Department of System Analysis
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System approaches‘14

Systems thinking
and global problems of the world

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Content

PREFACE

SYSTEM THINKING IN INFORMATION MANAGEMENT

Our time characterised as information society puts a lot of emphasis on information, its acquiring, processing, storing etc. The information we get is very often mediated in the strong sense which means we can´t get the information ourselves, but depend on a mediator who supplies the information and in many cases processes it to some extent.

The comfort we thus get can be mixed up with laziness when people uncritically accept the mediator´s message. It is very easy to use one established perspective on the information only and disregard all other perspectives. It is also tempting to forget the roots of all understanding in natural world and see the current (often technical) understanding only.

Where the risks are, hope can be found, too. More mediators can be found in our mediated world and their perspectives compared. The more complex and diverse world we get to know the more creativity is required to handle its problems. We learn that the problems are interconnected which contributes to their sophistication, that they don´t repeat and we are forced to look for new ways of their solution, for new tools, new colleagues etc. The old simple solutions don´t work anymore, be it TQM, balanced scorecard, downsizing, process management etc.

That is why information management is important, nobody can rely on automated ways of information processing only as new ways of dealing with information are necessary both in the competitive market and when dealing with the world. Information management provides guidance on how to handle diverse complex problems in creative ways by means of using information. It teaches us how to avoid manipulation and make the best of the information available.

I am glad this year´s conference “System approaches 2014” kept alive the tradition of new perspectives on complex and diverse problems while respecting their holistic aspects. The holism is not deducible from the particles, in order to see it we must ascend to a higher perspective where the particles are not seen as independent, but in their interaction only. The parts of a ship don´t float themselves, only their correct composition – a ship – does. The contributions brought to our awareness many different problems (social responsibility, mathematical models, programming, organization, education, censorship, decision making, management of change, computational immunology, new media, IT solution etc.) and their solutions. In the subsequent discussion the participants exchanged their ideas and new holistic understanding was established.

This respectful approach to the world together with stressing the lifeworld of man was stressed by the founder of this conference Mr. Antonín Rosický. Many of his students remember his enthusiasm, democratic character and ability to think in many perspectives.

I hope we will continue in this inspiring conference and discussions.

THE IMPORTANCE OF THINKING IN THE FIELD OF EDUCATION FOR THE „INFORMATION AGE"

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ABSTRACT

This paper discusses the importance of thinking in education. Based on critical analysis, the paper discusses obvious trend in this area - that we head towards the pure receiving of knowledge without thinking, instead of learning of knowledge. These sketchy fragments then fail to provide sufficient basis for future effective decision-making of individuals in todays computerized and data-supersaturated society. The current availability of data, the application of new technologies in the educational process, the orientation of a person to "having" mode in relation to the world (according to Fromm) which promotes the commodification and instrumentalization of education, together with above outlined related shallowness, in the meaning of the depth of information processing, shows and increases real risks.

KEY WORDS

System, thinking, knowledge, education.

INTRODUCTION

„Only shallow person can look at contemplative man as at man who wastes his time."

(Brouk, 1946, p. 34)

The present text seeks to briefly highlight the importance of thinking in education for individuals in 'information age', ie for his application in a computerized society whose characteristic is especially huge data availability and relationship with modern information technology. After a brief introduction to the topic we discuss the problem of tending to passive (uncritical) acceptance of knowledge that should (in our imagination) provide to us more convenient and richer life (instead of thinking and knowledge making). It is shown that maybe we're wrong, that our ideas are false, and vice versa, this life will be the poorer. The authors of this paper have no ambitions to predict the development of society, because this prediction is not possible. Given the limited space is the aim of our output mainly to highlight the potential risks and provide the text stimulating for contemplation.

KNOWLEDGE AND THINKING OR DATA AND PIECES OF KNOWLEDGE?

In context of the computerization of society[1], related economic changes such as the creation of new jobs or increase of the share of information products and services in GDP, and unprecedented information saturation enabled by internet, is often talked about today's society as about information society. The growth in data availability, however, among other things, calls for an adequate response in the field of education. Nowadays is education understood much more in the sense of Fromm's (1992) "have an education" than in the sense of "being educated" and the commodification leads to marginalization of deeper theoretical study as "immediately unusable in practice" and therefore bringing no current and desired (often financially) measurable profit.[2] In computer science is a major distinction date-information, when we can see data as a representations of facts with no meaning and information as the interpreted meaning of these data. In the theoretical interpretation then continues the concept of knowledge. Equally important, but in the literature in this context so often neglected, is the term piece of knowledge. The piece of knowledge is not knowledge nor the information. It is some sort of "internalized" information differing from the knowledge. Because if there is no connection with other findings in the learning process[3] is its value close to zero - ie it is just a memorized stub. Here we refer to the Austrian philosopher Liessmann (2009), who highlights the problem of fragmentation of knowledge. And this fragmentation is the reduction of knowledge to its mere fragments, thus mutually unconnected meaningless pieces of knowledge which can't mean understanding and don't allow adequate interpretation of reality (phenomena). This consequently leads to ineffective decision making within the considering system. Knowledge arises not on the basis of understanding (or better interpretation of data) but on the basis of deep understanding, which calls for a (deeper) mental activity (thinking). It is sad, that so often is this deeper mental activity considered unnecessary in a wannabe utilitarian way. And we are confirmed about that by our new "smart" information and communication technologies that should "think" instead of us. We underestimate the importance of thinking as in his article emphasizes Rosický (2010) referring to systems thinking as the thinking emphasizing understanding, especially if you release yourself from the dependence of analytical-mechanistic conception of the world. Deeper mental activity appears for students being in relation to the have world type as uneconomical. In this context Fromm (1992, p. 30) says: "Having type students (individuals) listen to the lecture, they hear words, understand their coherence and their meaning as best they can, literally everything written in their notebooks, later they memorize the notes and passed the tests this way. But the content does not become part of their own individual system of thought, enriching and extend them." Today we can additionally add that they do not write or they do not need to write notes at all, because all "test required" information are summarized in paragraphs of electronic presentation

[1] Informatization is the process of penetration of information and communication technologies (ICT) in many areas of human activity. For example Cejpek (2005, p. 105) states that it is "the process of penetration of information technology and technology into the society ... affecting its organization and functioning." This is related to the increasing dependence of the "ICT-enabled processes implemented" on applied information technology.

[2] Nowadays is it a little bit of trend. There are the "proponents of commodification and instrumentalization of education" with the aim to provide not theoretical but professional (practical) education at universities . In the context of our discussion, we can provide an answer by the words of the French sociologist Touraine (1969, p. 19), who in La société post-industrielle explains that "those who strive to provide mainly purely professional education at universities, are right in the effort of providing employment for graduates. There is, however, a risk that universities will produce managers and specialists, who will not be able to think critically about the company which employs them."

[3] The learning process can be understood as the formation of (or reforming) knowledge. An important concept in this area is known taxonomy of educational objectives of Benjamin Bloom (1956) or its extended version (Dave, 1975). We should ask ourselves whether we are not too oriented to its first phase - remembering facts, adoption, imitation.

that is simple to memorize. Now we come to discuss about the influence / importance of ICT in the educational process.

Growth in the number of students educated with the information technology support changes the verification of "knowledge". Aside from the deflection from the oral testing - from laying "open" questions, when student demonstrates the ability of thinking about the problem and understanding the context, to the "closed" (computer evaluable) test questions, when understanding of the substance (theme issue) goes to back and are what is tested is not knowledge, but just disintegrated memorized fragments - pieces of knowledge. With above outlined relates the important phenomenon of the present, which are electronic presentations. Synonymous for these has become PowerPoint software. Students which are preparing for tests often do not study literature, but just "learn" points from these presentations without any understanding. They can do that, because it is enough for test. Liessmann (2009, p. 104) to that noted: "The way the knowledge is now presenting, can also be seen as a growing contempt for knowledge. Often you can observe bad habit observable not only at business presentations, but increasingly on scientific symposia and universities, whose core is that the simple sentences and lofty concepts are projected through PowerPoint and then the speaker simply reads them, with no context and no additional value. On such occasions, there is a significant mismatch between technical and media equipment and spiritual content. Not only the domination of technology overlaps words, it already does not allow true thoughts." Although the number of university graduates (often in quotation marks) is growing, it can be observed inability of many to consider in context, rationally and critically about real problems. Internet (holding in discussed topic the crucial role such an important medium of today world) becomes itself along with other media dangerous for those who often voluntarily and paradoxically from a utilitarian perspective resigned to their ability to think. If we should discuss the consequences of the application of information technology to lower levels of education, it is good to remember, as writes Afemann (2011) in his article aptly entitled Ein Laptop macht noch keine Bildung, that "almost all studies on the success of learning using computers at school were initiated and sponsored almost without exception by computer companies and telephone companies." Also, authors of scholarly articles have long been claiming that there is no evidence to support claims that computers affect the learning at school positively. We noted that Oppenheimer (1997) described at the end of the twentieth century so called "Computer delusion" and the lack of evidence of a positive effect of Internet use for education since 1998, calls the "Internet paradox" (Kraut, 1998). However, there are studies that have come to the conclusion that when measured performance of students in learning using computers and without their use, then we can discovere the negative effect of using computers on performance (Wenglinsky, 1998). We also have other results. The authors of the study about relation between the use of computers at home and at school and individual student performance (Fuchs, Wösmann, 2004, p. 15) commenting on the results as follows: "The mere availability of computers at home leads mainly to the fact that children play computer games, which distract them from the learning and negatively affects the performance achieved at school ... Looking at the use of computers at schools (the ability of use the computer) on the one hand shows that those of students who don't used a computer show slightly worse performance than those who use the computer a few times a year or month. On the other hand, performances in counting and reading are - for those who use computers several times a week - much worse. The same is then shown for the use of the Internet at school." Yet we must take into account the current situation where pupils use computers and especially the internet several times a day for several hours, as observed by Spitzer (2014).

The named author (Spitzer, 2014, p. 64-65) in the present context refers to the fact that digital media "reduces the depth of processing" and as a psychiatrist notes that "what happens with the incoming information in our brain depends on the fact, if we process it just shallowly or thoroughly. This explains the effect of depth of processing on storage of information: if we deal with some content thoroughly, all these aspects and features will be captured by different brain regions. This intensive processing based on all possible aspects affects the change of many synapses and then cause better storage of the content. ... This idea applies of course also to the opposite: the more shallowly we deal with some content, the less synapses in our brain are activated, resulting in the less we learn." Such knowledge would claim, that the use of information and communication technologies, including the Internet can act negatively on learning. Stated practice leads to the greater shallowness, as aptly writes, for example, Carr (2011),

calling his title The Shallows. American logician and linguist Chomsky (2012) talks about it as well. The reason is that nowadays we don't understand the materials (theme), but we only "fly over" it or learn it by heart. Another bad habit (considering working on seminar papers, etc.) is just copy and past without at least reading the text (Ctrl + C replaces mental activity). Appreciable problems in that context are connected with for the internet typical anonymity. It is no secret that there are sites where you can download already done seminar work or even order a work on a particular topic (Morgan, Vaughn, 2010). Spitzer (2014, p 66) further notes that experience with ICT in schools shows that "if you drag a word on an interactive whiteboard from point A to point B (i.e. moving it to another part of the screen), then you are doing only the most shallow thing, that you can with the word do ... Read word or even rewrite it are some steps of deeper processing and require a kind of deeper mental activity. Electronic media make it weaker or even completely remove." Right because our computers facilitate mental work, do not notebooks, tablets and interactive boards designed for school teaching fit to enhance the quality of education (Spitzer, 2014), learning suppose individual mental work and it is true, that the deeper process we the substantive content, the better it mastered. "There is no sufficient evidence to suggest that modern information technology is improving the teaching in the school. Conversely it leads to shallow thinking, distracts and also has several undesirable side effects. All this follows from the way our brain works and from the replacement of mental work through the computer" (Spitzer, 2014, p. 88). The use of these technologies and media leads to apathy towards the inculcation of knowledge, because we feel that everything we need can easily be found "on the Internet". Many people have thus a very bad idea of useless of "background knowledge" that would allow adequate interpretation, assessment of validity and credibility of the information, etc. Scientific studies also provide the first evidence that the increasing digitization of writing has negative consequences for the reading abilities of children (and adults). It is reading and mainly so-called critical reading (Hausenblas, 2007), which is an important skill and prerequisite of critical thinking. [4] Also, learning the letters by "tapping them on the keyboard" (in schools) in comparison with the practice of writing with pencil leads to worse performance on letter recognition, in the case of adults leads to less thoroughness and lack of mental work (Spitzer, 2014). The use of ICT in education is becoming a fact of life, and it brings many benefits. In their use, however, we must be careful and remember also to their negatives, which is definitely not in the long run marginal. Risks or disadvantages of using ICT in education are also noted for example by Bacescu (2014). According to this study the main disadvantages are mainly the lack of practical activities, isolation and loss of personal contact and mainly loss of discussion skills and critical thinking. The big problem also remains lower quality of information provided through ICT (Orzan et al., 2014). This problem is related to a lack of context with the following information communicated.

