sensitive to the precise financial and non-financial identification of consequences from natural disasters. Another important factor is the elasticity of enterprises' behaviour towards the performance of adequate and optimal actions for further repairs and recovery of the business after the suffered losses.

The business needs to develop a methodology and proper instrumentation for combined qualitative and quantitative analysis to be applied for the study of economic consequences from natural disasters. On the basis of the results and conclusions of this analysis, we can proceed to the next step – development of strategy for reducing the scopes and duration of the consequences from natural disasters. The goal is to shorten, restrict and transform long-term effects into short-term consequences for the business growth and the overall development of the enterprise to the maximum extent.

The effect of each event is defined by complex and changing combinations of factors. Therefore, we should apply individual approach and "benefit-cost" analysis of each potential disaster, as well as "investment analysis" for reducing the risk of each natural disaster separately. Emergency situation management specialists should consider and recognize that natural disasters are not isolated, homogenous forms of economic shocks, just the opposite – they cause different vulnerability and instability statuses, which requires the use of different approaches to mitigate risks.

Therefore, we need to identify, evaluate and manage the potential risk of occurrence of natural disasters. The corporate management system of disasters and emergency situations may be successfully developed on the basis of the accounting system and its systematized information for incurred expenses and suffered losses due to disasters, based on the previous experience, on one hand, and on the other hand – by applying the management functions for risk modeling. The interaction between accounting and risk management allows to formulate different strategies for reduction, retaining, transformation and overall prevention against the occurrence of risk of natural disasters. The structure and the elements of this disaster management system are presented on figure 1.

The natural disaster management system comprises initial localization and identification of potential hazards from natural disasters. Preliminary preparation of the enterprise for immediate reaction in case of occurrence of specific natural disaster is performed. Actions for mitigating the consequences from natural disasters are planned. Each indicator of the disaster and failure management program is given cost expression in order to allow the recording of potential expenses in the budget estimates. Three types of evaluations are performed – pessimistic, realistic and optimistic forecast for potential material and financial losses.

On the basis of the information from the accounting system, the enterprise's management should evaluate the effect of natural disasters on the potential impairment of

cost of the enterprise's property and the expected additional expenses in the following key areas:

- Fixed tangible assets (FTA) – damaged or destroyed real estates, building structures, infrastructure facilities, plant and equipment, facilities, vehicles, etc.;
- Intangible assets – destroyed or lost development products, patents, licenses, matrixes and industrial designs, trade marks, standard and specialized software, etc.;
- Expenses for restoration, replacement, repairs and reconstruction of damaged and destroyed FTA;
- Inventories – damaged or destroyed materials and supplies, products and goods;
- Expected future expenses for legal and other claims to the municipalities and the government;
- Current expenses incurred for overcoming the damages caused by natural disasters;
- Ability to pay the debts to creditors and moneylenders;
- Changes in the structure of receivables and the deadlines for their collection;
- Further steps for regular development of the business.

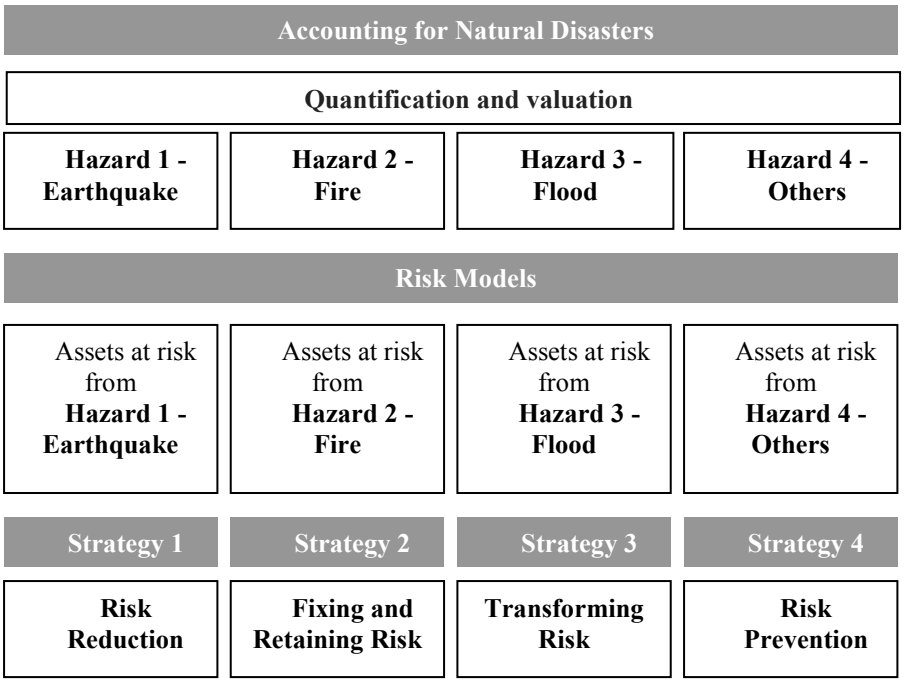

Fig. 1. Sample structure of a system for strategic management of natural disasters of business

Furthermore, the sources of funds for restoration of the property to the condition and appearance it has been before the occurrence of the natural disasters are planned. The remedy program of the risk managers is directed to the implementation of specific solutions in short- and long-term plan. Short-term adverse effects are usually overcome within one year, and the long-term ones require more efforts for their elimination within a couple of years. After the respective disaster or failure situation has been overcome, the remedy program should be

supplemented by statement of the expenses incurred for covering the staff needs, as well as of the expenses for recovery of the physical and mental health of workers and employees, providing additional days-off and paid leaves, for funding their treatment, expenses for construction of designated reinforced rooms for protection of the staff in case of earthquakes, floods, wind storms, hurricanes, etc.

The tools available to the managers for protection and survival of the enterprise as a separate economic subject are related to risk transfer by means of:

- Property insurances, life insurances and staff accident insurances;
- Tools for allocation of risk directly to capital markets;
- Allocation of specific reserves from the profit for natural disasters.

Due to such tools for transfer of risks upon occurrence of the respective adverse event, the business has some chances to continue its existence during the periods when it is not able to function with its own funds.

When managing natural disasters, managers of private and non-governmental economic enterprises may use the experience of the public sector, which has serious achievements in:

- Creating databases of the territories suffering material and financial damages and evaluation of human victims;
- Developing systems for quantitative and cost reporting of losses caused by disasters and failures;
- Developing a system of expertise and analysis of collected, selected and systemized information about natural disasters, as well as for caused damages and victims;
- Developing a system for modeling of risks from natural disasters in future.

3. Approaches for reporting the consequences from natural disasters for the business

Measuring and reporting damages caused by natural disaster comprise two main components. The first one refers to the cost registration, measuring, reporting and summarizing the direct financial and material losses. And the second one is aimed at measuring and summarizing the direct, secondary effects on people and on all public sectors.

The accounting and financial reporting at international level comprise and report in quantitative and cost way the direct financial and material losses. The most widely used at global level International Financial Reporting Standards (IFRS) allow the recognition and measuring of income and expenses related to natural disasters as “Other income” and “Other expenses” for operations. In contrast to most accounting standards of different countries, IFRS do not allow the recognition and measuring of extraordinary income and expenses in the financial statements. The information about extraordinarily incurred expenses and income should be stated in the annexes disclosing the applied accounting policy and clarifying the information in the components of the financial statements. To the author’s opinion it is appropriate to include the reporting of natural disasters’ adverse effects in International Accounting Standard (IAS) № 36 - Impairment of Assets. Thus, the enterprise’s management will have the opportunity to revaluate the new recovery value of fixed tangible and intangible assets formed as a result of natural disasters. This will allow fair and correct presentation of the information in the enterprise’s annual financial statements.

If natural disasters have caused the enterprise extremely serious damages, it is required to carry out a test for the enterprise’s ability to continue its normal business in near future. This means that the applicability of the main assumption or accounting principle called “going concern” should be verified. The enterprise should disclose the significant

threats to its business and should present the measures and actions it plans to undertake for overcoming these threats.

IFRSs have adopted the following accounting rules for subsequent evaluation of the enterprise's assets and obligations, which are fully applicable also in situations of damages caused by natural disasters:

1. **Fixed tangible and intangible assets (FTA and FIA) –** an evaluation for the extent the respective assets are affected by the disasters is made, and:

- Fully destroyed assets should be derecognized from the enterprise's property at their book value as at the date of the disaster and should be measured as other, extraordinary expenses for operations. The reasons, character and amount of derecognized assets should be disclosed in the annex to the financial statements;
- The assets that may be used after repairs and improvements should be impaired, i.e. their book value should be decreased to their expected recovery value;
- Expenses incurred for overhauls and improvements of damaged assets are recognized and measured as increase of the value of these assets. Current repair works required for making the assets in working condition that should not contribute for improving their standard efficiency are measured as current expenses for operation in the Statement of Comprehensive Income.

2. **Investments and participations –** if a subsidiary, associated company or jointly controlled company in which an investment has been made, is affected by natural disaster, the investing company should revaluate the investment or even to derecognize it, if total damages are caused, taking in consideration the accounting policy approved by the management.

3. **Inventories** – supplies, materials, products and goods affected by natural disasters are measured as follows:

- Fully destroyed and unusable – they are derecognized from the enterprise's property as other expenses for operations;
- Damaged but repairable, remediable and cleanable inventories – they are derecognized up to their net realizable value, and the expenses incurred for repairs and remedies are measured as current expenses for operations.

4. **Trade and financial receivables from clients** affected by natural disasters – depending on the transaction that causes the receivable, receivables are impaired, and if there are firm proves for the client's inability to repay his/her debts, receivables are 100% derecognized.

5. **Loans and payables** – tests are performed for revaluation of the structure and the maturity of payables to financial institutions, suppliers, government authorities, staff, as well as of the possibilities to claim immediate payments and repayment of specific amounts to creditors.

6. **Provisions and contingent liabilities** – provisions for the guarantee maintenance and administration of contracts for sale of products, goods and services are reviewed.

7. **Insurance compensations** – in case the enterprise has insured its damaged or destroyed property it has to bring claims and demands to the insurance companies. Thus, on one hand, receivables from insurers occur, and on the other hand, income from insurance compensations are recognized.

8. **State aid and grants** – depending on the earmarked purpose of the state grants, different models for their accounting reporting are applied. When received state aid is used for remedying small-scale damages and covering current expenses, received amounts are recognized and measured as current income from operations. When funds are used for

acquisition of fixed assets, the amount of financial aid may be stated in the enterprise's balance sheet as deferred income and may be recognized as income in the statement of comprehensive income systematically and rationally for the period of the useful life of the asset. There is an alternative approach that allows the grants to be recognized as income for the period of useful life of the amortized asset by reduced depreciation allowances.

9. **Adjusting and non-adjusting events** – adjusting events are the events, i.e. the natural disasters that have occurred as at the date of the annual financial statements, that due to a number of reasons have not been recognized and included in these statements as at the date of their approval by the enterprise's management. They are called adjusting events as their consequences are stated in the financial statements for the period they have occurred in. There are other events that are indicative for conditions that have occurred after the end of the reporting period and before the date of approval of the financial statements for publication. When non-adjusting events are found, the enterprise does not adjust the amounts recognized in the financial statements, but only discloses the material events that have occurred after the end of the reporting period.

10. **Additional disclosures in the financial statements:**

- The nature and the amounts of recognized losses due to natural disasters and the amount of expected receivables from insurance compensations in relation to damaged or destroyed property;
- Description of unexpected expenses related to natural disasters that are not yet recognized in the financial statements, however, there are sufficient grounds to expect negative consequences that will be reflected in the financial statements;
- Assessment of the risk and the amount of potential losses from granted credits and loans;
- Potential losses due to failure to collect receivables from clients;
- Material collapse in the supply channel of supplies and materials;
- All kind of material uncertainties of the items and amounts stated in the financial statements;
- The applied accounting policy in relation to the treatment of impairment losses and the insurance compensations in the financial statements.

4. Case study

To demonstrate the application of accounting rules approved by IFRSs, we will review the following case study related to destruction as a result of earthquake and the further erection of new industrial building (fixed tangible asset).

On 15 March 2015 an earthquake has destroyed the industrial building of the company KLM FOODS. The book value of the building is EUR 200 000. Its acquisition price is EUR 350 000, and the depreciation charged until the date of the earthquake is EUR 150 000. As the building is insured against the risk of earthquake, the management of KLM FOODS brings a claim to the insurance company to pay insurance compensation in the amount of EUR 350 000. On 30 April, the insurers confirm that they agree to fully pay the damages caused in the amount of EUR 350 000 and that they will pay the compensation until 31 May 2015. Within the above period the insurance compensation has been received to the bank account of KLM FOODS. The construction of a new industrial building starts and the construction has been completed on 31 August 2015, and the construction expenses in the amount of EUR 350 000 have been paid by means of bank transfer to the construction company that has erected the building again.

As a result of the above transactions and events, some changes in the property position and the financial results will be made in the accounting system of KLM FOODS, which are presented in table 1.

Table 1. *Chronology of accounting records in "KLM FOODS"*

		Debit	Credit
15 March 2015			
To record impairment of the destroyed building	Impairment (expense)	**+ 200 000 Euro**	
	Industrial building (asset)		**- 200 000 Euro**
To record derecognition of the destroyed building	Accumulated depreciation (contra-asset)	**- 150 000 Euro**	
	Industrial building (asset)		**- 150 000 Euro**
30 April 2015			
To record receivable from insurance compensation	Receivables from insurers (asset)	**+ 350 000 Euro**	
	Insurance compensation (income)		**+ 350 000 Euro**
31 May 2015			
To record bank transfer of the compensation from the insurance company in respect of the approved claim	Current bank account (asset)	**+ 350 000 Euro**	
	Receivables from insurers (asset)		**- 350 000 Euro**
31 August 2015			
To record the rebuilding of the new Industrial building	Industrial building (asset)	**+ 350 000 Euro**	
	Current bank account (asset)		**- 350 000 Euro**

This example leads us to the conclusion that on the basis of recorded events and transactions, the accounting system may provide information for the funds (own funds or borrowings) required for the recovery of the property and the restart of the business after the occurred natural disaster, in the following key aspects:

- Total replacement of destroyed FTA – comprises the purchase price of the asset and all direct expenses for its purchase, transportation, installation and commissioning. The specific structure of elements of the acquisition price of fixed tangible assets, as well as the items that should not be included in this price, are defined in IAS 16 - Property, plant and equipment;
- Current and subsequent expenses for repairs and restoration of damaged FTA – expenses incurred for minor repairs required for the normal

functioning of the assets are recognized as current expenses for operations, while the expenses incurred for overhauls, reconstructions, total construction of destroyed assets that result in increase of their standard efficiency and functionality are recognized as new FTA. The classification and the items of current and subsequent expenses for FTA are defined in the applicable IAS 16 - Property, plant and equipment;

- Total recovery of the availability, items, range of supplies, materials, spare parts, packaging, purchase of minimum amounts of goods, etc. used in the principal and supplementary business;
- Repairs and remedy of affected and partially damaged supplies, materials and products that might be made usable inventories (expenses for recoverable waste);
- Other cost evaluations, depending on the specific property structure of the enterprise (structure of assets).

5. Conclusions

As a result of the study of functions and abilities of accounting for forecasting, subsequent evaluation, management of losses and restoration of business after natural disasters, we can outline several key conclusions.

Firstly, medium-sized and big enterprises should develop plans and programs for natural disaster and failure management.

Secondly, the management of natural disasters should be based on the accounting information and management strategies of the risk management.

Thirdly, the management program should be aimed at preventing the property against damages, maximally quick restructuring of payables' maturity, ensuring sources for timely recovery of the business (insurance compensations, state aid and grants).

Fourthly, the business plans for disasters and failures should comprise cost evaluation, measures and actions for training and protection of life, mental and physical health of workers and employees. Furthermore, responsible persons should perform preliminary, current and subsequent control over undertaken measures and achieved results and over the consequences for the staff.

Fifthly, the enterprise's management should constantly verify, test and review the risk management strategies for reducing, retaining, transforming and eliminating the risks of natural disasters.

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Development of an Early Warning Expert System

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Abstract: The paper reviews the basic requirements which can be used to evaluate a problem domain in order to determine if the development of an expert system is possible, justified and appropriate. The criteria system, developed by David Waterman is used in case of an expert system for early warning (EWES)

Keywords: Artificial intelligence, expert system, early warning

1. Early Warning Systems

The basic concept of an early warning system is the real need for monitoring the potential risks for the stability in different socio-economic spheres. In fact, an Early Warning System (EWS) could be defined as a 'set of actions towards informing the decision makers about the possibility of a conflict or crisis'. The main goal here is to identify and to prevent possible crisis situations prior to their occurrence in order to eliminate major threats for national and international security. The most important activity is the conflict prevention as an activity that deals with predicting the crises. This should be an ongoing process including monitoring of the different risks, evaluating different critical factors, issuing warning signals and well-grounded suggestions for action. In particular the evaluation of the critical factors could be done with an expert system and the purpose of this paper is to prove using such a tool as possible, justified and appropriate.

2. An Early Warning Expert System for (EWES)

In his fundamental book 'A Guide to Experts Systems', David Waterman defines developed a series of questions which could be used to evaluate a problem domain in order to determine if the development of an expert system is possible, justified and appropriate. These questions are arranged into three groups:

Is the development of an expert system possible? Waterman suggests seven criteria that must all be satisfied if the project is to be possible. We are going to prove, that an early warning expert system (EWES) meets these criteria:

- *Task does not require common sense*. Proving here is an easy task, as the knowledge needed to evaluate the different critical factors is by definition an expert knowledge.
- *Task requires only cognitive skills*. Of course, solving problems using physical efforts in this stage of technological development couldn't be performed by a decision support system and the proposed EWES fully meets this requirement.
- *Expert can articulate their methods*. This requirement is in regard of the necessity to establish effective communication between the experts and the knowledge engineers (A knowledge engineer is 'a professional engaged in the science of building advanced logic into computer systems in order to try to simulate human

decision-making and high-level cognitive tasks.' (https://www.techopedia.com/definition/7966/knowledge-engineer)). Meeting this requirement is mainly a result of the fact, that there is a significant historical experience in crisis analysis, the expert knowledge in this area is well structured, and there is working practical solutions.

- *Genuine experts exist*. This requirement is in direct connection with the previous one, so the prove is the same.
- *Experts agree on solutions*. This is maybe the most controversial requirement. Regional specifics, historical prerequisites, different process dynamics in the different countries prevent extracting axiomatic principles about risk assessment and as a result – in the area of early warning. Of course, there are a number of widely adopted conflict factors and indicators, allowing the experts to see the signs of a rising instability, incipient conflict or emerging crisis. Unfortunately unanimous expert opinion is unrealistic to be expected. This puts limits to the scope of the prosed EWES – it could be developed only in the particular areas, where expert consensus about the solutions exists. Such areas could be political stability, income policy, ethnical stability, etc.
- *Task is not too difficult*. This requirement puts limits before the complexity of the problems, which are subject of expertise. It could be met during the EWES design without negative effect on its functionality and scope.
- *Task is not poorly understood*. A problem which can't be clearly defined and as a result of this can't be understood by the people, responsible for solving it actually can't be solved. Meeting this requirement is connected very tight with the existence of an expert knowledge in the problem area. This is the case with the early warning experts – they have to possess sound expertise and proven experience. This is of crucial importance for EWES success.

As a result of the analysis of the requirements it could be concluded that the development of EWES is **possible**.

Is the development of an expert system justified? Waterman identifies five reasons that would warrant the effort of developing an expert system for a given task:

- *Task solution has a high payoff*
- *Human expertise being lost*
- *Human expertise scarce*
- *Expertise needed in many locations*
- *Expertise needed in hostile locations*

If one of these prerequisites is met, then the development of an EWES could be considered justified. The primary justification is the first requirement – the human history has proven that preventing crises and conflicts is much less expensive than post-factum actions. And this is true not only in terms of actual money, but also in terms of time, resources, human development, etc. At the same time the knowledge to assess the risk and to propose viable solutions is not a common knowledge, it is scarce and there is risk to be lost. The existence of all three factors is enough to conclude, that the development of an ESERW is **justified**.

Is the development of an expert system appropriate? As with the criteria to determine "possibility," Waterman identifies five characteristics of the task that must exist if an expert system is to be appropriate

- Task requires symbol manipulation
- Task requires heuristic solution
- Task is not too easy

- Task has a practical value
- Task is of manageable size.

The ability to perform symbol manipulation instead of number processing is a distinctive feature of the expert systems, compared to the traditional information systems. In the area of early warning a significant part of the knowledge is of this type – opinions, expert evaluations, personal impressions, attitude, even rumors. And even in case such type of information is quantified, it is in form of evaluations according to a given scale, which prevents it to be directly used in calculations. Here we could use the power of the expert system methods for knowledge formalization and logical inference, allowing the knowledge engineer to unite both calculative and logical approaches to the initially highly fragmented and inconsistent information. At the same time the process of early warning is a heuristic task – it uses empirical data which the expert recreates in a given context.

We already stated that the task has a high payoff, which means that the EWES meets the requirement to have a practical value. And as we already stated the manageable size could be achieved with a careful design and limiting the scope to only some of the areas of research and monitoring like political stability, income policy, personal security or ethnical stability

So, in conclusion we could state that the development of EWES is **possible**, **justified** and **appropriate**

3. Expertons Theory

In this paper we will pay additional attention to approach, which could be used to solve the problem with the formalization of symbol data in expert systems. It is not very difficult to use measurable facts – determined value of a parameter does not need extra preliminary work. However the case with undetermined, more often semantic data is different. Such data resists qualitative measuring and the most suitable way to turn it in knowledge of an expert system is through using expert evaluations.

If we accept that expert opinion is the main source of knowledge with undetermined data, then its formalization is mandatory precondition for making it usable in the inference process. Usually the expert opinion is expressed in giving an evaluation according to nominal scale. Most often used scales consist of 3, 5, 7, 9 and 11 stages, without real limitations.

Generally speaking, evaluations of only one expert shouldn't be accepted as enough to be stored in the knowledge base of an expert system. Of course this does not mean that its reliability is in any kind of a doubt – there are a number of cases, where the view of one specialist in certain area is more trustworthy that the view of the majority of his/her colleagues. However, these cases are more kind of exceptions than a rule. Actually an assessment made by a multitude of experts is more reliable and more trustworthy than one given by only one expert. On the other hand, the aggregation of big amount of evaluations is obligatory in knowledge formalization and it has been issued as a problem for decades. Below we are going to review an approach for summarizing of expert evaluations, submitted in the 1980s by professor Arnold Kaufman from the University 'Stendal' in Grenoble. This approach is based on the theories of fuzzy sets and confidential intervals and it is called 'Expertons Theory' by its author.

Prof. Kaufman examined a case where based on the evaluations of number of experts, an interval of probabilities is found for each level $\alpha \in (0,1)$. It is well known that an interval of probabilities is not a probability. On the other hand, after generalization of experts' views

there might be an aggregated interval of their assessments which later on might be used in calculations of probabilities.

Here is a brief explanation in his method:

1. Each one of the ten experts offers confidential interval (a1, a2) in which it is the assessment, using, for example scale between 1 and 11, where $(a1,a2) \in (0,1)$, a1 could be equal to a2, '0' stands for full disagreement with the statement, '1 is for 'fully agree with the statement'. A response (0.0, 1.0) is generally 'no willing to answer', unlike 0.5 which means 'cannot evaluate'.

2. Next thing that needs to be done is counting of the frequency of different evaluations separately for upper and lower limits of the intervals. Then by dividing them by the number of the experts we can calculate their frequencies.

3. Using these frequencies, find the cumulative frequencies for each level, starting from 1.0 up to 0.00. This set of intervals is called 'experton'.

4. The resulting experton is used to calculate the mathematical expectation. It is obtained by adding the lower and respectively the upper values of different levels in the experton except for level 0 and division of the result to 10. In this way from experton we can receive an interval. This result is aggregated opinion of the experts for the assessed statement.

4. Conclusion

Early warning systems are rising in popularity due to their importance for preventing crises and conflicts. An important tool in a complex early warning system could be a specialized expert system. Its development is possible, justified and appropriate.

It is important for EWES to have the ability to process undetermined semantic data. Reliable way to perform such a task is to use expert evaluations.

Using prof. Kaufman's method allows the knowledge engineer to aggregate the opinion of a multiple experts on undetermined statements and to transform symbol data into more useful numeric data, which could be used in inference engines in expert systems. Given the fact, that the resulting opinion is an interval, additional research could be made in order to facilitate interval processing during the inference process.

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Knowledge Base Structure for Expert System Shell, Using Modified Bayesian Inference“

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Abstract: The paper reviews the basic requirements which can be used to evaluate a problem domain in order to determine if the development of an expert system is possible, justified and appropriate. The criteria system, developed by David Waterman is used in case of an expert system for early warning (EWES)

Keywords: Artificial intelligence, expert system, early warning

1. Preliminary Notes

During a complex research in the last three years the author developed a modified Bayesian method for inference in expert system. It uses interval calculations instead of regular ones and allows easier acquisition of the expert opinions and more reliable aggregation of the opinions of multiple experts, using the ‘Expertons’ theory of A. Kaufman. The essence of the complex method is a subject to another explanation. In this paper we will present only the solutions which were found in regard with the knowledge base structure and main system features.

2. Expert System Features

There are a number of requirements which an expert system should meet in general:

Regarding the content of the database:

1. To allow the creation and storage of list with experts who will be interviewed
2. To allow the composition and storage of questionnaire, which has to be given to the experts.
3. To allow input, processing (using expertons) and storage of expert knowledge in formalized manner (as mathematical expectations of evidence and hypothesis)
4. To allow creation and storage of abstract decision trees which will allow connecting hypothesis with evidences.

Regarding inference engine:

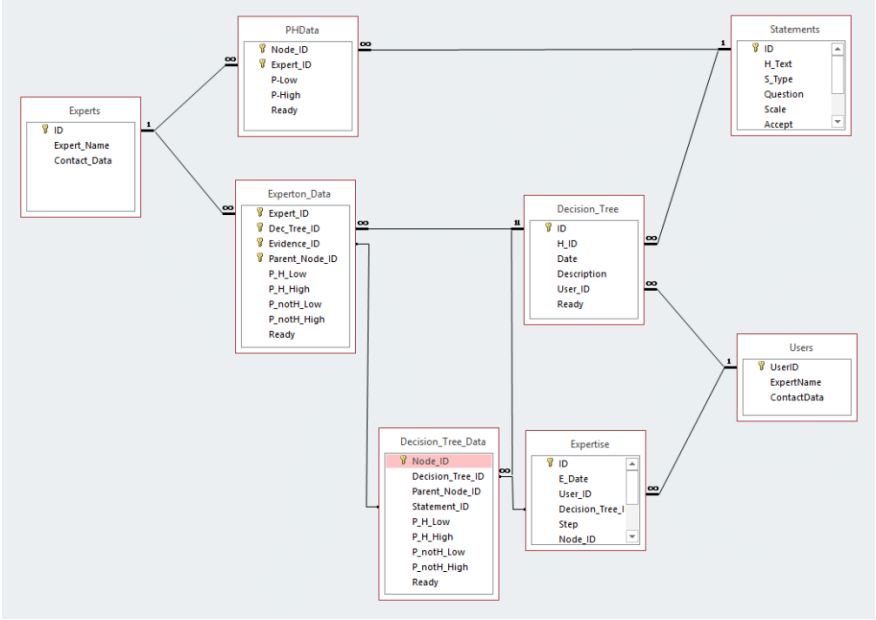
1. To allow creation and storage of interactive expertise sessions
2. To bring out explanation to the users regarding the current expert report
3. To allow evaluating the influence of different evidence about acceptation or rejection of a hypothesis.

3. Knowledge Base Design

Range and function. In order to use the Bayesian inference engine, it is necessary to store information about probabilities of evidences and hypothesis. These probabilities will be stored in the knowledge base as interval evaluation. For each hypothesis or evidence (which

can also be taken as hypothesis) there are also going to be thresholds for acceptation and rejection of the statement. The order of the logical conclusion is being described by using decisions trees. Also, in the knowledge base there is going to be data for different users who use and interact with the system and data for the experts whose evaluations are registered. In order an expert report to be made there is data about it and current values of probabilities that need to be registered, while there are certain questions to the user related to a given evidence.

Table: The resulting database schema is shown on the following figure for illustration purposes only



4. Business logic of the expert system

There are three main business processes implemented in the proposed expert system:

1. Creating and updating the knowledge base.
2. Performing an expertise, leading to accepting or rejecting a hypothesis.
3. Analyzing results from the expertise.

These processes have to be preceded by creating a draft of the expert system. By doing that we need to define all the hypotheses which will be proven and also we need to define as many evidences as possible which could affect the process of finding a solution. The next step is gathering initial data for the selected evidences. Possible sources of that kind of information in the subject area are national statistical institutes, periodical (most common monthly) polls, research, unofficial information from local observers and mass media, expert evaluations, etc. All these activities are out of the scope of the expert system and this is why they are not part of its business logic. However, their accomplishment is necessary premise for further work. It is incorrect to make a decision tree first and counting on gathering the needed information in the process of work. Detailed preliminary projection and adequate estimation of the needed information range give the possibility for working on samples and mistakes to be avoided and achieving higher effectiveness in creating the expert system.

Knowledge base creation algorithm

The sequence used for primary data input in the knowledge base is:

1. Adding hypotheses and evidences – creating and filling table Statements, without entering the probabilities data and the thresholds for accepting/rejecting a hypothesis.
2. Creating decision trees – filling tables Decision_Tree and Decision_Tree_Data, where for a given hypothesis there are the evidences applicable to it.
3. Experts are being interviewed and fields for the probabilities in tables PHData and Experton_Data are being filled.
4. Expertons are being calculated. The results from the calculations are stored in tables Decision_Tree_Data and Statements. When updating the knowledge base there are some features which need to be mentioned as well. They are about the necessity of updating the knowledge base without aggravating its administration. In order to do that we can use flags – fields that give information for the knowledge base and triggers – events that initiate automatic recalculation of the values in fields.

Expertise Algorithm

The order of user actions and system processing while making an expertise is:

1. From table Decision_Tree we choose a hypothesis which is going to be proven by providing evidences.
2. Next, we define according to a recursive algorithm level by level what the intermediate hypotheses are and which evidences need to be used in order to accept or reject those hypotheses. Searching is accomplished by post-order traversal of Decision_Tree_Data, until we get to an element from the lowest level of the decision tree – an evidence which will be used for proving the intermediate hypothesis before the last. This evidence is put in table Expertise as a first one and it is going to be the first for which user‘s valuation will be asked for. Searching continues in width in order the next evidence for the same intermediate hypothesis to be found. When we find such, there is one more search in depth till we find the lowest level possible. Every search in depth ends by inputting data in table Expertise. When there are no more evidences for checking of a certain intermediate hypothesis, the algorithm starts checking next intermediate hypothesis from the same level and the process continues till table Expertise has all the records related to our expertise (ordered logically by the values of field Step).
3. We start working on the logical conclusion by asking the user a question about the first evidence and getting the answer.
4. If the user chooses stopping the expertise instead of answering, in the field Expertise_Status, it appears „process“, the current record is being saved and the expertise discontinued. As a result, the expertise might be started again from the moment it stopped (thank to that record) by asking the user the question related to that evidence.
5. Depending on the degree from the scale about a given question, chosen by the user, we obtain probabilities values from table Decision_Tree_Data. A calculation of a posterior probability of the hypothesis, based on Bayes method is being made Obtained values are stored as current probabilities.
6. These probabilities are checked against the acceptation and rejection thresholds If these thresholds are passed then the expertise ends with the co-responding result. Otherwise it continues until the last evidence is checked.