So the main question is how the meaning attributed to thinking and deep knowledge will be changing at the time of wannabe economically utilitarian orientation of education. We can find quite apt description used by Fromm (1992, p. 39), we can paraphrase it as follows. A huge sandwich topped with an enormous amount of knowledge is now offered for students and each student can from time to time "take a nibble" from it to not have to focus on one topic, much less to read the book until the end.

The right option to solve this problem or better right way to go within the field of education in “information age” is to use information and communication technology wisely. It offers great opportunities to show the theme of education more efficiently and graphically. But it is not salvation, it can not work just itself without critical thinking about the theme. The right way should be to use technology to extend the possibilities of teaching, not subordinate the teaching to technology (because

[4] Critical thinking differs from ordinary thinking by the depth and distance. It is not only thinking about the causes and consequences (ie, the causal thinking), but also thinking about how is the topic related to us, to someone else and what is important, how it serves to different kind of people and whether we know enough about it. Therefore, these thinking emphasizes the perspective, ie. who actually tells us about the theme, what is his motive to deal with the theme, how is he presenting it and so on. Is also critical to distinguish facts from opinions, what is the origin of facts and also search for the given arguments for any opinions (Hausenblas, 2007).

it decreases it), develop system and critical thinking or (at least) thinking in general and interconnect theory with practice.

CONCLUSION

The paper titled the importance of thinking in the field of education for the "information age" tries, in the given format, to provide a brief critical reflection, which is intended to encourage further reflection and discussion on the discussed phenomena and problems. The distinction of piece of knowledge - knowledge was pointed out and in this context we also highlighted the importance of thinking as a prerequisite for real understanding. The idea of uselessness of having some unnecessary knowledge base, shallowness in information processing and aversion towards the thinking are the main problems. It is necessary to react adequately to them.

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ARE SYSTEM APPROACHES STILL BASED ON MATHEMATICAL MODELS?

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ABSTRACT

System thinking rose hand in hand with the development of quantitative methods of the management of economic units. It is a similar symbiosis that exists between the astronomy and the mathematics. This paper presents information about how this bond is affected by neo-liberal polemics on mathematical models versus economic reality. We are going to deal with the relation between the science on complexity and the classical model of general balance as well as its more contemporary version in the form of the model of dynamic stochastic general balance. Considering the fact that the economic science investigates one of the most complex movements of most complicated reality, there is no wonder that the existing model tools are still affected by numerous limitations that make their use more difficult. Nevertheless, the reasons mentioned in the paper show that the mathematical modelling can be regarded as a research guided in the right direction.

KEY WORDS

Company productivity, efficiency, process organizational innovation, intensity, extensity

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INTRODUCTION

System thinking has been developed as a separate exact discipline; however, its findings also become common part of other disciplines, such as project management, business process re-engineering or concurrent design. This way, the system thinking has been integrated into design planning and management, e.g. in the USA as well as in other countries, such as Japan. In the Czech Republic, the 90´s saw opposite views besides the similar tendencies. They were based on overrating the assertion of the „pure" liberalism which recognized in system approaches a sort of reflection of the rejected planned socialist economy. However, not seeing the integral connections of the real complex market economy, during the supervision of different economic units, leads to uncritically simplified and often incorrect decisions. This applies both to the state, municipal policy and to the management of firms. The firms then cannot see a long-term perspective in a qualitative development that prefers intensive factors of development; they cannot invest in reliable search for staff with adequate skills, show no interest in cooperation with schools and research institutions etc. Non-system decisions have been taken not only by firms, but since the 70´s also by the government, ministries and the parliament and the non-system concept is also visible in the contemporary legislation. The fact is that the system approach is challenging and therefore when searching for reasons for its rejection it is suitable to use every

applicable argument. One of them refers to the imperfection of quantitative methods and modelling tools used during the supervision of economic units at different hierarchic levels. Later with a detailed description, we will see e.g. that the models cannot precisely predict the breakthrough events or the prerequisites for the application of mathematical models are too far off from reality. This paper aims to specify the described issue and to search for a suitable basis.

1 EXACTNESS OF THE SYSTEM ANALYSIS

The system analysis, system approach and system thinking follow from the very start exact scientific approaches based on mathematics and cybernetics. We know, that today's broad concept of systematic approaches also implies a soft approaches and uses non-mathematical modeling. The founder of the system thinking, Austrian biologist Ludwig von Bertalanffy based his general theory of systems on mathematical methods. In his book (Bertalanffy, 1960, p. 137 – 259) he states: *„the general theory of systems would be in a detailed form a mathematical discipline that is purely formal by itself, however, applied to various empirical sciences. It should have a similar significance for sciences dealing with organized units, as the probability theory has for sciences dealing with random phenomena…"*

If we are to perceive e.g. the firm as a structured whole, the parts of which interact at various levels, we are able to describe, express, examine or control these relations only by means of an exact apparatus, applying creative thinking. System thinking cannot cope only with the system definition as a complex of elements with some relations since it has several levels:

- The first level presents transparent hierarchic **description** of the system by means of meaningful partial and aggregate quantitative and qualitative quantities. They help us express both the mutual relations of the parts of the whole and their proportions, both in space and in time and in relation to the system environment. This system description is better if it is more illustrative, using suitable display methods.
- The second level of the system thinking is defined by the description of system **goals** and **performance**.
- The third level of the system thinking describes reciprocal **influence** and relations between the system structure and the system performance. This level is dependent on the usefulness of the examined system and the adequate model display.

The fourth level of the system thinking deals with the structure changes and the system performance with regard to **changing** targets (Gouldner, 1964), who dealt with the levels of system thinking in his book questioned the possibilities of exact methods or (Horáček, 1998, p. 156).

Entrepreneurial thinking of managers should be strategic, system- and economy-related. Traditional economic thinking focusing on gain and profitability is not enough. The system analysis was historically developed not only within the issue of company management, but also as part of the analysis of social or political systems, even in the context of non-economic sciences. A high degree of exactness was set by the evident system completeness as well as by the inspiration from natural sciences and significant development of cybernetics. This applies to quantitative as well as qualitative quantities, see e.g. (Patton, 2002, p. 120) „Some system approaches directly lead to qualitative examination or even fully depend on it." Although the paper is focused primarily on economic models, but mentioned herein dynamic parameters of intensity and extensiveness are applicable in any scientific discipline as well as the basic principles of the science of complexity.

2 GENERAL BALANCE MODELS

The application of the system analysis in the economic theory is clearly obvious not only within the development of firm tools but also in areas that attempted to model extensive economic units. A typical example is Walrasian General Equilibrium Theory. Leon Walras is considered the father of mathematical modelling. His model was made up of systems of equations that depicted the relations in economy. He was searching for the conditions to establish market equilibrium. His model of general

economic equilibrium was created on the assumption that there are fixed parameters, unlimited business activity, unlimited sources, perfect competition etc. The price in this model represented the factor of the equilibrium that has been derived from the consumer´s conduct. This concept has been criticized due to its stationarity and unrealistic assumptions. Although Joseph Schumpeter considers Walras one of the biggest economists of all time, he was one of the critics of his model. He mentioned e.g. that the basic mistake was to assume that the „normal" economy is in the state of equilibrium. In reality, economy is not in the state of static equilibrium, but it may be in the so-called dynamic equilibrium (Shumpeter, 1954, p. 827).

It was basically this well-founded criticism that was responded to by authors who made the model of general equilibrium more perfect and dynamic. In most cases, such a model is even more complicated and thus less controllable and many may consider it impalpable. Nowadays, a typical example of such a favoured model is DSGE model of the dynamic, stochastic general equilibrium. This in the past years fashionable model was criticized e.g. by professors David Hendry and GrayhamMizon from Oxford, who wrote from (Kohout, 2014, p. 15): „Many of the theoretical equations in DSGE models include dependence of the present variable (e.g. income) on the future expected value of the same variable. Unfortunately, most economies may suddenly experience a quick change in the statistic distribution of the values of this variable. Thereby, the assumption of stationarity is no longer true. Impacts on DSGE are deep. Mathematical base of DSGE ceases to function in these cases. It is similar as if in case of fire the fire station were automatically the first one to burn down."

Our experience with the dynamization of the general equilibrium model, however, is positive. We are able to expand this tool in order to model even the dynamic processes corresponding to the knowledge society. We do not consider it necessary to work with stochastic quantities, however, we can abandon the strong assumption of perfect competition. The model does not need to be unproportionally complicated since for determining the quality of development we have derived a universal tool - the so-called dynamic parameter of intensity, which expresses the share of intensive factors influence on the product development. These dynamic parameters are mentioned in (Mihola J., Kotěšovcová J. 2013) "The parameters of the intensive development of the trajectories of the knowledge society" presented at international conference System Approaches 2013.

Such a model as any other model is applicable for specific tasks only as no model can have an entirely general use. It can be used e.g. for didactic modelling of relations in the market economy or for the research of the performance of knowledge market economy with limited sources. We can thus search for answers to questions such as: „On what conditions can we rely on the „invisible hand of the market" and when can we not do without any form of meaningful regulation?"

3 SCIENCE ON COMPLEXITY

The theory of complex systems elaborated mostly by (Stewart, 2013, p. 246 - 251) became well-known in 1984 as Mr. G. Cowan and M. Gell-Mann founded Santa Fe Institute. The main objective was to develop and expand new mathematical methods that could examine extensive systems with numerous interactive objects through simple rules. The key phenomenon is the so-called emergence, which represents such conduct of the complex which is not possible with an individual object. For instance, brain emergence is the state of consciousness or intellect. This led to the discovery of the so-called cellular automata. A most successful illustration of the complexity theory approach is the evolution in the Darwinian sense. The traditional mathematical model of evolution was already developed by British statistician Ronald Fisher in 1930. The eco-system is viewed here as the storage of genes. The reproduction of organisms is modelled here as a rearrangement of genes into new combinations. Lots of models of this kind have been developed. At the beginning, it is necessary to set simple rules for the interactivity of many individuals and then the computers just do their work and show us what is going to happen. A well-known project Tierra, the so-called „artificial life", developed by Tom Ray in 1990. This often results in a number of remarkable phenomena that appear as completely natural.

These phenomena can be often observed in the economy. This modelling method, however, does not require fulfilment of many little realistic conditions, such as real awareness among individual economy actors. Imperfect awareness among the actors then easily becomes the reason for achieving the so-called sub-optimal states although consumers as well as entrepreneurs try to achieve the optimization of their conduct. I thus quote professor Stewart „*The complexity theory represents a challenge for this easy capitalist utopia for many reasons. One of the central dogmas of the classic economic theory is the „law of diminishing returns“, discovered by English economist David Ricardo around 1820. The law says that the growth of any economic activity will sooner or later be restricted by certain limits,“* (Stewart, 2013, p. 250).

In terms of the complexity theory, the market is not only a simple mathematical viewfinder of equilibrium, but a „complex adaptive system“, where the participants themselves change the rules that control their behaviour. Complex adaptive systems often create interesting situations that shockingly remind of real-life situations. Classic economic models compared with the complexity theory models have the disadvantage of containing built-in mathematical restrictions that in advance prevent most interesting movements. Use the principles of complexity theory allows to bring decision-making and economic elements in the processes of lack of awareness or bounded rationality of actors that will define some elements of their behavior. The purpose of the model is then seek consequences of the changes , like it is done in game theory . Therefore, the complexity theory models are one of the possibilities to realistically model economic processes by means of mathematical tools.

4 CONCLUSIONS

From the very beginning, the system approaches have been connected with the development of quantitative methods within the management of economic units. Founder Ludwig von Bertalanffy created a general theory of systems through mathematical objects. This paper gives negative answer to the question whether this concept can be challenged by neo-liberal argument about the possibilities of mathematical models in real economy. |However, that does not mean that the criticism of historically established models of particularly more extensive economic units such as the state is not well-founded to a certain degree. Walrasian General Equilibrium Theory was a unique pioneering act in his days that created the foundations for mathematical modelling. Shumpeter´s criticism of his too static concept and reality of distant assumptions can be responded to by our efforts to improve this model or basically by applying other mathematical instruments. Perfection of the general equilibrium model consists both in its dynamization and in loosening of its too simplifying assumptions. One of the current attempts to improve the classic model of general equilibrium is also GSDE model, i.e. a dynamic stochastic model of general equilibrium. This widespread model might be dynamic, however, its complexity is not well-balanced with universal options of its use. The key problem is the fact that every mathematical model is suitable for specific tasks only, which is why it can never be fully universal. Nevertheless, we consider mathematical modelling a research guided in the right direction. The implementation and perfection of system thinking in our mathematical models are very encouraging. See e.g. the paper and international conference System Approaches 2013 (Mihola, Kotěšovcová, 2013). One of the promising possibilities to apply system thinking for modelling the development of more extensive economic units is the theory of complex systems. This theory seems quite suitable for the modelling of human behaviour which does not demonstrate a high level of rationality or knowledge in all respects.

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MODELS AND SIMULATION AS A TOOL OF TEACHING

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ABSTRACT

Models and simulations are irreplaceable in all of human activity. We can find their application in the planning, the system design, construction, facilities of all kinds, etc. The authors in this article draw attention to the validity of the models and deal relationship between the model and emergence. In the paper is pointed out the fact that model is a simplification of reality and emergence represents the creation of new properties, which is not a simple summary of the individual parts of a whole. When using the models penetrate crucial contradiction between emergence and reductionism, which is the basis for creating models. So emergence is a challenge to create models of the new generation. Teaching is one of the large areas where the models and simulations are used. In this context, this article points out the role of models in education, this can be understood as a learning tool. Authors in the article attempted to categorization of the models in the field of education. There are a mentioned number of examples in which the models used. From our practice, based on the experience of teaching t the Faculty of Electrical Engineering suggests that models are irreplaceable in the modern conceived teaching. It offers arrange of models in particular abstract, which are based on the use of computers. Their application depends on the subject in which they are used. Models have an important place in education for their catchiness simulation and active student access. It points out also the difficulty with the technical equipment and the inevitability of computer literacy. Modelling and simulation require that the principles of these activities have mastered the teachers but also students. Therefore, it is necessary to assign subjects into learning which will prepare students to use models and not only in teaching but also in professional practice and everyday life.

KEY WORDS

Model, simulation, teaching, training.

INTRODUCTION

Models and their use in the form of simulations have important instead in human life. Currently, almost every activity is related with the use of models, both directly or indirectly. If we understand the model as a simplified of the reality, then the model allows understand the world and the events that take place in it. The models allow us to verify the scheduled events, equipment, buildings i.e. the proposed systems and their functions. Very often the models are used in ordinary human life. Then it is possible to construct a model of certain life situations for achieve the vision what will be the result of these situations. This process can be used on to influence the system based on the knowledge of function model in order to achieve optimal results when you use the real systém (Senge, 1995).

Models have an important place also in the process of discovering. New discoveries were created by using the models which assisted to believe man in the concrete phenomenon. They were subsequently verified and confirmation in practice. Similarly is carried out the learning process.

The use of models is not new. In ancient cultures we find mentions of how the people learned and sought solving of the situation just using the model. At the time they no talk about models, but the principles which were used fully meets the definition of models and principles of the simulation. Using the models is a natural characteristic of human, which is different from other animals. Thinking is essentially the creating images that can be considered as abstract models. These human subsequently used for simulation and it allows him to predict how they will proceed going on under certain conditions. Models usually allow a simple procedure to change the input conditions and thus obtain simulation results to choose the best solution (Koščová – Exnar, 2012).

It should be recalled that the simulation results are not only depend on the input conditions but also on the model. It depends on what will be the structure of model; how links will be established in the model and how will be the model reflect the reality. In this context it is useful to recall the definition of the model and that the model is a simplified the reality. When assembling the model we take into consideration just some of the factors that we believe are critical for the operation of the model. In this process, but some of my relationships, particularly from the real world into the models do not include (Lacko, 1998). This may in a certain situation, input conditions (data) to cause during the simulations that we obtain results that do not match with reality. This is the reason for reflection on the complexity of the model and it is in relation to the systemic thinking.

From what we have said, it is possible to derive the partial conclusion that human behaviour will be largely depend on his ability to use the models that coincide with reality (Exnar – Exnarová, 2013).

Applying the models has a wide range of applications. For example, one of the complex models are models of military operations. Instead of the model of military operations on plastic tables for modeling operations are currently using mathematical models for simulation with powerful computer centers and subsequent training of soldiers using simulators. Training apparatus combat techniques are associated with the virtual reality simulated computer. These are directly linked to models of the training areas. Other very common using models are in the form of flight simulators, vehicle simulators (for example in driving school) but also game consoles are a form of model.

In the area in which we work, models have an important place in the design of telecommunications networks. In this case, there are several models cooperating with each other. It is a terrain model, in which, for example, plans to build a GSM network and model of propagation of electromagnetic waves. Based on the selection places for the location of the base station, the transmitter and antenna models allow you to create signal coverage area and determine its intensity. So it is possible to detect places that are not covered by the signal and subsequent of simulations for different location the base station coverage area to verify the signal. Such an iterative procedure allows finding the optimal location for the base station. Consequently, it is possible to decide on the location of the neighbouring base stations.

From what we have said, it is possible to draw a conclusion about the models from the systemic view. The model should contain two parts: the actual structure of the model and the defined functions which are required by the model. As a crucial requirement is the definition of internal relations between the subsystems of the model and model relationships to their surroundings.

In connection with the models it is recalled one of the basic properties of the large system and it is emergence. Case of large complicated systems, is the spontaneous formation macroscopic properties and structures that cannot be derive from the properties of its components. This creates the properties and structure of number relatively simple interactions. The whole is more than the sum of its properties. When we use of models a fundamental contradiction between emergence and reductionism occurs. Reductionism is the basis for creating models. Emergence is a challenge for creating models of the new generation.

MODELS IN EDUCATION

The models are used in the education since time immemorial. For understanding principles of the system operation is necessary abstraction from important direction to more detailed information. This requirement prefers to use of models in the education. Teaching is based on their using. The teacher

verbally describes the facts on the basis of which students create images and ideas on the subject. In some particular technical subjects uses a graphical presentation of the system in the form of sketches, flow charts or diagrams, physical or virtual models. The teacher uses models with different degrees of abstraction.

Models in the education perform other functions, and it is the development of imagination, which is important for the development of the whole person. The model used in the education is an abstraction of reality and allows students to complete an abstract model that is created in their minds. This process activates the mental activities of students. Active approach to the issue which is the subject of teaching are supported more permanent remember of it. It turns out that the use of models in the education objects which are focused on remember the data, such as study of foreign languages, better results can be achieved by using images that represent also a type of models.

Technical disciplines often used the physical model that not only grab the attention of students, but enables the teacher to demonstrate the operation of the device and the partial sequence of individual consecutive activities. A typical model of this type are, for example, models of steam engines, airplanes, robots, ...

Models supporting education can be divided into several categories (Figure 1).

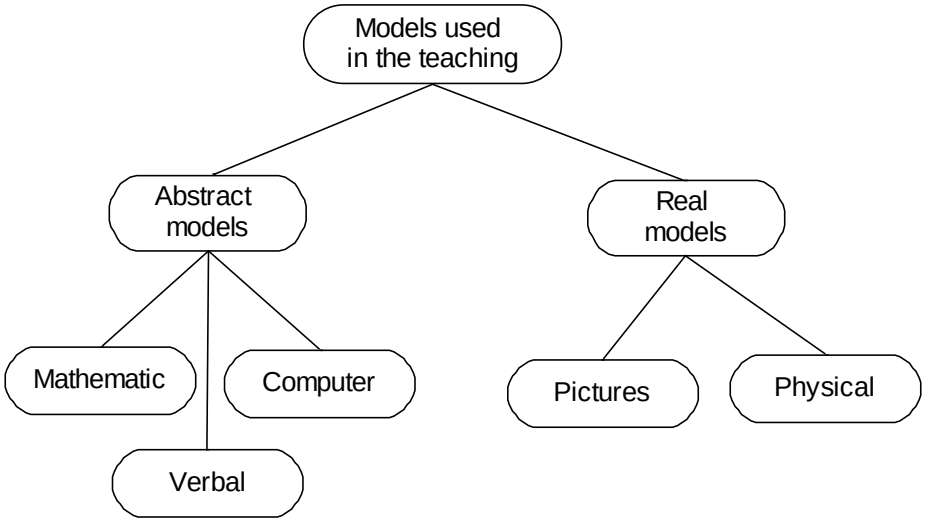

Figure 1 The basic classification models for the teaching

Due to the accessibility of computational means, increasing computational power and display of options results are to the foreground in the education in the utilization of models receive computer models. From the perspective of utilization computer models they can be divided into groups (Figure 2)

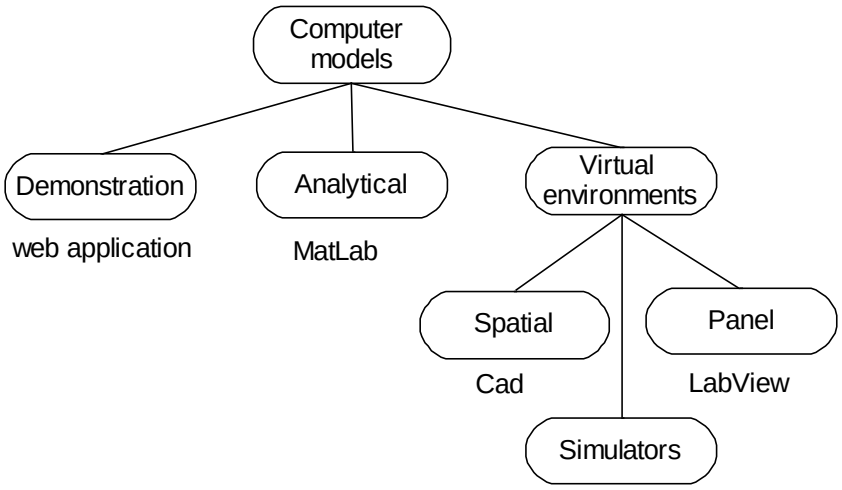

Figure 2 The basic breakdown of computer models for the teaching

Accurate classification of models (Rybár, 2000) into different groups is difficult because some of the models have characteristics of several other groups.

EXPERIENCE OF USING MODELS ON FACULTY OF ELECTRICAL ENGINEERING

Teaching on Faculty of Electrical Engineering has its specifics. Authors of the article have experience of teaching technical subjects. In their practice they are rely just on use of the models in teaching especially in the form of laboratory exercises. An interesting experience is from the subject Theory of Automatic Control. Authors of the article as an illustrative example used Watt's centrifugal regulator, which is used for regulating the speed of rotation machines. n his time, he had irreplaceable position in regulating the speed of steam engines and model steam engine was used for demonstration of this device. Many students saw steam engine for the first time in their lives. Using this model had great influence on them. In connection with the model of steam engine they will have the memory a problem with the regulation for many years.

In the teaching process very often are used the mathematical models. Their creation is currently supported by a number of programs from the standard Excel to specialized programs such as MatLab. Using these modelling tools requires previous knowledge in the programming or from the service area of the program. This fact has some limitations. Therefore, the high schools prepare their students in courses on programming for use this type of models. Model which student creates himself have the great importance for his learning lessons, because at the first the student must master the issues of modelling and then with using of modelling means to build the model. This supports deepening of knowledge in this area and assesses the impact of input parameters on simulation results.

Nowadays internet provides an interesting possibility of using models in the teaching. On various pages you can find not only the static imaging from studied problems but also the dynamic imaging of phenomena. Some sites have the ability to actively change the parameters on which the simulations underway. Interesting and very nicely created are pages which describing the physics of waves, wave propagation, electromagnetism...

Currently, have virtual of views measuring instruments associated with the circuit solution the electrical circuit in the form of diagrams an important place in the teaching of electrical engineering subjects. LabView is one of the tools for this kind of teaching. This allows on two interconnected cards (Figure 3) to choose the necessary measuring instruments and on other card build the circuit from a variety components and equipment. The actual simulation allows us to see the results of processing the input signals in assembled circuit. On the card of imaging measuring panels is possible to change input signals

and follow how impact have set circuit parameters on the resulting signal. Composition of circuit and change parameters of components is possible to change and other not inconsiderable features of the system are that it uses models of real components. This modelling tool shifts the modelling and simulation from the field of teaching into the field of design facilities with real possibilities verifies their properties before their actual manufacturing.