Expertise Results Analysis

Besides making a conclusion about accepting or rejecting the main hypothesis of a decision tree, an expert system needs to provide tools for analysis of results. In order this to be done whoever makes decisions based on the conclusion from the expertise, need to be informed about the influence of different evidences in the outcome. Therefore, the system displays the following information about process of the expertise:

1. An ordered list of the evidences which adducing led to the biggest alteration of their presumptive probabilities.
2. An ordered list of evidences which adducing led to the smallest alteration of their presumptive probabilities.
3. A list of evidences, which are omitted during the expertise, because of crossing the limit for accepting or rejecting of the main hypothesis. The first two lists consist of the answers of the questions. An important instrument for analyzing is also the possibility for different versions of already made expertise. The system offers the possibility of creating a copy of the expertise and automatically changing of the logical conclusion if there is a change in some of the answers. By another logical conclusion there is a chance for us to discover that after getting to an evidence in flag proven, there is no crossing of any of the limits for accepting or rejecting of the main hypothesis. In this case, the logical conclusion is being made in an ordinary way.

5. Conclusion

The design of an expert system using the modified Bayesian mechanism for inference in expert system was a challenging, yet interesting task. During it and after that, during the implementation a number of solutions was found, allowing smooth work, performing automated tasks and providing the user with useful tools for expertise process analysis.

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The Role of Legal Information Systems in Legal Education

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Abstract: Quality education in various subjects offered to students pursuing law degree requires certain competence in working with information systems that are inextricably linked to the future work of prospective legal experts. The article draws attention to the beneficial effects of the inclusion of legal information systems in the learning process, their practical value and importance for creating proper and modern content for education materials.

Keywords: Legal information systems, information systems, legal education.

1. Introduction

Information systems and technologies play an important role for diversified, timely and fairly comprehensive knowledge of the members of the modern society. The variety of normative acts, as well as administrative and judicial practices made it necessary to introduce information systems for the purpose of information management. Information systems are supposed to facilitate access to the information, to provide timely updates and to systematize practice on certain normative acts. These information systems are conventionally called legal information systems and are either in the form of a software program or a web-based application that provides access to a database of documents, mostly connected to the legal field, but not restricted to it.

2. Importance of legal information systems for theoretical and practical training in legal education.

The existing legal information systems generally include all current and repealed normative acts (published in the Official Section of the State Gazette), EU legislation, all the issues of the State Gazette (both its Official and Unofficial sections), comments from the experts, analysis, legal cases, forms, templates, tax and other calculators, calendars with mandatory deadlines, legal proceedings, as well as legal definitions and law dictionaries.

In the modern society information systems are part of the daily routine of legal practitioners. That includes not only legal information systems, but also other information systems that allow access to the information on certain institutions and their activity, case reports, electronic registers and web addresses of government bodies of the judicial and executive systems.

In general, change is needed not only in the curricula but also in teaching methods to bring studies closer to practice. Some universities offer a course on Legal Informatics for students pursuing law degree. Focusing on the topic and offering performance tasks within the boundaries of only one course is not sufficient given the opportunities information systems and technologies present for the enrichment and diversification of educational content in all legal disciplines.

Legal information systems represent a rich and systematized resource which can be used for different purposes. On the one hand, it can be used for creating and updating of educational materials which provide theoretical training for students pursuing law degree and for presenting and solving practical cases during the seminars.

On the other hand, helping students gain practical skills necessary for work with legal information systems is important for their training as prospective legal experts. This will help eliminate those cases when newly-graduated students with law degree face unfamiliar software which in effect is necessary for their quality work in any field of law.

Practical training within the academic education is the key to its quality. Several studies on the needs of modernization of education programs in legal education and their relevance to practice revealed the lack of training of prospective legal experts to efficiently work with legal information systems as one of the main flaws of the education system.

Research and analysis are adamant that it is necessary to enhance the practical part of education in the training of prospective legal experts. One of the main requirements of the practical training is ability to work with legal information systems. This determines the necessity to include work with these information systems in certain legal disciplines. Moreover, these systems are very useful for the teachers themselves in preparing for classes, both lectures and seminars.

Separation between the field of theory and practice and breaking the link between the two is destructive for quality legal education. Practice should go hand in hand with theory at least for the reason that, for example, practical task on a given case can create lasting knowledge which can be a prerequisite for better information absorption in legal studies.

Legal information systems offer systematization of numerous normative acts, multiple amendments to them and their practical application, as well as important legislation and practice of legislative and judicial bodies of the European Union. The digital format of legal information systems allows quick search, use of hyperlinks, comparison between two versions and many other opportunities thanks to the digital processing of the information. All of the above facilitates both work and studying.

Judicial practice is a rich source of specific cases that can be included in the education process. In this case legal information systems can be of great use for students when they try to solve given cases.

A legal case that was resolved by all courts provides a basis for a practical task, the solution of which is already determined. This allows both for independent analysis and verification of achieved results. The inclusion of role-playing training is becoming increasingly popular method not only as part of the learning process but also as prerequisite for developing professional skills and a chance for students to get into roles they will have to play in their future practice. Legal information systems and resources that they contain can be used for all of the above.

Next, as noted in the Strategy for the effective application of information and communication technologies in education and science of the Republic of Bulgaria (2014-2020), higher education is not a goal but a means of acquiring new knowledge and skills, better social implementation and ultimately, higher quality of life.

In this sense, innovative and modernized system of higher education based on ICT would have a healing effect on the economy as a whole, because it would allow students for more informed choices, more flexible forms of training and higher level of satisfaction from their expectations for quality education and personal development.

For all of that we need required resources and responsible attitude from the government, educational institutions, teachers and students. This is the only way to form

knowledge and skills that meet modern needs of the labour market, to develop certain practical skills and to contribute to greater flexibility and adaptability in the acquisition of specific knowledge to help students pursuing law degree in their studies and prospective legal practice.

3. Conclusion

Development of the information society poses constantly changing and new challenges for education, including legal education. Dynamically changing societal needs that require a change in the number of normative acts, the diversity of jurisprudence and developing information processes in the field of law require more extensive use of information systems in the legal theory and practice.

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Big Data Logical Architecture and Strategy Principles

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Abstract: Big Data appears to describe the next generation of new data sources that will support the next level of information management and analytics penetration in organisations. Big data solutions are very complex and sophisticated to be analyzed and solved. The sheer characteristics of big data generate difficulties to extract information and business insights. Big Data Logical Architecture levels introduce dimensions-based vision that becomes a critical approach for addressing the complexity of big data solutions today. It is impossible to start building a new or revising an existing big data solution without introducing clear and logical structure of the architectural layers and identification of respected components required for a big data project.

Keywords: Business Intelligence, Big Data, Logical Architecture

1. Introduction

The phenomenon Big Data appears to describe the next generation of new data sources that are required for supporting the next level of information management and analytics penetration in business, academia and government. These solutions will radically change the way organizations work and manage their business. The analytics performed by Big Data enables decision-making process to be better informed and even could be very differently transformed from the way it is today. Big Data approach appears because data processing and analytical needs today are not satisfied within the traditional environment. The old way of performing analysis is not effective anymore. Big Data is coming with new requirements for the new data sources and their management in organizations. Additional scale of Big Data necessitates utilize specific processes, tools, and technologies. The need for change to the next level advanced analytics is already there.

Advanced analytics has gained enough experience and figures out large impact on the expanding growth of new and powerful data sources. Each industry today has several new data sources coming online.

Big Data expands dynamically everywhere and requires appropriate measures to be introduced accordingly in order organizations to get competitive advantage. Missing the opportunity to establish Big Data on time will put organizations at risk and cause competitive damages. Organizations should consistently follow identifying, capturing and analyzing the new data sources in order to get the right insights. Analytical processes should be thoroughly changed in order to satisfy the management needs. It is inevitable to invest much time and efforts to incorporate Big Data alongside and future development without Big Data is almost impossible.

The explosion of data is not a new trend. The data growth started in late 1970s. What has changed is the speed of growth of diverse and complex data. The new challenge today requires innovative approaches for improving the analysis and use of information that could support and transform businesses.

Big Data becomes a challenge and strong direction for the IT infrastructure development of all companies' types and sizes. Companies need to introduce new approaches, methods and tools for processing data and intelligently to manage the data to be analyzed in order to get to new insights of organizations' performance.

2. Main Characteristics of Big Data Sources

In order to understand what is the important difference between Big Data and traditional data sources the focus should be put on the main characteristics of Big Data. There are many characteristics typical only for Big Data, but this is not required all of them to be met in every Big Data source.

- Big Data appears to be an entirely new source of data. It is not simply an extended data collection. Many customers execute transactions - banking or retail online. In general, the transactions they fulfill are not different from those they have done traditionally. The difference is that they simply execute the transactions through new channels. In fact capturing browsing behaviours while customers execute transactions create fundamentally new data.

- Big Data is typically automatically generated by a machine. Traditional data sources that are used to be created always require a person to be involved and responsible for the data generation, for example different transaction types – retail, banking, telephone call records, product logistics, invoice payments, etc. All of these data generation processes involve a person who is doing actions being supported by a data record creation. It is not the same with Big Data. Most of Big Data sources are generated without any human intervention at all. For example, a sensor embedded in an engine produces data even if nobody asks for it.

- Most of Big Data sources are not standardized and concretely designed. For example text streams from social media sites. People use their own way of expressing their opinions - users do not follow any standards of grammar, or sentence ordering, or vocabulary. It is very difficult to process and analyze people's posting. In general, traditional data sources were specifically designed to be user-friendly. Systems used to capture transactions, provide data in a clean, formatted templates and as a result, data could be easily loaded and processed. Traditional data sources are very tightly defined. Every bit of data has a high level of value. With the almost negligible cost of storage space today, Big Data sources are not always tightly defined and typically capture everything that could be of use. This is what creates the challenges for Big Data - to cope with messy, junk-filled data when processing and analyzing it.

Big data is a new philosophy that supports organizations in gathering, storing, managing, and manipulating huge amounts of data at the right speed, at the right time, to gain the right insights.

Perhaps the term sounds and could be connected to the amount of data, but this should not be the only focus. The term Big Data refers to the technology and includes processes and tools.

The traditional data management ways could not deliver a solution how knowledge could be extracted from so much information in so many different forms. It appeared obvious to introduce new approaches and technologies in order to manage data differently and this is the opportunity, and on the other hand, the challenge of Big Data.

3. Big Data Logical Architecture Levels

Big Data Logical Architecture levels introduce dimensions-based vision that becomes a critical approach for addressing the complexity of big data solutions today. It is impossible

to start building a new or revising an existing big data solution without introducing clear and logical structure of the architectural layers and identification of respected components required for a big data project.

Structuring and describing the architectural levels outline the main components that should be elaborated for a big data solution including data acquisition from various data sources, processing the analysis required, deriving new insights to the business processes, resources, and consumers. The purpose for defining the layers of logical big data architecture is to exhaustively present and organize all the components that should perform specific functions (Figure 1).

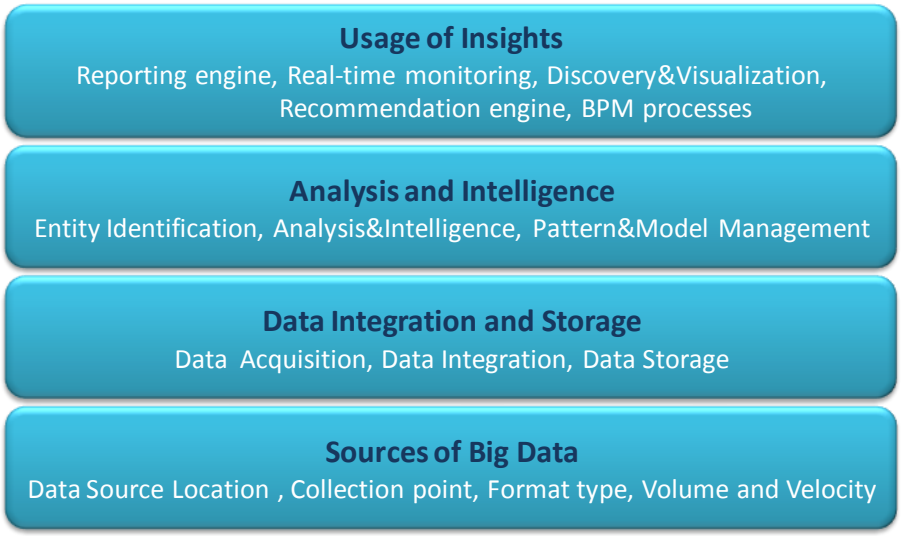

Fig. 1. Levels of Big Data Logical Architecture

A principle big data logical architecture comprises the following layers - Sources of Big data; Data Integration and Storage; Analysis and Intelligence; Usage of Insights.

- *Sources of Big data:* At this level all the data that will be required for analysis and intelligence should be described and all the channels transmitting the data should be considered. The main difficulty at this point is to match all the requested analysis with adequate data and respected sources. The data comes from different sources - Enterprise legacy systems, Data management systems, Data stores, Smart devices, Aggregated data providers, Automated sources, etc. The data dimensions that should be taken into account are:
    - *Data Source Location* — In general the Data sources are internal and external for the enterprise. Special attention should be paid to the data with limited-access in order according measures to be taken to get it for the requested analysis.
    - *Collection point*— Description of the way data is collected - directly or with the support of data providers, in real time or in batch mode. Enterprises today are approaching the possibility to receive the data from primary sources or to build relations with reliable secondary sources.
    - *Format type* — The main data format types are Structured, Complex Structured, Semi-Structured, and Unstructured.

- *Volume and Velocity*— The volume and speed of data creation and arrival varies for different data sources.

- *Data Integration and Storage**:*** The main objective of this layer is to acquire data from different data sources and to transform it in a form suitable for integration, collaboration and further analysis. Coming data could vary in formats, sizes, frequencies, channels. Because of that the components of Data Integration and Storage layer should be capable to cope with all different data aspects:
  - *Data Acquisition* — In order to acquire data from various data sources, this component should be very intelligently constructed in order to adequately cope with incoming data. A mechanism for determining the specific transforming procedures for each single data should be introduced.
  - *Data Integration* — This component is responsible for integrating the data in the format required by the purpose of further analysis and intelligence. Implementation of transformation logic and/or complex algorithms to convert source data is needed. The requested data format should be defined and appropriate transformation mechanisms should be introduced. The main challenges are still caused by unstructured data formats.
  - *Data Storage* — This component is responsible for storing the data. There are multiple data storage options available that should be selected for this component - structured data sources, distributed file storage, NoSQL, cloud storage, etc.

- *Analysis & Intelligence layer:* The main objective of this layer is to run analyses on the data that is organized and stored by the Data Integration and Storage layer. The design of this layer requires very careful business planning and visioning. The main results of this layer should supports the decisions making processes by – Locating the right data, Identifying advanced algorithms and tools for analysis, Performing the appropriate analysis and intelligence, Deriving clear insights from the data. This layer becomes very important for supporting the delivery of business insights:
  - *Entity Identification* — This component is responsible for identification of the requested contextual entities. Such a sophisticated task requires establishment of optimal high-performance processes in order to ensure access to the right entities into the required format.
  - *Analysis & Intelligence* — This component derives insights from the data by applying different analytical algorithms for performing analysis and intelligence. The component consists of various workflows, algorithms, and tools for supporting parallel processing.
  - *Pattern & Model Management* — The main purpose of this component is to maintain various patterns and models for verifying and validating the analytical results. On the other hand, this component considers continuous patterns and models training for assuring their accurateness. The feedback given by this component is very important for further development of Entity Identification and Analysis & Intelligence functionalities.

- *Usage of Insights**:*** This layer relies on the quality results and business insights received from Analysis & Intelligence layer. In order to support understanding the obtained results this layer should maintain tools and instruments for better visualization of the outcomes. The main receivers and consumers of the results could be internal and external - applications, business processes, services, employees, customers, suppliers, competitors, etc. This layer provides internal users with instruments to find and understand the information needed. There are encompassed

appropriate tools for building reports and dashboards, for designing business strategies, for improving operational effectiveness, for alerting real-time business performance based on generated indicators:

- *Reporting engine* — This component brings all the necessary reporting tools for - scheduled reports, self-queries, Ad-hoc queries, analysis to be elaborated by taking the insights delivered from Analysis & Intelligence layer.
- *Real-time monitoring* — Alerts are generated using the Analysis & Intelligence layer outcomes and sent to the users and devices. Key performance indicators should be appropriately defined and monitored accordingly in order to improve operational effectiveness based on the comparison with the insights generated. Information in real time should be available to the users through varied sources and delivered on varied devices.
- *Discovery&Visualization* —The varying in content and format data could be combined from different sources for visualization. This functionality supports enterprises in combining content from their managements systems and data warehouses with content from social origin within a single interface.
- *Recommendation engine* — This engine processes in real time the available information and produces dynamic and relevant, personalized recommendations to respected users.
- *BPM processes* — The insights from the Analysis & Intelligence layer could be used by BPEL processes, APIs, or other business processes in order to ensure further business value through automation of functions for improving applications, processes and users performance.

Figuring out the levels of a logical big data architecture help the various components of a big data solution to be defined and organized.

Developers need to follow the approach of architectural layers in order to successfully categorize the functions that should be included in a big data project and based on that to design the organization of software solutions that would fulfill the respected functions. Business users also need the approach of architectural layers to better derive insights from big data, because it is helpful to them to think in terms of big data scope, access, processing, storage and ways to use big data and always keeping in mind the picture of the whole organization..

4. Big Data Strategy Principles

In order to approach correctly building the Big Data Strategy, organizations first should well understand what Big Data is and the architecture for developing it. If they miss to start with this for their particular organization, defining the strategy would become impossible. The main purpose of understanding Big Data and requirements for its architecture is to support the management considering the importance of such a project for the organization. In many cases Big Data is wrongly simplified to an IT solution only, probably because of the fact that the final results are implementation of hardware and software to fulfill the strategy.

After figuring out what exactly Big Data is for the organization and what are the architectural levels, the second becomes the need to identify how a Big Data strategy would benefit the organization. The last but not least at all, and probably the most difficult would

become the challenge how to implement the developed Big Data strategy. Many organizations consider the third step to be the hardest one. Therefore, the responsibility of the management board to define the scope and priorities within the Big Data strategy becomes critical and most important.

In practice could be identified two main approaches for developing Big Data strategy - technology-centric/bottom-up and business-centric/bottom-down.

Considering the importance of a big picture business view doesn't mean that technology-centric/bottom-up approach to big data strategy would not work. In many business cases executives could not understand the potentiality of a technology until they are presented concrete solutions. But we should be well aware that a pilot Big Data project in a business context is different from implementing a Hadoop cluster and waiting for the business to start using the solution for their objectives.

On the other hand, with business-centric approach, could emerge risks that pilot projects would be established in isolation, addressing a specific business issue, and missing to introduce the wider business and technology context into consideration. The result in this case becomes a very limited application silo.

Whichever approach would be taken to start with, the final result should be a well developed and structured, with a strong consideration of the role of both business priorities and IT solutions, Big Data strategy.

The Big Data strategy is guiding an alignment across the various business stakeholders and IT, on the other hand it also becomes a measuring tool against which technology decisions can be made. The strategy helps managers to prioritize the business objectives and technology requirements by selecting them according to the ability to support the targeted business strategy, key business initiatives, critical success factors, and key tasks.

Big Data strategy is mapping the business initiatives with respect to the desired goals = what the business developments should achieve, how the success should be measured. The objectives should be explicitly stated and then IT solutions would be appropriately selected and built, and business stakeholders would be satisfied with the insights received.

There are always multiple objectives to be considered in Big Data strategy – optimization of processes, optimization of resources, optimization of investments, etc. and not to forget about technology investments. So, the effective strategy provides a process to ensure that technology investments support what is important for the business. The main principles that should be followed when building a Big Data strategy are:

- Identifying the key performance indicators that would be the desired achievements of the business initiatives.
- Identifying the business metrics and dimensions for analyzing the fulfillment of the business initiatives.
- Identifying the key decisions required to support the critical success factors.
- Identifying the supporting data sources, measures, dimensional attributes, updating frequency, storage location and access methods.
- It is essential to make the most of the accessed data - identifying the approaches for how data is captured, processed, and used to support decision-making with valuable insights.

It is important not to forget that IT is in the role of supporter for achieving the strategy defined by the organization. This strategy could approach - increasing customer satisfaction, increasing revenue, improving the operational efficiency, etc. The way to achieve such strategies today is only to encompass the business strategy within the frame of Big Data strategy.

5. Conclusion

Organizations should accordingly reflect on the new requirements related to the business processes design and modeling for meeting the need to introduce analytics for all the aspects of management.

Organizations should start devoting additional efforts today for understanding the characteristics of Big Data in general, and to figure out the specific dimensions of their own environment. They should reconsider the whole data generation, collection, analysis and use processes. Each big data source has different characteristics, including the veracity, value, variety, variability, velocity, volume of the data. Processing and storing Big Data require many approaches, tasks and components to be considered. Building a logical Big Data architecture is an important starting point for developing an appropriate Big Data solution. While figuring out the levels of Big Data architecture it is critical the Big Data strategy principles to be taken into consideration.

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Technical Criteria for Evaluation of Business Software Systems Integration

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Abstract: Existing and practically integration approaches and techniques can be compared from both operational/technical and management/business aspect. This paper proposes a set of technical criteria for assessment of software integration approaches. These criteria cover the operative, technological and architectural characteristics of an integration solution, as well as its implementation specifics. *Measurement indicators* for each criterion are also proposed. If all criteria are applied together, they can be used to compare and/or choose the right integration approach from technical and operative point of view.

Keywords: Business software, Integration, Technical criteria. Integration approaches and techniques

1. Introduction

In order to research the opportunities to define a common integration approach, we need a criteria system to help us evaluate and compare the exiting and practically adopted integration approaches.

Integration approaches and techniques can be compared from both operational/technical and management/business aspect.

Technical criteria cover the operative, technological and architectural characteristics of an integration solution, as well as its implementation specifics.

2. Coupling and Shared Knowledge

One of the most important aspects of exposing of the functionality of an information system for external usage is its impact on coupling and shared knowledge between systems in the integration environment. Integrating systems on business logic level is based on sharing functionality, which naturally leads to higher level of coupling (Trowbridge D., 2004) (Stevens, et al., 1974). The main types of coupling we can observe in an integration environment are as follows:

Time coupling – this type of coupling is related to the timing of remote functionality calls. If remote calls are synchronous, the calling system should wait for the remote one to complete the request and if this call is asynchronous it can continue its operations. Generally, asynchronous calls offer lower level of time coupling.

Type system and data model coupling – when two systems are interoperable, they should have common type system, which is increases the level of coupling. Sharing knowledge about data models also makes coupling tighter.

Run-time dependencies – if a system's module is trying to consume remote functionality during its execution and it can not access the remote modules on which it is dependent *(a run-time dependencies)*, there will be a functionality outage. In this context, the

executables of stand-alone but integrated systems has some level of run-time coupling between each other.

Other types of coupling – usually, in an integration solution we can observe also semantic, implementation, performance, life-cycle, etc. types of coupling (Stovell, 2011).

Based on this information we can conclude that it is possible to compare integration solutions based on synchronous to asynchronous calls ratio, the number of data types and entities which systems share knowledge about and the number of unexpected functionality outages caused by run-time dependencies.

3. Maintainability and extensibility

Modern organizations are operating in highly dynamic and fast changing business environment which leads to constant change in information systems' business requirements and growth in business operations scale. One of the most aspects of a contemporary information technology is its abilities to react to change. They can be divided in two main groups – scalability and extensibility:

Scalability - the ability of the integration solution to react to growth in operations scale. Increased load can be observed due to different reasons – addition of new systems to the integration environment or increased number of users, which increases the number of messages transmitted, or increased data volume in the repositories, which will affect messages payload. Scalability is affected by number of machines and compute resources which are serving the integration solution, clusterization abilities, etc.

Extensibility - the ease of addition of new systems and functionality changes in the integration solution. Adding of new functionality to the environment is not always easy, since it is related to new data models and formats, data transformations, adding new integration adapters, etc.

In this regard, we can note that integration solutions scalability can be compared by the number of messages which can be transmitted by the environment and the number of systems which the environment can serve. On the other hand, the extensibility can be measured by the average effort for adding a new system or service to the environment (in man-days) and by the number pre-implemented integration adapters included in the solution.

4. Transparency

Integration solutions are usually deployed in large organizations, which makes them operate in an environment of a lot of different execution platforms, networks, geographical locations, cross firewalls, etc. In this context we have to take into account the so called transparency as one of the main technical criteria for evaluating of an integration solution.

Transparency of an integration solution is related to the differences in complexity, performance, technology and implementation between local and remote functionality calls. An integration solution is more transparent when it is harder to distinguish remote from local calls. Transparency has two main components:

Machine Boundaries – every crossing of a software, hardware, network or geographical boundary – software system, hardware machine, network segment, firewall, etc. If definitions of local and remote interfaces are more similar, the crossing of machine boundaries.

Platform compatibility – corporate information systems and infrastructure has very large scale, so the environment in which an integration solution operates is highly heterogeneous – different systems are using different platforms, hardware, operating systems, etc. To be compatible with all of them the integration solution should be compatible

with a large number of protocols and should use open standards and widely adopted protocols.

Based on these data we can conclude that integration approaches can be compared by transparency through difference in local and remote functionality calls, the number of protocols supported by the solution and the number of open and adopted standards.

5. Message passing

One of the key motors of almost every integration solution is the business driven need for message passing and functionality sharing between remote systems. In this context, the message passing abilities are an important criterion for comparison of integration solutions. There are to main components of message passing:

Style – the two most common message passing styles, used in most of modern integration approaches are the document style (or message-oriented style) and the RPC style (remote procedure call style) (Trowbridge D., 2004). The document style usually consists of messages with a payload in XML, JSON on another standardized format. In this case the message content can be freely agreed between the two parties. In the RPC style, the messages contain a remote call with a method or procedure identifier and parameters, again in a standard format. The problem in this case is the difference in the type systems of the two parties. In this context, usually the document style

Message Exchange Patterns – the so called MEPs are describing the time aspect of a message passing, which can be synchronous (blocking) or asynchronous (non-blocking). Popular MEPs are the so called "request-response", "publish-subscribe", etc. Important aspect is that both models of message passing should be supported by the integration solution, since business problems are diverse and flexibility in message timing will be required.

Based on this information, we can conclude that we can compare the message passing abilities of an integration solution by the number and type of the supported message passing styles and the number of message exchange patterns.

6. Abstraction Level

An important element of an integration solution is its abstraction, which is related to its applicability and the level of generalization of the approach to integration problems. In this context we can cover two main points:

Topology – this is a logical abstraction which covers the communication and configuration characteristics of an integration environment – type of communication channels, strategy of message passing, data transfer mediator agents, number and type of integration adapters and interfaces, etc. Usually integration approaches that use a central mediation agent (broker, bus, etc.) and those who has higher number of pre-implemented adapters are more applicable, while the ones with more direct connection between systems have better performance but are less applicable.

Abstraction Level – this is the architectural complexity and the level of pre-implemented functionality and integration services of the integration solution. Usually approaches with more pre-implemented functionality and services and higher level of abstraction are more widely applicable, but with not that good performance, while approaches with less pre-implemented functions are performing better, but are applicable in more specific cases.

Based on this information we can conclude that it is possible to compare integration solutions through the existence of central mediators, number of pre-implemented adapters,

reliability of communication channels and the level of pre-implemented integration functionality and services.

7. Exception Handling

As it is well known, one of the most important problems in software engineering is exception handling, since normal use cases sometimes lead to exceptional situations which can be handled gracefully by the system and related side effect like user experience degradation, data loss and corruption, etc. should be prevented. Same problems are applicable for integration middleware – execution of integration business logic can lead to an exception, which should be handled transparently for end users. In this context, exception handling is one of the main aspects of integration approaches comparison. Important points in exception handling in an integration solution are as follows:

Transparency and independence of exception handling – this includes both transparency of the exception handling from end user's perspective and its independence from stand-alone systems. In case an exception is thrown in integration business logic, the best scenario is to be handled independently by the integration solution, without passing to the calling system. The more exceptions are handled independently, the better the integration services are.

Exception type transformation – in any case some part of the exceptions will have to be transmitted to the calling system for further handling. In such cases the exception information should be transmitted in a known type system for the receiver – either a common exception type system for the whole integration environment (which is known to all systems) or in the type system of the receiving party.

Based on this information we can conclude that it is possible to compare integration solutions through the percentage of independently handled exception and the percentage of exceptions passed in a known type system. Logging and tracing abilities can be additional indicator.

8. Source code characteristics

Integration environment specifics have impact on those parts of stand-alone systems source code which are related with remote functionality calls. One of the main challenges in integration solutions development is securing technological comfort and simplicity of implementation. In this context, it is highly important to compare integration solutions through their main environment connection source code characteristics:

Flow and decision control, cyclomatic complexity – it is obvious that if a large part of the integration functionality is implemented in the integration solution modules then the number of decisions in stand-alone systems remote calls code will be lower and the flow will be more simple. The integration solution offers better code characteristic if the decision number is lower and the code of the stand-alone systems is more linear. The same characteristics can be measured with the cyclomatic complexity of McCabe which cover the number of linear independent paths the graph of flow control (McCabe, 1976) (N.E. Fenton, 1999) (Serebrenik, 2011).

Complexity and depth of inheritance hierarchy – this is one of the main characteristics of source code and is universal object-oriented code metric in the industry, so it is needed to include it in the comparison criteria. If a system is consuming another system's functionality, knowledge about remote types will be needed, so integration will add some number of additional classes and inheritance levels. We can say, that an in integration

environment which leads to adding a lower number of classes and inheritance levels is easier to be used and have simpler and better source code characteristics.

Based on this information we can conclude that it is possible to compare integration solutions through the number of decisions and branches in code, the level of cyclomatic complexity of source code and the number of classes and inheritance levels added for integration.

9. Conclusion

This paper proposed a set of technical and operative criteria for assessment of software integration approaches. If all criteria are applied together, they can be used to compare and/or choose the right integration approach from technological and architectural point of view. A comparison of approaches based on this criteria can be used for either a classification of integration approaches or defining new integration methods.

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Migration Policy of the European Union and the Member States and the Risks to Economic and Security

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Abstract: The European Union is first in trade in the world, accounting for 16.5% of global exports and imports, which supports the growth of development. Free trade between EU members is one of the founding principles of the Union, which is committed to the liberalization of the world economy. The migration wave that crossed the external borders of the EU challenges the security and economy of the European Union and the one of each Member State. The lack of a common European migration policy allow any foreigner to request refugee status, which mobilized a wave of economic migrants who do not meet the requirements of the Refugee Convention of 1951 and Protocol.

Keywords: refugees, migrants, migration policy, security, economic development resettlement.

The lack of signals to ceasefire conflicts in the East and the process of smooth admission of migrants in the union activated hundreds of thousands of residents of the southern continents to move towards Europe for economic reasons. EU has become a magnet and reliable harbor for the migration wave in search of survival and better life, which is difficult to predict what rates will reach even by the end of 2015.