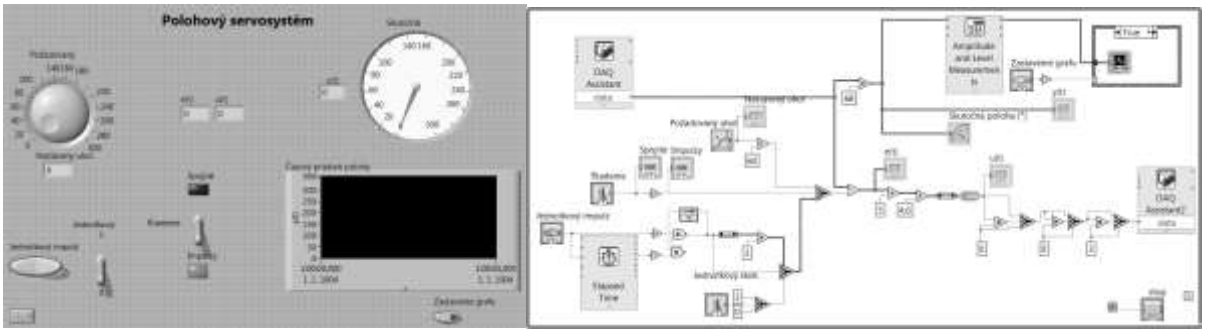

Figure 3 Example of models in LabView

Using of models in the teaching brings several new requirements. In particular use computer models are associated with the requirement good technical background of computers not only from the technician computer parameters but also from the technician who computers have to maintain in the desired operating mode. Additional demands are placed on teachers. Every application of models requires their preparation, which is against the standard teaching more professional and time-consuming. On the students are imposed increased demands on the knowledge for using of the models. We have to remember to that fact when compiling modern conceived STUDY programs. Into these programs, it is necessary to include subjects such as programming, modelling of real processes that support knowledge required for using but also compiling models. In this way achieves the active participation of students on teaching process and will deepen their knowledge. This leads to sustain remember of the taught subject. Not inconsiderable are also financial eligible on purchase modelling tools.

CONCLUSION

Models have a wide application in a broad range of human activities. They have an irreplaceable position in science teaching and in daily life. Allows you to optimize activity and encourage the decision making process in order to achieve the best possible results in any given situation with minimal costs.

Models occupy a significant place in education. They allow developing the imagination and creativity. They have a positive impact on mastery of the curriculum.

Imagination is the driving force for the development of personality. Using the models support this feature.

ACKNOWLEDGEMENTS

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ANALYSING AND REORGANIZATION OF IT SOURCES AND AN INFRASTRUCTURE IN A SMALL BUSINESS NETWORK

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ABSTRACT

Contemporary IT puts emphasis on security, service availability and backup. Complex services, their provision and general definition for the introduction to the company are described by standards and norms, which aim to achieve greater efficiency, transparency and responsibility not only for IT. They lead to increased competitiveness, better use of resources and thereby to price reduction. The introduction to the company may have investment character – it says to the investors whether the company is all right in the international comparison.

In large companies, the standards such as ITIL, COBIT or ISO certification has become a common part of their operation. Nowadays, they are being introduced to smaller organizations, especially those of medium size. In companies of small size standards are adopted only slowly and rarely.

KEY WORDS

SMB, ITIL, COBIT, ISO, services, service management, life cycle management, standard, process management, systemic approach in SMB.

INTRODUCTION

The main purpose of the theoretical part of the paper was to acquaint the user with the basic aspects of ITIL, COBIT and ISO 9000 and 9001 standards. Normative requirements are used for effective work in terms of overarching processes in the management and resources organization.

Motivation: to review of efficiency using of current resources in the company, assistance in case of key decisions in the area of ICT, risk identification and their prevention. This work shows the possibility offer for customer and supplier and reflects the need to possess, as well as the need to outsource and generate cash flow.

Objective: to demonstrate that a systematic approach to assessment resources i.e. ITIL / Cobit can be used not only for large companies, as usual, but also in the SMB segment of tourism.

The result is not only a presentation of an informal deployment of ITIL and COBIT in small companies, but also the highlighting of the benefits that they have and the nature of the organization, systematic and economical at the same time. Especially the last point may help to increase competitiveness. The suppliers of services will increase service quality using the systematic approach.

For reasons of practicality, the process of analysis is implemented according to the two companies.

WHY ITIL AND COBIT?

In the last few decades the importance of a systemic approach has proved. It performs an essential role in business management.

ITIL is a very robust framework designed for corporate companies and now descends into the lower segments. For our purposes we will summarize it in one sentence while you answer the question - What is a service?

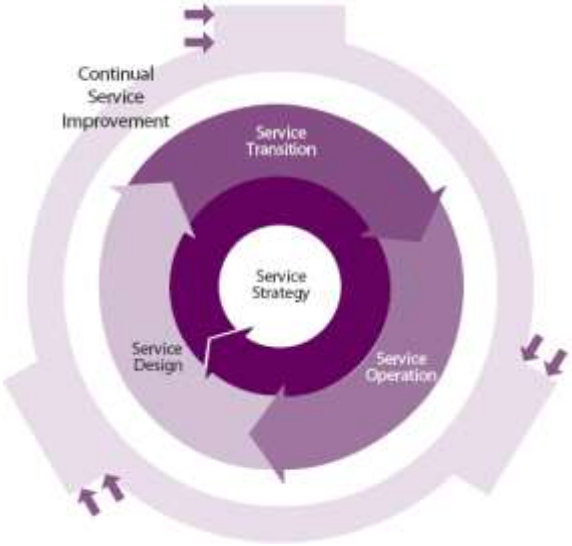

Figure 1 - “The ITIL Service Lifecycle“ (Michael Faber, 2010, p. 5)

"The service is a means of delivering value to customers by facilitating outcomes it wants to achieve customer without possessed specific costs and risks." (Alison Cartlidge, 2007, p. 7)

Conversely, COBIT is more technological and looks at the organization in terms of information criteria, compared to ITIL, which still dominates the organizational and process management. COBIT is working with applications, information, infrastructure and data. This is a "narrow COBIT". In a broader spectrum, it is about defining general objectives such as efficiency of the information relative to the business, their efficiency, confidentiality, integrity, availability, compliance with laws and ensuring their reliability.

The standards establish a systematic approach to preventing problems and their possible solutions. It simplifies complex problems and their solutions and increases the level of quality and control. One of the example is the data security (store and access). More cheaper and faster is prevention than a single rescue in the event of equipment failure or human error.

STANDARDS AS A TOOL

The bases of each company are the people, tools and processes. SMB suffer many differences from corporate companies, long cycle renewal work tools, informal processes, lower degree of specialization. The main benefits of establishing standards and formal proceedings are a protection of know-how, an increasing of security, a retention of knowledge, a focus on the core business, a selection of appropriate tools and long-term IT development concept. For example, Gartner estimates about increasing spending on cloud services by 48.7 % and in the outsourcing data centers by 34.5 % in 2012. This trend with decreased growth will continue to be maintained. IDG Czech Republic (2012)

The outcome of this part was the formal problem definition, solution design, the choice of implementation services (internal, outsourcing), documentation (RFI, RFA, SLM, NDA, etc.) and the ensuing contract or process itself with as control mechanisms. An integral part of the documentation is a process modeling, which contributes to faster orientation and easier understanding.

The selection of the supplier may not be simple. Investment to audit helps you in identifying needs and choosing closer range of potential suppliers. The selection on the basis of criteria will help you to select the currently best possible solution.

PREPARATORY PHASE

The analysis was divided into several parts. In overall, the ICT environment area was divided to computer analysis, network infrastructure, applications and licenses, servers and virtualization, data collection and management, planning. Integral elements of the processes that creates added value can us not directly express money. Individual elements were further elaborated on the sub items from which each had a range of evaluation 1-5 (best to worst). The scale was two dimensional. It presents actual status and level of anticipated risk for the company.

From the perspective of time, it is the current state and future state. Future state approximate life cycle solutions and the phase in which it is located. In this work a future state level of risk (in the short term to one year) was selected.

For own analysis and design process were used variously modeling tools as MS Visio – Freemind for mind mapping, MySQL Workbench to design ERD diagrams and data management, MS Project and Open Project management software for scheduling stages time.

Already at this stage, one of the main ideas of COBIT methodology was used. This is the cycle of "Plan, Do, Check, Act" (PDCA), introduced by W. Edwards Deming. (Wiki Foundation, 2012)

RESULTS

To compare differences two companies from different segments of the SMB market were chosen. The first is the utilities company, the other is a four star hotel. The companies have vastly different problems. Companies have been evaluated anonymously due to their protection. In the following chapters the companies are briefly summarized. Both companies are typical example for the investigated segment.

The example of the utilities company demonstrates that ownership of the ISO 9001 may not ever guarantees the required quality. Standard builds functional processes and their monitoring. The processes, however, in most cases use IT. Crash of IT has direct impact to company and its clients.

The second example illustrates the hotel situation. Requirements of the standards and technologies are performed. Real states in terms of COO (Chief Operating Officer) are higher operating costs and reduce the quality of services, including dependence on suppliers.

UTILITIES COMPANY

It operates in the field of air across the EU. Is the owner of ISO 9001, 14001 and OHSAS 18001. It has 37 employees, of which 5 are in administration. The annual turnover is around 40 million CZK. Net income in 2012 was 5.5 million CZK. PC network consists of five desktop workstations and 3 laptops. The average age of the machine is 3.5 years. SW is 90 % illegal, except for the accounting application that comes in the form of SaaS. PC network is unsecured; data are not protected or backed up. Processes exist or have only a formal character with zero impact to operation. The analytical result can be seen on the chart (5 - bad, 1 - great, 0 – imaginary ideal):

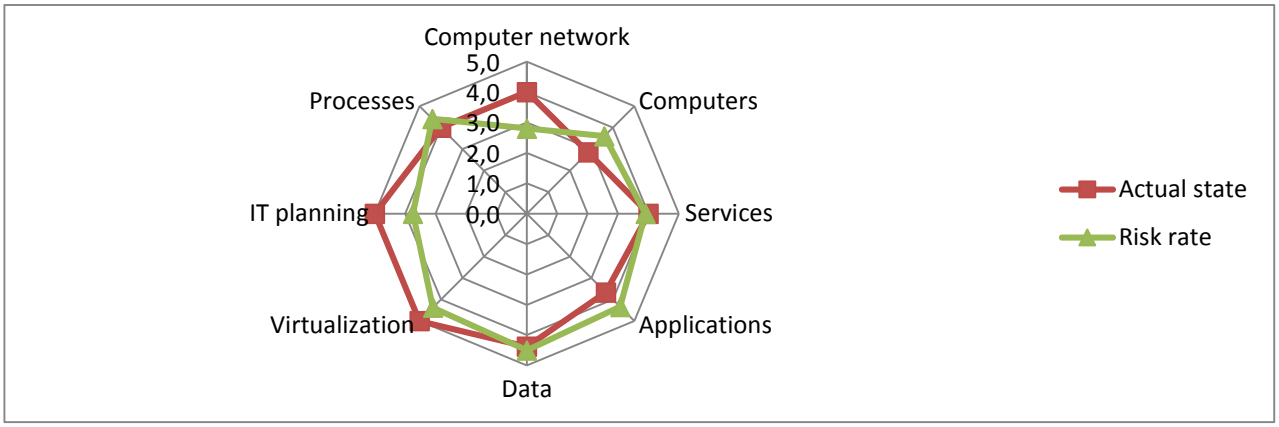

Figure 2 - Graphical representation of the output analysis of IT resources

All surveyed areas have currently bad state. The level of risk of the problem is also highly probable and ui could cause major impacts, for example loss of data, license sanctions or hacking the network or PC. In addition to the analysis it creates the risk that at a later stage it will serve as a resource for the development of processes and their technical and administrative implementation.

As you can see from the chart above, the company has acute shortages in all areas of research. The output of the analysis was simultaneously the calculation of the amount required to improve the current state of all elements, including new infrastructure, purchase, licensing, configuration and implementation of backup, application management, including the accounting requirements of the client platform. See the calculation below:

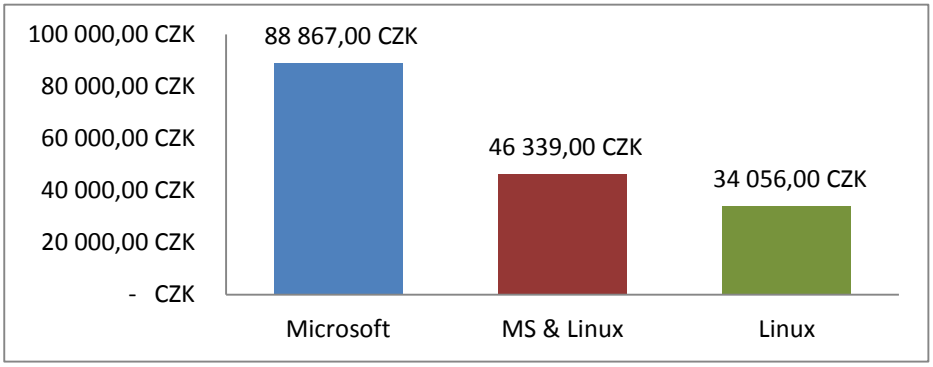

Figure 3 - Acquisition costs

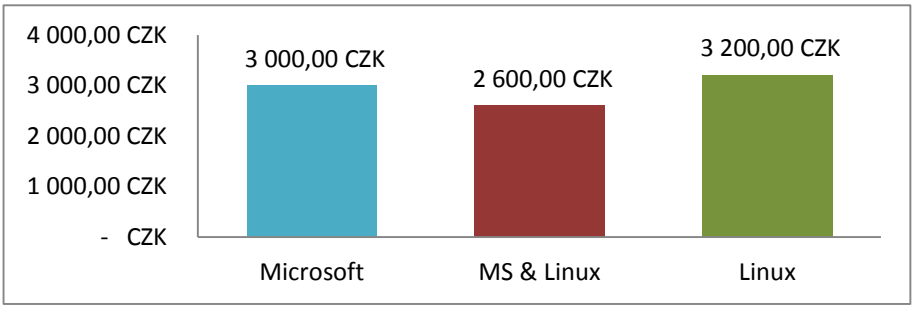

Figure 4 - The maintenance costs of running SW

The result of the analysis was consulted with the owner and a narrow management of the company, which had a fear of these factors:

- Learning to use a new operating system
- Outsourcing - remote connect computers v. unstable internet

• Increased investment in HW and SW

This solution provides a space in the next years to adapt their IT strategy with regard to current trends. (In Czech Republic start first cloud services in the form of PaaS, IaaS and SaaS with support SOAP and XML connections for wholesale using, devices with Android OS, etc.)

HOTEL

Four star city hotel in location in the centre of Prague. Parameters: over 250 rooms with class standard - Exclusive, over 60 employees and 50 PC stations and 8 servers. Additional information with regard to the requirement of maintaining anonymity of the client is not contained. Result of processing in the analysis revealed a surprisingly good state of the entire IT.

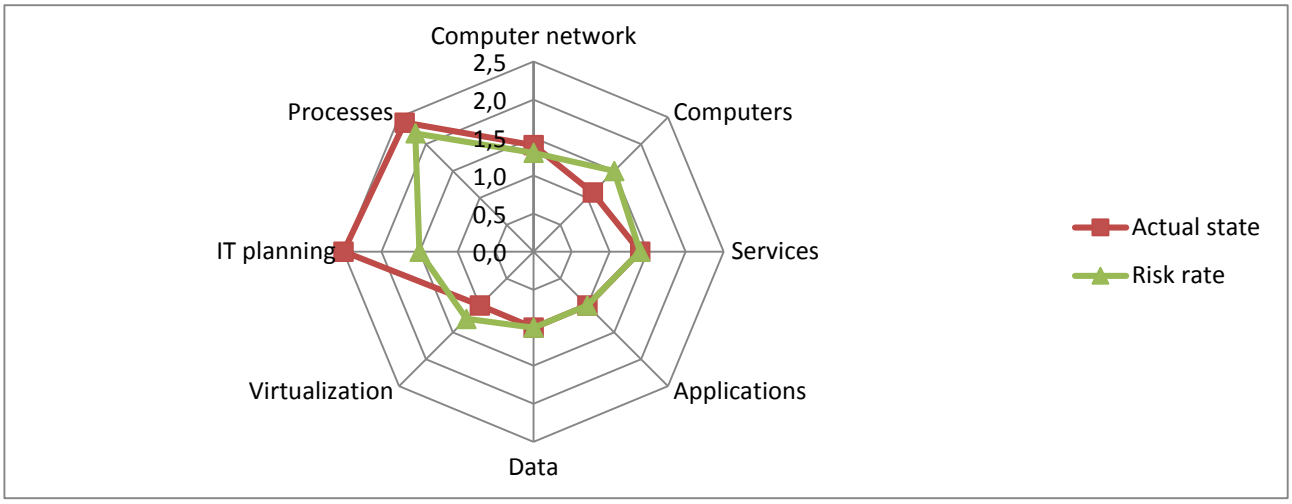

Figure 5 - Graphical representation of the output analysis of IT resources in model Hotel

Output of analyzing corresponded consultation with the Chief Operating Officer (COO) of the hotel, which confirmed the fact that the biggest problem is the limited sources of finance for long-term IT processes planning at the same time, in which the company with multinational hotel owner has requirements to inefficient use of centrally purchased outsourcing with very ill-defined SLA (view of COO).

The processes associated with the quality of delivered services are disturbed and increased risk of failure of strategic services (booking system, mail server, CRM). Thanks to the secondary processes, which provide hotel itself is also, minimized this risk. The impacts are so primary on processes, resulting inefficiencies and work organization. It is showed in Figure 5.

CONCLUSION

We illustrate in the examples how the state of IT can be different in individual segments within SMB. Times have changed, IT is now the mainstay of the business, interweaves with all company processes and provides strategic added value.

These particular elements are the verticals of IT departments of today's companies. Behind them there are hidden the issues of security, data and analysis, and preservation, organization of work, automation routines that otherwise hamper to your employees be effective and attend to values in the form of services and products that your company creates and sells.

It's a way to achieve goals quickly, efficiently and controllably. It's an opportunity for new types of products and services, which are already appearing on the market and use of innovative licensing, cloud services with high availability services. This trend helps the formation of new companies which

themselves derive from the benefits of system access and transmit in the context their products as an added value to their clients.

Companies from the SMB segment have large space for improvement in functioning of their IT, streamline services, the transition to new, modern and cheaper solutions at competitive prices that the market in recent years brings. Finally, it is outsourcing to a reasonable extent with well treated contractual relationship and long-term development strategy and support for business.

Do not afraid about standards. Keep in mind that standards are a good servant and bad master. Select a gradual transformation and do not forget to be practicality. In the first stage sufficient introduce casual. Processes do not bother, but lighten life. Help to mapping and ideally eliminating critical situations. In this regard the investment will save you time and current sources.

Norms have too another important role - reflect the expected level to your business partners, investors and customers. It is up to you, how to grab processes, connect with a business, create synergies, and join to the successful enterprises that the introduction of competitive advantage in today's very turbulent and dynamic market.

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IMPACT ON EDUCATION BUILDING KNOWLEDGE SOCIETY IN SLOVAKIA

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ABSTRACT

The last Population and Housing Census of 2011 showed that Slovakia is still increasing level of education. Increases the share of people with secondary and university education. Literacy has long been almost foolproof. On the other hand, the test results are literacy 15 year olds in the European Union and the OECD, which were last tested in 2012 achieved the worst results since 2003, these two findings, in my view exclusive. How is it possible that the slow learners in reading and numeracy are a few years graduates of secondary schools and universities? One reason may be a decrease in the number of school age children and surplus schools and study programs, which together with the system of financing education means that schools adopt the secondary and higher education students whose academic performance in the past would suffice only for admission to a lower level of education. Have the title has become in recent years "fad trend" and the result is graduates who, after completing not applied and are classified as unemployed.

KEY WORDS

graduate, literacy, economy, unemployment, science, education, knowledge society.

KNOWLEDGE SOCIETY AND EDUCATION

The knowledge economy is the basis for the functioning of modern society, and it seems that the very survival of the company and its potential for further development. Ingrid Brocková from the World Bank defines as the knowledge economy's ability to acquire and use knowledge is becoming increasingly determinant of the competitiveness of its economy also implies that the importance of knowledge for development in the future will increase, may become a key factor differences prosperity and poverty between countries and differences in their internal development. Ability of a country or community benefit from the knowledge revolution stands on four key factors:

1. Educated and skilled population that is able to create and use knowledge in its entirety. This requires a system of education and lifelong learning, which is based on the needs of companies and is flexible in relation to market requirements.

2. Effective innovation system, linked undertakings, research centers, universities, think tanks and other organizations responding to global developments and local needs, plus a business environment conducive to innovation.

3. Economic and institutional framework, which creates conditions for effective use of knowledge and promotes entrepreneurship.

4. Dynamic information infrastructure.

5. Fifth, equally important pillar of the role of government, traditions and value systems of the country (Brocková, 2003).

The basis of differences in the information age economy from the industrial age economy is a rearrangement of the organization and structure of the economy so that the main **source of development of economy and society, information and knowledge** and they contribute significantly to the generation of new economic and social structures. This requires the **support and development of science**, which is an important element in the development of advanced knowledge-based economies. The knowledge economy is built on the fact that information and knowledge are the main form of capital itself and the knowledge economy operates in the production of information and knowledge goods. An example of the development of economy and society as South Korea, which is pursuing a policy of increasing economic efficiency by increasing **the spending on science.** Currently, spending on science about 4% of gross domestic product (GDP). The European Union speaks of the need to increase spending on science in individual member countries to 3 % of GDP. The Czech Republic currently gives science 1.6% of GDP. Slovakia is currently funding science at the level of 0.4 % of GDP, which is one-tenth of South Korea's expenses (Klinec, 2014).

SR draft general budget for 2015, approved by the Slovak Government assumes that universities receive nearly 456 million. euros, compared to 2014, over 22.2 million. euros, science and technology without a university science research in other state organizations, departmental science and other chapters Slovak Academy of Sciences (SAS) will go over the amount of 154 million. euros, **is it decrease of around 132 million. euros.** In science, for example, SAS worse off when next year is to receive from the state budget, the amount of 47.0 million. euros, which represents a decrease of 10.3 million. euros. (Návrh rozpočtu na rok 2015).

As mentioned, one of the basic prerequisites of creating a knowledge society is an educated population. Education in Slovakia takes place within the school systems, which consist of a system of schools and associated facilities from kindergarten to high school, in society and ensure appropriate levels of education. The individual stages are managed centrally through the Ministry of Education, headed by the competent minister. In an advanced society, it is natural that the education system respects the nature of people and trying to meet the individual needs of the individual and society, while fully respecting freedom of occupation in secondary and tertiary education. Primary education is provided for all children in general. Compulsory education in Slovakia lasts ten years and up to the end of the school year in which the child reaches 16 years of age. From compulsory schooling is not exempt anyone (Zákon č. 245/2008 Z.z. § 19).

Diferentiation of society based on natural human predisposition to respect his freedom and cultural environment, the generation of different social layers to specified on the basis of completed education. The most widespread is divided into the following groups - people with basic education, people with secondary education without graduation, with graduation, with a university degree first, second and third degree, and finally with higher education as the third cycle of higher education. Slovakia ranks among countries with nearly zero rate of illiteracy and increasing share of university educated people. Official results of the census of population and housing census of 2011 surveyed on increasing **the share of university graduates to 13.8 %** (747,968 people). Of functional illiteracy is estimated at 0,3 to 0,5 %, from a total of 5,397,036 inhabitants (Štatistický úrad, 2012). In addition, there is the so-called society. follow illiteracy, when a citizen while passed education system, but after the end of compulsory education-use of literacy is becoming illiterate. This form of illiteracy is a problem particularly in social environments uninspiring. In a globalized society and at a time of significant development of information technology, many receiving information directly to the user through a simple access channels. The Internet provides an incredible amount of information, but also carry the risk that the individual information can not be properly evaluated. At this point enters the process of personal qualities - education and knowledge, which are in the process of decision-making a significant impact on the processing of information received.

In the Slovak Republic, but also in the European Union are regularly identifies and assesses literacy pupil. One of the most famous is the **PISA (Programme for International Student Assessment**), which provides information on the knowledge and skills of 15-year-olds participating countries in selected areas of **reading, mathematical and scientific literacy.** PISA is conducted since 2000 in three-year cycles. Slovak Republic, no longer as a member of Organisation for Economic Co-operation and

Development (OECD), for the first time participated in PISA 2003**. The main with the area of the fourth cycle of PISA 2012 was mathematical literacy.** This year was the opportunity to carry out the testing paper and electronic form, and watched the other areas: **financial literacy and problem solving area.** Do this cycle studies in 2012 involved 65 countries and has been involved in testing 512,343 pupil. Administration testing PISA 2012, held in Slovakia from the 16 th. to 27 th. April 2012 and testing was attended by 5,737 students from 231 schools. **Slovak piupils achieved in all three tested literacy significantly worse results than the OECD average and placed at the bottom of a ranking.** Compared to the previous testing that is worsening in all areas. mathematics and reading have deteriorated by 15 points in scientific literacy by 19 points. This means that in mathematics lag behind the OECD average of 12 points in reading by 34 points and scientific literacy of 30 points. In the financial literacy of Slovak pupils achieve average power at 470 points, which is significantly less power than the average performance pupil OECD countries (NUCEM, 2012).

THE SCHOOL LEAVERS LABOR MARKET

These results are not a good sign for the Slovak education - primary as well as secondary schools and vocational schools, where students were tested. Nevertheless, most graduates continue their studies at colleges and universities. **In 2013, the higher education competing for 54 561 applicants and began studying 41 894 young people.** Only a minority of high school graduates continued studying and looking in the labor market. But many ended up as jobseekers.