Bulgaria, Malta, Italy, Greece and Cyprus are members of the European Union undergoing migration wave since 2011, which gained unexpected dimensions in 2012 and 2013, reached the daily invasion outside regulated places for crossing state borders in 2014 to escalation the problem of illegal migrants in 2015. Last year Hungary joined this group of countries, pressed by people arriving from Macedonia and Serbia. These are the countries which are most often criticized by human rights groups for their attitude towards refugees. The big problem still has not been fully studied for its impact on international law and the functioning of the Schengen system to establish with certainty where the root of discrimination and who may benefit from legal asylum system.

Everyone has the right to hope and action to secure a better and secure life, but it must be generally accepted and according to the legal rules and not for reasons beyond those which are defined and regulated, because there will be anarchy and unrest will endangering national security and economic opportunities of the Member States and the EU as a whole.

The right to asylum is sacred and inviolable, but cannot be taken only by few countries. ***"Before Europe has two ways,*** says the Interior Minister of Italy - Angelino Alfano *or to come here and to raise EU flag over operation "Mare Nostrum", or after you define the status of migrants and make sure they have the right to protection and want to go to other countries, just to let them go."* The refugee problem remains topical and since there is no uniform policy for application every year migrants extend their attacks to invade countries not only in Malta, Italy and Greece directly but in Turkey through Bulgaria and Hungary through Macedonia and Serbia in 2015.

European leaders agreed to triple to 9 million Euros a month to fund operations for patrolling the maritime borders of the EU. More ships, aircrafts and equipment to rescue people in distress in the Mediterranean. On the other hand *"The EU will explore ways to seek and destroy vessels that may be used by human traffickers,"* said European Council President Donald Tusk. Delayed reaction after years in which thousands of people have died in the Mediterranean waters.

The idea of the distribution of quota principle was praised by UN Secretary General Ban Ki-moon. At the same time, however, he was very skeptical about the plans for the destruction of boats of the Libyan smugglers of people, which European Union is preparing to do. This comes as an irrefutable proof of the lack of a unified international policy against organized crime in relation to care and the cost of human life against the lack of expertise and willingness to look for cardinal and correct decisions established after extensive research and analysis, which effectively supports the deepening of the problems until it escalate. Opinions and decisions take advantage that are in close institutional and administrative interest, which creates conditions for each country differently and in its own discretion to seek protection of its sovereignty, security, identity and national interests, and this is detrimental to the unity and the principles of Schengen area.

While waiting for the EU to deal with smugglers in the Mediterranean, the migration flow change the direction of the way for entry into the European Union. Road which is not less risky and subject to a number of unforeseen difficulties and obstacles during its long transition blackmailed again by the traffickers and hailed as undesirable by the countries of Europe.

The first signs of the coming wave of migration to the European Union emerge as early as in 2011. These primary signals remain uncaptured by the security services at both the national level and the central level of the European Union. With the increase of migrants entering the EU countries in 2012 and especially in 2013 increasingly began to visibly stand out different views and opinions of the Member States of the Union. Delineated the boundaries of two significant conflicting opinion trends:

1. the countries directly affected by the wave of migration that have an obligation to allow and accept migrants to establish their identity, to register them in the European EURODAC system to accommodate them and take care to integrate and socialize, which forms the Group of States subjected to - **primary migration pressure** and

2. Member, which later under pressure from the wave of migration to find a better life and work realization, the so-called group of countries undergoing - **secondary migration pressure.**

From 2014 and 2015 increasingly the two categories of countries more clearly express their concern by the daily increase of the refugee wave. It's basically in the last five years to shift its position and views differed often leading to accusations relating to the application of refugee law. Heads of Member States increasingly find it difficult to unite solutions that are acceptable to both categories divisions - primary migration pressure on the secondary. Europe is not out of the refugee pressure, and migration of peoples from several continents to the European Union and more specifically to a few economically powerful countries. This poses a threat to security on the continent, economy and identity, which exacerbates relations and reactions of the first leaders of the parties.

1. The argument for the migrants along the common border between France and Italy continues to be complicated. In June 2015 France requested Italy to establish a system for the selection of migrants on its territory if it wants to get solidarity from its European partners to take on the famous count asylum seekers. According to French Interior Minister *"We support solidarity, but not solidarity without responsibility. If there is no responsibility, Schengen*

will be in danger and finally there is a risk for no solidarity at all. "The position of France is that responsibility means to design a system that allows differentiation of migrants who have asylum in Europe from the **illegal economic immigrants, whose return should be organized** in Italy by creating centers for identification and registration of new arrivals. The selection, according to Interior Minister of France, is a prerequisite for harnessing the wave of migration among those eligible for asylum and those to be returned. With this position, France is trying to solve a crisis in Italy similar to that of 2011, triggered by the government of Silvio Berlusconi to launch on French territory the migrants who arrived in Italy without controlling them, prompting France to strengthen border control at Ventimiglia acting with the same power and control to the present. The camping migrants mainly from Sudan and Eritrea near Ventimiglia are not allowed by the French border police to enter their territory. For these reasons, the Italian interior minister has said that what is happening in Ventimiglia is a *"punch in the face of Europe"* blocking the Franco-Italian border. For its part, France states that the country complies with European rules providing registered migrants in Italy to be returned there.

The facts described above of the different positions and opinions between the two powerful countries like France and Italy is undeniable proof of the proper division of countries according to their geographical distribution of primary and secondary migration pressure.

2. The German Chancellor Angela Merkel highlights the problem of refugees from the Middle East, Africa and Asia in the EU and defines the current situation as "*completely unacceptable"* to public television ZNG of 17 August *2015. "The issue of hundreds of thousands of migrants seeking refuge with us will be the next great European project, which will show whether we are really capable of taking joint action. "*[1] Noble words but must be followed by real action.

Convinced by the need to develop uniform rules for the reception of refugees, she calls on Member States to agree on drafting **a list of countries whose** citizens are not threatened by violence and mass persecution because they must give priority to the people of the countries in war zones such as Syria, Iraq and Afghanistan and asylum applications from their nationals to be treated as quickly as possible, and the rest to be returned to their homeland.

In recent months, the summer of 2015, Germany was split on the issue of migrants. The president acknowledged that there is still *"dark side of Germany", referring to the more frequent* xenophobic attacks against migrants Protesters against refugee centers often develop into clashes with police and arson attacks against refugee centers from far-right groups that Merkel called *"shameful" and "lower". "Let's be clear. There will be no tolerance for those who question the dignity of others. And the more people make it clear the stronger we will be."* [2]

3. Cyprus is the country that deliberately shuns refugees. In July 2015, more than 100 000 migrants risk their lives trying to reach Europe. Fifty thousand of them were rescued by boats and small fishing boats on the Greek islands near the Turkish coast. Syria's main port, Latakia is about 110 miles from Ayia Napa, but Syrian refugees prefer to travel by land through Turkey, followed by a brief but painful sometimes deadly boat trip to Kos. This distance is four times bigger. Kos was literally flooded by Syrian refugees and none preferred to go to Cyprus, which is the closest country to the EU. A year ago, in September 2014, 339 Syrian refugees are abandoned off the coast of Cyprus after having paid eight thousand dollars per person to reach the shores of Italy. [3] The reasons to refuse staying in Cyprus is that the country is not part of the Schengen area and to leave the island must have a travel document that is difficult to obtain by Cypriot institutions. Bulgaria is not part of the

Schengen area, but unlike the Cyprus travel documents can be issued more easily. In Cyprus, refugees believe they have no chance to find work and integrate, which is why they avoid its territory for salvation.

4. The Greek newspaper "Kathimerini" on August 26, 2015 wrote that the head of state of Greece, President Prokopis Pavlopoulos wants immediate summit of EU, to discuss migration and refugee problems and appeal to all his colleagues from the European Union the need for a European policy in line with the principles and values of the EU and solve the humanitarian problem defined as *"explosive scale that acquire ever increasing flow of immigrants and refugees arriving daily in Greece"*

Wave of migration to Greece comes mainly from the Greek island of Kos. Throughout the years, however, it led to major changes in the routes of refugees to Europe - currently the largest burden in their adoption falls mainly to Greece and Italy. The change in routes and the countries of origin from which come most refugees depends on the new outbreaks of violence and conflicts. The beginning of the war in Syria has significantly increased the number of asylum seekers. The crisis Greece is experiencing at the moment was foretold - the increasing number of refugees is not surprising really, but to keep the refugee flow the country needs proper infrastructure, which Greece says it does not have.

The situation on the Greek island of Kos is dramatic and terrifying, but the Greek state for years is neither able nor willing to establish a functioning system for reception of refugees, regardless of the offered cash aid from Brussels. The same applies to Italy, but to a lesser extent, which registers a considerably smaller number of candidates for asylum from the real arrivals in reality. Most of the refugees prefer to go on their way north. The Mediterranean Southern European countries constantly complain that it is unfair for them to bear the brunt, but this argument contradicts the agreement of Dublin, which the EU failed to foresee.

According to Health Minister Panagiotis Kurublis refugee *wave "threatens to obliterate them as a country and must use all available means and efforts at European level to convince their partners, that this is not just a problem of Greece."* The opinion of the Minister does not differ from that of Greek President Prokopis Pavlopulis, which calls for an emergency meeting of EU leaders on which to discuss the refugee crisis. *"It*

5. Czech Republic is one of the countries who believe that migrants should be returned to the country from which they entered. In early September 2015 law enforcement caused a scandal with registration numbers on the skin of the hands of detained migrants in trains, a measure that allows them to identify families and their large number of children. The police justified their actions as a preventive measure by the loss of children and information about train travel and the country of origin, so they can be returned in the event of readmission under the Dublin Regulation. From a public consultation in 2015 among 1040 citizens, 93% of the Czech population considered the actions of the police as proper and necessary.

According to the League for Human Rights in the Czech Republic *"No law allows to mark people that way."* In Eastern Europe, this procedure inevitably reminiscent of the way the Nazis have identified inmates, although the refugees are accepting the marking quietly confident that it is in their interest because they have no identity documents.

Czechs are afraid of the unknown and 70 percent of them said they were against the arrival of people from Syria and North Africa. Czechs, Slovaks and Hungarians want to consolidate the ***"refusal front"*** against the European refugee quotas. Several Western officials, including German Chancellor Angela Merkel and French Foreign Minister Laurent Fabius recently criticized the Eastern European countries that are reluctant to engage in efforts for the adoption of migrants.

Czech Republic wants to help refugees on the basis of independent decisions of his government and not through mechanisms set by the European Union that do not defend the principles of *"common sense"*. According to the arrangement of Dublin, the Czech Republic returned migrants in their home countries, if they don't submit ***preliminary application*** for asylum- argument which deserves attention as procedure and from legal point of view.

6. Small part of Polish society is xenophobic and since the anti-Semitism is no longer politically correct, the phobia from the Arab countries takes his place. Polish negative emotions can be summarized as: *"no money, no place," "terrorist threat", "Poland is too poor," "Islam brings violence", "Polish society must preserve its homogeneity " "multicultural model does not work "" migrants take away jobs from Poles "or" Poland should take only Ukrainian refugees.* "Although the public mood, the problem with the refugees is accepted with a growing understanding by the locals according to the Polish Prime Minister Ms Ewa Kopacz and the country is ready to increase the number of refugees who will accept.

The latter argument was even used by the new conservative Polish President Andrzej Duda although major political parties stand more or less behind public opinion fears that the EU cannot cope with the immigrant wave. The situation in Libya and Syria was established by the EU and political circles are of the opinion that Poland, which has no colonial past, is not at all responsible for the refugee wave. *"It is right that Member States has to decide how many refugees are able to accept."* Poland tries to get a permanent allocation, citing the paragraphs of the Lisbon Treaty for *'emergency'*, which concerns only Italy and Greece. It offers to accommodate 40,000 refugees deserving protection who ended up in these two countries only in 2014, which should be regarded as a ***"minimum of solidarity"*** within the EU, for each EU country which came under exceptional migratory pressure.

7. Slovakia is also generally hostile to the acceptance of migrants. Polls show that Slovaks are not interested at all in this problem. Prime Minister Robert Fico, categorically stated that *"Bratislava will never agree with the admission quotas of migrants in the* EU". Against quotas are announced also Britain, Finland and Poland. Bulgaria is for equitable distribution of the refugee flow and sharing the responsibility.

Slovakia's foreign minister accused the EU for the refugee crisis: "The EU alone is to blame for the crisis of refugees involved in the civil war in Syria, the country's opposition against President Bashar Assad. EU countries create their own reasons for refugee wave, which all must seek a solution. Slovakia is ready to offer material and personnel assistance to improve border security of the EU but does not accept the EU to allocate quotas for admission of migrants from other countries. The escalation of refugees is a threat to the Schengen decomposition. Today tens of thousands of people are walking around here and no one to check them. So do we have a Schengen or not? *"" The European Union is actively involved in the events in Syria. There are countries that send weapons there and train Syrian opposition. In a sense, we assist the civil war in Syria, and that push the fleeing immigrants in Europe ".*

8. Latvia would agree easier to open its doors if half of the refugees which need to enter the country come from Ukraine, whose aggressor threatens also the Baltic countries. Estonians and Latvians have witnessed mass migrations, who failed to turn them into minorities in their own countries. But this heritage is reflected in their emotional positions.

9. While refugees were not a problem for Hungary, the country maintained a radically different politics than that which supports now when the refugee wave rushed headlong into their territory and provoke fighting between refugees and the special forces and the use of

tear gas to scatter them. Actions that many countries of the EU doesn`t afford the same conditions so far.

Hungarian authorities closed the international railway station in the capital Budapest for hundreds of migrants attempting to board a train to Austria and Germany. Some of them have paid hundreds of Euros for the tickets, but the police did not allow trains to leave. According to Austrian police 3650 refugees arrived by train from Budapest to Vienna, which is a record for one day. About 400 migrants arrived by train from Budapest to Munich, Southwest Germany and more so in Salzburg, Austria in just one day. According to the Hungarian police thousands of migrants embarked from "Keleti" train to Austria and Germany, just a few days in late August and early September 2015.

The main appeal of EU immigrants should be: **"Please do not** come", said Hungarian Prime Minister Viktor Orban during a press conference in Brussels. *"We must send a clear message to the refugees, saying:" Do not come, do not cross the border, because it is dangerous. "This is the only fair and moral position. You have to tell them to stay in Turkey to remain in Serbia because these are safe countries, free from the war."* [4]

Europe's population is frightened by the inability of European leaders to deal with the migration crisis and ensure its effective settlement, because the refugee crisis is a problem of Germany, not Europe. The words of the Hungarian Prime Minister Orban quite surprised politicians in Brussels, where the entire political conversation is built on the need to adopt a maximum number of refugees in the European Union.

Austrian Interior Minister Johanna Mikal-Leitner made clear that Austria will continue to carry out random checks at its borders, but will not introduce border controls and asked Germany to clarify its position on EU rules on asylum to not be given false hopes of refugees in Hungary. German Chancellor remains firm on its position: *"that any failure to reply to a migrant crisis will put into question the very ideals of the European Union."*

Hungary is another country that build barbed wire fence on its 175 km long border of height of 4 meters with neighboring Serbia against the wave of refugees. This is confirmation that the decision for extension of the fence between Bulgaria and Turkey is a good foresight and action. The goal is not to close borders but to direct people to the official border crossing points (BCPs) and to prevent human trafficking and illegal crossing of the state border, which has been declared a crime by all EU countries. The Hungarian army with the help of hundreds of workers in the state program for temporary employment frantically finished the fence even if there are different opinions about its effectiveness and guarantees to stop and prevent its passage. The project is among the priorities of the government in Budapest, but it can be a weak barrier to foreigners willing to pay more than 100 Euros per person just to learn where the weak points in the fence are.

Since the beginning of 2015 to the end of August in Hungary arrived over 140,000 refugees. If this trend continues until the end of the year will arrive in the country at least 250-300000 people. There is not a question of refugees, but for Migration, which could threaten European values and way of life. The Hungarian government cannot just solve this global problem, but is obliged to protect national sovereignty and state borders, as well as to fight against the crime of "trafficking", which has become a European illegal trafficking network that takes continuous victims who paid high price hoping to cross the border and reach the desired location.

Serbian-Hungarian border is the front door for the Kosovar refugees to the European Union. For most Kosovars Hungary is only a transit country but discontent against them grows, fueled by a government campaign against migration. The neighboring Serbian town of Subotica has become a hub for refugees from Kosovo. The mayor of the neighboring Hungarian border town Asotalom - Laszlo Torochkay estimated that for a day in Hungary

has arrived 3,000 refugees from Kosovo. "The situation is intolerable. Whole families have arrived with small children. There are already dead from the cold. The refugees worried locals knocking on the doors of houses, light fires and scattered debris," said the mayor.

The government in Budapest deliberates a decision to build a second wall on the Hungarian-Serbian border. Hungary has so far received funds of EUR 61.5 mln. in aid to resolve the immigration crisis that is insignificant amount compared to the amounts that have received Greece, Italy and Spain - at 450-500 mln. Euros. In 2014, 43 000 migrants have applied for asylum. Approved applications are barely 500 people. In 2012, there were 2,200 applications for asylum. Since the beginning of 2015 the Hungarian authorities have registered about 25 000 illegal migrants, of which 13,000 have applied for asylum.

Hungary is strongly opposed to the proposed EU system of quotas for asylum seekers, said the head of the office of Prime Minister Viktor Orban on Tuesday and Wednesday.

10. France. Difficulties of achieving a single European position and policy provoked a row between Paris and Budapest, which is the reason for the construction of a wall along the Hungarian border with Serbia. According to the position of Foreign Minister of France *"... number of European countries do not accept contingents distribution of refugees, which is outrageous ... Hungary does not respect the common values of Europe as rises fence along the border with Serbia ... which should remove ... and the EU should discuss seriously and strictly the issue with the Hungarian leaders.* "Hungary countered with a statement *that" Instead of making shocking and unfounded statements, it is better to concentrate on looking for common solutions for Europe ".*

After the terrorist attacks in January in Paris, the Hungarian prime minister said that *"economic migration to Europe brings no benefits, only grief and risks. Therefore we must stop migration. We do not want one of us to have a significant minority of people who are different to our culture. I want to preserve Hungary for Hungarians.* "This position would be shared by each country undergoing primary migratory pressures and collect more and more supporters and citizens of the countries subjected to secondary migration pressure.

The EU should explore the depth and expert costs and benefits to the parties and the threats to their national security and that of the Union as a whole and soberly reconsider its position and actions. It would be a huge mistake to do it after major terrorist act in one of the Member States, after giving countless innocent victims for the European Union to acknowledge the situation and to preserve the regulations of the Schengen Code.

11. Austria. Following the statements of the Government of Hungary that their system for asylum is most crowded among the EU countries on the amount of illegal migration and for technical reasons, has the capacity to process more asylum applications, and expressed the opinion that *"the situation requires rapid action, which require the country to act beyond the decisions of the EU* "Austria immediately criticized the Hungarian *position:" Whoever wants Europe without borders continue to exist, must comply with the Schengen rules. This, of course, presupposes adherence to Dublin. "*

Austria is the main country affected by refugee wave coming from Hungary and its position fully meets the interests of the countries subjected to secondary migration pressure. "The EU countries that refuse to accept more refugees should not receive financial assistance under the European programs." This urged the Interior Minister of Austria, Johanna Mikal-Leitner live on German television ZDF.

The statement came on the day Vienna has tightened strong control on its eastern borders through massive checks, causing huge traffic jams in neighboring Hungary, with the excuse that the country has taken action after previous week were found 71 dead refugees in an abandoned truck, traveling from Hungary. Verification period will be indefinite for each border crossing point and beyond, and all cars that could have places to hide people.

Ministry of Interior of Austria considers that the checks are not a violation of the Schengen agreement on free movement and aim to ensure traffic safety, security of passengers and the fight against gangs for trafficking. The results are 5 smugglers and 200 migrants in just one week. Austrian police continued to tighten their measures and apply different methods for disposal of entrant's refugees. From massive and comprehensive checks to refuse checks and allow refugees arriving from Hungary to continue their journey to the desired state. [5]

12. In the present Estonia was not ready to accept refugees from Africa quotas. Existing infrastructure does not allow Estonia to adopt the additional amount refugees "according to Interior Minister Hanno Pevkur.

13. The Spanish Minister of Foreign Affairs Jose Manuel Garcia Margalyo Marfan said that the government does not agree with the proposed system. According to him, Spain has applied *"a lot more effort than other countries' admissions of immigrants and refugees*. Thanks to the migration policy of the Spanish Government, according to Marfa, *"Immigration in Spain through countries such as Mauritania, Senegal and Morocco significantly reduced ... We believe that we must counteract this problem, it is a common European problem, problem for all. We never refuse cooperation, but it must be given what is already done, the burden that we bear proportionally in much higher degree than other countries. "*

14. For small island of Malta it is very difficult to cope with the large influx of people. Most Africans headed for Europe in the Mediterranean and reach the European country where treatment of illegal refugees is considered particularly severely by the Member States. These statements and assertions stop when is actually felt the reality of the huge problem and more restrictive measures are applied to curb refugee flow in their countries.

European Union has doubled its annual aid for emergency for Italy to 50 million, Greece and Malta which need to cope with the mass influx of migrants from the Mediterranean Sea. The funds can be used for reception centers for migrants, medical assistance or additional staff resources as part of the general fund of the EU migration and asylum. The measures come after the tragedy, when a ship turns over and 800 migrants die in the Mediterranean, headed by Libya. [6]

Malta is not the only country, as it is determined by the beginning of 2015, which examines each migrant who arrive illegally and without documents to clarify their identity and right of asylum. Malta with its 370,000 inhabitants and limited territory deal alone with the problems of refugees. The adoption of the 2000 refugees in Malta amounts to 400 000 refugees accepted from Germany according to the Maltese Parliament in 2011, and today it is a fact that the EU failed to provide and to take timely and adequate measures.

15. Bulgaria, Malta, Greece, Italy and Spain are the countries that suffered the most serious pressure from refugee waves. Naturally Bulgaria is not in the situation in which Greece and Italy are therefore not eligible to be activated art.78 of the Treaty for refugees of the Third Countries. But it should not forget the shock situation in 2012, when literally within two months of the Bulgarian territory stepped over 10,000 illegal migrants.

For these reasons, these countries must be taken outside this' Annex № 1 and № 2 "of the EC, which sets quotas for all Member States. Our country must request "special status" and not participate in the administration of allowances for new refugees from other Member States in which they now reside in the next two years. Bulgaria must ask a second level of protection which is still not legally regulated. Bulgarian government failed to protect this position and Bulgaria was included in the European scheme for relocation and resettlement. Bulgaria will insist on changing the Dublin Agreement.

At the end of July 2015 the Board of Home Affairs in Brussels, the Member States agreed to find places for distribution of 32 256 people (this figure has been repeatedly amended to increase to 40 thousand and then reduced to 20 thousand people) who are seeking protection. Bulgaria will adopt 500 immigrants in the next two years,. This is about 33% fewer people than expected initial allocation information to the month of August 2015.

According to the State Agency for Refugees (SAR) more than twice as many people try to cross the border in the first months of this year compared to the same period in 2014. In recent months, from June to August nearly 200 immigrants a week were trying to cross the Bulgarian territory. Over 3600 people, which is nearly four times more than the first half of 2014, are trying to leave the country, mainly in the border with Serbia, shows the statistics of the Ministry. Bulgaria does not remain unaffected and from participants from the channels of commerce of migrants who again revealed other EU countries. Taxi drivers also become traffickers transporting refugees from the Turkish border to Sofia and from there to the Serbian border, where they continued their way through Serbia and Austria to Germany. [7]

Balkans are now center network in Europe for trafficking. So far, the focus of attention on the escalating crisis with migration in Europe was aimed at people who take the risk to cross the Mediterranean from North Africa and has left tens of thousands crossing the Western Balkans, relatively unnoticed, unregistered and unrecorded statistics from these countries.

Bulgarian traffickers assist refugees by boat across the Danube to Western Europe, imitating the pattern of drugs, which earn billions.

16. Macedonia and Serbia. Since the wars in the former Yugoslavia in the Balkans there was no such asylum and immigration wave. According to Austrian Foreign Minister Sebastian Kurz situation *"is dramatic"* and criticized Greece which did not apply the requirements of the EU to meet and register immigrants, but simply to transfer them to land and directs them to the border with Macedonia. It is expected entrants immigrants in Serbia to focus to Bulgaria.

In early September 2015 through the Macedonian-Serbian border have gone over 8,000 refugees and economic migrants en route to Germany and Northern Europe, where large Syrian, Afghan and Iraqi communities exist. After processing their documents in the southern town of Preshevo they continue northwest to Subotica in Vojvodina. Serbian authorities are organized in the processing of the documents, but the border with Hungary established a cluster of thousands of migrants. From 19 June to 30 August 2015 in Macedonia were registered 51 300 foreign nationals, including 35 400 men, 7000 women and 7960 children with their parents and 898 abandoned children. The largest number of illegal migrants from Syria - about 41 000 Afghans and Iraqis are 2,500 while Pakistanis - 1500. Macedonia has received more migrants from Palestine, Somalia, Bangladesh, Congo, Nigeria, Cameroon, Eritrea and Ethiopia. The distance from the Serbian-Macedonian border to the other side of the country at the Serbian-Hungarian is 500 km, which is less than what we have come from Syria-Turkey-Greece-Macedonia. The ultimate goal is usually Germany. After the expiry of 72 hours migrants should leave Serbia or apply for asylum in the country or return back along the routes in Macedonia. This is where foreigners from Syria, Iraq, Pakistan, and Afghanistan receive documents which ensure 72-hour stay in Serbia.

In practice, the state has opened its border. People come on foot or by bus from Mirovats - village 10 km from Presevo. They receive documents remain for about twenty-four hours in the center and then again take on the road to Belgrade and then to Hungary - the first country in the Schengen area on their way. In the last two months of July and August of 2015, according to information of BGNES across the border with Greece officially passed

nearly 25,000 migrants, while in Serbia there are about 70,000 refugees expected to reach the countries of the EU.

Greece, organized by trains and buses transport thousands of immigrants from the Middle East to the very border with the Republic of Macedonia. Situation in the Macedonian town of Gevgelija is unpredictable and this requires the commencement of construction of a second station platform. Only in two months though the border point Gevgelija arrived over 44,000 people from neighboring Greece. Macedonian security forces used noise grenades and tear gas to disperse dozens of migrants who try to cross the border with Greece on foot. This situation forced the authorities in Skopje to establish a special body - Coordination Center, in addition to coordinate work between different state institutions must also offer very fast analysis and solutions to resolve the situation. Foreign Minister Nikola Popovski said that in the last few days there has been a sharp increase in the number of migrants - in 3000 - 3500 people daily, which necessitated the country to strengthen the control of the border because it does not have the resources to accept all new coming refugees which in turn creates a stampede on the border with Greece. [8] In fact starts working principle of the transfer of the hot potato and its return back, but how long this maneuver will last without taking casualties?

Transport of immigrants to the EU together with human trafficking and labor exploitation is now more profitable than arms trafficking and the drug trade, according to the European agency for border protection (FRONTEX). For example, the network operated by Eritreans route from Eritrea to Libya through Sudan and then to Europe. Once you get to Libya, migrants board the boats, threatened with weapons in case they request to quit because of the poor condition of the vessels or realizing the enormous risks of the journey. Another channel is through Ghana, Burkina Faso and Nigeria. [9]

Wealthy Syrians pay exorbitant sums to secure direct charter flights from Turkey to Germany or Sweden. The transfer becomes easy and most safe for life and health, but the amounts exceed 100,000 dollars. Criminal boom in the internet is so fast, that Europe has already created a special investigative department of Europol to monitor online. So far, the department has followed mainly related to terrorist activity on social networks, but recently expanded its activities on smuggling. National enforcement bodies have difficulties to meet the pace of migrant influx, as the old criminal networks turning to new areas of business.

EU regional policy, as a program that aims to improve the economic status of certain regions in the Union provided one-third of the entire budget of the Union or around 347 billion Euros coming from the European Regional Development Fund (ERDF) European Social Fund (ESF) and the Cohesion Fund ((CF), in line with the strategy "Europe 2020".

The financing of this program is to achieve a reduction of economic disparities by transferring resources from richer to poorer regions, while fostering economic integration, which is **an instrument of financial** solidarity. The objectives are to achieve the full potential of each area, to improve competitiveness and employment more quickly, to raise the living standards of the countries which joined European Union in 2004 and 2007.

With the increase of the migratory pressures and ongoing financial needs to tackle the problem, which instead of decreasing increases, the regional policy made way to the refugee policy. It is about hundreds of thousands of citizens of Asian and African countries who undertake dangerous journeys to reach the desired European countries through Turkey, Greece, Bulgaria, Macedonia, Serbia and Hungary believing that the transition will be easier, cheaper and more secure than in Libya and Italy. Within this huge stream of migrants it is highly likely to have people who embrace the ideas of the radical Islam, he possibilities are there, but the likelihood of identifying them is very small. All this increases the risk to the national security of the states and the European Union- issue that is not yet considered by the

Commission with the necessary sharpness and concern, but the threat is real, probably a matter of time.

It should not be forgotten the historical truth that migration flows have always been a key factor in the creation, formation and sometimes the collapse of the great empires or countries. On current data the EU has a population of 380 million, of which over 20 million are foreigners, representing 5% of the total EU population, of course, without taking into account the refugee wave from 2011 up to date.

The European Commission recognizes that we are facing the worst wave of refugees after the Second World War. Since the beginning of August 2015 the European Commission approved a 2.4 billion. euros which will be allocated to 2020 to finance activities such as the construction of protective structures improving the capacity of the supervisory bodies and the integration of refugees in countries affected by the crisis. Greece will receive 473 mln. euros from the package. Bulgaria will receive funds for 72 mln. euros. These millions can financially help the Member States but will not solve the migratory pressures and their security, which requires a uniform migration policy of the European Union.

Conclusion: Despite the fact that numerous meetings of Ministers of the Interior and the Government were held, the Member States still find it difficult to consolidate to a common opinion, which threatens the national security of Member States, their economies for support and integration of the migrants and the Schengen system of European Union.

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Mapping of Morphometric Indicators in Small Drainage Basin and Flooding Risk Assessment

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Abstract: Physiographic conditions for occurrence of river floods and inundation in small watersheds of southwestern Bulgaria on the example of Aidarovska River, a left affluent of Struma River, are considered. The morphometric parameters of the drainage basin are calculated based on GIS. The presented own data show that this type of processes are widely spread and often accompanied by debris flows.

Keywords: catchment area, morphometric parameters, GIS, Struma River valley

1. Introduction

High river discharge, torrent rains and floods are distinguish features of the hydrological regime of the rivers in Bulgaria. The main reasons of occurrence of which are the substantial spatial and timely fluctuations of the rainfall as well as the morphometric features of river drainage basin (river pattern, inclination and exposure) also the geology setting, soils and vegetation.

As a result of the flash flood events a various geomorphological elements are formed and modified for example- alluvial and alluvial-proluvial sediments and fans, slumps and landslides, river bed migration, erosion and soil destruction. In the mountainous areas of the country which predominantly occupy around 70% of the country's territory the water bodies substantially increase it's cinematic energy because of the increase amount of sediments (mud, sand and different size pebbles and cobbles), that are transported by the flow. These types of events are known as mud flows or debris flows and are distinguish element of the flash floods observed in South-West Bulgaria.

The tributaries along mid Struma river valley are often subject of flash floods with typical mud or debris flow features, as result of which, a considerable changes in the river valley morphology are observed as example, cut and widening of the river channel along the flood plain and deposition of big amounts of sediments often in shape of alluvial-proluvial fans. These events are subject of numerous researches by many Bulgarian scholars that worked in the field of hydrology and geomorphology. First Glovnya [1] describes the significant damages caused by the catastrophic flood that occurred along Blagoevgradska Bistritsa river in July 1954. This catastrophic flash flood was observed along the main river as well as along the right river tributaries especially in the Kovatchitsa river valley, where during the abnormal rain storm a high discharge of water, loaded with huge amount of sediments was observed. As a result of this debris flow an alluvial fan, with significant dimensions was formed in the main river valley. This alluvial fan bented the main river and caused the flash flood down the river valley [2]. Kenderova et al., 2013, 2014 [2, 3], Vasilev, 1997 [4] analyzing the main reasons of debris flows with high frequency of occurrence in the area of Zheleznitsa threshold of Struma river. Dobrev 1994 [5], Dobrev , Georgieva, 2010 [6] worked on the natural hazards in the area of Simitli kettle. A comprehensive analyze

about the reasons, accumulation forms and the hazards that are associated with the debris flows was made by Gerdjikov et al., 2012 [7]. The abnormal rain, floods and the errosinal processes associated with them, were subject of investigation by [8] and [9]. According the last, over 2000 catchment areas in Bulgaria are associated with flash flood character of the river discharge. [10] also worked on debris flows around Struma river drainage basin.

Relief inclination, deforested slopes and substantial amount of weathered material along the mid Struma river valley, are main reasons for high river discharges as well as debris flows frequent observations. Particularly high risk profile holds the small Struma river tributaries valleys, with dip cut and steep slopes covered with thick layer of weather materials in the area of Kresna and Zheleznitsa threshold.

During the last years increased numbers of flash floods and debris flows are detected.

This hazardous events wear a high risk at the places where it interact, with different types of technical infrastructure as the pan European road E-79, as well as some populated areas in the area including few Blagoevgrad city neighborhoods.

Risk management processes require large amounts of spatial data [11], including different thematic maps, statistical information and expert knowledge. Geographic Information System (GIS) had been used extensively in all phases of risk processes - prediction, identification,response, mitigation, and recovery [12, 13], 14]. The strength of GIS is in its ability to integrate diverse amounts of data, spatial analysis, visualization [15].

2. Object and methods

The purpose of this research is based on the morphometric data of Aidarovska river catchment area (left tributary of Struma river) as well as an evaluation of geology setting, soil and vegetation cover, the level of risk of flash floods and debris flow occurrence to be determined. In this study GIS is used to determine the morphometric characteristics of the relief and the impact of natural components (rocks, soils and vegetation) and human activity on the risk of flooding. An integrated database that can be used for decision-making in natural phenomena with risk character is obtained.

The object of this enquiry is Aidarovska river, which is left tributary of Struma river (Figure 1, Figure 2). The river has a drainage basin developed in the South- West foot hill of Rila mountain, South of Blagoevgrad kettle. The springs of the river are situated westwards of Yurukdzhamia top (1184 m and after it Aidarovska river flows to SW, then to NW and after a new turn to SW near to the beginning of Zheleznitsa threshold the river goes into the Struma river. The catchment area is irregular in shape with length of the East-West axes more than 10 km., with average wide of 2.6 km and maximum 4 km. The drainage basin covers an area of 26,24 sq.km the highest point is 1180 m and lowest is 320 m. With average above sea level altitude of 704 m (Figure 1).

Morphometric data of the catchment area were determined and based on existing topo maps with scale of 1:50000 and ArcGIS software a spatial database is created. As a result digital model of the relief in the catchment area, with cell size 30 by 30 m is created. The area, average altitude exposure, minimum, maximum and average inclination and length of the catchment area are calculated. By using 2d and 3d relief models in Google Earth, areas of accumulation and erosion also different types of slopes and alluvium-prolovium fans are determined. Stream order (Strahler, 1952) of the river including temporary creeks and coulees are defined and also the water discharge data are collected. During field observations, river canal, morphosculpture forms and the associated sediments as well as the stage of vegetation cover are described and also inquisitions with local inhabitant about past floods and GPS measurements of key points around the catchment area are conducted.

With Google Earth the change of the Vegetation cover between 1982 and 2012 was

analyzed and an attempt for interpretation of numerous objects as modern areas of accumulation, changes in the river canals, gullies, rocky slopes and slopes covered with thick layer of weathered material are made.

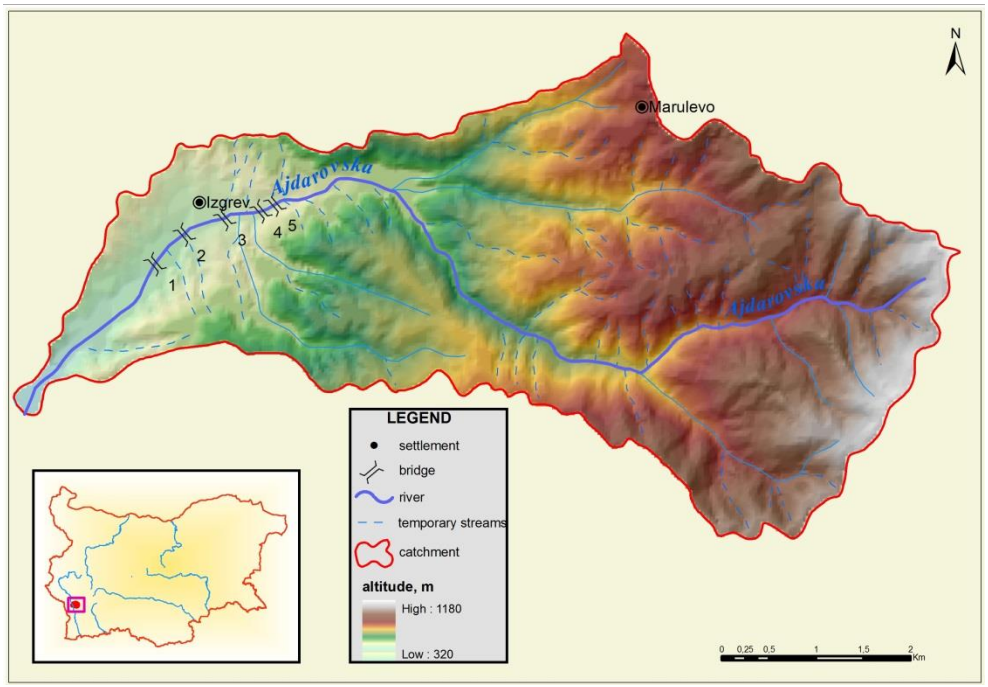

Fig. 1. General geographic map

Fig. 2. General overview of Aidarovska river.

Fig. 3. Longitudinal fossil lobe deferred debris flows

3. Results and discussion

The valley bottom of the main river has complex morphology, with well distinguished cut up to 5m of the river canal in the river flood plain well observed up and down the river valley (Figure 4a, 4b).

In the area of Izgrev village the valley bottom is wide open, with low inclination around 4º, occupied by vast river terrace, covered with agricultural lands. Predominantly the civil and technical infrastructure, are situated along the right shore above the high water level. This valley widening, is controlled by the geology setting in the area mainly soft, easily erodible clays, sandstones and conglomerates with late Neogene age.

Fig. 4 a,b. Flood palin and river canal of Aidarovska river.

In the upper part of the river, a different morphology of the valley bottom is observed. Alternation of valley narrowings (2-3m) and widenings (30 m) separated by rock steps is typical for this part of the river, at the same time this is connected with change in the longitudinal profile of the river, with alternation of steep and flat areas. In the places where the inclination of the river canal is smaller, a perfect condition for deposition of sediments occur and as a result substantial amount of sediments mainly pebbles, cobles, and sands are deposited. Fossilized Traces of past debris flows in the shape of big pebbles up to 1 m in diameter and fossil side levee (Figure 3), that cover the ancient flood plain are also observed.

Above Izgerv neighborhood, the river canal is artificially narrow by huge depo for industrial waste with hight of 8-10 m above the canal and inclination of the slope up to 60º. This represent a real danger during a high river discharge a disintegration of the depo slope to occur and potential bent of the river to be formed, which can have disastrous consequences for the nearby village down the river. (Figure 4b)

Valley slopes are steep, with average inclination of 15-20º and length between 300-500 m up to 1000 m. They posses positive profile with maximum inclination in the lower parts, which can be used as a evidence of active, modern and positive tectonic activity in the area. The maximum slope inclination is between 28-30º and up to 30 и 40º, which can be observed in the upper part of the river valley and along the right valley slope above Izgrev village. The water divide ridges are flatten with small inclination up to 8º and have a typical morphology of block dislocated slope steps, that gently rising up to 1000 m. (Figure 1, Figure 5).

Geology setting of the area is monotonous mainly Precambrian metamorphic rock complex of Maleshevska group – Biotite and Biotite, Mica Gneiss and Amphibolies around the mid and north part of the catchment area and Chetirska Amphibole formation in the South part of the area. Both are extremely weathered and fracked and are subject of substantial, erosional activity which is the reason of wide spread gully network to be

presented around the NE part of the drainage basin. Along the South river divide ridge, a small bodies of ultra, basic and metamorphic Serpentinite rocks are presented. Along the lower part of the river around Izgrev village a Neogene sediments as clays, sandstones and alevrolites of Dzhermanska formation, are well presented. The last are covered by the pebbles, cobles and sands of Barakovska formation [16, 17]. These two formation are easily erodible and are important factor for debris flows genesis.

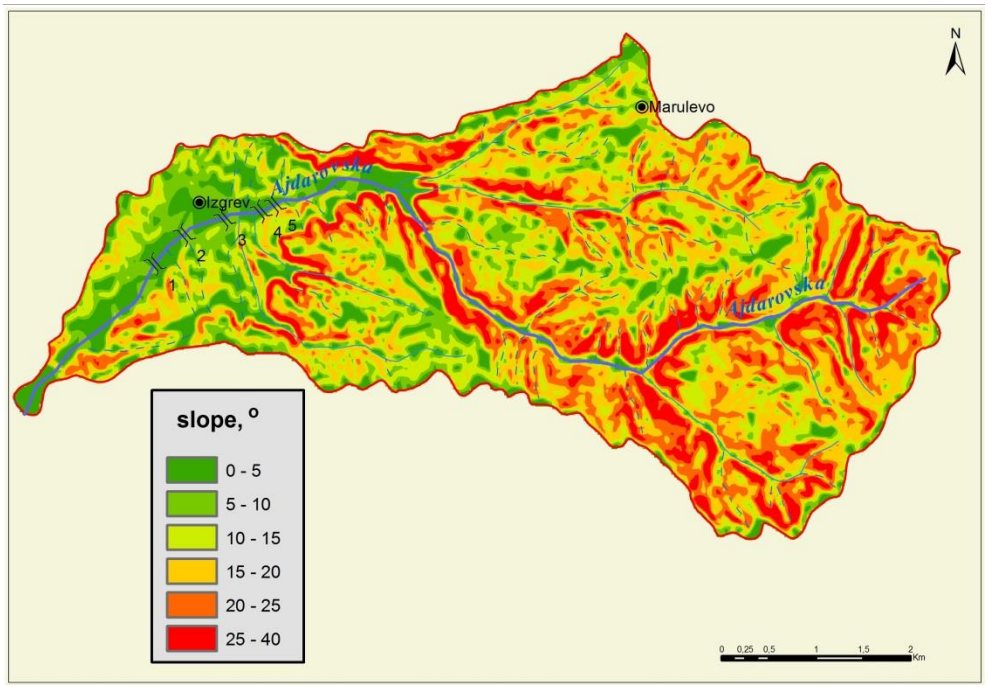

Fig. 5. Map with slopes inclination rates.

Morphometric of the catchment area.

According digital model of the terrain, morphometries of the drainage basin are determined (Table 1)

Average alt.,m	Max. altitude, m	Min. altitude, m	length of main river, km	Average slope, degrees	Max slope, degrees	Horizontal segmentation km/km^2	Horizontal segmentation, km/km^2 (with temporary creeks)	Relief of the catchment area Hb	Index of Melton, R	Hypsometry Hi
704,09	1180	320	11,92	15,15	40,74	1,20	2,56	860	0,17	0,45

Using Gerdjikov's methodology [7] few indicators, that evaluate the possibility of debris flow occurrence in the catchment area were determined and are listed bellow.

- Hb – relief of the catchment area, defined as relative altitude calculated as ratio between the highest and the lowest point of the drainage basin in meters;

- Melton's index – R.

$R = \frac{Hb}{\sqrt{Ab}}$, where Hb is the relief of the catchment area, Ab is the area of it. This index, gives information, about the slopes inclination and connected this, with the possibility of flash floods and the stage of erosion. When the index is greater than 0.5 a real danger of debris flows appearance persist [7].

- Index of hypsometry *Hi*.

$Hi = \frac{Hav - Hmin}{Hmax - Hmin}$,

where *Hav is the average height , Hmax, Hmin* are the maximal and minimal height of the catchment area. As it was stated by [7], when the index is greater than 0.6 there is real chances of debris flows occurrence.

Soil cover is important element, that has a great influence over the level of river discharge. Soil cover is aquifer that holds substantial amounts of water and has anti erosional functions. Shallow chromic cambisols (CMx, FAO, 1988) are observed in the area. Over the steep slopes, this soil is cover with sporadic low stem forest vegetation with low aquifer functions, which is positive significant erosional activity to be observed.

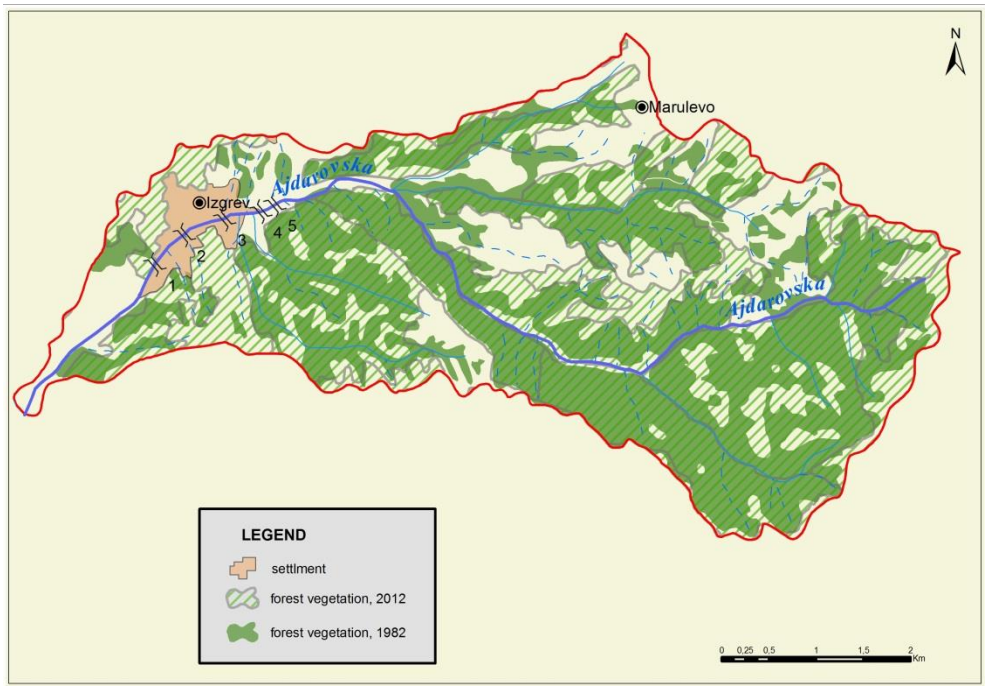

Fig. 6. Changes in the areas covered by forests 1982-2012.

The vegetation cover around the drainage basin is strongly influence by the human activity the population in the area and the agricultural activity in the area. In the catchment area two villages Marulevo(43 inhabitants) and Izgrev (576 inhabitants) are situated [18].

The area has been populated since centuries as the first accounts are from XVIII th century, when 25 house are counted in Marulevo village [19]. Since then until XIX century, it was constantly on the rise to reach 14 neighborhoods and 850 inhabitants in 1947. After that it started decreasing slowly mainly due to migration towards nearby villages and Blagoevgrad city. The local inhabitants, were mainly occupied in stocking and some agricultural activities as growing of corn, rye, oats and Tabaco. Because of this substantial agricultural activity, the natural forests were limited to sporadic low stem forest of oak, hornbeam and etc, preserved in the upper part of the catchment area. Erosion are intense and the high river discharge, are often observed. After 1960 the population of the area rapidly decreased and the area was subject of artificial forestation mainly with *Pinus nigra*. According the topo maps whit scale M 1:50000 (1982) and Corine Land Cover (2012) the percentage of the catchment area covered by forests rise from 50.4 % (1982) to 63.9% in 2012. This is the main reason of decreasing rate of erosion observed around the area (Figure 6.).

High level of risk for the growing population of Izgrev village, represent the waste depo situated in the valley of the main river above the fore mention village (Figure 4b).

4. Conclusion

As average, annually along Struma river catchment area 5 to 7 floods like, high discharges of water are observed [10]. According data collected by the State Basin Directorate between 2000 and 2010, 99 floods occur along Struma river valley and 83 of which, can be described as significant [20]. Flash floods are typical not only along the main river but also along its tributaries. The Geomorphological and geological settings helped by soil and vegetation factors, around some small catchment areas are extremely positive for development of high river discharge with typical morphology of debris flow. This is the reason, big numbers of debris flows to be observed around small river basins in South West Bulgaria.

Acknowledgment

The authors express their gratitude to the Bulgarian National Science Fund for the partial financial support under the Grant № DFNI-I02/15 from 12.12.2014, titled "Information System for Integrated Risk Assessment from Natural Disasters".

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The Bulgarian Experience in the Automatized Usage of the Crisis Management Lessons Learned

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Abstract. The authors present some issues related to lessons learned database development while researching different aspects. The aim is to facilitate effective and efficient Lessons Learned Information System for utilizing in the area of security and defense and for improving education and training processes of Bulgarian Armed Forces for successful participation in Crisis Management and other operations The history of Bulgarian contribution in developing Partnership for Peace lessons learned system is also presented.

Keywords. Lessons learned information system, database, Partnership for Peace, Crisis Management

1. Introduction

The issue of collecting lessons learned has its own tradition in the historical development of the Bulgarian army. In scientific reports lessons learned are considered to be an important factor in developing the Bulgarian Army. What is interesting is that the research of lessons learned in historical perspective shows that understanding lessons learned is developing the whole history of the Bulgarian army.

Earlier in the historical sources the lessons were not considered as a whole information system. Furthermore, there was no automatized processing. They had been collected good examples, practices and approaches from national and foreign experience. In reference to different sources for lessons learned (national and from other countries), they are collected with relation to: from the wars in regional and world scope; from different international, ethnical and religious military conflicts at the end of XX century. Lessons also have been collected in reference to developing military politics and doctrines, training and education of military personnel; command and control structures; different forms of military collaboration; improvement of organizational structure of Armed Forces and Ministry of Defense; logistics, education, legislation, armament, military administration, military statistics, developing documents as field manuals, guidance, regulations, instructions etc.

2. Lessons Learned Data Base

Lesson learned is a technique, procedure, or practical workaround that enabled a task to be accomplished to standard based on an identified deficiency or shortcoming [1] Nowadays in our information century lessons are considered as a part of a whole information system. The lessons learned should be considered as a process, which has to be automated using an information system as a tool.

Bulgaria made her own efforts in creating Lessons Learned Data Base (LLDB).

Local Database in Interoperability Department

In order to keep track of the process of fulfilling the Partnership goals, Lessons Learned information database has been developed. It concerns appropriate education and experience to working together with NATO/WEU (Western European Union) officers in Multinational and Crisis Management operations.

Local Database in the Interoperability Department was created in 1999 by the team of experts and scientists from the Defence Advance Research Institute (former scientific research institute of the General staff) and was maintained as the Local Database in Interoperability Department at Rakovski Defence and Staff College**.** Database as an information system is defined as the mechanism which provides the means of storing, generating and distributing information for the purpose of supporting the operations and management functions of an organization. It is important to distinguish the term "Database" , which is a collection of data from "Database System", all the components of which cooperate to collect, manipulate, manage and deliver information from different queries.

By maintaining LLDB is possible to collect, analyze, and disseminate lessons learned. It also serves as a feedback mechanism of the PfP experience in NATO-led education, training, exercises, and operations. Its High-level timing goals were to contribute for development of the PfP Consortium Lessons Learned System.

Bulgarian LLDB maintained two different aspects of data related to participation of Bulgarian armed forces officers and experts in Partnership for Peace activities on the one hand and data concerning qualification of the Personnel on the other hand, that includes collecting and managing data about STANAG 6001 testing sessions and test results and tracking process of improvement of English language skills by deriving different type of queries, reports from Database and making analysis of determine period.

The purposes that database carried out were:

- To assist staff in their daily work.
- To ensure information about the personnel trained in Interoperability Department and participation of the personnel in PfP activities.
- To provide sufficient part of the data including Language proficiency according to STANAG 6001 Test results; results from courses held in Interoperability Department, Lessons Learned reports etc.
- To support the way for making decisions**.**

Documents in the database are of a structured type at the point when we try to do something with them: to enter, process and save the data. Data Base System maintains information in order to develop various enquiries and reports about:

✦Active duties at different levels and positions in Real operations led by UN/ NATO/EU, Command Post Exercises (CPX)/CAX and Participation in Multinational operations.

✦ Appropriate education and experience to work together with NATO officers.

🕮 English language skills qualification:

✍ 1. STANAG 6001 Test and Computer skills results,

✍ 2. Training and education (including variety of Staff courses, Language courses, College Study courses etc.),

Some examples of reports that are result from specific quires are about:

- STANAG 6001 results – Listening, Reading, Speaking, Writing, Date of Exam;
- List of officers and civilians who attended language courses abroad;
- List of officers graduated from General Staff Colleges abroad;
- List of officers graduated from defense academies in partner NATO countries.

Lessons Learned derived from database in Interoperability Department related to participation of personnel of Bulgarian Armed Forces in wide range variety of activities on PfP program as:

- joint exercises and planning conferences;
- inspections and visits;
- workshops and working groups;
- International seminars, workshops and courses.

Research reports based on **unstructured** data as briefings, articles, newsletters and initial impression reports are also saved in the database.

In its first prototype lessons learned database was realized by client server technology including first server and a client workstation using Oracle database management system. (Fig. *29*).

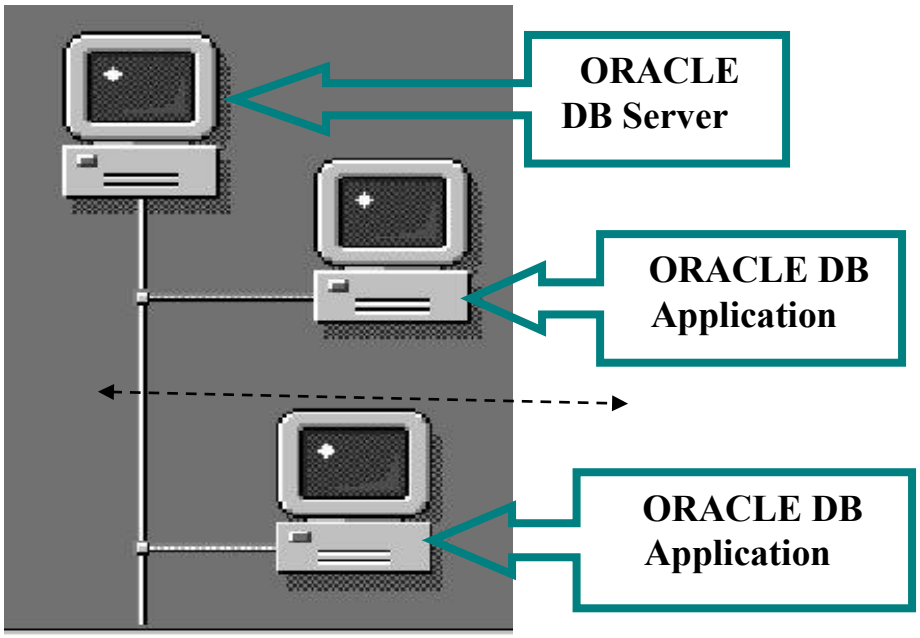

Fig. 29. Local Database configuration

Lessons learned derived from the database were put into practice in a variety of ways. Some examples of Lessons Learned implementation in education and training process are:

- In 2001 Intreoperability Department led – Distance learning course "Bulgarian participation and Experience in Peace Support Operatins"; (Figure 2) I
- n March 2002 Military Terminology course with Bulgarian staff officers led by RHQ AFNORTH, held in Rakovski Defence and Staff College;
- Curricula; etc.

The use of the system analysis method in the study of lessons learned allows the application of the architectural approach for lessons learned information system (LLIS) development.

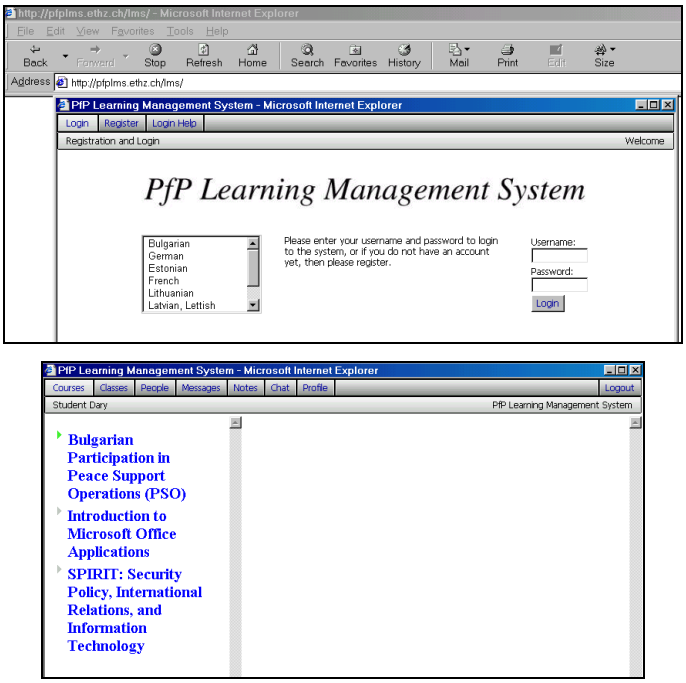

Fig. 30. Distance learning course "Bulgarian participation and experience in Peace Support Operations" welcome screen

The architectural approach should be used in order to develop the lessons learned information system. Bulgarian Armed Force LLIS could have functions as user's identification and authorization; input, update, saving, searching, deriving and dissemination of data.

The main functions of the LLIS are implemented in the form of an information system with capabilities of full text search. In this respect lessons learned system development challenges are:[5]

Improvement of operational architecture of lessons learned system, that includes**:**

- defining organizations exchanging information;
- defining type of information that has to be exchanged;

Achievement **of interoperability in technical component of the system architecture** that includes:

- Features of the interface;
- Support both English and National Languages.

3. History of Bulgarian contribution to the Partnership for Peace lessons learned system

The Partnership for Peace Consortium Lessons Learned Database (PfPLLDB), was established and maintained by the U.S. Army Center for Army Lessons Learned (CALL). It was the initial vehicle for the collection and dissemination of lessons learned from military an crises respond operations of the partner nations. Individual lessons learned was originated within the partnership countries themselves and flowed to CALL. CALL then uploaded the electronic lessons learned documents it had received into the PfPLLDB. Both the electronic files and the search-and-retrieval software capabilities of the PfPLLDB were maintained for general use by the partner nations. The system would export knowledge and experience in lessons learned methodologies and enabling technologies to the PfP and individual partner nations using Advanced Distributed Learning (ADL) techniques and technologies.

"G. S. Rakovski" Defence and Staff College participates actively in the international military academic exchange in the framework of the Euro-Atlantic Partnership Council. The focus is on the development of curricula in the area of interoperability and standardization of officers' training at the middle and high command level. The transfer of modern know-how and lessons learned in the sphere of modern military education is a matter of current practice. Programs for students and instructors exchange are being prepared and implemented. The College represents the Ministry of Defense in the PfP Consortium of the Military Academies and Security Studies Institutes and very actively takes part in it. For the purpose of exchanging different opinions and experience derived from real Peace Support Operations the College takes part in the project led by the Consortium of Defence Academies and Security Study Institute named as "Lessons learned". In accordance with the annual plan of the Consortium of the Military Academies and Security Studies Institutes in Rakovski Defense and Staff College were carried out the Consortium's Lessons Learned Working Group meetings and workshops.

The Lessons Learned Working Group was established at the 2nd Annual Conference of the Partnership for Peace Consortium of Defense Academies and Security Studies Institutes held in Sofia, Bulgaria in December 1999. It aimed to establish incrementally a lessons learned system that would facilitate the exchange of ideas, knowledge and experiences, enhance trust, and would establish a corporate knowledge base and "interoperability in thinking and acting" across the Partnership for Peace countries. The PfP Lessons Learned System would serve as a major component of the feedback mechanism of the PfP experience in training, education, exercises, and operations conducted by NATO.[2] The idea for creating PfP Lessons Learned System was discussed and approved during the first meeting of the Consortium group at "G S Rakovski" National Defence & Staff College in December 1999. It prompted a discussion that resulted in "The Guide for Creators of PfP Lessons Learned". The basis of discussion was the developer's guide for "The ABCA Coalition Operations Lessons Learned Database" which was proposed by the Center for Army Lessons Learned. The Guide was subsequently developed and presented as the "PfP LLDB and User's Guide" at the Third Annual Conference in Tallinn in June 2000.[3] In addition, "The ABCA Coalition Operations LL Database" was adopted and developed by the CALL as "PfP Consortium LL Database" (PfP LLDB). This Database was discussed and approved at the Lessons Learned Working Group Workshop in November 2000. At this meeting the Working Group approved the latest version of CALL-developed user's guide for the PfP LLDB and reached an agreement for it to be translated into the different national languages of the Consortium and to provide these translations to CALL for incorporation in Lessons learned Advanced Distributed Learning (ADL) module. The Bulgarian and Romanian Lessons Learned Working Group members first sent the translation of the Guide to the CALL which was input in the database's Website.(Fig. *31*)

Each country may have its own format for preparing their lessons for dissemination. In the "Guide for Creators of Lessons Learned" are described rules in what format lessons learned reports should be send. Submissions to the PfPLLDB must meet several requirements: first, that the file be in ASCII text; second, that six lines of fielded information be included at the beginning of each document; and third, that all submissions be translated into the English language (though automated translation capabilities). There is also securing access to the database.