Unemployment rate reached in December 2011 unemployment rate of 13.59 % in December 2012 the amount of 14.44 % (425 858 persons), in January 2013 stood at 14.80 % **in the current period is approximately 14 % of the 386 000 inhabitants.** The largest group in the age structure of job seekers are young people. In September 2012 accounted for unemployed 20-29 years to 28.7 %.

Regarding the educational level of the unemployed and the season 2011/2012 the unemployment rate of high school graduates stood at 19.3 %. In October 2012 reached the maximum number of 29 900. **In April 2013 it was registered with Úradov práce, sociálnych vecí a rodiny (the Office of Labour, Social Affairs and Family) 22 800 unemployed high schol students.**

employment data for graduates by level of education	number to the 30.04.2013	of time, according to records		
		to 6 months	to 12 months	over 12 months
Apprenticeship and secondary school	4 273	1 149	1 988	1 136
Apprenticeship with leaving exam (maturita)	6 282	1 692	3 268	1 322
Full secondary general	2 463	1 191	1 001	271
Vocational higher	9 092	2 876	4 635	1 581

Table 1 - Status employment data - graduates by type of school was to the 30.04.2013 (NKÚ SR, 203)

At public and private universities in the last five years the number of students oscillates at 200 000 graduating about **70 000 graduates**. (In 2013 high school graduates 65,779). There is a disparity between the number of graduates and demand of the labor market, which currently offers fewer than **1000 jobs** for university graduates, which translates into a surplus of graduates in the labor market and public higher education, financed from the state budget, without further analysis of market needs work produces new recruits (NKÚ SR, 203).

The highest number of unemployed **graduates** for years 2011/2012 was in June 2011, when there were 9,663, and the lowest in April 2012 with the 2518. The share of **unemployed graduates of secondary schools and universities** together for the school year 2011/2012 ranged from 6.2 % in August 2011 to 8.7% in September, 2011. (Ústav informácií a prognóz školstva, 2013).

Supreme Audit Office SR published on its website a questionnaire „Application of graduates in the labor market" (Uplatnenie absolventov vysokých škôl na trhu práce). For the period from 19.06.2013 to 22.10.2013 was attended by 1 298 respondents. The results showed that 29.5% were unemployed, with a period out of work to one month was 9.6%, for a period up to 6 months of 29.7%, to 15.2% a year, and more than 19 years were unemployed, 3% of respondents. According to a given field of study, the problem with the labor market had 39.0% of graduates of science, in which 100% of geology graduates, 36.8% of graduates of technical sciences and theories, 40% of graduates from agricultural, forestry and veterinary sciences and theories. For graduates of social sciences, theories and services without employment was 37.4%, including 55.8% of philosophical sciences, historical sciences 52.6%, and the science of physical culture 50.0%. In the field who have studied not work 20.1% of all involved, and it accounted for the largest share, 57.5% of graduates of social sciences and theories, 23% of technical sciences and theories. Since the academic years 2010/2011 and 2011/2012 and the labor market in the Slovak Republic will not enter 6359 graduates, the average value of normative cost of a graduate student 8 750 euros (1 750 euros / year times 5) is a short-term inefficiencies incurred from the state budget in EUR 55 570 000 (NKÚ, 2013).

CONCLUSION

Knowledge society as is clear from the name of the knowledge, information and knowledge. If Slovakia wants to include the knowledge of the knowledge economy must begin to emphasize the development of education and science. About this need was for years in Slovakia says, but the real state - as evidenced by the results of the survey literacy pupil, and employment of graduates of secondary schools and universities in the labor market suggest that really just talking about it. Shortage of public spending on education and science is just one of the reasons for this situation. Low teacher salaries cause lack of interest in the teaching profession and their great fluctuation in schools. Another is the method of financing secondary and higher education, which „forces" schools also receive pupil with poorer academic results, who would previously not have a chance to take the grammar schools, or high schools. Excess fields of study allows to obtain higher education almost every applicant. Since those elected path of least resistance, they choose universities and trade unions, which they consider "easy" regardless of the fact that after graduation not find application. Insufficient links between schools with the requirements of the labor market caused by "producing" graduates with degrees without employment opportunities. At colleges and universities are studying young people who are easily reach the school selected, but can not stand the test of literacy compared to their peers from other European Union countries. It is therefore important that the Slovak government had long-term vision of education to improve the quality of education, science and research to the extent that Slovakia could rank among the developed knowledge-based society. So far none of the proposed measures lead to systematization approach to developing a knowledge-based society and it seems that measures the current government in Slovakia even more mess up this process. Unfortunately, even today is not designed interdepartmental system of interconnected and are not known and its financial implications of the proposed reforms. We also at every change of government efforts to see refomovať education and its financing, but there is no continuity concepts, this is the only system?

That the situation in the field of education and training improved, is neccesary to focus on several areas. In the case of post-primary education to focus on the education of professionals who are in the labor market strong demand. Priority will focus on obtaining skills useful in practice that it is not necessary that the majority of the population had a baccalaureate. Another proposed measure is to restore the supply of education so that the schools based experts needed in the labor market, what is important to coopered closely with businesses, particularly those that are dominant in the market.

University education should be a priority on supporting education programs that are needed in the labor market, and which have a high potential businesses with focus on innovation development and implementation of the latest scientific knowledge into practice. Thus creating potential for development, economic growth and development of industry and expertise. Along with that, however, also plays as a kind of social - state need, as well as graduates are required fields of study where there is a large number of students (but needs to practice it enough). In this case, it is difficult to talk about “effective” education - from the perspective of the set of economic factors of higher education, so these courses should be "financing in the form", they are not lost, and are able to produce the required number of experts. One of the solutions is to create a system of "numerus clausus" which would be based on a survey of the labor market and on the basis of real needs created a list of the quota for each courses. Signed candidates should have passed competitive entrance procedure, based on which the ranking is compiled and received other candidates for the study could study, but would have to pay for studying. Thus "saved" by funds remained in education and would have supported through scientific activities of educational institutions aimed at creating inovations, primary and secondary research.

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TECHNIQUES OF INTERNET CENSORSHIP

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ABSTRACT

Our civilisation has a long tradition of censorship in various forms. With the advent of media such as radio, television and the internet the number of people who can be directly targeted by a certain message or information has greatly expanded. As a response the censorship was forced to adopt increasingly sophisticated methods and procedures to be able to effectively block or alter the ever-growing number of publicly available, but for some reason undesirable information.

There is no sense to discuss the reasons of censorship, whether political, religious or moral. Rather, it is useful to focus on the techniques and tools that are censors forced to use to effectively control the extensive information space like the internet. Most of these techniques are practically same as those used by hackers and are designed primarily to disrupt the availability, integrity or confidentiality of processed/transmitted data.

Altought there is some general knowledge about internet censorship many people don´t have deeper insight into the techniques used to block the access to certain information sources[5]. Because in the past the internet censorship techniques were scrutinized, it is possible to describe some of them to a decent level of detail. Of course not always we can get enough information on the operation of a particular "solution", e.g. Golden shield of China[6]. Sometimes are available only fragmentary information and expert community can only guess which techniques are used.

KEY WORDS

Internet censorship, hacking, DNS manipulation, TCP/IP manipulation, search engine results manipulation

INTRODUCTION

Censorship usually involves blocking or slowing down the communication passing through routers under the control of the censor (or the company that is supervised by the censor) or is based on altering the proper DNS communication[7]. These methods for slowing or preventing connection can be generally described as attacks where the attacker (censor) is between a client and a server, or also called Man In The Middle (MITM). The article does not cover all currently used techniques of censorship, but primarily are presented the most frequent ones.

[5] Readers usually have a chance to face the censorship in countries like China, UAE, Iran, Cuba etc. This article is not focused on reasons of censorship but we can generally say that in Cuba and China are reasons for censorship mainly political whereas in UAE are rather religious. We also have to take into account simple fact that each of these countries has different level of internet penetration and quality of IT infrastructure so methods of censorship also differ.

[6] Also known as Great firewall of China.

[7] Problem is with a transit traffic that can also be affected despite the fact that neither source nor destination address is located in the country with censored traffic.

The following techniques can be divided into three categories according their nature. The first is the manipulation of TCP/IP, the second is the manipulation of DNS and the last is the manipulation of search engine results.

TCP/IP MANIPULATION

RST PACKET FLOODING

When establishing TCP/IP communication the three-way handshake (RFC793) is employed. This process is initiated by sending a synchronization packet with the SYN bit set and the other party responds with SYN, ACK. The process of three-way handshake is accomplished by sending packet with ACK bit set by an initiator of a communication. When the data transfer is complete, the connection between the nodes finishes similar way as has been established, but instead of ACK and SYN, ACK packets with a bit FIN, and FIN, ACK are used. After delivery and confirmation of these packets is the connection between computers terminated.

In the process of establishing a connection via a three-way handshake a conflict caused by the old synchronization packet may occur. To avoid this conflict a reset packet created (with RST bit set) has been created. If a node receives a packet with the RST bit, it responds with a packet with the RST, ACK and subsequently ACK is returned. To avoid affecting valid TCP communication packets sequence number is used. Unfortunately, if the spoofing third party sends a RST packet with a valid sequence number, the packet should be accepted and the connection is reset.

For example some censorship systems use according to (Clayton, 2006) these reset packets to block communication between computers on the Internet. After detection of communication that violates the rules (such as containing banned terms), a fake RST packet from censorship system is sent. After client receives this reset packet replies with a RST packet to the server, and the connection between the client and the server is reset. These packets have a IP address of the sender spoofed to match the address of the server or client. There is a way to detect a fake reset packets by checking the time to live attribute, or TTL. Time-to-live is a value that tells a network router whether or not the packet has been in the network too long and should be discarded. For a number of reasons, packets may not get delivered to their destination in a reasonable length of time. The main use is to remove packets that are lost or looping. With TTL client can also distinguish which packets originated from the valid server and which are spoofed. It is because that if the TTL significantly differs from other packets coming from the same source it means that a packet passes through a completely different route in the network or the server itself is located in a different distance from the client on the network.

In (CLAYTON, 2006) the system that can prevent connection reset caused by fake RST packets from the censoring system is designed. The solution lies in ignoring all incoming packets for both client and server. The problem with this solution is, according to the author, difficult implementation for common internet users. An alternative solution is to ignore the received RST packets if the TTL value is significantly different from the expected value. This solution is also demanding from the perspective of the common user (as the previous method). Another problem is that according to (Weaver, 2008) also in valid communication may packets with a TTL value significantly different from expected occur and could cause complications due to dropping these packets as spoofed.

SYN-ACK PACKETS SPOOFING

This method of censorship occurs after the connection is blocked with the help of fake RST packets. The principle is sending spoofed synchronization SYN, ACK packet during the three-way handshake as explained above. This step alone will not block the connection, but prevents the client to communicate with the target server because sending spoofed synchronization packet does not create the connection between the client and the server. The connection is then terminated by RST packet flood described above.

This method is used after previous interruption of the connection between client and server using RST packets. By observing the behavior of the censorship system was found that after the initial connection

is interrupted communication is blocked for some time. The same conclusion was presented in (CLAYTON, 2006) that the connection has been blocked for 20 minutes. Furthermore, it was found that connection is blocked only when using the same IP address and the same port. Reason for blocking connections using only the same IP address and port can be attributed to an effort to minimize the restriction of other "safe" connections to the same IP address.

IP ADDRESS BLOCKING

Every packet that is transmitted during the communication between client and server includes data portion and header portion where the source and destination address is stored. These information are crucial for routing the packet through the internet. In some countries with a restrictive regime the packet blocking is based on the destination IP address. For example in China this technique is the most historic one.

Based on the research of this method of censorship by (GIFC, 2002), and also (VILLENEUVE, 2002) was found that the packet is usually discarded when contains blacklisted IP and passes through a controlled router in China. In this case, user usually receives a time-out connection warning. This method is mainly focused on the sources of communication from inside the China and packets that don´t contain the banned terms are routed through different non-discarding routers.

PORT BLOCKING

This technique is relatively well known from the firewalls. Communication is allowed only on certain ports and other packets are dropped. The problem is that in the context of censorship also packets for legitimate ports as TCP ports 22 (SSH) are dropped, because these ports are sometimes used for tunneling connections (with a purpose to evade detection). This behaviour unfortunately blocks very important communication channel. A similar problem is blocking TCP port 443 (https), which is essential for online business. Unfortunately without https interception censors are not able to identify the data flowing through encrypted channel, so for them is the only solution to block the whole port/protocol.

DNS MANIPULATION

DNS servers are very important and integral part of Internet communications (RFC3467, 2003). With the help of DNS service the end users do not have to type the IP address of the server, but they can enter server address in the abstract form of URL (human readable) addresses. The DNS service translates URLs to IP address of the server and vice-versa. Without DNS servers will be the internet communication very difficult and sometimes even impossible. Due to this fact, they are also a prime target for hackers, censors and other organizations aiming to prevent or otherwise affect the availability of certain resources on the Internet (Anonymous 2012).