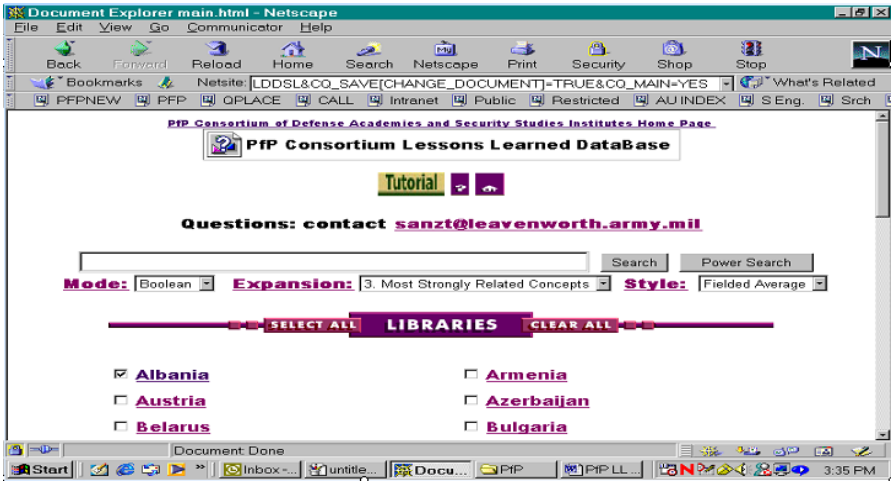

Fig. 31. Under button "Tutorial" the Bulgarian translation of the Guide could be downloaded

4. Partnership for Peace Consortium Lessons Learned Database

The PfPLLDB is used as a library. The user is able to search not just for the descriptive information about each document, but also the full text of those documents. User can begin to browse the "libraries" that together constitute the PfPLLDB. A separate library for each country has been created. To browse the contents of one of the libraries, must simply click on the underlined library name.

Technologies for Quering and Searching that are implemented in PfPLLDB are also used in the current Public archives that are hosted on the CALL World Wide Web site (http://call.army.mil/).

With the PfPLLDB, a clue or query terms is entered into a "query" box, then after clicking on the "Search" button, the "results list" is viewed.

The PfPLLDB offers powerful search capabilities as searching simultaneously all PfP libraries or searching in any combination of libraries. It is possible to select the type ("Mode") of search that user want to conduct and select what to display on a query results or search hit list ("Summary").

All the Database's searches are full-text searches, looking for the clue in the text of the documents in the libraries that were selected. The database also offers the possibility to do fielded searches, that is, searches on the individual metadata fields reflected in the first few lines of the document.

The database offers three "**Modes**" or types of search: **Pattern, Boolean**, and **Concept**. (Fig. *32*).

The Pattern Search looks not just for the exact words that constitute the clue, but also for other words that are similar in their spelling and appearance. The Pattern Search will always provide a score from 0 to 100. The score is not based simply on the presence of the search clue in the document, but also on other factors, such as how often the search clue appears in relation to the length of the document. The higher the score, the more relevant the document is to the search.

The **Boolean Search** is an exacting search that offers no latitude and always produces fewer hits than a Pattern Search or a Concept Search. Recognizing the way that the Boolean Search operates, the proficient user can use the wildcard asterisk (*)to overcome some of the variations in spelling. The Boolean Search does not give a relevancy score.

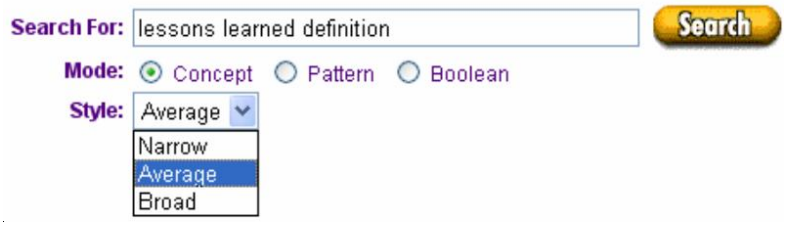

Fig. 32. Search query screen

The **Concept Search** looks not just for the exact words in the clue, but also for other words meaning the same thing. Not only does this search find alternate spellings of the same word, it also finds other words that mean the same thing. The concept search produces hit lists that are just as long as pattern search hit lists. Like a pattern search, the concept search provides a relevancy ranking score.

SEARCH MODES		
PATTERN	**BOOLEAN**	**CONCEPT**
Fuzzy -- appearance of words	Exact -- what you search is what you get	Semantic -- word meanings, not exact words
Most hits (usually)	Fewest hits	Most hits (sometimes)
Relevancy Score	no score	Relevancy Score

In a search technology also is included **Style** of search. Style offers three options: **Broad, Average**, and **Narrow**. A Broad Style produces the most hits, while the Narrow Style produces the least. A Boolean search always produces the same number of hits. To conceive of Style in another way, an Average Style search will accept lower relevancy scores than a Narrow Style search, but not nearly so low as a Broad Style search.

Each search will report on what it has found, even if that report is as simple as "No documents retrieved by this query." Most searches produce a document hit list of retrievable documents that includes the document name, pieced together from information included in the fielded lines at the beginning of each document.

Above each results list there are statements on the number of documents "that match the query" and on the libraries searched.(

Fig. *33*).

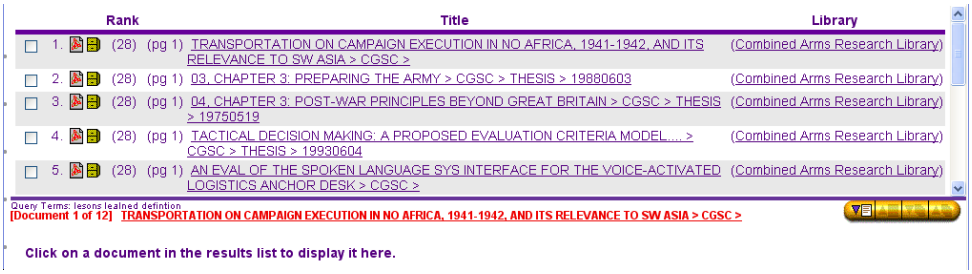

Fig. 33. Search Results Lists screen

Search can be limited by introducing simple Boolean operators that introduce an added degree of precision to the search. Just as with any sophisticated database, the user is able to use wildcards on the search. The principal wildcard is the asterisk (*). This is particularly useful if the user is not quite sure how to spell a query word. The search engine also has special rules for handling special characters in the full text of documents. The search engine may ignore, treat as spaces, take literally, or apply a completely different meaning, all based on the context.

According to the reports and appreciation of our NATO partners Bulgaria had, has and will have a significant contribution to Partnership for peace Lessons Learned system. The process of gathering and inputting reports (lessons) into the PfP LLDB started after the Nov 2000 Lessons Learned Working Group workshop. Method of data collection that where used was passive. The Bulgarian Lessons Learned Working Group members first sent the translation of the Guide to the CALL and it were input in the database's Website. From the Bulgarian site some reports have been found, translated, properly formatted, approved for PfP release and finally sent to be published at site of CALL of US Army LL database [4] and to PfPLLDatabase. The reports were based on unstructured data reports about:

- Participation in SFOR;
- Model of Engeneer troops in PSO;
- LL from the Kosovo Crisis regarding Host Nation Support;
- Peports from Medical Staff participated in refugee camps Kosovo and Macedonia;
- Participation in Crisis respond operations, etc.

Nevertheless, it is also useful to address the following questions for discussion:

- What can the form of the data? (text, multimedia file, etc).
- What form of data preparation is required? (For example, will a transcription of audio or video materials be necessary and, if so, what transcription procedures need to be adopted? Alternatively, if the data are in the form of field notes, will these require development, contextualization and editing?)
- Has sufficient time and/or resources been allowed for the analysis process and the data preparation?
- What factors can be anticipated which may affect the validity of inferences drawn from the data (for example, reactivity)?

But if we consider documents as *objects* for research and deriving lessons learned, it would be necessary to use **structured documents** for collecting lessons learned and constructing lessons learned report. It is important to discuss and answer to the following questions:

- What documents are important for the issue?
- How can these be characterized in terms of what are the implications concerning authorship, access, authenticity, credibility, representativeness and meaning?

Authorship refers to the origins of documents as "personal" documents and "official" ones (which have their source in bureaucracies). Official documents can be further sub-divided into "state" and "private" (non-state: for example, business annual reports and accounts). The second criterion, "access", refers to the availability of documents to individuals other than the authors.

However, it could be usefulness of a classification based on the criteria that it poses four key questions pertaining to the validity of particular documentary sources. Who has and has not authored a document, and the degree to which a document is accessible or withheld, influences its authenticity (whether it is original and genuine); its credibility (whether it is accurate); its representativeness (whether it is representative of the totality of documents of its class);and its meaning (what it is intended to say).

- Are the documents and their features appropriate for critical analysis (for example, in terms of representing discourses)?
- What questions should be asked about these documents in order to map the central features of such discourses (for example, what is seen as problematic by the authors of the document, what explanations do they provide and what kind of solutions)?

For further developing of lessons learned database should be addressed by the following questions for discussion. Concerning structured documents it is necessary to define rules for "key words" for lessons learned documents; areas of PfP activities; type of events; year of event, type of forces (Army, Air forces, Navy, Military police, Prosecutor's office an so on); elements of logistics, critical infrastructure etc.

After seven months' experience of testing PfPLLDB and working with the Guide for Creators of Lessons Learned could be drawn the conclusions that the Guide is applicable, user-friendly with an appropriate level of detail; the Guide and PfP LLDB are covers two from the four main LL processes (documentation and dissemination), the remaining two (identification and institutionalization) need further work bearing in mind that the other two processes are basically a national responsibility; the Guide ensures interoperability between the different national reports (protocols and procedures for submission of LL); the technology facilities that the Information Technology Working Group offered to the members of Consortium (computers, internet connection and PIMS account) are sufficient to ensure initial conditions to be involved in the PfP LL System. This system ensures only a passive collection of LL reports (the responsibility for collating these depends on national collection systems);

In addition, according to the CHAIRMAN OF THE JOINT CHIEFS OF STAFF INSTRUCTION, [1] an example of lessons learned report is enclosed.

LESSONS LEARNED REPORT EXAMPLE UNCLASSIFIED

1. (U) LESSON LEARNED ID: 16574-57108
   DATABASE SEQUENCE NUMBER: 00002
2. (U) ORIGINATOR: USCENTCOM J6-D, POC: LT COL PRACTICE
   DSN: 111-2222, COMM: 111 222 3333
3. (U) OPEX: DESERT THUNDER, DATE OBSERVED: 02/23/98.
4. (U) TITLE: LESSON LEARNED -- Standardized SIPRNET Web Pages for Crisis Operations
5. (U) OBSERVATION:

The Joint Staff requested each CINC create a set of standard links on their website for use during a crisis in J33-CSOD message 220118Z JAN 98, Subject: Standardization of SIPRNET Homepages. These links contain warfighter information spanning all functional areas.

6. (U) DISCUSSION:

US Central Command's set of links, accessible via the SIPRNET, was placed under the heading "Mission Critical Links" at the homepage level. The most critical link within this list was the Crisis Response Cell (CRC)/Crisis Action Team (CAT) page. CCJ3-O established policy for the information placed on that page. Other directorates funneled their requests for links on that page through CCJ3-O. Agencies outside USCENTCOM found access to DESERT THUNDER data easier and directorates within the headquarters understood the internal information linkages better as the operation progressed. CCJ3 control of the web information flow via the CAT paralleled traditional quality assurance steps for paper production. Web postings were elevated to the "record" level.

7. (U) LESSON LEARNED:

The establishment of a single source for links on the SIPRNET web page improved the quality of and access to crisis data, reducing distribution delays and confusion. The Web was used more extensively than ever before and proved its reliability and value for command and control.

8. (U) RECOMMENDATION:

US Central Command's process and Web capability worked well. Recommend this implementation be used as a model for other CINCs.

9. (U) COMMENT:

This Lesson Learned is applicable outside of US Central Command. Action is required of all CINCs.

TASK DATA

Task: ST 5.1 OPERATE AND MANAGE THEATER C4I ENVIRONMENT.

UNCLASSIFIED

5. Conclusion

In conclusion we can say that there are a lot of challenges in the future work and research in order to develop LLIS. It could be assumed a possible approach for study of the LL as follow:

- Lessons Learned have to be considered as a process;
- LL can exist and function in the environment such as the Armed Forces Lessons learnt system (LLS);
- There are information flows both in the horizontal and vertical directions of the LLS. These information flows form the LL information process.
- The information process contains activities for identification, collection, processing and dissemination of lessons learned. These activities could be automated by information technologies implementation in the respective LLIS, which has specific functions.
- LLIS is the tool for implementation of the LL information process.

According to the mentioned above some aspects for future work could be formulated:

- Personnel lessons learned information needs and formatted documents have to be defined for processing in a LL database.
- operational and system architectures of lessons learned information system have to be developed
- LLIS functional subsystems have to be defined.
- A technological scheme, describing the logical succession of working in the lessons learned information system has to be established.
- LLIS technical architecture has to be developed through defining of Information technologies for computer networks and data access.

Acknowledgment

The authors express their gratitude to the Bulgarian National Science Fund for the partial financial support under the Grant № DFNI-I02/15 from 12.12.2014, titled "Information System for Integrated Risk Assessment from Natural Disasters".

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About Information in Crisis Management

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Abstract: The specifics of using the information during emergency situations are examined in the report. Modern applications and technologies for gathering and processing data in real time during emergencies are described. These are proposed measures for improving the stability, rapid response and efficiency in providing real-time information in different types and nature of crises and crisis situations.

Keywords: Unambiguous and credibility of the information, 7C model, mobile applications and platforms, an early warning system.

1. Introduction

Actual report table 1[6]

Sofia Airport Terminal 1 Evacuated over Suspected Bomb Threat

"Authorities in Bulgaria were on high alert after a bomb was reportedly discovered an explosive device inside a minibus parked outside Sofia Airport Terminal 1.

Passengers and staff have been evacuated from Terminal 1. Flights will go on schedule according to airport officials, but takeoff and landing are both redirected to adjacent Terminal 2, with authorities promising to mitigate delays.

Earlier media reports suggested a "suspicious package" had been found inside a white minibus with Belgian license plates.

Police have not confirmed an explosive device or substance was found, Nova TV said. The Interior Ministry's press office denied information from an airport official who was heard telling several national TV stations a device had been discovered.

A search is still underway.

The area around Sofia Airport Terminal 1 has been sealed off.

Reportedly, the minivan was parked by a non-Bulgarian national around 01:00 local time (EET).

His flight took off around 05:00 leaving the vehicle in front of Terminal 1, police say, without elaborating.

Police carried out a controlled explosion of one of the bags found inside the minivan.

Officials at the Interior Ministry explained that a police dog trained to discover explosive devices had reacted "positively" during the first routine check of the minivan on Tuesday afternoon.

However, that reaction was not tantamount to "a bomb inside", the Bulgarian National Radio quotes them as saying."

Crisis management requires rapid response and efficiency in the provision of information in real time. This need is driven by the changed social environment and conditions in connection with the processes of globalization, the emergence of global risks and threats, and the emergence of new technologies as part of the information society. This

applies especially to reliable protect the lives of citizens and prevention of various dangers in the occurrence of critical and emergency situations.

Obviously there are a need of improving sustainability, rapid response and efficiency in providing real-time information in different types and nature of crises and crisis situations. The most problematic are the first few hours, when the response are delayed and the consequences are catastrophic, suggesting more concentrated use of new Internet technology and improving of efficiency information.

These issues should be dealt in accordance with the specifics of various systems and subsystems of crisis management and their characteristics in rapidly changing IT realities. [2]

2. Important characteristics of information crisis management

The information is correct (integrity) [4] it can be defined as a measure of proximity information (or source) or accuracy of the information in communication channels.

Often can be faced up with cases, when the commercial proposals are verbal transmitted by various brokers and in the same time they do not actually correspond to actual neither as price nor as type.

Credibility of the information is its accuracy:

Objectivity of information: In operational terms, it is understood that the information is free of distortion. Systematic errors of obtaining and transmitting, the actions of offenders, as well as subjective distortions in psychological terms are also available. After clearing procedure (filtering) are very likely to decide that this information is 100% suitable for use. This is not always true-the objectivity of analysts in the world is not so simple: it is possible that everything is true, and only one false information can lead to failure.

Unambiguous of information: Unambiguous of information: Among with objectivity information also it should be unambiguous. For example, the object of negotiations can demonstrate readiness for collaboration and as to admit as rumor to their divisions what lead to an imitation of the preparatory work of various departments. In this situation if these observations are considered as facts is risky or deciding that the partner has friendly intentions can be dangerous.

This example shows that even reliable information be objective, it is not enough sure for decisions making and definitive conclusions because objectivity itself is not straightforward. The degree of objectivity is estimated using probabilistic methods in the "very likely", "probably", "likely", ect.

In practice, to assess the quality of the information are used a simple and convenient features. Firstly, they are connected to the source and the channel for receiving of information.

3. Procedures

Communications in emergency situations should be action oriented in disastrous conditions when it is necessary to inform people about the risks. The communicator, in this case, is not perceived as a participant in crisis or disaster, but rather seen as a mediator trying to resolve the situation. Communications are aimed more at informing people about possible solutions with limited time and a threat to public health by nature. Decisions are made, often with inaccurate and ambiguous information. This type of communication provides opinion and knowledge of experts, which allows people to take appropriate action and to respond appropriately to recover from the disaster quickly.

Detailed information can be obtained by geographic information systems. They provide an integrated approach for access to geographic data. Using GIS the employees of

the administration who responsible for disaster protection can draw up plans for management of natural disasters.

Through GIS can identify potential risks through simulation method "What would happen if ...". You need to know the speed of propagation of the effect, geographical location of critical assets and what are the pros and cons of the area in slowing the action of the effect on the assets. Mobile GIS applications, such as ArcPad on ESRI, allow sending of accurate and current information from the place of events to GIS platform. [4] [122-124]

GIS can be seen as tools for decision support. For example, in case of emergency, GIS can perform in-depth analysis and provide possible alternatives to solve.

Geographic Information Systems (GIS) provide a mechanism to centralize and visually display important information during an emergency. All activities in flood protection depend on data sources. The relevant data is collected, organized and show the size and scope of Emergencies. Decision makers in emergency situations often require details (piping, electrical, sewage systems, etc.). By using GIS all competent and responsible authorities can share information through a database of computer-generated maps in one piece in a given area, both during the event and before him. Without this ability protection in emergency situations is difficult as the process as various actors in the defense and stakeholders must have access to information from various institutions involved in the management of resources, including strategic ones for national security, which takes time and additional forces and means. Geographic information systems support the planning and urgent response to emergencies.

Emergency communications require intelligent based IT solutions and provide real-time information on disadvantaged groups and communities to reduce the level of destruction and the number of victims. Used special network, and semantic-based knowledge platforms for the environment, scanning the effects or potential risks and visualization of information.

This type of communication relate to information systems for early warning: Disaster Warning System, Tsunami Warning System, Information Point Alert, Global Warning System, Galileo, GPS, Glonass, Google Crisis Response System.

To provide quality information in the first hours after the critical and problematic situation to target the possibilities of new media. For example, with success may lie in the practice model, known by the name "7C" [7] which includes the following key initiatives:

- *Support access to new media platforms before the crisis;*
- *Development preliminary plan in crisis-defining the communication protocols;*
- *Information for crisis, published online meet the following conditions:*
  - are oriented towards action;
  - relevant to the situation;
  - targeting specific communities;
- *Public information is updated regularly and timely and to be consistent with the context;*
- *Communication participants in the social process:*
  - be bilateral;
  - provide comments;
  - allow for conversation and dialogue;

Table 2. Emergency management and application of a method based on GIS technology [3]

Emergency activities based of information	Geographic Information Systems
Planning of emergency	Using GIS can pinpoint hazards and assess the possible occurrence of the emergency. GIS facilitate this process by allowing to trace suitable combinations of spatial data by computer generated maps.
Mitigation of emergency	Through GIS after risks are identified, emergency mitigation activities can be prioritized in order to reduce the impact of it. GIS give answers to the questions - Which facilities require reinforcement or relocation? What are the facilities in areas with high risk (key bridges, main roads, highways, bridges, hospitals, hazardous material storage facilities of various hazardous substances, etc.)? Where are the areas of risk of emergencies? What combination of characteristics (eg, topography, time) presents a danger of emergency and through topographic maps to chart the path of potential damages
Preparedness of the emergency	Preparedness includes those activities in preparing for real emergencies. GIS can answer the questions such as where have to find power for emergency response? How many doctors are needed and where they have to locate? What evacuation routes have to chose? How will people be notified? What quantities of supplies are necessary for evacuees? GIS can display real-time monitoring for emergency and early warning.
Emergency Response	GIS can provide closest (fast) forces and response capacities. Depending on the emergency GIS can provide detailed information before the first destruction.
Recovery	Recovery starts immediately after the emergency response. It can be seen in the short and long term.

The requirements are aimed at introducing integrated WEB platforms that promote: information sharing; integration of video and text; programs for the exchange of ideas; deployment of available mobile resources for free exchange of information; be tailored to the preferences of the audience to use the most accessible and most familiar forms of social media; build an adequate web structure and domains related thereto; pre-drill teams using new technologies, improve their communicative competence.

An important part of management, with the aim of improving communication practice in contemporary crises is to develop information platforms such as Ushahidi popular system (www.ushahidi.com).

Some of the objectives of media, mobile platforms of this type can be summarized as follows:

- *Building based on the trust system for sharing data during a crisis-oriented end user and reaction in real time;*
- *Improving communication practices and information management, follow strict rules and protocols for the collection and dissemination of information;*
- *Creation of an open-ended system where everyone has the right to exchange information on certain protocols relating to risks / currently prevail closed type info command systems /.*

Ushahidi management system of information flow in emergencies, with the following characteristics: a decentralized communication network; "feedback loops", integrated in the system collected information about the disaster directly directed to vulnerable groups inclusion in the early warning systems. It is important to note that not effectively use those

information systems for early warnings to people no access and cannot be adjusted according to needs, their competencies and interests. For the world has accumulated enough experience in the open, citizen-type platforms to generate content, we also have people who can use them necessary Simply integrate the national response system and train specific community groups to work with them and to provide them with critical data in the event of various threats to nature or society.

Using the new mobile applications and platforms is possible to disseminate information in the range of several seconds to several hours. Within seconds can be used following popular social media: Tumblr, Twitter, Friendfeed, Plurk, Posterous with success. Within minutes it can provide information to affected communities using applications such as: Google+, Pinterest, Facebook, LinkedIn, Flickr, Picasa. During several hours the applications include the following resources: Google news, Yahoo News, You Tube, Vimeo, Digg, Reddit, and Wikipedia. So throughout the day it includes all global media as: Euronews, BBC World, CNN, NY Times, E-mail, Internal Intranet Network, E-newsletters, and Blogs, maintained by the offices of the news sites.

Each crisis situation implies mass to apply those tools that provide real-time information and these are: mobile media platforms; scanning techniques of reality; semantic networks; mapping of what is happening and visualize threats, ie visual methods to display the direction and speed of the threat; constant contact with people affected by the crisis. Social media can help inform people during emergencies, ensuring the generation of content and presence of managers in the media before and during the crisis. The requirement is the dissemination of information in real time and be consistent with information strategies and the environment.

In recent years, passes to introduce interactive platforms that provide retrieval of personalized information from the external environment and automatic exchange of applied knowledge.

Interesting practice is of the Google during the disaster in Japan in 2011, when Google started special application about rapid detection of people without news and missing people (Person Finder 2011 Japan Earthquake App). In the beginning of January, 2013 Microsoft public presented mobile platform about working during emergency situation named Help Bridge.

Platform Data is stored in the cloud resources of Windows Azure. Using the app gives opportunity to make a list of people and institutions that can help during the crisis as automatically send SMS, e-mail and publish information on Facebook. The application provides data for exact location of the person if the phone has GPS capabilities. The work program is simplified and informs others during the disaster, whether we are better or need some help.

In the Bulgarian legislation does not provide for the use of this type of "open" systems [1]. Possible solutions for Bulgaria:

- Create effective communication structure for interaction between people; teamwork beginning; generating of ideas; creativity in decisions making; selectivity of the information; interact; limiting the information uncertainty; specify criteria for behavior in the networks; quality content corresponding problems.
- Risk assessment as the first step in prevention and includes identification and analysis of major threats, dangers and the sensitive structures.
- Construction of systems for early warnings based on technologies to detect threats and automatically activating pre-identified action plans in emergencies.
- Accumulation of stocks, equipment and supplies organized in advance of the training squad for the reaction, creating effective mechanisms for coordination of efforts.

- Establishment of appropriate organizational structures, clear policy on allocation of resources, and determining budgets, ensuring the response to crises.

It should be noted that currently there is no unified rescue system to exchange information in a secure channels. The recommendations are based on analyzes of the crises in recent times.

- Risk assessment, including scanning the horizon of the event; radar for risk assessment; prospective analyzes for the detection of emerging threats; continuous updating of the system; setting different time frames; international analysis; interdisciplinary approach to key features;
- Capabilities based on planning and networking;
- Strategic crisis management - training for acquisition of speed, adaptability and networking and partnerships;
- Strategic approach when the centers and management tools.

Acknowledgment

The authors express their gratitude to the Bulgarian National Science Fund for the partial financial support under the Grant № DFNI-I02/15 from 12.12.2014, titled "Information System for Integrated Risk Assessment from Natural Disasters".

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Possibilities for Application of Specific Software Products for Risk Assessment of Natural Disasters and Economic Assessment of Their Consequences

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Abstract: This report discusses some possibilities for software products application for risk assessment of natural disasters, economic evaluation of their consequences, and evaluation of prevention activities. The following logic is used. Initially, the functions of assessing the risks in the process of natural disasters risk management are analyzed. Then, the contents of the assessment and measurement of risks are analyzed, taking into account the attitude towards the risk of stakeholders and stakeholders' groups. As a result, some specifics of the risks of natural disasters are displayed and some guidelines for risk assessment through simulation methods and application of models of system dynamics are proposed.

Keywords: Risks, risk management, risk assessment, risk attitude, simulation methods, Monte Carlo simulation, system dynamics.

1. Introduction

In the early 21st century, problems concerning the evaluation of the threats of natural disasters are becoming more and more important to society. The risks of natural disasters are increasing. Some researchers argue that this is due to human activity. The society is becoming more sensitive to the presence of such risks. On the other hand, available resources to combat natural disasters are limited and must be controlled rationally. There is a need to create a precise methodology for the evaluation and selection of an alternative in the development of investment projects for the natural disaster prevention.

Intensive research in the field of assessing and managing the risks of natural disasters are conducted globally. There are powerful tools and methodology which can be used in Bulgaria. There are software products that can substantially assist the collection and processing of needed for this purpose data.

This report uses the following logic. Initially, the functions of assessing the risks in the process of natural disasters risk management are analyzed. Then, the contents of the assessment and measurement of risks are analyzed, taking into account the attitude towards the risk of stakeholders and stakeholders' groups. As a result, some specifics of the risks of natural disasters are displayed and some guidelines for risk assessment through simulation methods and application of models of system dynamics are proposed.

2. Risks assessment and measurement

An essential question of this study is whether it is possible to assess and/or quantify the risks in their particular aspect. The answer to this question is ambiguous and can be searched in a variety of disciplines – the theory of measurements, econometrics, statistics and

more. When it comes to physical variables, the term "measurement" can be understood as a "process" (set of operations) to find the importance of physical variable experimentally using special equipment with a certain precision and under certain conditions [1].

In the field of natural disasters risks various parameters should be evaluated (measured), some of which are physical – such as distances between geographic objects, maximum volume of reservoir, number of buildings in a village, height of a dam, etc. Even with these variables, there are certain difficulties to measure – related primarily to the accuracy of the measurement results using different technical means of varying accuracy, need for repeated measurement, dynamics of the variables values even during the measurement, influence of the measuring process on the value of the measured variable, availability of measurement errors, and more.

Another big part of the variables to be assessed (measured) are economic in nature. More complicated theoretical and methodological issues occur here, most of which have not yet found appropriate solution. Much of the variables are random and need a specific assessment approach.

An essential question is the choice of an appropriate assessment and measurement scale. Choosing an inappropriate scale can lead to distortion of the assessments and as a result – taking wrong decisions. Each of the available scale of measurement (nominal, rank, interval and proportional) can be used in various aspects of risk assessment.

3. Features of the risks of natural disasters

The analysis of characteristics of risks of natural disasters from the point of view of opportunities for their study by specific software application identifies the following features (The proposed list of features is not exhaustive and is subject to completion in the future.):

1. There are risk events that cannot be foreseen at all (such as earthquakes, volcanic eruptions, etc.). However, there are events that are result of predictable circumstances and whose occurrence can be forecasted for a given period (e.g. heavy rain and snow, storms, etc.).

2. There is data from long-term observations of actual risk events. This allows to perform statistical analysis and (in some cases) to establish trends. Thus, it is possible to apply simulation models loaded with reliable from statistical viewpoint information.

3. Risks of natural disasters are usually pure.

4. The emergence of threats and dangers from natural disasters cannot be removed. Risk management can only influence other elements of the "risk chain" – exposition of the threat, impact on objects, damages appearance, and impact assessment.

5. Risks can influence each other. The occurrence of a particular event may affect the probability and/or negative effect upon the occurrence of other event or events. For example, an earthquake can cause or may not cause a tsunami.

6. Risks characteristics are generally affected by natural factors, which are usually random. At the same time, risks are influenced by human activities which are sometimes lengthy and generally can be controlled. Such actions are usually not malicious, e.g. uncontrolled deforestation, disposal of construction and other waste in the river beds.

7. One risk event may affect large areas and large populations. The impact can be trans-regional and cross-border. This means that the potential damages depend not only on the prevention efforts and allocated resources in a particular region or country, but also on the factors relevant in other neighboring regions and countries.

8. Prevention requires substantial resources, time and efforts. The society (national and local) is not always willing to provide such resources especially in cases when a natural disaster has not occurred for an extended period.

4. Simulation methods for risk assessment

A variety of limited resources are necessary to cope with risks. At the same time, risks are innumerable. It is not possible to ensure the prevention of all existing risks. This requires the assessment and prioritization of risks. Risk assessment is seen as one of the essential elements of risk management. The assessment is a systematic procedure for risk investigation, which determines: the probability of event occurrence, the magnitude of the expected negative effect and spheres of influence in case the event occurs, the relationship between possible risk events, the expected interdependence.

A wide array of quantitative and qualitative methods can be used to assess the risks of natural disasters. Here are presented some of them, whose content and logic are close to and are complemented by simulation models.

"Monte Carlo" simulations have wide distribution and large possibilities for application. It is based on a model that reflects the relationship between "input" and "output" parameters. For example, in a project risk assessment "output" can be parameters, such as: time to complete the project or one of its phases, the full cost of the project implementation or its phases, expected revenue, valuation indicators as NPV, IRR, PBP and the like.

The value of the "outputs" will depend on the value of a set of deterministic and a set of random "input" variables. Availability and level of risk is determined by the presence and characteristics of random variables. The simulation model must be able to calculate the values of "outputs", using the preset "input" parameters. (Fig. 1).

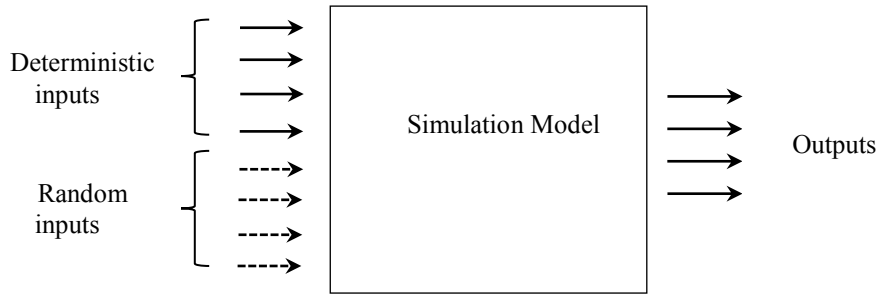

Fig. 1.Simulation model

The random "inputs" can be determined by the type of their probability distribution, as well as their specific probabilistic characteristics. This can be based on an analysis of historical data or research and summarization of experts' opinions. There are numerous types of probability distributions. For the purposes of risk assessment the following distributions are most relevant: triangular, beta, uniform distribution, general distribution and discrete distribution (Fig. 2). An adapted to the use of PERT methods "betapert" distribution is often used in practice [5].

Triangular distribution is very suitable for experts' opinion summarization. Experts must determine three parameters that characterize it – minimum, most likely and maximum possible value of the random variable. Betapert distribution is commonly used in assessing the duration for the activities of a project. It requires a determination of the same parameters as the triangular distribution – minimum, most likely and maximum possible value of the random variable. When choosing a uniform distribution, the assumption is made that it is

equally likely that the variable holds any value within a specified range. The expert must only indicate the lower and upper end of this range.

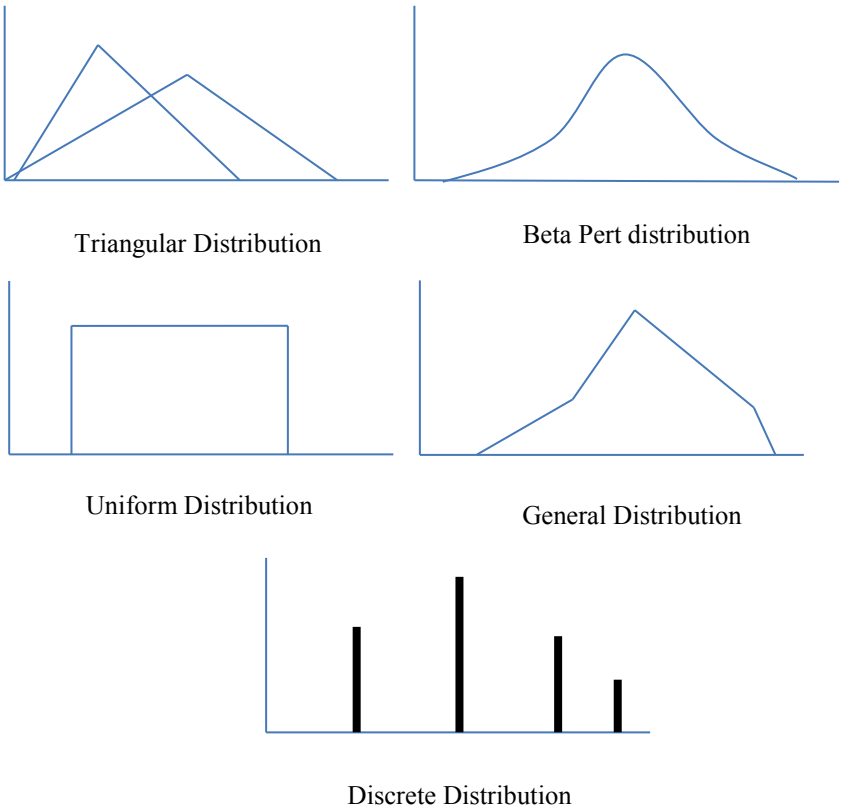

Fig. 2. Types of probability distributions used in the threat assessment
Source: Adapted from: Fundamentals of Risk Analysis and Risk Management, ed. by Vlasta Molak, LEWIS, 1997, p. 62-63.

The general distribution allows for high flexibility in covering the experts' opinions. They must determine the coordinates of refraction points of a broken line that represents the distribution. To adopt a discrete distribution, one must believe that the random variable can take only specific values. In this case, experts must determine what those values are and how likely it is for them to occur.

After developing the model and establishing the parameters of the inputs, one can proceed to simulation. Each random input is given a value with the help of a random number generator. Deterministic inputs are given fixed values. An algorithm calculates the values of outputs. The results are stored for further processing.

The software performs this simulation repeatedly, and each time results are stored. The number of simulations depends on the parameters of the random variables, and may reach ten thousand or more. The aim is to accumulate enough data for statistical analysis, wherein to achieve a sufficient degree of reliability.

Simulation results can be used for several purposes. For example, it is possible to calculate the mean outputs values and their standard deviation, the mode of the results and other statistical parameters. All of these values provide valuable information for the evaluation and analysis of risk. One can accept the average value of a given output as its expected value. For example, if the output value is for example NPV, one can calculate the expected value of this indicator, and use it in choosing the project alternative. The standard deviation of the output variable can be used as a quantitative measure of the risk level for the project. The mode of the results shows the most likely value of the output.

Another direction for analysis of the "Monte Carlo" simulation results concerns determining the frequency distribution of the output values. For this purpose, it is necessary to determine an interval for calculations. The software draws a graph in which the output variable is applied on the X axis. The Y axis reflects the number of cases of simulation in which the output received values within the respective interval. Upon normalization of this distribution one can obtain a graph which gives valuable information about the probability distribution of the output variable.

Based on a frequency distribution, the cumulative frequency distribution may be determined in two ways – by summing the values from left to right, and from right to left. This allows for answering questions, such as "what is the likelihood for the output to take a value not greater than..." and "what is the likelihood for the output to take a value not less than...".

There is a variety of software products for quantitative risk assessment. Some of them are specialized for the development of various types of Monte Carlo simulation models. For example, GPSS and Simula provide platforms for specific languages for the construction of simulation models. Excel software product can be used for the development of simulation models. Nowadays, software packages such as: "@Risk" [11], "Crystal Ball" [12] and many others are widely used.

The package "@Risk" for example can apply a significant number of typical probability distributions: normal, beta, gamma, exponential, Laplace (double exponential) and many others (The full list of available distributions can be found for example in: http://www.palisade.com/models/RISKDistributions.asp). Strength of the product is that it can be used in environment familiar to the user (Excel). Once created, the deterministic calculation model can be transformed into a simulation one. Fig. 3 displays the result of a simulation showing the distribution of a particular indicator (investment costs), used to evaluate two alternatives of an investment project. Such evaluation can be made when assessing different construction options of flood protection facilities.

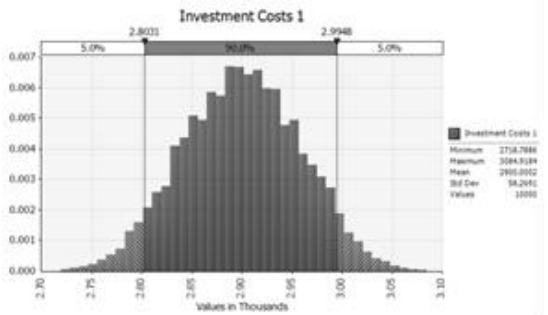

Fig. 3. Statistical distribution of investment costs for a project (Result of @Risk simulation)

5. Application of system dynamics models

The system dynamics tool kit can be used to solve problems and to model variable types of systems – economic, industrial, social, biological, ecological, etc. The author of this approach is Jay Forrester who applied it in the 1950s to study the behavior of industrial systems.

The logic of the development of system dynamics models requires initial development of a verbal model of the system. This means to gather the necessary input data about the system by systematizing relevant to the purpose of the model information. The purpose of modeling, the main variables of the model and the limits of the modeled system must be clearly defined. It is essential to determine the target horizon, the duration of the steps in simulation, and the hypothesis of the system's expected behavior.

Once the verbal model is ready one may proceed to develop a causal relationships diagram and a flow chart. The causal relationships diagram reflects the variables included in the model, the causal relationships between them and the direction of influence between variables. It does not contain information about the strength of these relationships. It is possible to define positive and negative feedback. The models use three types of variables – stock variables, speed variables (or control variables), and auxiliary variables.

The first type of variables characterizes the state of the system at a given moment. The second type sets the speed of change of the system status. Following this logic, the state of the system after a given period will depend on its state at the beginning of the period, the duration of the period, and the values of speed variables. In fact, the system control can be performed by changing the speed variables values.

Flows in the model reflect the processes and activities in the broadest sense. Flows can be material or informational. Material flows may reflect movement of raw materials, semi-manufactured goods (in production systems), movement of people and vehicles, cash exchange, movement of water or air masses (in ecological systems). The presence of a material flow reflects the reduction of at least one stock variable and the increase of another stock variable. Information flows reflect the movement of a given amount of information. The flow chart reflects the links between stocks by the flows that connect them. Connections between stocks can be positive or negative, depending on the functioning of the system logic.

To facilitate the development of the model, one can use standard blocks that are typical combinations of levels and flows. Examples of such blocks are: positive feedback, negative feedback, logistical or s-shaped structures, exponential delay.

There is a wide variety of software products to support the development and simulation of system dynamics models. The most famous among them are: IThink of Iseesystems [13], InsightMaker [14], AnyLogic [15], Vensim of Ventana Systems Inc. [16] and many others. We will present the functionalities of Vensim here.

Vensim software allows building various in complexity models that include all the elements explored in system dynamics: positive and negative causal loops, stocks, flows etc. A variety of analytical tools can be used in developing the model – syntax checking, causes tree diagram, uses tree diagram analysis tool, loops analysis tool, document analysis tool. Once the model is developed, various simulations can be implemented by changing the input variables. The results of the simulation can be compared in numerical and graphical form. Simultaneously, one can analyze causal relationships between output changes and changes in the variables upon which they depend.

6. Conclusion

The application of software products provides ample opportunities for assessing the level of risk of natural disasters. It is possible to assess the risk in terms of expected loss and

damage, as well as in terms of the probability of occurrence of disasters, and in terms of costs necessary for the implementation of projects for prevention of natural disasters.

The development of simulation and other models can be performed without a significant time and effort expenditure. It is useful, but not required for the experts who develop models to have a thorough theoretical knowledge in mathematics, statistics and probability theory.

Modeling results can support rational management decision making concerning the risks of natural disasters.

Acknowledgment

The authors express their gratitude to the Bulgarian National Science Fund for the partial financial support under the Grant № DFNI-I02/15 from 12.12.2014, titled "Information System for Integrated Risk Assessment from Natural Disasters".

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Information Services in Absorption of Funds from the European and Structural Funds in Bulgaria

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Abstract: The UMIS system for electronic date exchange and its successor UMIS 2020 were developed in relation to the EU requirements for electronic exchange of information regarding the absorptions of EU funds. Through its implemented functionalities, UMIS 2020 is a key instrument for optimization of the processes of management and control of EU funds and decrease of the administrative workload for everyone involved in the process.

Keywords: UMIS, UMIS 2020, information security, information system

1. Introduction

Information systems are an integral part of our public life and not only a necessity, but a requisite for the functioning of every activity. In accordance with the European legislation, each member-state must fulfill certain requirements for the availability of adequate systems for management and control in the management of EU funds. Some of the requirements are related to the information system for management, execution, monitoring and control of the operating programs, without which the projects cannot be financed.

2. Exposition

The requirements of Regulation (EU) № 1303/2013 (Regulation (EU) № 1303/2013 of the European Parliament and the Council from 17.12.2013) in the field of information technologies are related to guaranteeing the electronic exchange of information between all participants in the process of project and program management – beneficiaries, managing bodies, certification and auditing bodies.

In compliance with the requirements for the program period 2007-2013, in our country functions a Unified Management Information System (UMIS), administrated and maintained by „EU Funds Information and Management Systems" Directorate of the Council of Ministers Administration (Article 69, paragraph 2, item 8 of the Organization Rules of the Council of Ministers and its administration, State Gazette issue 78/2009). As of July 2014, the structure ensuring the carrying out of this activity is the „EU Funds Management Systems" Directorate of the Council of Ministers Administration (Article 69, paragraph 2, item 7 of the Organization Rules of the Council of Ministers and its administration, State Gazette issue 58/2014). The process of entering and updating the information in the EU funds management systems is performed by the directorate, which draws up methodic instructions, carries out inspections of the authenticity and timeliness of the entered information, provides the operating compatibility between the different information systems used by the separate administrative structures.

Information system for the period 2007-2013

UMIS was developed and intended to maintain, manage and control adequate and correct information regarding the funds provided by the EU for the program period 2007-2013. To ensure the maintenance of the system was created the Policy, procedures and rules of the Information system for management and monitoring of the funds from the Structural and Cohesion EU funds in Republic of Bulgaria (UMIS) (Ordinance P-233/11.11.2013 of the Secretary in chief of the Council of Ministers Administration for ratification of the Policy, procedures and rules of the Information system for management and monitoring of the funds from the Structural and Cohesion EU funds in Republic of Bulgaria.). The policy regulated different fields of functioning of the system, related to: the rules and obligations of the uses; control and access to the IT assets; the policy on the informational and physical security; the description and organization of maintenance of the information archives and users; maintenance of the IT infrastructure; as well as the applicable procedures of the Helpdesk unit.

The policy on information security of the Council of Ministers Administration (CMA) regarding UMIS is directed mostly at the ownership of the informational assets, the actions of CMA management, the main aspects of information security in all phases of its life cycle, as well as the policies and applicable documents related to their implementation.

The organization of UMIS information security management and control is designed with the purpose of regulating the distribution of responsibilities for information security, by appointing the duties of the management and personnel, as well as the coordination between the different participants. The main participants with information and security management and control functions are: the Secretary in Chief of CMA; the information security officer; the director of „EU Funds Management Systems", as well as their managers.

Information system for the period 2014-2020

For the new program period 2014-2020, the EU Funds Unified Management Information System in Bulgaria 2020 (UMIS 2020) summarizes the information
regarding the management, implementation and monitoring of the approved Operating programs, co-financed by the Structural and Cohesion EU Funds (https://eumis2020.government.bg/bg/s/Home/About).The main purpose of the system UMIS 2020 for the implementation of the operating programs is the ability to collect all data in electronic format as they arise, which ensures the effective management, monitoring, accounting, inspecting, as well as facilitates the information exchange with the European commission bodies. A major characteristic is the option for traceability on the basis of different criteria and indicators of each operating program, procedure and contract for financial aid. UMIS 2020 has the functionalities underlying in the main EU regulations:

- **"Onlyonce" Encoding Principle**– once entered, the date is not required again;
- **Interoperability**– the data entered in the system can be used by different users within one operating program; **ElectronicAuditTrail**– all documents are available in accordance with the European and national legislation;
- **Data IntegrityandConfidentiality**– to ensure security in data storage from the moment it is generated;
- **SenderAuthentication**– every user can be identified by their username, password and/or electronic signature;
- **eStorage**– ensuring enough space in the system for the storage of all available data.

UMIS is a completely web-based system; it does not require specific software, only a web browser. Data input is done electronically, with attached unified application forms for all operating programs. Data input and processing is done in a completely structured form, which facilitates and refines the preparation of reports and analyses. In order to use the system, a registration is necessary, which provides access to the modules and functionalities.

The structure of UMIS 2020 is separated in several main modules, which provide different functionalities and user options regarding the use of the public and internal module User Guide for UMIS 2020, https://eumis2020.government.bg/bg).

The public module is for the applicants; they can use it to prepare and submit project proposals. The system allows the users to create and fill in an electronic application form, to attach all necessary appendices and to submit their project proposal. So-called UMIS files have been developed and implemented (forms in special XML format) that the users can fill in, download, save and store, which gives them the ability for multiple access and data input, as well as file sharing with other users.

Applications are submitted online with electronic signature, and a part of the system functionality is the ability to accept documents after the deadline for application for the procedure. The assessment for disqualification of each participant is submitted by the assessment committee.

Another part of the system functionality in related to the project budget calculation, which is largely automated. There is an implemented ability for checking the data during input, calculation, control for eventual exceeding of the maximum allowable budget, which significantly decreases the risk of mistakes and eventual future disqualification of the participant from the procedure.

The ability for submitting project proposals is significantly facilitated – it is done electronically with electronic signature or in person with the Managing body. When the proposal is submitted electronically, but the applicant does not have an electronic signature, it is permissible to submit the proposal through the system, and later to submit in person a declaration on paper to the managing body, in order to guarantee the identity of the proposal with the unique code generated by the system. The unique code will also be the number of the application; the system will generate a label with a barcode.

There is an option for communication between the participant and the assessment committee, which will be realized electronically. There is a separate section in a system menu which contains any questions asked by the assessment committee, as well as any instructions given for correcting any inconsistencies. For such cases, there is an option to correct a particular section of the form, if applicable. The signing and submitting the answer of the question to the assessment committee can be done in two ways – electronically with a qualified electronic signature and on paper. For the paper option, the system generates a label with a barcode, which is submitted to the respective body (User Guide for module "E-application" https://eumis2020.government.bg/bg).

Another functionality of the system is a separate section, which will contain all open procedures for the separate operating programs. It is possible to generate reports for different indicators and parameters for the separate operating programs.

The internal module of the EU Funds Unified Management Information System in Bulgaria 2020 has functionalities which ensure the work of the management and monitoring units of the operating programs, the auditing and certification bodies. It allows the opening of new procedures, assessing project proposals, signing contracts, accounting and monitoring the results regarding the implementation of the projects.

In order to use the full functionality of the systems, it is necessary to register a user profile, which allows the project proposal to be created, edited, stored and submitted.

A registered user, after logging on to the system successfully, has the option of creating a new project proposal, editing an existing one, adding attachments to the proposal, which can be submitted electronically or on paper.

If the user is not registered or has not logged on to his user profile, the only accessible functions are related to viewing the list of instructions for the currently open procedures for the different operating programs, viewing and printing electronic forms premade by the system, the user or another user.

3. Conclusion

The experience from the previous program period 2007-2013 in the functioning of UMIS, the new rules implemented through the applicable regulations have resulted in the improvement of the UMIS 2020 functionalities for the program period 2014-2020. The new options provided by UMIS 2020 facilitate the access to EU funds, as well as reduce the occurrence of a variety of errors which lead to disqualification of applicants, slowing of the processes, as well as imposing financial corrections on the beneficiaries.

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Self-service Opportunities in the Presentation Layer of Business Intelligence System

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Abstract: The self-service opportunities in business intelligence systems arise due to the constant changing needs of organizations and reduce the delay in providing the result implemented through traditional opportunities of business intelligence system. There are two ways of realization of self-service business intelligence opportunities – basic concept and actual realization. The main objective is to limit the intervention of IT developers and business analysts as the tools of the presentation layer tailored to the audience that uses them.

Keywords: presentation layer, business intelligence systems, self-service opportunities, business intelligence tools

1. Introduction

In recent decades information technology are rapidly developing. They have become the engine, if not of all, then at least of a large part of the areas of activity in the reality in which we live. The most significant of these is the business area of or as we call it today - economy.

Information technologies are a combination of different areas, one of which are business intelligent systems. Through them the organizations can solve problems, discover new opportunities and establish links between various objects. These activities are the basis of effective functioning of the business organization as they allow informed decision to be made indifferent satiation, which can give competitive advantage in the market or quality of business management and guidance in the right direction.

Business intelligent systems can be classified according to different characteristics.. Each of which meets the specific needs of organizations. And because the needs are constantly changing, it is necessary to change and business intelligent systems.

The change of business intelligence systems most often is associated with proposals for new opportunities to improve the business environment. These are self-service capabilities.

Self-service opportunities in business intelligent systems answer the question "can I see what the data are telling me". This process is possible and offers new capabilities in two directions:

- the data - access to the data source, allowing for rapid deployment and smooth data management through warehouse operations, easy discovering of meaningful data;
- the visualization - a simple and customizable interfaces for end user that are built with the help of easy-to-use BI tools.

The second direction - in terms of visualization is actually the last layer of business intelligence architecture, namely the presentation layer.

2. Need for self-service opportunities in business intelligence systems

The need for self-service business opportunities in intelligent systems occurs as a result of the traditional approach to respond to business issues.

The sequence of activities in the traditional approach is presented in the figure:

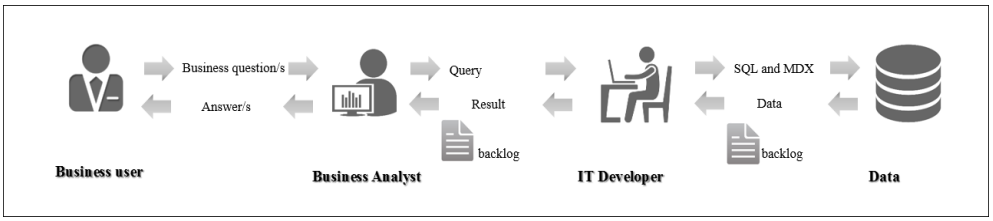

Fig. 34. Process of answering business questions - consecutive activities

Business user defines a business question or questions to the business analyst. To prepare the necessary reports with which to respond to the business user, business analyst turns to the IT developer, who must provide the necessary data set. After receiving the data business analyst analyze the data set and returns the response to the business user.

Very often there is the problem with a time delay in the preparation of requests by business analysts and IT developers. This leads to a delay in receiving a response from the business user. This problem leads to subsequent treatment processes. Through them, however, new problems arise:

- **Multiple versions of documents.** Numerous reports, each of which contains a variety of data representing different results.
- **Running costs and maintenance.** There are changes in source code format of the system, which leads to restriction of access to the source. Moreover, not always developed report provides qualitative data to answer the questions.
- **Inaccurate results.** This is a complex process of cleaning, referencing, consolidation and aggregation of data in process of collection. Moreover, business analysts often provides a personal perspective on the issue, which affects the final result.
- **Outstanding tasks.** When this happens, business users do not get timely answers to their questions.

This scenario is relevant for many organizations today. The creation and distrubution of reports is a process that encourages IT developers to offer new initiative - self-service business opportunities in intelligent systems. The aim is to provide easy set of tools to work with business users themselves to meet business questions asked.

3. Self-service opportunities in business intelligence systems

Self-service opportunities in business intelligent systems have the task to limit the intervention of IT developers, not to eliminate it entirely. The step from the process the preparation of the data is labor intensive, requiring specific technical training and business end-user or business analyst can not easily participate in these activities.

IT developers remain key drivers in dealing with business intelligent systems. Through self-service capabilities cease their frequent communication with the business user, which relieves them and allows them to concentrate on other important activities.

Self-service business intelligence is implemented in two ways:

- self-service business intelligence in reality - through the intervention of the business analyst

Business users believe that self-service opportunities in business intelligent systems are designed for advanced users. The last one understand the functionality that provides intelligent business decision. Such advanced users as business users are namely business analysts. They are the people who have to provide the final result.

In this case, self-service opportunities in business intelligent systems can be grouped into two main types of consumers who uses them:

- Business users - they need a simpler and fewer tools to create reports to answer business questions;
- Business analysts - have a greater and more complex set of tools to create reports to answer business questions.

The process looks like this:

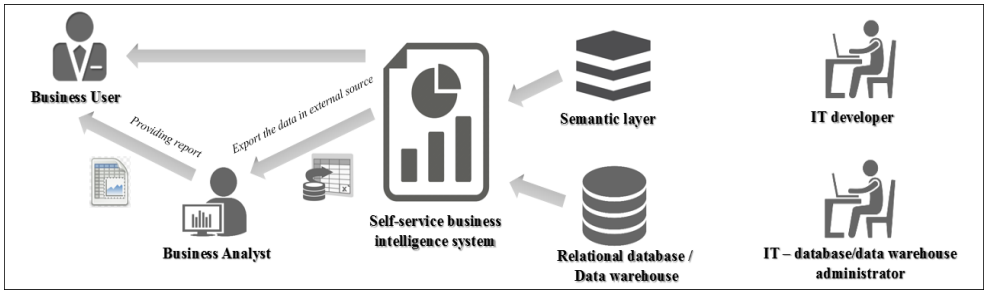

Fig. 35. Self-service BI reality

The business analyst and the business user are able to work with self-service business intelligence solution. In most cases, however, business analysts design a report, then export the data to an external source, perform additional processing to build a final version of the report and then make it available to business users.

- basic concept of self-service business intelligence - without interference of business analyst

Business users meet business issues that arise independently. They can determine the scope of the report, based on the solution created by IT developers.

This decision usually is:

- web page accessible from a web browser;
- there is a homepage that is associated with dashboards and links;
- it allows to filter the results, for example by selecting the period, a subset of business units, product categories, etc.;
- users can obtain more details through process research and browsing items such as folders, files and related components;
- it support various storage formats;

To facilitate business user, self-service business intelligence application provides better visualization of the data.

It can:

- be simplified to capture the "essence", the most important data;
- be comparable i.e. allows for the comparison;
- focused on the truly important moments i.e. draws the attention of business users on the essential data;
- provide an opportunity to "peek" into the data;
- look to expand business user i.e. to look at the same data from a different perspective;
- be graphic i.e. uses a variety of graphical means to represent data and retrieve information.

The decision, however, works well when the reporting requirements are well defined and where there is a necessary budget, which is possible throughout the process. The latter is shown in the figure:

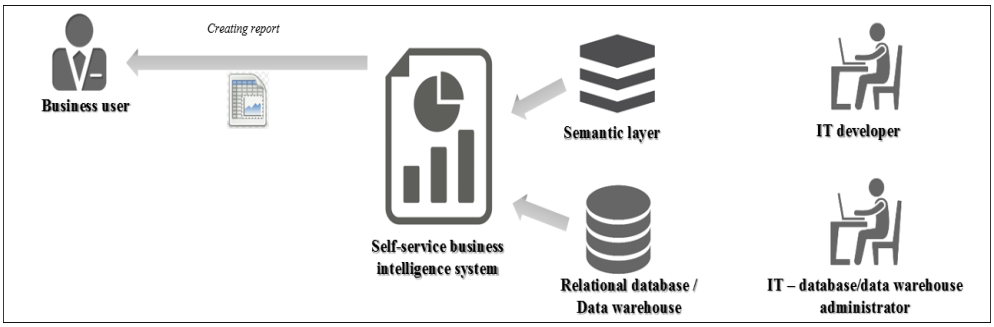

Fig. 36. Basic concept of self-service business intelligence (SSBI)

The process is limited to individual work of business users with an intelligent business decision. He alone determines the factors influencing the final result. Thus creating a report with the high analytical value.

However, in most cases, there are still many business leaders who choose to hire a business analyst i.e. first variant. According to them, the man in office should be responsible for creating and providing adequate documents in the form of reports.

4. Self-service opportunities in the presentation layer of the business intelligence system

Presentation layer is logical part of business intelligent architecture where intelligent client software is used by business users through tools for visualizing data (see. Figure 3: The basic idea of the self-service business intelligence (SSBI)). This layer is sometimes associated with the presentation of knowledge, not only as it to be represented reasonable, but also in an easy to use format.

In a typical business intelligent realization, usually there is no single software for presentation of business intelligence software. There are many tools that are used by different audiences. It is important the user to be properly recognized. Depending of user's specifics An example can be given. If the user is part of the university's management and wishes to review the situation related to the specific activities in the organizaciotn, the result may be provided by dashboard or report. If the user is a financial analyst, a person familiar with the financial data, it may prefer tabular format. Others are cases which require the simplicity of diagrams or graphs. This is because business intelligent realization presents a

set of tools that are consistent not only with the specific functionality of the tool, but with the users that will use them.

Presentation tools can be used in various forms, including web, desktop and mobile. The tools of the presentation layer can be:

- created particularly for the organization that need them;
- created as parts of business intelligence software for a specific user or group of users within the organization;
- reusable components, which are distributed by third party vendors which van from the original vendor of business intelligence platform.

By the presented self-service capabilities of the presentation layer of business intelligent system, we can safely say that they are no different from traditional options. The only difference is that if a business analyst using dashboards with multiple tools, the business customer uses a small set and simple tools, which ensures ease of use with business intelligent system. Right now this process is called self-service options in the presentation layer of business intelligent system.

5. Conclusion

Business intelligent systems are developed following the needs of organizations and the development of information technology. It focuses on facilitating the ongoing activities and processes, but not at the expense of efficiency.

The traditional approach requires active participation of IT developers and business analysts. Moreover, through their full intervention it is possible the produced reports and analysis to be refracted through their specific interpretation and knowledges

Self-service business intelligence not completely removes theof the need of IT developers and business analysts, butallows their release, to some extent, from the process of creating reports and preparing reports. Self-service capabilities in the presentation layer of business intelligent architecture are actually the tools by which business users can operate by there one . They do not differ in kind from the traditional, and were divided into groups to be used by the end-user. But they provide the ability business user to design their own comprehension, which is more adequate to their business needs.

By the presentation layer of the business environment and intelligent tools that provide end users self-service possibilities can create greater analytical value. Furthermore, through the self-service delay can be minizied, which is present as a process in the traditional approach to yield timely answer the questions.

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Management Criteria for Evaluation of Business Software Systems Integration

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Abstract: Existing and practically integration approaches and techniques can be compared from both operational/technical and management/business aspect. This paper proposes a set of management and business criteria for assessment of software integration approaches. These criteria cover the project management and costs characteristics of an integration solution, as well as its abilities to meet the business goals of an organizational units. *Measurement indicators* for each criterion are also proposed. If all criteria are applied together, they can be used to compare and/or choose the right integration approach from management and business value point of view.

Keywords: Business software, Integration, Management criteria. Integration approaches and techniques

1. Introduction

In order to research the opportunities to define a common integration approach, we need a criteria system to help us evaluate and compare the exiting and practically adopted integration approaches.

Integration approaches and techniques can be compared from both operational/technical and management/business aspect.

Management and business criteria cover the project management and costs characteristics of an integration solution as well as its use to meet the business goals of an organizational units.

2. Implementation costs

One of the most important aspects of each business project is its implementation price. It defines the basic budget parameters and to a great extend the future of the project, as well as its implementation or cancelation, because the price is a definitive factor for any investment. Because the integration projects are basically software projects, and their implementation requires highly qualified software engineers, we can mention that their implementation price may be evaluated based on person-hours that are needed for development and on the effort for implementation which is the main factor influencing on the amount of needed person-hours.

Implementation effort - the effort of implementation is directly related to the amount of available functionality provided by the integration technology used and the specifics of source code that are defined. Obviously, the technology providing a large amount of available functionality releases engineers need to implement these features by themselves, but simple and linear source save time and effort in the realization of the connection with the environment and other systems.

Engineering hours (person-hours) - usually in software engineering the man-hours required for an implementation are measured based on a preliminary assessment and average values, as this information helps to choose the best approach to the current problem. Since the basic steps for the implementation of any integrated approach are known in advance, such assessments can be used in selecting and comparing integration solutions, thus choosing the one that would cost at least.

Based on this information we can conclude that it is possible to compare integration solutions based on the assessment of the implementation effort, and based on a preliminary average value of the required amount of person-hours of engineering work.

3. Total cost of ownership/operations

Besides the cost of implementation, each information system, including integration environments, requires costs for operation, maintenance and possible expansion. These costs must be added to the cost of implementation to estimate so called TCO (Total Cost of Ownership - TCO). In terms of project management and business, this is one of the most important indicators, as it measures total cost of the investment in an integration project and allows this value to be compared with the potential benefits. The total cost of ownership includes the total amount of cost of implementation plus operational costs, maintenance costs and expansion costs

Evaluation of the operational costs – generally, the various integration technologies have different requirements for computing and communications power necessary for the operation of the integration environment, which means that the needs for hardware and network equipment are different. Based on these requirements can be estimated price of necessary hardware, equipment and infrastructure necessary for the implementation of each integration approaches.