One of the favorite techniques of redirecting or blocking the traffic is the DNS spoofing (and DNS cache poisoning as a subtype of a DNS spoofing attack). According to (RFC5452, 2009) when the client sends a DNS request, the attacker responds with a false answer and the client is redirected to the address specified by a hacker or censor. In addition to disabling the connection between the client and the target server the sniffing or other attacks like html injection can occur. Badly configured DNS can also be employed for DDoS amplification attacks.

SEARCH ENGINES RESULTS MANIPULATION

Full-text search engines are nowadays a very popular tool for finding information and due to this fact became the target of censors worldwide. The censors usually edit the search results or block the communication when banned keyword is entered. This issue is addressed in paper (Zhu, 2011) and

(HRW, 2006). In most cases (but not all) is user warned that the search results are edited according to a local laws[8].

On example is key word "Falun Gong", that is the name of a religious group (or a sect) prosecuted in China. Originally a connection of the user who entered this key word was reset by TCP/IP manipulation but later the connection has been left untouched, only the search results were tampered. We can see that censoring system is constantly changing over time and adapts to current events or political situation. This also makes the defense against censorship more challenging, because users must perpetually change their tools to circumvent the effort of the censorship.

COUNTERMEASURES

Hand in hand with a development of censorship systems also the tools for defeating these systems are being introduced. The most important are anonymous networks[9], encrypted connections[10], VPNs, proxy servers and protocol tunneling. However, it is important to note that the use of some of these techniques is detectable, thus, in some countries users can expect subsequent action by the repressive forces (outside cyberspace). As the author plans to publish a separate article on the topic of countermeasures against censorship they will not be discussed in more detail in this paper.

CONCLUSION

Censorship as well as hacking is ethically very questionable. Although censors and hackers motivation is different, the tools to achieve their goals are largely the same. Hackers, like the censors, have in some cases the same interest – to disrupt communications and make specific source of information unavailable. The difference, however, is that while hackers are forced to operate in anonymity and risk the detection and arrest, censors plan their actions by orders of a repressive regime which "protects" (not only) its citizens.

As we can defend against hackers attacks, there is also a portfolio of techniques and tools to circumvent censorship systems. Using this tools can have unfortunately consequences outside the cyberspace, so it is necessary for the user of this tools to have minimally essential knowledge about the basic principles to effectively assess the probability of detection.

Generally we can say that common techniques like TCP/IP and DNS manipulation are very effective against common users that are not able to circumvent these obstacles. Advanced users are always able to find (or even create) a solution how to reach the desired information. Especially the anonymous networks are very powerful, but we have to keep in mind that also the state intelligence agencies operate in this "darknet", so privacy can be easily breached if user fails to properly secure his computer.

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[8] Report having roughly the following form: "The search results that may not be in compliance with applicable laws, rules or regulations have not been shown. We recommend other related search words."

[9] E.g. TOR.

[10] E.g. https, ssh, sftp.

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SPACE 2.0? BELATED ENCOUNTER WITH MANOVICH`S NEW MEDIA THEORY

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ABSTRACT

Article deals with Manovich`s account of space. The author herald its prospective ability to become universal form of information representation in new media. Our aim is to review such claims from perspective of contemporary online practices. We try to show that although the space as a category lies in the center of some fields of new media, typically in computer games, there has been very little conceptual or qualitative development in contrast to its commercial and quantitative dissemination. In our considerations, we are trying to highlight the role of user experience, which has changed significantly in the last 15 years and reflected in the commercial sector (e.g. marketing) on the border between reality and virtuality (especially towards augmented reality).

KEY WORDS

New media theory, Immersion, Space, Lev Manovich, User experience

INTRODUCTION

Language of new media, seminal monograph by Lev Manovich, represents first and one of the most systematic and thorough analysis of new media and its theory. As such it does not only provide common basis for further consideration, it also foreshadows possible and prospective trains of development in the field. Manovich himself points out this double-edged goal, when he states that common vice in writing on new media is speculating about the future. Instead he clearly focuses on a theory of the present (Manovich, 2001, p. 7). Problem with such approach is already in defining the present, since it changes so quickly in new media sphere. Indeed the idea of being new in itself resists simple identification of a present state. By assessing the contemporary possibilities we simultaneously herald certain oncoming tendencies. Moreover such attitude presents a hedged bet for Manovich. He argues that either his account turns out to be proven by forthcoming development, thus he will win. Or if his analysis fails to recognize main prospective it will represent one of the "possibilities heretofore unrealized, of horizon visible to us today but later unimaginable." (Manovich, 2001, p. 8)

Today almost one and half decade from original publication of Language of New Media we can position ourselves to such comfortable position from which we can assess the trains of development foreshadowed by Manovich. Moreover there has been considerable reluctance in getting back to former theories since the discussion is burdened by new conceptualization, trends and even technologies. For general retrospective let us mention *What is new media? Ten years after "The Language of New Media"* by Alexander R. Galloway. Author positions Manovich into the "first generation of Internet culture" (Galloway, 2011) that enjoyed different conditions related to certain optimism. Along these line we aim at mapping difference in conceptual dynamic too. From secondary literature we can point further to the debate around website as prospective category in research of online environment. In his article from 2007 *The website as unit of analysis? Bolter and Manovich revisited* Niels Brügger tries to compare approach of David Jay Bolter with that of Manovich in order to find more favorable account of webpage. Brügger argues that "website plays a still greater role on the Internet today than ten years ago." (Brügger, 2007) However true this may be for the decade spanning from 1997 to 2007, when the article was

released, today we would adapt such claim mainly in respect to social media, internet of services and things (ambient intelligence). We agree that, there is not significant jump from a technological point of view, but only the iterative improvement of web technologies (e.g. descriptive and scripting languages – HTML, PHP; libraries – JQuery) and therefore the website is still dominant. If we leave aside from technological ensuring and focus on qualitative shift with regard to interface and human-computer interaction, so we find, that today we do not talk about browsing, but about being and the use of a bounded (collections of) services (e.g. Facebook, Google Services). Hypermedia has fully transitioned from considerably static form at the turn of the 20th and 21st century to fully dynamic form – said by Manovich (2010), they become much more variable and fluid, it means variable to its users. An example might be an optimization of internet-based services according to the entry points (devices) or user. Towards the future, we often called this way as internet of everything (as new type / version of Internet / medium), that connects data, things, people, and processes towards new agility (Drubin, 2013). Internet is no longer primarily hypermedium, but on the contrary herein increase the sense of immersion into the environment, including other qualitative experiences – at the level of physical and virtual environments.

Anyway webpage nor website is not such prominent topic in Language of New Media. Manovich is occupied with overall theory of new media. In the course of the book he discusses basic assumptions (chapter 1), the interface (chapter 2), operations (chapter 3) and finally even forms (chapter 4). But we won`t find webpage among these forms. His two section are mapping databases and navigable space. While databases are without doubts integral part of research in digital environment, consider for instance the concept of data mining, big data or mash-ups, situation is far more interesting with the category of space. Manovich strives to herald this form as prospective universal form of data representation. Even for his present situation Manovich claim flying through spatialized data to be "one of the most common forms of navigation used today in computer culture." (Manovich, 2001, p. 277).

SPACE IN NEW MEDIA ACCORDING TO MANOVICH

Importance that Manovich attributes to navigable space can be seen in the scheme of general cultural scheme in the age of computerization and new media. By this model he tries to delineate key changes in the concept of space and influence of new media on deeper cultural levels (Manovich, 2001, p. 284):

1. modernity—"supermodernity,"
2. narrative (= hierarchy)—database, hypermedia, network (= flattening of hierarchy),
3. objective space—navigable space (trajectory through space),
4. static architecture—"liquid architecture," and
5. geometry and topology as theoretical models for cultural and social analysis—trajectory, vector, and flow as theoretical categories.

Thus according to Manovich current cultural changes brought us toward new condition of "supermodernity." He borrows this term from Marc Augé drawing on his notion of non-place. Augé argues that while modernity formed places as means of identification, power relations where architectural plan already presupposes hierarchical structure (for instance institutional buildings), supermodernity creates non-places that are in contrast ephemeral and fluid (for example airports). Non-places are informed by the very people who are temporarily inhabiting and moving within (Augé, 1995, p. 78). Augé himself draws heavily from Michel de Certeau and his famous essay The Practice of Everyday Life, where he foregrounds ability of everyday motion of individual people to inform their surrounding (de Certeau, 2011, p. xiv). Anyway what Manovich aims to say with help of the concept of navigable space. He argues that our cultural communication in general is starting to inhabit new type of space and this context redefines our very nature as users of new medium or online subject if you wish: "Non-place becomes the new norm, the new way of existence." (Manovich, 2001, p. 280)

But Manovich does not only herald the concept of general space. He is preoccupied with the concept in literal sense, he takes it as space of navigation or more precisely as a 3D virtual space that can represent data. Consider the case of computer games that Manovich often invokes. He argues that navigation

through space together with the database thus even structures our experience: "In short, the computer database and the 3-D computer-based virtual space have become true cultural forms—general ways used by the culture to represent human experience, the world, and human existence in this world." (Manovich, 2001, pp. 214-215)

SPACE IN CONTEMPORARY ONLINE ENVIRONMENT

With such preconception of Manovich`s position we can finally turn back to the question: Does this prospective of navigable space as a dominant form for representing data reflect contemporary condition of online environment? But firstly how to assess whether this role of navigable space is legitimate? Within our train of thought we have took firstly the opportunity to trace Manovich`s own examples today that turn around three field (1) computer games, (2) the interface and (3) the context of cinema and art projects. (4) Afterwards we will try to find more examples of proposed representation by navigable space in respect to online environment and particularly online marketing.

(1) Manovich himself traces the concept firstly in computer games. He mentions first of them, such as *Computer Space* or *Spacewar* (Manovich, 2001, p. 253) invoking their very titles to back his assumption. But he draws mainly on *Myst* and *Doom*, couple which he analyses in the first section of Navigable Space chapter in his book. (Manovich, 2001, p. 244) From one side we can confirm complete reliance of computer games on certain conception of space. On the other hand there has been very limited development of any essential features altering the game space that was popular at the time Manovich wrote his book. The shift can be seen at the level of massiveness user interaction and on the basis of it a new quality of experience. In this perspective, it is especially the massively multiplayer online (role-playing) games.

Although Manovich as well as Pierre Lévy (2001), expected direction to the cyberspace and its use by "data cowboys", so we must conclude that the hardware resources for immersion to the environment are not on a massive scale available or there is no mass demand for them. We assume that current level of (computer-mediated) virtuality suffices and users prefer passive immersion into the story. It is like you read a book and brain automatically completes the imagination of the story (Smutny, 2013).

(2) Follows from the foregoing the preserving of "old" interface. In the direction of the 3D space nothing has changed, except the quality of rendering scene on the display device (hardware progress in the field of microchips for graphics card). Even less has changed in the field of human-computer interface, where even some technologies were rejected by a certain potential customers or did not have greater success. For example (Angelini, 2009), attempts to equip the graphic card with pseudo-3D glasses to enhance the experience in 3D space while playing games – we can remember *Nvidia Riva TNT2* with shutter glasses from 1999. The prospective of 3D image is enlivened by cinema industry today, thanks to advanced technology that offers a better user experience. The interface in form of glasses had been also developed as an accessory – like mobile phone, but its use is on the boundary of virtuality and reality, see (Milgram et al, 1994). It offers us augmented reality and it connects much more intensively the physical three-dimensional space with a virtual environment – example is sheepishly adopted *Google Glasses* (Hong, 2013).

(3) Last plane on which Manovich articulates his idea of navigable space is the field of cinema and art. Let us mention that throughout the whole book the development of new media is intertwined with that of cinema and its language in order to trace their mutual impact. On one side he is mapping how not only cinematic aesthetic but also its technology influenced interface and metaphors used in new media. From the other side he concludes his book with chapter assessing the impact of new media on cinema. There is no doubt that both spheres are one way or another trying to intensify their cooperation. Nonetheless concerning their conception of space there is again little to foreground as a principal step forward. Within filmmaking new techniques of rendering 3D space are being developed but we cannot really creating almost fetishism in relation to realistic representation of space. Situation is thus similar to that of computer games, although the category of space and its representation lies in the center of contemporary cinema, it does not constitute line of further development. In both cases space is strongly

implemented in technological and aesthetic system of the field, but does not present challenge to represent data in new ways.