Evaluation of support and administration and configuration costs – they include the required number of qualified administrators needed to support the system during normal operation, the potential costs of consultancy services in the operation of the environment and the expected number of engineering person-hours required for minor changes to business logic and requirements. We should note that usually the more complex integration environments, providing a large amount of available functions, require a large number of highly qualified administrative staff, but spent less engineering work in small changes because of its good configurability.

Man-days of engineering work needed to add a new system – these include the potential costs of adding new systems and integrating their functionality to the environment once it has been implemented and has begun to operate. This indicator can also be assessed in man-hours of engineering work based on averages and estimates that take into account the characteristics of the environment.

In this regard, we can note that integration solutions can be compared in their total cost of ownership through the evaluation of the implementation costs, the measurement of operating costs such as hardware, equipment and physical infrastructure and the estimated costs for maintenance, administration and changes and evaluation of engineering work to expand and add new systems.

4. Success rate

One undoubtedly important indicator in terms of project management is the possibility of its success or failure. This is important because it affects the predictability, business planning and future operations of the organization. The larger number of unexpected

difficulties and delays or failure of the project could lead to deviations from business forecasts that were already made and respectively to losses for the organization. The failure degree can be measured by:

Risk assessment based on the technical characteristics of the approach - normally integration solutions with less amount of available functionality and less flexibility pose a greater risk of errors and underestimation of the tasks in the preliminary assessment work and may lead to greater unexpected delays in implementation of the necessary components. On the other hand the more complex integration environments that provide more opportunities require more labor intensive configuring and may involve risk of delays in these tasks.

Real data tracking about the success rate of the approach in integration practice – of course, this is one of the surest ways to assess the possibility of success and monitoring of a sufficiently large number of real projects and for measuring the success of each approach in practice. In the presence of a sufficiently large amount of data for each of the approaches, their success can be measured and compared as a ratio (percentage) of successful applications of functional approach to all its applications. It is normal for a business to have a preference for approaches with a high success rate due to better predictability they provide.

Based on these data we can conclude that integration approaches can be compared by their degree of success through evaluation of project risks based on the technical specifics of the approach, and by monitoring and measuring the real data on the percentage of success of the approach in practice.

5. Business and users perception

One of the key factors for the success of any project in the field of information systems is the attitude and perception from the business and potential users. This is critical since consumers generally tend to have some resistance and varying degrees of realistic expectations to changes in workflow and new technologies. Unfortunately this criteria, though important for the comparison of integration approaches is associated largely with human psychology and behavior and is more difficult to measure. Ways to measure and / or evaluation are:

User experience real data measurement – one way to evaluate the acceptance of different approaches is the survey of users who already used for integration environments implemented based on different integration approaches. If the consumers of different approaches are surveyed with the same questionnaires can measure and evaluate their reaction after the introduction of an integrated information system. A good idea is to measure how noticeable was the change in the workflow of users and in the established business processes in the organization before and after the integration.

Expected resistance assessment based on the technical characteristics of the approach – as well as with the estimation of the degree of success, we can prepare a preliminary assessment of the likely resistance from consumers, based on an analysis of the technical characteristics and technological specifics of the integration approach. In general, approaches which provide a higher degree of available functionality and a higher degree of transparency for the individual systems offer a higher degree of transparency for end users, which in turn provoke relatively lower degree of resistance. Customer satisfaction is increased and more reliable integration environments where failures in functionality are rare.

Based on this information, we can conclude that we can compare the perception of integration approaches from the consumers by measuring the empirical data about user experience and assessment of the expected resistance of the base of the technological

characteristics of the approach.

6. Service Level Agreements - SLAs

An important element of relations between providers of a service are the arrangements for service level. As in any integration environment, each participating system actually provides its functionality in the form of an abstract service of other systems integration solutions can be compared and the level of service they provide.

Service level indicators values are standardized documents, which indicate concrete indicators of the service level provided by the service provider (Rouse, 2015). Such indicators usually are the estimated time of withdrawal operability (downtime), the mean time to restore operability (mean time to recovery - MTTR),the responsibility for reporting on service failures, the capacity and the throughput of communication channels, performance, the measurable response and serve request times, the percentage of rejected applications (abandonment rate), the scheduled interval for preliminary warning about a change in the work of the service or infrastructure (schedule for notification in advance), the response time of the help and support desk on various classes of problems (help desk response time) and others. It is important that these indicators are clearly defined and marked as the document is subject to regular communication between the parties and further adjustments in case of need such (Shacklett, 2011).

We can mention that some integration approaches have better opportunities to define and agree on the service level, while such opportunities are more limited or totally lacking in others. For example integration solutions that allow the use of web services have an advantage in this area, as Web-based services have a formal language for defining the service level arrangements so called Web Service Level Agreement - WSLA (H. Ludwig, 2001). On the other hand in integration approaches that do not provide a formal method for defining the arrangements between the parties and systems, we can use empirical methods to assess the service level through observation of the implementations of the method in real-world, but the lack of formalization can be marked as a drawback.

Based on this information we can conclude that it is possible to compare integration solutions through indicators of service level agreements in their implementation, as well as the presence or absence and their options for formalization of the arrangements that this method offers.

7. Conclusion

This paper proposed a set of management and business criteria for assessment of software integration approaches. If all criteria are applied together, they can be used to compare and/or choose the right integration approach from management and business value point of view. A comparison of approaches based on this criteria can be used for either a classification of integration approaches or defining new integration methods.

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Reduction of Dimensionality of Dynamical Systems in Economy

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Abstract: Many processes in the economy are described by systems of great (at least final) number ordinary differential equations. We can reduce dimensionality of these systems to quasi-steady state approximations (QSSA) if there is time hierarchy in the different stages of the process, considered. In this work we discuss a basic author algorithm for reduction of dimensionality of dynamical systems with different time scales. From a pure mathematical point of view the algorithm is based on a well-known QSSA theorem.

Keywords. Modeling of economic processes, different time scales, quasi-steady-state approximation, QSSA theorem.

1. Introduction

Mathematical modeling of dynamics of many economic and social processes is realized by high-dimensional systems of ODEs, because of its complex and nonlinear properties [1-9]. Because of high dimensionality of these systems they can be investigated only by pure computational methods. In this aspect, there is not information for the qualitative behavior of such processes. One way brings to reduction of dimensionality of the corresponding dynamical systems to solve this problem. In this aspect, the choice of an adequate methodology for reduction of dimensionality of ODE systems is very important for two reasons: 1) The methodology should be mathematically valid; 2) The reduced system,, that is obtained on the basis of the proposed methodology, should adequately represent the main qualitative properties of the original model.

In this paper we discuss a basic methodology for reduction of dynamical systems with time hierarchy. The main idea of the methodology is that the some stages of one process are realized faster than other ones. This approach has been used for investigations of biological processes [10-14]. However, it can be applied to models, which represent dynamics of many economic events, such as catastrophes, business cycles, economic chaos, economic development and growth, where "fast" and "slow" stages can be identified.

The reminder of this paper is constructed as follows. In Section 2, the problem statement is presented. The basic aspects of the QSSA methodology are given in Section 3. In Section 4, we illustrate the basic algorithm for reduction of dimensionality of high –dimensional dynamical systems in the form of a scheme. Remarks and future plans about application of the methodology to dynamical models in economy are summarized in Section 5.

2. Problem Statement

Taking into account actuality of the task for reduction of dimensionality of dynamical models with time hierarchy, the following *treatment* is presented for it:

It is assumed, that every economic process can be described by a system of great (at least final) number *n* ordinary differential equations in the following manner:

(2.1) 

where $f_i(x_1, x_2, ..., x_n)$ are continuous functions of the variables x_i of the system in the region $D(x_1, x_2, .., x_n, t)$, for which it is assumed, that the requirements for unique and continuous dependence of the corresponding solutions on initial conditions are performed, and t is the time. In this context, the basic task is to reduce dimensionality of the system (2.1), by applying of a Tichonov's theorem [15].

3. QSSA Methodology

In the common case, the economic models with different time scales can be presented by dynamical system in the form:

$$\varepsilon \frac{dx_p}{dt} = f_p(x_1, ..., x_r, x_{r+1}, ..., x_n), \quad p = 1,2,..., r \tag{3.1}$$

$$\frac{dx_q}{dt} = f_p(x_1, ..., x_r, x_{r+1}, ..., x_n), \quad q = r+1, ..., n, \tag{3.2}$$

where $x_p \in R^m, x_q \in R^n, 0 < \varepsilon << 1$. Furthermore, for such a system it is introduced the following terminology: The first part of equations, having ε in the numerator, is called an attached system, with respect to the other part of equations, which form a degenerate system. In this way, the variables of the attached system are called fast variables and these of the degenerate system are considered as slow ones. We stress that the methodology for separation of every system of ordinary differential equations to fast and slow subsystems (or to a system of kind (3.1)–(3.2)) is performed by combinations of two well-known approximation approaches. The basic idea reduces to individual scaling (normalization) of the coefficients (the rate constants) as well as the variables of the system on the basis of well -known data of their numerical values. The proposed scaling procedure is similar to the dimensionless principle. It requires that each term in the right-hand side of the system equations should have one ane the same order. The set of both systems form a complete system. In accordance with this terminology, the Tichonov's theorem [15] claims that:

The solution of the complete system (3.1-2) tends to the solution of the degenerate system (3.2) at , if the following conditions are satisfied:

a) There is an equilibrium (steady state) solution of the attached system, which is isolated one (i.e. there is not other solution in its neighborhood);

b) The existing equilibrium solution of the attached system is stable one for every value of the slow variables;

c) The initial conditions (states) lie in a region of influence (a basin) of the equilibrium solution of the attached system;

d) The solution of the complete system is single-valued and its right hand sides are continuous.

The essence of the QSSA theorem is that the character of the solution of (3.1-2) does not change when the small parameter ε converges to zero. Thus, we can assume ϵ=0 in (3.1) and instead of differential equations obtain algebraic ones for the steady-state value of fast variables.

$$f_p(\varphi(x_q,t),t)=0, \qquad x_p=\varphi(x_q,t) \tag{3.3}$$

$$\frac{dx_q}{dt}=f(\varphi(x_q,t),x_q,t) \quad q=r+1,.....,n \tag{3.4}$$

In principle the economic systems satisfy conditions a), c) and d) from the theorem. Thus, we stress our attention only on analysis of stability of the stationary solution of the attached system. In this way, the complete system (3.1-2) can be reduced to the degenerate system (3.4). For every fixed x_p, Eq. (3.4) has an unique solution that depends continuously on the slow variables x_q. Thus the variables x_q play the role of a driver of the subordinated variables x_p. In accordance to the QSSA theorem, when the stationary solution of the attached system is isolated and stable, then the solution of the reduced (degenerate) system depends only on the post-initial values of the slow variables. The term 'post-initial' is introduced in sense of the considerations of initial and later intervals of validity of the complete and degenerate systems, respectively. Certainly, the complete system (3.1–2) holds any time, and the degenerate system (3.4) shall be valid from some later period of time.

4. A Scheme of the Algorithm for Reduction of Dimensionality

The basic scheme of the algorithm for reduction of dimensionality of dynamical systems with time hierarchy is presented in Fig.1.

5. Discussions and Future Directions

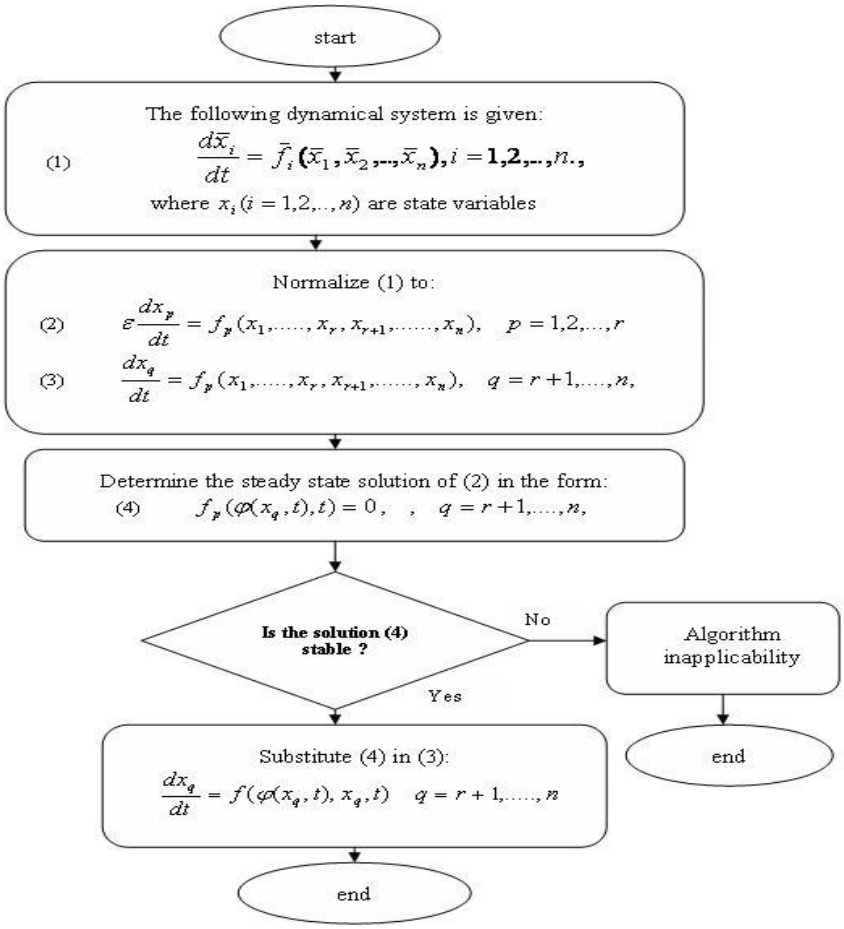
In this paper we present a basic algorithm for reduction of dimensionality of dynamical systems with time hierarchy. The algorithm can be applied for qualitative investigation of the dynamical features of any economic process, if there is information for numerical boundaries of the coefficients and the variables of the corresponding model. The main advantages of the QSSA methodology are:

1) By use of this methodology we can identify the fast and slow stages in the economic event;
2) This identification can help to determine the driving stages of the process, which are valid near to its stationary state;
3) The qualitative analysis of the reduced system (QSSA approximation) can give a basic tendency for control and management of the considered economic event.

In the near future, we plan to apply the QSSA algorithm to a special class of social systems, which are connected to migration of populations.

Acknowledgment

We would like thank to the "ISCH COST Action IS1104 the EU in the new complex geography of economic systems: models, tools and policy evaluation" for the support of our research.



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Application of the Method of the Simplest Equation for Solving Space - Time PDEs

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Abstract: In this paper we describe the dynamics of two interacting spatial and temporal economic agents systems are described using nonlinear partial differential equations. The general model is reduced to analytical extracted partial differential equations (PDE) with polynomial nonlinearity. For the case of two economic agents and a spatial dimension we have received a partial differential equation of the fourth line. Applying the method of the simple equation, we get the exact solutions of this equation.

Keywords: Agents systems, PDE, polynomial nonlinearity, economic agents, method of the simple equation.

1. Introduction

The agent models are an important tool for the analysis of complex systems. Depending on the nature of the system, the agents may have a variety of properties, as well as to interact in a different way. In recent years there has been rapid development of the agent models because with their help we can adequately describe the processes in a number of economic and social systems. Nonlinearities arise in the model equations of such systems due to interactions among the individuals, and the limitations in the environment. Such nonlinear model systems require applying methods of nonlinear dynamics [1 – 3, 7, 12 - 17], chaos theory [8,], and theory of stochastic processes [4].

If the number of economic agents and chaos in their behavior is small, it is possible to describe the system of interacting agents with more or less - less complicated systems of ordinary or partial differential equations. Such systems should describe the characteristic of the collective behavior of agents (their movement in space). We need just such modeling is required to describe the interactions between different economic groups of agents. Therefore, the deterministic model using the various kinds of systems, differential equations is widely spread further. There are different methods for the preparation of a solution of these systems of equations. Some of them are obtained values of the solution corresponding to the specified time and space coordinates. In some cases, however, a good idea will give us the decision itself, although derived under appropriate assumptions about its type. We note the papers of Kudryashov [9 - 11] who advises us to be careful when using the methods for obtaining of exact solutions of the nonlinear differential equations.

In this paper the general model is reduced to analytical extracted partial differential equations (PDE) with polynomial nonlinearity. For the case of two economic agents and a spatial dimension we have received a partial differential equation of the fourth line. Applying the method of the simple equation [], we get the exact solutions of this equation.

2. Method of Simplest Equation

Let us briefly describe the modified method of simplest equation [20 - 23], which is a powerful tool for obtaining exact and approximate solutions of nonlinear PDEs. We have to solve a partial differential equation and let by means of an appropriate this equation be reduced to a nonlinear ordinary differential equation, cited below:

$$P(F(\xi),\frac{dF}{d\xi},\frac{d^2F}{d\xi^2},...)=0. \quad (1)$$

For a large class of equations from the kind (1) exact solution can be constructed as finite series:

$$F(\xi)=\sum_{\mu=-\upsilon}^{\nu_1}P_\mu[\Phi(\xi)]^\mu, \quad (2)$$

where $\nu>0,\mu>0,P_\mu$ are parameters and $\Phi(\xi)$ is a solution of some ordinary differential equation referred to as the simplest equation. The simplest equation is of lesser order than (1) and we know the general solution of the simplest equation or we know at least exact analytical particular solution(s) of the simplest equation. The modified method of simplest equation can be applied to equations of the kind:

$$E(\frac{\partial^{\omega_1}F}{\partial x^{\omega_1}},\frac{\partial^{\omega_2}F}{\partial t^{\omega_2}},\frac{\partial^{\omega_3}F}{\partial x^{\omega_4}\partial t^{\omega_5}})=G(F) \quad (3)$$

where $\omega_3=\omega_4+\omega_5$. In the paper [15], the application of the modified method of simplest equation is based on the following steps:

1) By means of an appropriate ansatz (for an example the travelling-wave ansatz) the solved class of nonlinear PDE of kind (3) is reduced to a class of nonlinear ODEs of the kind (1);

2) The finite-series solution (2) is substituted in (1) and as a result a polynomial of this obtained. Value (2) is a solution of (3), if all coefficients of the obtained polynomial of are equal to 0;

3) By means of a balance equation one ensures that there are at least two terms in the coefficient of the highest power of .The balance equation gives a relationship between the parameters of the solved class of equations and the parameters of the solution;

4) The application of the balance equation and the equalizing the coefficients of the polynomial of to 0 leads to a system of nonlinear relationships among the parameters of the solution and the parameters of the solved class of the equation; 5) each solution of the obtained system of nonlinear algebraic equations leads to a solution a nonlinear PDE from the investigated class of nonlinear PDEs.

3. Formulation of the Problem

The system describing space and time for two interaction agent systems is [5, 6, 18, 19, 22, 23]:

$$\frac{\partial\rho_i}{\partial t}-\sum_{j=1}^{2}D_{ij}\frac{\partial^2\rho_i}{\partial x^2}=f_i(\rho_1,\rho_2),\ i=1,2. \quad (4)$$

When the two equations of the above system are linear (if they are homogeneous), we differentiate the first equation in time and substitute it in the second, we get the following

partial differential equation of the fourth order:

$$\frac{\partial^2 Q}{\partial t^2}+(D_{11}+D_{22})\frac{\partial^3 Q}{\partial t\partial x^2}+(D_{11}D_{22}+D_{12}D_{21})\frac{\partial^4 Q}{\partial x^4}+$$

$$+(D_{22}A_{11}+D_{11}A_{22}-D_{12}A_{21}-D_{21}A_{12})\frac{\partial^2 Q}{\partial x^2}+(A_{11}+A_{22})\frac{\partial Q}{\partial t}+(A_{11}A_{22}-A_{12}A_{21})Q=0.$$

If we do the above conversions and the second equation of (i=2), we'll get to the equation: (i=1), i.e. receive the same equation for both. The above equation is linear. Adding and polynomial nonlinearity of the fourth degree and lay:

$$a=D_{11}+D_{22}+D_{11}D_{22}+D_{12}D_{21},\ b=D_{22}A_{11}+D_{11}A_{22}-D_{12}A_{21}-D_{21}A_{12},$$

$$c=1+A_{11}+A_{22},\ d=A_{11}A_{22}-A_{12}A_{21},\ Q(\xi)=Q(x-vt),$$

we come to the equation:

$$b\frac{d^4Q}{d\xi^4}-av\frac{d^3Q}{\partial\xi^3}+(v^2+c)\frac{d^2Q}{d\xi^2}-dv\frac{dQ}{d\xi}+EQ^4+FQ^3+GQ^2+HQ=0. \quad (5)$$

4. Application of the Method of Simplest Equation

We assume that $\rho(\xi)$ has the form:

$$\rho(\xi)=\sum_{i=0}^{n}a_i\phi^i,\quad \frac{d\phi}{d\xi}=\sqrt{\sum_{j=0}^{r}c_j\phi^j}, \quad (6)$$

for this case

$$\rho(\xi)=a_0+a_4\phi^4,\quad \frac{d\phi}{d\xi}=\varepsilon\phi(p+q\phi^3). \quad (7)$$

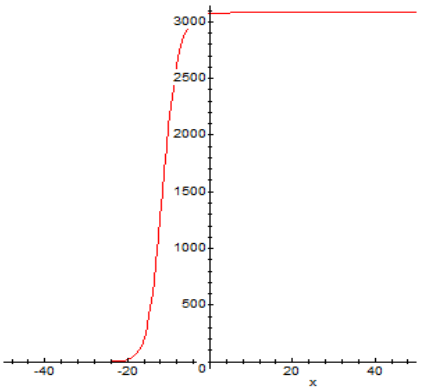
If now the conditions are met:

$$\varepsilon=v=1,\ b=\frac{411a^2}{1156(c+1)},\ d=\frac{70516(c+1)^2}{168921a}, \quad (8)$$

we will obtain the following solution of the equation (5) of the kink (7), where:

$$a_0=-\frac{F}{4E},\ a_4=-\frac{2q}{E}\sqrt[3]{455bqE^2},\ G=\frac{3F^2}{8E},\ H=\frac{3F^3}{64E^2}. \quad (9)$$

In the figure below we show how it will look the decision of the equation, we send the following values: a=c=1, E=F=q=-1.



Conclusion

In this paper, we discuss a model of partial differential equation for description of the spatio-temporal dynamics of two interacting agent systems. From a practical point of view Eq. (5) can be used for eventual prognosis and control, for example in the borders of a specific area. From statistical data sources estimations of the coefficients can be obtained. The most difficult task is the determination of the coefficients and, but they can be obtained by standard or appropriate statistical procedures as well. After determining the coefficients we can simulate Eq. (5) with known or appropriate initial conditions. On the other hand we can obtain some information about agent system in the considered regions without numerical solving the system of equations but on the basis of qualitative analysis of PDEs only. For the purpose here we discuss in more details simplest case of 2 equations. For this case, the model system is reduced to a single (1+1)-dimensional nonlinear PDE fourth order for which an exact analytical solution can be obtained. This equation describes the evolution of the spatial density. Solitary waves can travel through the system if the amplitude of such a density becomes large. In addition, by means of appropriate ansatz, we obtain an exact particular analytical solution of the model equation. This solution describes nonlinear kink and solitary wave, expressing the spreading of the density changes in the space.

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Evaluation of Atmospheric Deposition at Spruce Stands in Bulgaria

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Abstract: The comparison of throughfall fluxes of Na, Ca, Mg, K, Pb, Cd, Mn, Cl, S-SO_4, N-NO_3 and N-NH_4 at mountain spruce stands and bulk deposition fluxes at the open area at fifferent altitudes were carried out in period 2014-2015. Throughfall deposition fluxes of selected elements at spruce stands were higher compared to bulk deposition fluxes at the open area. Throughfall deposition fluxes are influenced by the processes in the canopy layer. The composition of deposition varied between open areas and under canopies becouse of different elements' origin and mechanisme of canopy prosseses.

Keywords: Atmospheric deposition, Throughfall, Norway spruce, Beech

1. Intruduction

Forest ecosystems are open systems that exchang energy and matters with an environment. That's way they are strongly influenced by atmospheric composition, e.g. gaseous and dissolved compounds. Anev et al. established seasonal variability in the physiological responses of some forest tree species in relation to air pollutants [1, 13]. Soluets are transferred to terrestrial and aquatic ecosystems by dry and wet deposition [2]. It is known that the composition of precipitation is altered considerably after passing through the forest canopy. Internal nutrient cycling includes the nutrients transfer from aboveground biomass to forest as litter. On the other hand nutrients leach from the plant to the soil when rainfall passes through the forest canopy as throughfall and stemflow [3, 8, 10, 16]. Nutrient balance depends on the forest type and forest structure [7, 11], site characteristics [4] and weather conditions. Thus local environment may reflect different patterns of behaviour of forest ecosystems.

Air pollution is the main cause of forest soil and water acidification. That was recognized as a serious problem in the last decads of XX centurry [14, 15]. A lot of International programs and agreements such as "Convention on Long-range Transboundary Air Pollution", "International Cooperative Programme on Integrated Monitoring of Air Pollution Effects on Ecosystems" have investigated an impact of atmospheric deposition on ecosystems' structure and functions. Damages have found not only at urban and industrial regions but at isolated not directly influenced by anthropogenic influence [6]. European countries have made a great effort to evaluate the situation and to prevent further damage by emission reduction policy mainly [5, 12].

The aim of the study was to evaluate deposition of solutes: K^+, Na^+, Ca^{2+}, Mg^{2+}, Cd^{2+}, Pb^{2+}, Mn^{2+}, SO_4^{2-}, NO_3^-, NH_4^+, Cl^- at spruce mountain forests and open areas at different altitudes for two years.

2. Sampling, analysis and data base collection

The study sites were located at 1400 and 650 m a.s.l. in Western Balkan of Bulgaria. Soil type was Distric-Euthric Cambisols (FAO) with humus content 5-10% rich in nutrients [9]. Bulk and throughfall precipitation were sampled once a mount in the period 2014-2015. Monitoring was carried out using permanently open polyethylene plastic collectors with a collection area of 314 cm^2 that stood approximately 1.5 m above ground level. Collectors (three at each plot) were situated under canopies of two spruce stands, and at two open areas located nearby to each stand. Precipitation amount and pH were measured at each sampling event on the plots. To analyse dissolved elements, all samples were filtered through a cellulose filter with pore size 0.45 μm using a membrane filtration system. The samples were kept at 4^0C after adding 1 ml of concentrated HNO_3 acid to prevent heavy metal adsorption on the walls of the samplers. Metals (K^+, Na^+, Ca^{2+}, Mg^{2+}, Cd^{2+}, Pb^{2+} и Mn^{2+}) were measured using inductively coupled plasma emission spectrometry (ICP-AES). Sulphates (SO_4^{2-}) were determined spectrophotometricaly and N-compounds (NO_3^-, NH_4^+) by Keldal method.

The average amount of throughfall precipitation for each sampling event was calculated as the arithmetic mean of the amounts captured in the throughfall collectors located on a particular plot. The fluxes of elements ($kg.ha.yr^{-1}$) in bulk precipitation and in throughfall for each sampling event were calculated as the product of the amount of water (mm) and the relevant element concentration ($mg.dm^{-3}$) multiplied with 10.

3. Results and discussion

Precipitation amount in 2014 year were higher than in 2015 year at the both spruce stands and open areas. More over at lower altitude amount of rain water at the open area was 1640 mm and at higher altitude 1270 mm respectively in 2014 year. Precipitation amount in 2015 year were higher (1160 mm) at 1400 m a.s.l. and lower (1010 m) at 650 m a.s.l. The same ratio were detected for throughfall precipitation amount: 1098 mm at spruce stand located at 1400 m a.s.l. and 11431 mm at lower altitude respectively. Differences in throughfall and rainfall amount were resulted by different stands' characteristics and meteorological conditions of the studied stands. Generally the lower amount of water penetrated onto the forest floor at the stand because of interception of horizontal precipitation by the stand canopy.

Acidity of rain water were "normal" for the study period. At the open areas were measured mean values of pH: 5.84 (2014) and 5.36 (2015) for higher plot and 6.04 (2014) and 5.65 (2015) for lower one. Throughfall precipitation were more acid because they are influenced by the processes in the canopy layer. At higher altitude were measured 5.32 and 4.99 pH values for 2014 and 2015 years respectively. At lower altitude pH were: 5.66 (2014) and 5.51 (2015) that is "normal" values for pure atmmospheric water.

The results of average calculated solutes' deposition at the study spruce stands and open areas are given in a Table 1.

Results have shown that water collected under the forest canopy contained larger amounts of ions than rainfall collected in the open area [7, 16]. Throughfall deposition fluxes had a higher contribution of elements Ca, Mg, K and Na because of leaching from the spruce crowns [7]. The similar trend was found for Mn because of a higher contribution of dry deposition under canopy. These observations were found at plots situated at higher altitude, where the dynamics of atmospheric processes were more pronounced than at the plots at lower altitude. On the contrary heavy metals such as Pb, Cd were deposited in a higher concentration at the open area compared to these at the spruce stands. The main source of these elements are traffic that's way at open areas around the road their deposition were

higher. Deposition of Cl have anthropogenic origin from a see salt used in the winter mainly. It was not any ratio found between deposition at both spruce stands and open areas plots.

Table 1. Average deposition at spruce stands and open areas for 2014 and 2015 in kg.ha.yr^{-1}

Solute	Spruce stand 1400 m a.s.l.		Spruce stand 650 m a.s.l.		Open area 1400 m a.s.l.		Open area 650 m a.s.l.	
	2014	2015	2014	2015	2014	2015	2014	2015
Na^+	9.11	2.74	2.34	3.81	2.58	2.61	4.92	3.06
K^+	17.41	13.15	9.50	13.03	4.05	2.39	4.90	5.03
Ca^{2+}	22.08	13.94	9.48	12.52	9.48	8.35	11.22	9.19
Mg^{2+}	3.07	1.75	1.11	1.90	0.90	0.78	1.05	1.04
Pb^{2+}	0.25	0.25	0.28	0.17	0.32	0.18	0.35	0.18
Cd^{2+}	0.19	0.05	0.19	0.05	0.21	0.06	0.16	0.05
Mn^{2+}	1.45	0.98	0.24	0.34	0.25	0.20	0.30	0.25
NO_3^-	12.92	8.11	6.56	5.52	6.68	5.86	14.33	8.25
NH_4^+	10.55	11.14	10.89	8.32	17.94	15.07	15.52	11.98
SO_4^{2-}	22.70	36.47	11.70	30.38	11.11	22.15	9.01	17.52
Cl^-	45.95	36.18	23.96	29.12	37.10	38.68	27.66	25.44

N-compounds had different behavior at the two different altitudes. Throughfall deposition of NO_3^- ions were higher at 1400 m a.s.l. compared to the open area one. On the contrary, at lower altitude they were taken up by the canopy, which decreased their concentrations. NH_4^+ throughfall deposition were lower compared to the open areas at both altitudes because of biochemical processes in the canopies [7]. Throughfall deposition of sulphates were higher than these at open areas at all study sites. Deposition level was higher in 2014 year when precipitation amount was lower. Thus it was measured the higher contribution of dry deposition such as Mn and SO_4^{2-} ions.

4. Conclusons

Throughfall deposition fluxes of Ca, Mg, K, Na, Pb, Cd, Mn, S-SO_4, N-NO_3, N-NH_4 and Cl at the mountain spruce stands and bulk deposition fluxes at different altitudes were measured. The individual study years differed both in the precipitation amounts and in the element distribution of precipitation. Deposition amount corresponded to the precipitation amount. Throughfall fluxes were enriched by most of study elements: Ca, Mg, K, Na, Mn and SO_4. Last two ions were mainly the result of dry deposition. Toxic metals Pb and Cd prevailed in open area deposition at both altitudes. NH_4^+ throughfall deposition were lower because they were taken up by the canopy.

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The Control as a Reason and a Cause between the Natural Disasters and the Corruption

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Nostradamus: "After a total eclipse Comet will pass nearby. Will throw hot stones. There will be floods and climate change. In October the Earth's axis will shift. Will start hunger, disease, war. "

Over the past 12,000 years of human history have been found listed some large-scale natural disasters. 280 nations keep memories written on clay tiles from the Sumerians to the "Great Flood". According to ancient Indian Vedas there were several floods and according to the ancient Greeks there were three floods. The first one is at the time of Ogygia but the bigger one was at the time of Deucalion. According to Plato disasters are periodic, sometimes caused by fire and sometimes by water.

In 1500 BC happened a global cataclysm, for which there is written information by Lucas who described it in the "Old Testament", Chapter Exodus, which describes "10 God's punishment for Egypt. The description of the same event is stored in Leiden Museum in the Netherlands under № 344 of the 1828 manuscript of the XV century BC, known as "Papyrus of Ipuver."

From the beginning of the new era up to date floods are becoming more frequent and disastrous, the ice melting on the ice poles, rise of sea level, climate warms and mankind hardly take real measures to protect the environment from harmful emissions and greenhouse effect (the ability of a thermodynamically active gases in the atmosphere to retain long-wave terrestrial radiation and prevent heat loss by radiation time. In result of these processes increases the temperature of the ground air layer.) and the risk of natural disasters which are destroying mother earth. The risk of natural disasters - probability of incurring losses due to interaction between a dangerous natural phenomenon and the vulnerability of objects exposed to its impact in the environment.

The areas with permafrost and the ice shields in Greenland continue to reduce, the ice in the Arctic and the glaciers across the continent. The ice shield in Greenland lose about 250 million tons from its mass each year, and the glaciers in the Alps have lost about two thirds of the volume that had up to the 1850. This process will have an increasing impact on the amount of the flow regime of rivers fed by them, including river Danube. The consequences of this will affect not only our country but the entire European Union. In this connection, in 2007 the European Commission published a Green Paper "Adapting to climate change in Europe - options for EU actions", followed by the White Paper in 2008, which sets the framework of the European strategy for climate adaptation and is accompanied by an impact assessment of proposed policies in this area (Impact of European's Changing Climate, 2008). In March 2012 is enabled the European internet platform for adaptation of climate Climate-ADAPT, and in April 2013 was adopted "EU Strategy for adaptation to climate change."

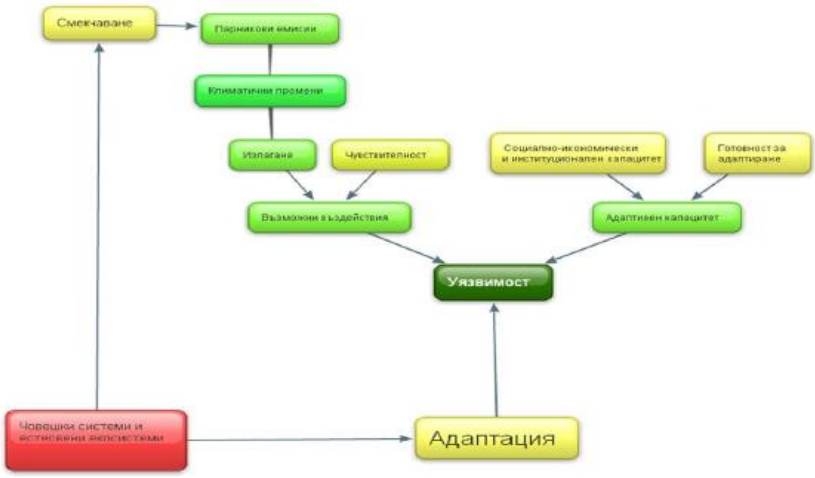

Fig. 1. Conceptual model of the relationship between the impacts of climate change vulnerability, mitigation and adaptation (in Isoard, Grothmannn and Zebisch, 2008 at Impact of European's Changing Climate, 2008).
Source:http://www.moew.government.bg/ files/file/Press/Konsultacii/2014/Obshta_chast.pdf

Bulgaria is among the countries with many scientific research for management the risk of natural disasters systematic application of policies, procedures and practices for analysis, evaluation and risk prevention, rescue and rehabilitation activities for disasters and their vulnerability. Natural disaster - event in which is affected and destabilized a critical infrastructure of a given territory and damages are so great that the local government or community are not able to deal with the damage with their own resources and requires the involvement of specialized units and additional resources to deal with the crisis. Vulnerability - characteristics of a complex of factors (natural, social, economic, legal and managerial) which reduce the resilience of the system regarding the impact of a dangerous event.

The difference between the risk assessment of climate change and the risk assessment of a natural disaster consists in the fact that in the first case it is estimated the risk of realization of a probabilistic output, while in the second one is the realization of a particularly dangerous event. Not as extensively is developed the theme of control implementation of planned activities in disaster risk management by natural disasters and more scantily examined the causation between disasters and corruption. Management of risk of natural disaster - development and systematic implementation of policies, procedures and practices for analysis, evaluation and risk prevention, rescue and rehabilitation activities in case of disaster and monitoring the execution of these activities.

When it comes to corruption, the European Commission has a ready answer. This is Bulgaria, which for eight years has been monitored according to a "Mechanism for Cooperation and Verification ", and the signals it sends are always the same:

- lack of effectiveness of many anti-corruption authorities and their ability to identify and collect suitable evidence as also to wear liability for acts and omissions;
- lack of a mechanism for civil control of an independent judiciary, which for these years didn’t manage to put in jail no politician or clerk at the highest levels, and the state pays for the expense of the state Budget thousands of levs for their incorrect and unlawful court decisions;

- lack of efficacy of the strategies to combat corruption and the plans for their implementation;
- lack of punishment for dozens of avoidable floods, landslides , intentional fires, illegal development, deforestation, etc. etc.

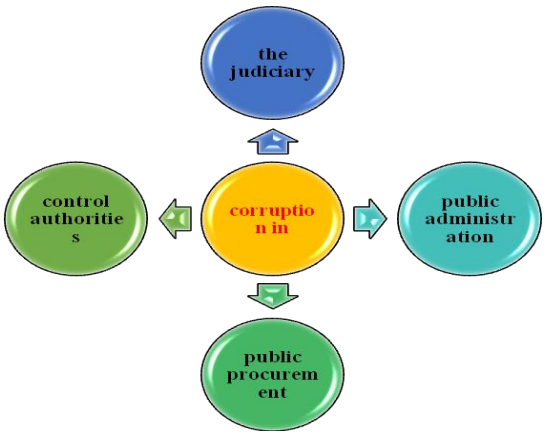

Fig. 2. Corruption Bulgaria

The answer is plain and visual practice is seen in our neighbouring also EU member state Romania, which for several years did put behind bars several corrupt ministers.

The recipe can be described in one sentence, as freely and selflessly was given by Monica Macovei, a former justice minister and current Romanian MEP in a meeting organized by the Initiative "Justice for All" in Sofia in 2015 for the fight against corruption in Bulgaria:

"Politicians will not change the system. The system must change the *politicians. Politicians want to keep the status quo and do not want to have changes. A functioning judicial system will inevitably deal with politicians and political corruption, so it cannot rely on the "political will" for real change"*

Corruption is a problem throughout the European Union, although some countries achieved control and managed to limit its size. On June 6, 2011, in view of the billions of euros lost due to corruption, the EU adopted a new package of measures called "Report of the European Union to fight corruption", which will monitor and evaluates the progress made in this field by the 28 member states every two years.

According to international conventions related to combating and fighting corruption and in particular the UN Convention against corruption, all countries which have ratified them, including Bulgaria, are advised to revise their laws for the corruption to be declared a crime.

The above mentioned commitments require formalization of the term "Corruption" in the penalty codes of the member states as a crime that no Bulgarian government and People`s Assembly showed will to fulfil this commitment, despite the dozens of changes in the Penal Code.

Every crime is socially dangerous, but not every socially dangerous act is a crime. In full force this applies to bribery. Each bribery is a form of corruption, but not any corruption can be identified with a bribe. The newly adopted in 2015 National Strategy for Prevention and Countering corruption in Bulgaria 2015 - 2020 and the rejected by MPs project of corruption bill does not give a definition to corruption, which is why there is no accused and

convicted of corruption in Bulgaria and there will not be in the near future.

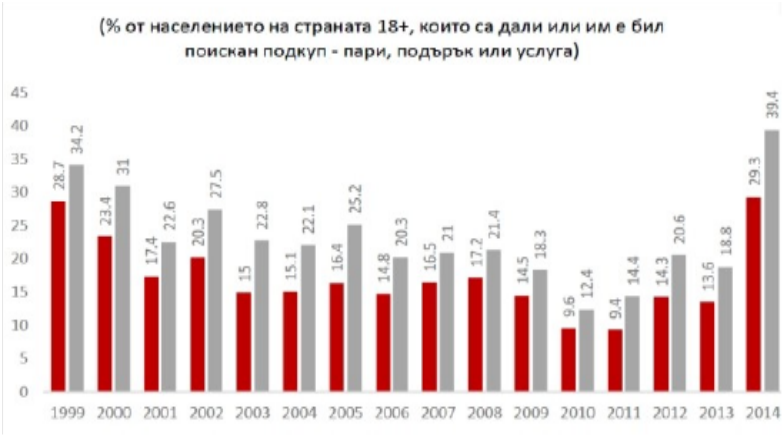

Fig. 3. Participation in corruptive acts and corruption pressures
Sources: http://velikabulgaria.eu/tag/
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The two main forms - corruption and corruption pressures are monitored for a longer period from 1999 to the end of 2014, which is fully sufficient to derive objective conclusions. One of them shows that for all these years outpacing indicator is the "corruption pressure" and its growth is in its highest levels in 2014 with a value of 39.4 at 29.3 for corrupt practices. Second highest is in 1999, when the pressure stood at 34.2 or 5.2 less and corrupt practices 28.7 or 0.6 less than in year 2014.

The trend is apparent that corruption increases, regardless of declared desire to solve this problem, learning from the experiences of others EU Member States.

Declared desires without declared legal norms to sanction and look for responsibility of any anti-corruption body and his staff that idle, does not investigate, does not possess the required qualified but still occupy high rank positions or that they are in the scheme of conflict of interest and instead of taking necessary actions against those officials, still keep them, tolerate them and cover their acts.

Any corruption exists and develops its content only if the chain guarding the values reach to the high level. For these reasons, the battle for power is so fierce at election time because the channels remain and only the patrons change. This is also noticeable in the activities of the Prosecution which with any newly formed government raises charges against those in power. Accusations which generally still lack something to be effectively condemned.

Corruption is a characteristic for every sphere of public life. With heaviest consequences in recent years emerged the damages caused by natural disasters, the irreversible damage and the dozens of lives lost in the process.

A law for protection from natural disasters was adopted in 2006 with multiple amendments and additions, the last one from October 20, 2015. The Act regulates the provision of the protection of life and health of the population, of the environment and of property in case of disaster.

What is the definition of the term "disaster"? It was finalised after two adjustments in Art. 2 of the Act and reads as follows:

"Disaster is significant interference with the normal functioning of the society caused

by natural phenomena and / or from human activity and leading to negative consequences for the life or health of the population, the property, the economy and the environment, the preventing, controlling and overcoming of which exceeds the capacity of the service system usual activities to protect the public. "

The actions of the authorities coordinate into unified rescue system for protection from disasters led by the following principles shown in the following figure:

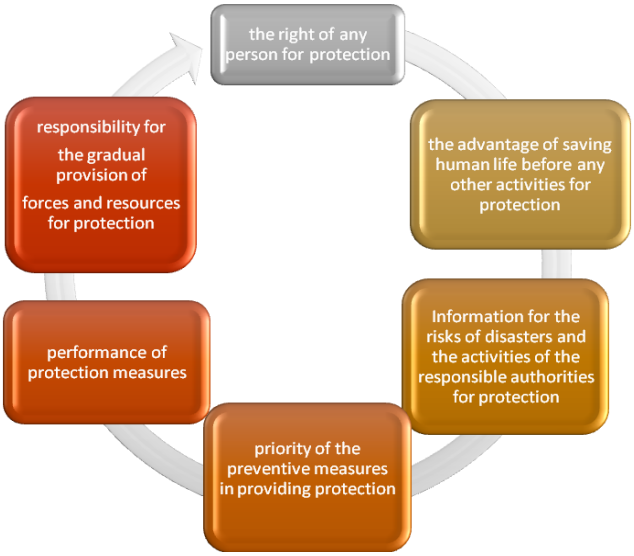

Fig. 4. Basic principles of the unified system for protection in case of disasters

Disaster protection is done at national, regional and local level and is carried out at:

- ✓ conducting preventive activities;
- ✓ conducting activities for protection in case of disasters;
- ✓ support and reconstruction;
- ✓ resourcing and
- ✓ providing and receiving aid.

The government adopted a Plan for the implementation of the National Programme for Protection of Disasters 2014- 2018. Its main objective is to improve the preventive activities for protection of disaster, prevention, control and overcoming of its consequences, protection of life and health of the population and protection of the cultural heritage. The plan describes 137 specific activities of the ministries and departments for the current 2015. They are associated with repairs of dams and hydraulic structures, including the following measures:

- which are still not in operation or have lost its original purpose;
- development of documents and programs related to protection from disasters in the sphere of economy and energy sector;
- training of the executive authorities and their administrations in regard to protecting the population from disasters;
- design and construction of a national system for water management in real time (pilot project of the Iskar river);
- development and implementation of instruction for training actions under fire, disaster and first aid in schools and kindergartens;

- planning, organizing and providing activities for evacuation - Search, reception, accommodation and psychological care to persons, victims of disasters and others.

It is visible that two very important measures are missing- who will carry out the control- current and subsequent implementation of these 137 specific activities and who as an employee / operator holds the responsibility for any low quality finished project or not finished at all and what will be the personal responsibility and sanction according to the caused damage, and in which cases will bear any criminal responsibility. Without proper regulation of these anti-corruption criteria the plan appear only as a 'Forecast of good intentions. "

As a result of the implementation of the plan the government provides:

-to achieve assessment and mapping of the risk of earthquake, nuclear and radiation accident, geological risk;

-assessing flood risk and mapping of the threat and risk maps;

-preparedness of the executive authorities and the forces for response in case of disaster;

-preparedness for disaster protection in the secondary education system.

Of public concern is the answer of an important question for the preventive activities. As with the case of corruption, the prevention is the predominant feature because its purpose is to act before the harmful moment, so to avoid its appearance and development.

Legislative activities for prevention of disasters is developed in twelve points in Art. 6 Chapter Two of the Law on Protection of Disasters. The structure of the legal rules should provide sufficient guarantees that anticipate and assess each risk and provide mechanisms through their effective protection against each predictable and unpredictable situation.

Assuming the hypothesis that this conclusion is not enough credible and does not coincide with the understanding of the essence of prevention, then it should be considered the counter hypothesis that there is no effective application of the preventive activities and it cannot be relied on them as activity against the risk of disasters.

In general there is a lack of systematic theoretical study on contemporary organisational architecture, trends and patterns to optimize the system for management of disaster crisis and the impact of corruption on these processes.

To determine the importance of the arguments in the hypotheses and their practical credibility to be used in emergency situations in Bulgaria in recent years and based on the method of analytical and critical analysis the hypotheses will be either approved or rejected. The end result will answer the question of the effectiveness of preventive measures for disasters and will seek opportunities to display the proposals on the basis of systemic problems.

Flooding

Temporary flooding of a particular area or territory with a huge amount of water from heavy rains, melting snows, floods, increasing the river levels, ponds, water sources, breaking dams or formation of tsunami that cause significant damage to buildings, properties, cars, bridges and even causing death *is* a state of *flooding.*

A brief overview of some flooding in Bulgaria will be done in order to find the reasons, the responsible persons and the results from the preventive actions provided and regulated in the then-current legislative framework.

Some flooding in Bulgaria from the last century will be analysed so to set a benchmark for comparison:

Floods in the twentieth century

1. Plovdiv is a place where floods often happened in 1900, 1911, 1929, as a result of melting snow and heavy rains. Maritsa River goes out every time from its bed and flood the areas around it. In 1929, the most affected was Filipovtsi and in 1957 all Roma populated Stolipinovo is flooded and the gypsy population moved to a new neighbourhood - Adzhisan. Soldiers were involved in the rescue and in strengthening the embankment of the river, in order to limit the size of the disaster. After the disaster on the banks of the Maritsa River high and stronger river walls were built.

2. Targovishte experience some floods as well in 1903, 1906 and the most disastrous one of 6 July 1944. The reason is always the same - the high waters of the Vrana River, the left tributary of Kamchia River overflowing and from the direction of the Dervenska Pass waves, at least three meters high, sweeps away everything in its path. Losses are estimated at around 5.17 million lev.

3. Vidin is destroyed after the great flood of March 4, 1942 by waters of the Danube river. During the first days of spring after melting ice from the frozen river in winter huge blocks of ice at Island of Bogdan blow away the dikes and 5 metres high waves flood the city and reach the villages of Vidbol and Smardan. 13 people were killed and 500 housed were completely destroyed.

4. At 11:25 am on May 1, 1966, during celebration on the occasion of *"International Labour* Day" in Vratsa a thunder was heard from the mountain along the Leva River. Continuous rains for four days have broken the wall tailings of lead and zinc flotation plant "Peace" and mine "Seven Saints". For these reasons Zgorigrad village is flooded with over half a million tons of heavy metals, cyanides, dagger, trees, landslide and mud. Three metre high mud storm had swept people, animals, trees and houses along the road of 7 kilometres reaching the square of Vratsa. For three days the army pulls out corps and trucks are driven on stadium for recognition of over 500 dead. More than 2,000 were injured and more than 150 houses were completely destroyed, for which the government allocated 20 million lev, as compensation from which resources were also built blocks "May-1" "May-2 "and" May-3 " in Vratza.

Thousands were evacuated in Sofia, and authorities forcibly imposed the message: *"From Vratsa came a colonel and issued a written order that anyone who refuses to shelters citizen, who is homeless, who have food and do not share them with those in need, who steals and commit other offenses in connection with the flood in capture will be shot."* (http://www.desant.net/shownews/30934/).

Years later after the tragedy directors and engineers from the mines and the metallurgical factory near Eliseina were sentenced for the tragedy with effective sentences between 5 and 10 years in prison.

Floods in 2005

The biggest flooding in half a century was in the summer of 2005 with more than 2 million affected by the floods.

The first wave of floods is in the period May 25-31 2005

Torrential rains trigger hundreds of landslides which destroy 52 bridges, flood railways, roads, yards, homes and schools. Emergency situation was declared in Mezdra, Svoge and Sofia. More than 4400 buildings were flooded at the beginning of June. Without electricity remained 41 villages and 13 without water.

Second flood wave was from the beginning to June 11, 2005

Luxembourg, Slovenia, Austria and the Czech Republic express their readiness to assist Bulgaria. Dozens of municipalities were again affected by the floods and damage amounted to millions of levs. Sofia region is most damaged of the downpour. Strengthening

of the landslide on the road Samokov-Sofiya was planned to clean and restore roads, bridges and sewer. Torrential rains and strong winds complicated the situation in Targovishte, Veliko Tarnovo, Shumen, Stara Zagora and Rousse and separate municipalities in Haskovo, Burgas, Vratsa and Lovech. A state of emergency was declared in Antonovo, Targovishte, Popovo, Veliki Preslav, Smiadovo, Novi Pazar, Resimenovo villages, Lyubenovo and Trayanovo of Radnevo Municipality, Stara Zagora.

Hail and torrential rains destroyed 297 thousand acres of grain, fruit and vegetables and crops in July, flooded buildings are nearly 6300, and damaged and destroyed bridges are close to 120.

Third wave of floods

The apocalyptic picture continues also in August, but the government refuse to establish a National Crisis Committee. Two corps of men were found floating in Pazardzhik reservoirs, which rise the number of victims to eight. Netherlands provides 20 thousand Euros in aid for Bulgaria and 500 thousand Levs collected from donations. Destroyed and damaged bridges are already 273 and 201 are the destroyed anticorrosion facilities. The necessary funds for reconstruction of those facilities is estimated at 3 135 million leva. By the torrential rains on 4 and 5 August were affected Ihtiman Municipality Botevgrad, Svoge, Etropole, Samokov, Sofia city, Razlog, Pazardjik and Velingrad. In the area of Dolni Bogrov there were broken levee. In Dolni Kamartsi two bridges were destroyed and district with 60 residents was detached.

In the Parliament was held a debate on the floods in the country. On August 9 the outgoing Prime Minister Simeon Sakskoburgotski apologized for not announcing the crisis situation and for not appointing a crisis headquarters in the recent floods, which killed at least eight people and submerged thousands of homes.

"Maybe it's my fault that I considered that it's better to be among people instead of counselling, but there are modern means of communications", he said from the rostrum of parliament and practically took responsibility for the inaction of the Council of Ministers to coordinate its actions and tackle the crisis.

Fourth wave of floods in 2005

In the second half of September for the fourth time this summer Bulgaria is engulfed by water. Stara Zagora, Veliko Tarnovo, Ruse and Sliven are the focus of the water element in the days of 20-22 September. Two to three times more than normal is the rainfall in Northeast Bulgaria.

Only for four months from May to September, more than 20 tragic deaths were registered as a result of the water element. Hundreds of villages were flooded. The railway network is damaged and hundreds of kilometres of roads and bridges were destroyed or damaged.

The conclusion of the international experts is: *lack of preventive actions for proper maintenance of watercourses, protection dikes and management crisis situations to which the opinion was joined by experts of Civil Protection, who add that there is also "a lack of early warning system."*

In the last several years water disasters didn't skip Bulgaria again.

1.Beginning of August 2014. State of emergency in Central and Western Bulgaria caused by torrential rain. Skat River has flooded 100 houses in the village of Krushovitsa and the damage counts to millions of levs.

2.In the region of Plovdiv state of emergency was declared for 7 villages of Rhodopes district.

3.Nivyanin is the most damaged village in the Borovan municipality. Dozens of houses are buried under water for two days and when the water withdraw more than 30 buildings are destroyed and swarms of mosquitoes cause a new disaster.

Interdepartmental Commission for Reconstruction and Assistance to the Council of Ministers has allocated 3 million lev to cover damage from floods in February and the heavy snowfall in March 2014 in Kardzhali region from the approved additional expenses of the state budget reserve amounted to 13.9224 million lev clearing road infrastructure, construction of embankments, cleaning riverbeds and restoration of water supply systems and more than 50 landslides in the Kardzhali region.

4. From midnight on August 1, 2014 the town of Mezdra and constituent villages are under declared state of emergency. The reasons for the flooding is lack of protective dike and blocked riverbed of Moraveshka River and Bodenska River.

5. In the villages of Mezdra Region- Oselna, Zverino, Ignatitsa, Rebarkovo, Dolna Kremena, Darmantsi, Bodenets, Varbeshnitsa the flooding create the need to build retaining walls, cleaning of drains, recovery of damaged fences and paving of streets.

6. In mid-December 2014 the flooding caused state of emergency in Stara Zagora. In Maglij municipality the level of Tundzha River cause subsidence of the road between the Vetren village and Slivito village.

7. In Galabovo, Radnevo and Nikolaevo municipalities also announced state of emergency. Drainage facilities in the power substation "Galabovo" provides power supply to all residents in dire conditions.

8. The level rise of Blatnitsa River threatened the security of the population of Radnevo Municipality. The disaster showed the need for additional 4,000 cubic meters of inert materials to build a protective dike near the Roma neighborhood and the bypass road.

9. In the village of Nova Mahala the pumping of water from basements and yards continues with days. Most of the evacuees were awaiting the opportunity to reach their homes. The disastrous flooding broke the dike of the Tundzha River near the village, and its reconstruction is included in the plan for removal of consequences.

10. Big water disaster haunt the region of Blagoevgrad as well, which this year marked exactly 60 years since the great flood in 1954 that killed 13 people. The mayor declared a state of emergency and ordered the men from 18 to 60 years to be mobilized to participate in the rescue and clean up activities.

11.Bansko was also not spared from the water element on the night of 15th May. Glazne River flooded the new district "Stragite" after levee break just above Bansko. In 2011 the dike was rebuilt for 1.8 million lev in very short time frame, which rise the suspicion for its quality performance, although it was accepted without any comments. Remains the option for the prosecution to look into the matter on its own initiative and verifying the claim that *"this is no levee, just thrown stones here and there and little soil and reported that a proper facility was built." (*http://www.segabg.com/ article.php?id=0001201&issueid=5929&sectionid=5). The district is overbuilt in the last ten years and with many of the hotels built outside regulation and not included in the master plan (WSA) of Bansko, but signed with individual development plans and signed building permits.

12. Another broken dam buries in water villages and crops. Cascade of dams in Stara Zagora and Dimitrovgrad are overfilled and the manmade pond - Martvitsata over Stransko village overflowed and flooded the village with 2.5 meter water column. State of emergency was announced in Opan, Galabovo and Radnevo Municipalities. Water element swept also the neighbourhoods "Builder" and "Lozenets" in the town of Galabovo, where it is partially suspended power supply. Serious damage was caused to Byal Izvor, Aprilovo, Svoboden, Trankovo, Lyubenovo, Zemlen and Trakija. The rising water destroyed and damaged roads

and bridges. The village of Brod was in a direct danger of flooding but the municipality decided to destroy the dike of Maritsa River and allow the water to drain saving the village from the water element.

13. Over 500 signals for flooding are received at the operations centre of the fire service in Burgas. Stransko is flooded early in the morning from broken wall near the 300 acres dam.

14. International road E80 is closed near Harmanli due to the level rise of Oulu River which reach the level of 1.5 meters in height in stretch of 200 meters.

15. After the floods in Momchilovgrad in February seven villages- Zagorsko, Progress, Bagryanka, Chukovo, Novo Sokolino, Postnik and Devintsi are with insufficient water supply due to flooding of the pump station and the water is unfit for drinking and cooking.

Floods in Asparuhovo, Varna and Dobrich have not publicly announced results of the reasons for the disastrous flooding, no convicted and no sentenced.

There are only the same conclusions:

- *lack of preventive action;*
- *lack of guilty and held accountable;*
- *lack of convicted despite dozens of casualties given to the water element.*

Prevention activities

Article 6 para. 1 of the Law points out the characteristics of the preventive action justified by twelve features which help the legislator to achieve disaster risk reduction, with the following measures:

1. Analysis and assessment of disaster risks;
2. Mapping of disaster risks;
3. Categorising of settlements according to the number of potentially affected population;
4. Establishing the critical infrastructures and their locations and Risk Assessment;
5. Measures for protection of critical infrastructures;
6. Planning of protection in case of disaster;
7. Acting according the requirements for planning the territory, investment design, construction and operation of buildings;
8. Creating and maintenance of systems for monitoring, early warning and disclosure;
9. Guaranteeing collective and individual measures for protection;
10. Education and training of central and local executive authorities, Special Forces, voluntary formations and population;
11. Accepting and implementation of national programs for protection of disasters;
12. Preventive control.

The legislator did not seek a way to prevent disaster through prevention, such as controlling the pre-cleaning of river beds or building quality and well-maintained dikes, but manage only to reduce the risk.

The logical question which arise after the flooding in Mizia, Asparuhovo and Burgas is what is the numeric expression of the risk and if the flood repeat, how would the risk will be reduced after the ravine of Asparuhovo is still not cleaned and illegal buildings are being recovered again day after day.

It is not correct to accept that the above mentioned 12 points are not practical and acceptable as preventive actions and have no significance. They are the core of the circle, without which the wheel will not rotate, but still are lacking the points making up the outer

core round, which should cover the last 12th point, which should contain, legally regulated, the following mechanisms for control:

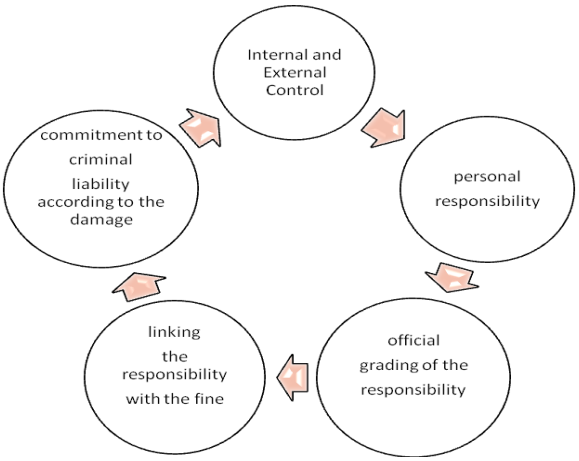

Fig. 5. Mechanisms for control to prevent corruption

Planning disaster protection is done at the municipal, regional and national level under Article 9 of the law, and these are:

- Interdepartmental Commission for Reconstruction and Assistance to the Council of Ministers with Chairman the Minister of Interior Affairs;
- Governors who exercise control over the implementation of the decisions of the commission on the territory of the region;
- Council of Ministers, which forms the state policy for protection of disasters;
- The members of the Advisory Board of the Council of Ministers;
- National Headquarters with certain leaders and members who have obligation to supervise the implementation of the tasks and measures to manage the disaster;
- Ministers and other responsible persons according to art. 19, para 4 of the Administration Act within their competence to carry out controls on the implementation of measures for protection in accordance with the their delegated by the law powers ;
- The district governor, who organizes and controls the implementation of the preventive measures in order to avoid or reduce the effects of disasters, organizes, coordinates and controls the process of supporting and disaster recovery and provides annual report to the Ministry of Interior Affairs for the work done on the protection of disasters;
- The mayor of the district shall submit to the governor an annual report for the work on disaster protection and shall organize and control the implementation of urgent work in the recovery process after disaster.

The total control over the observance of the whole law is implemented by the Minister of Interior Affairs and authorized by the officials who should bear corresponding liability under the proposed scheme to control the entire series of authorities charged with the preventive activity.

Flood victims are accusing all governments, all regional governors and mayors for all inactions, lack of comprehensive control, corruption in the process of awarding and winning

the European projects and uncontrolled and inefficient absorption of European funds, for the rampant corruption and for all the victims of the water element.

Conclusion

And since, according to the investigation, according to prosecution, according to the court, according to the parliament, according to the government, according to countless government specialists, experts and scientific theorists in this field there is no one to be blamed for the floods, maybe we should assume that the floods in Bulgaria are caused by the US conspiracy climatic weapon HAARP 5.00 / 5 (100.00%) 1 vote ionospheric weapon.

One of the main properties of HAARP, is that it can influence climate change, namely the cause and contribute to flooding by causing heavy snowfall and torrential rains to affect the upper layer of the atmosphere. According to proponents of the theory, on various forums on the subject, this is the reason behind both the earthquakes in Haiti, the volcano in Iceland , the catastrophic tsunami and the devastating earthquake in Japan, etc. all with the economic purpose of destabilizing the countries and in the case of Bulgaria- its refusal of shale gas exploration (http://www.razkritia.com/139009/navodneniyahaarp).

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