(4) Of course marketing represents the sphere aiming at providing the most affordable and attractive presentation of information. Nonetheless even in this field new development resides rather in creativity and aesthetics of the presented thing. In this area we see shift at the level of (online) computer-mediated environment and also hardware technologies. Nevertheless it's just a metaphorical approach to space, which envisions Manovich. On the one hand, there are behavioral technologies that try to seduce us from our original path in this space and transfer our attention elsewhere (behavioral advertising) and on the other hand, there are hardware technologies, which are creatively used in marketing activities – QR codes, geocaching (or generally positional technology), mobile phones, tablets (toward ubiquitous computing) and other. Marketers try to highlight the user-friendliness and harmony of software and hardware technologies (user experience), or in the context of a certain television non-impose communication (e.g. product placement in TV programs).

CONCLUSION

Concerning the overall importance of space and navigation through it, Manovich can be without doubt reaffirmed even today. But taken from the perspective of expectations the category have not brought any significant change. Especially online environment including marketing strategies in their present state does not support space as innovating or universalizing form of representation since mere reproduction of already existing forms of interface and marketing seem to suffice.

Nowadays, it is very difficult to find larger number of examples of what we might call Space 2.0 – where we would experience data directly. But we are able to find some indications of this direction in the form of non-contact control or specific graphical user interfaces. The problem is their mass use in computer culture. If we generalize the above said, the greatest progress is in the field of user experience and its improve by new hardware and software technologies. In the case of marketing activities over the internet, we can find qualitative shift due to behavioral mechanisms that change some parts of website environment (behavioral advertising) and try to focus the user's attention to advertising or direct him to perform an action. The online representation of information is rendered in the web (2D) space, but not in 3D space, which emphasizes Manovich. Another important shift is the issue of linking the physical and virtual environment, where is created augmented reality using idea of navigable space, thanks to technologies based on global navigation satellite system (e.g. navigating in space and augmented reality for physically disabled persons) – respectively toward the representation of information in space. Another contemporary challenge consists in integrating their marketing activities into the space between reality and virtuality.

Concerning further research in the field of online marketing or even interface design our belated encounter with Manovich conception of new media offers another insight. While he foregrounds the category of navigable space, he almost avoids any theorizing about the changes in subjectivity affected by new media. We see precisely this train of thought as not only more viable but as a watershed for further inquiry in the recent changes of new media and online environment in particular.

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TYPES OF SOFTWARE DISTRIBUTION AND APPROPRIATE SW DEVELOPMENT METHODOLOGY

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ABSTRACT

Paper deals with different approaches of software (SW) design, implementation and distribution. Based on both impact papers research, Gartner analyses and author´s quantitative research, this paper aims to focus on near future of SW distributions channels (mainly SaaS) and an appropriate usage of SW development process and design methodology. While using quantitative data, this paper estimates the market behavior in upcoming 2-5 years, which expected running agile methods on SaaS models.

KEY WORDS

SW development, SW distribution, SaaS, Agile development

SOFTWARE DEVELOPMENT IN GENERAL

A system development methodology refers to the framework that is used to structure, plan, and control the process of developing an information system. A wide variety of such frameworks have evolved over the years, each with its own recognized strengths and weaknesses. One system development methodology is not necessarily suitable for use by all projects. Each of the available methodologies is best suited to specific kinds of projects, based on various technical, organizational, project and team considerations (CMS, 2008).

According to Elliott, in software engineering, a software development methodology (also known as a system development methodology, software development life cycle, software development process, software process) is a division of software development work into distinct phases or activities with the intent of better planning and management. It is often considered a subset of the systems development life cycle (Elliott, 2004).

The methodology may include the pre-definition of specific deliverables and artifacts that are created and completed by a project team to develop or maintain an application. Common methodologies include waterfall, prototyping, iterative and incremental development, spiral development, rapid application development, and extreme programming. For further rigid acceptable system development methodologies and its basic principles, strengths, weaknesses, and situations where the methodology was most appropriate, please refer to CMS Information technology research (CMS, 2008).

Agile software development is a group of software development methods in which requirements and solutions evolve through collaboration between self-organizing, cross-functional teams. It promotes adaptive planning, evolutionary development, early delivery, continuous improvement and encourages rapid and flexible response to change.

Compared with traditional rigid techniques and methodologies, agile principles deliver approach of the closer cooperation, reducing project risk and increased overview of the project. This is especially true in such cases of ICT projects, whose common denominator is changing environments and evolving requirements (Hihgsmith, 2002; Cockburn, 2001; Beck, 2001). Agile methodology also better integrates

into the customer's software development process and thus reduces the number of errors (Buchalcevová, 2009).

In historical terms, many elements of agile methodologies traced back to Japan's postwar "miracle" (Toyota Kata, etc.), which was in fact the work of experts from the US, who helped a devastated Japan's economy to rebuild. With a little exaggeration to say that the first recorded promoter agile approaches has been Walter E. Deming, which is in the modern process management primarily known as a promoter of PDCA or Deming cycle[11] (Barlow, 2011).

SOFTWARE DISTRIBUTION MODELS

We are located in the modern era of ubiquitous computing[12], in which individuals and organizations have tremendous opportunities in the selection of the type software to satisfy any of your needs (CRM, BI, ERP, individuals - social networks, communication applications, applications that support teamwork).

For the business, this time brings tremendous opportunities for reaching customers in foreign markets. However, the age of the long-term economically profitability to develop software individually for a specific customer recedes (Demirkan, 2010). On the contrary, the modern trend is to develop such software that can be quickly distributed and used by the end client, regardless of its location or level of technical maturity (Holoubek, 2013; Manuja, 2014).

Generally, it can be distinguished three types of SW distribution model within the enterprises:

1. Unique project approach – on demand project, on demand software. Waterfall, prototyping or iterative SW methodology can be easily adopted on that approach.
2. COTS – Commercial of the Shelf. Also commented as a product approach. A COTS product is one that is used as-is- Products are designed to be easily installed and to interoperate with existing system components. Almost all software bought by the average computer user fits into the COTS category: operating systems, office product suites, word processing, and e-mail programs are among the myriad examples. One of the major advantages of COTS software, which is mass-produced, is its relatively low cost (Mangieri, 2014).

   COTS purchases are alternatives to custom developments or one-off government-funded developments. COTS typically requires configuration that is tailored for specific uses and the key characteristic that differentiates COTS from Custom software is that the user configurations are within the defined parameters of the commercial item and not the result of customizations to the commercial item itself. The use of COTS has been mandated across many government and business programs; as such products may offer significant savings in procurement, development, and maintenance.

   Motivations for using COTS components include hopes for reduction of overall system-development and costs (as components can be bought or licensed instead of being developed from scratch) and reduced long-term maintenance costs. In the 1990s many regarded COTS as extremely effective in reducing cost and time in software development. COTS software came with many not-so-obvious tradeoffs—initial cost and development time can be reduced, but often with an increase in software component-integration work and also a dependency on the vendor, security issues and incompatibilities from future changes (McKinney, 2009).

[11] It is a method of gradual improvement such as the quality of products, services, processes, applications and data running in the form of repeated application of four basic activities: Plan, Make, Check, Do.

[12] Ubiquitous computing refers to the generation computing, which is mainly characterized by mobility, accessibility, connectedness, sociality and an emphasis on working with information and applications. Other generational principles are "ambient intelligence", "internet of things" and "Internet of Services".

3. SaaS model – Software As A Service. SaaS is a modern concept where the entire application or application service operates its creator and provider. This service is also offered to customers via the Internet. By eliminating the need to install and operate applications on their own devices, SaaS has recently become a popular way traffic application. SaaS was created as a response to the need to reduce software costs; rapid deployment and outsourcing (focus on your own business and flipping all non-critical component of business to a third party. Here it should be noted that there may be also ICT components that are not, although this organization operating in the field of ICT, the main business focus for the company).

SAAS MODEL

SaaS model (also refered as a Cloud Model) has no physical need for indirect distribution since it is not distributed physically and is deployed almost instantaneously. The first wave of SaaS companies built their own economic model without including partner remuneration in their pricing structure (except when there were certain existing affiliations). It has not been easy for traditional software publishers to enter into the SaaS model. Firstly, because the SaaS model does not bring them the same income structure, secondly, because continuing to work with a distribution network was decreasing their profit margins and was damaging to the competitiveness of their product pricing.

Unlike traditional software which is conventionally sold as a perpetual license with an up-front cost (and an optional ongoing support fee), SaaS providers generally price applications using a subscription fee, most commonly a monthly fee or an annual fee[13].

Consequently, the initial setup cost for SaaS is typically lower than the equivalent enterprise software. SaaS vendors typically price their applications based on some usage parameters, such as the number of users using the application. However, because in a SaaS environment customers' data reside with the SaaS vendor, opportunities also exist to charge per transaction, event, or other unit of value.

SaaS was initially regarded as a potential security and operational risk. Many companies want to keep their own data under internal control. However, the trend is reversed. SaaS providers have secure servers and data being protected better than the customers themselves (with a much bigger budget for IT). Finally, SaaS providers offer better value-added services for even better security (application and log monitoring, etc.). It must be stated the well-known fact, that most data theft is done by their own employees (Doucek, 2009) and not the competition, nor targeted security attacks.

Following diagram shows differences in several parameters of SaaS and non-SaaS distribution model.

[13] Regarding to CIO Meredith Levinson, Software as a Service (SaaS) Definition and Solutions, please refer to http://www.cio.com/article/2439006/web-services/software-as-a-service--saas--definition-and-solutions.html

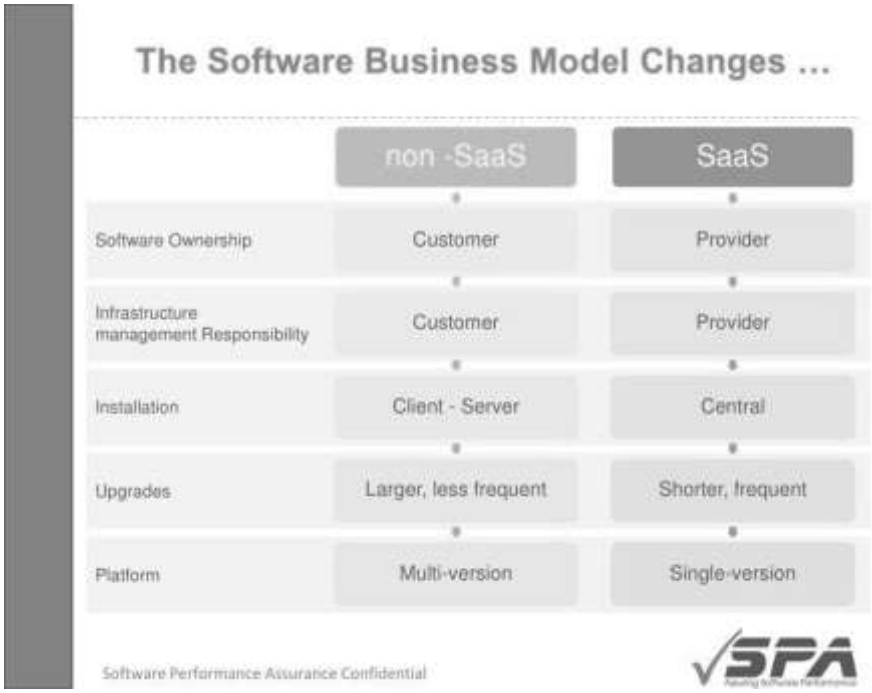

Figure 1 – Comparing non-SaaS and SaaS Business Model (resource: SPA)

While interpreting the business models changes, a word of cloud computing is widely use. Cloud Computing is a broad term that describes a broad range of services. As with other significant developments in technology, many vendors have seized the term "Cloud" and are using it for products that sit outside of the common definition. In order to truly understand how the Cloud can be of value to an organization, it is first important to understand what the Cloud really is and its different components.

Since the Cloud is a broad collection of services, organizations can choose where, when, and how they use Cloud Computing. Not only SaaS, but Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) and give some examples and case studies to illustrate how they all work. We will also provide some guidance on situations where particular flavors of Cloud Computing are not the best option for an organization.

Platform as a Service (PaaS) brings the benefits that SaaS bought for applications, but over to the software development world. PaaS can be defined as a computing platform that allows the creation of web applications quickly and easily and without the complexity of buying and maintaining the software and infrastructure underneath it.

Infrastructure as a Service (IaaS) is a way of delivering Cloud Computing infrastructure – servers, storage, network and operating systems – as an on-demand service. Rather than purchasing servers, software, datacenter space or network equipment, clients instead buy those resources as a fully outsourced service on demand.

GARTNER PREDICTION

Gartner predicts that Infrastructure-as-a-Service (IaaS) will achieve a compound annual growth rate (CAGR) of 41.3% through 2016, the fastest growing area of public cloud computing the research firm tracks. The following graphic provides insights into relative market size by each public cloud services market segment:

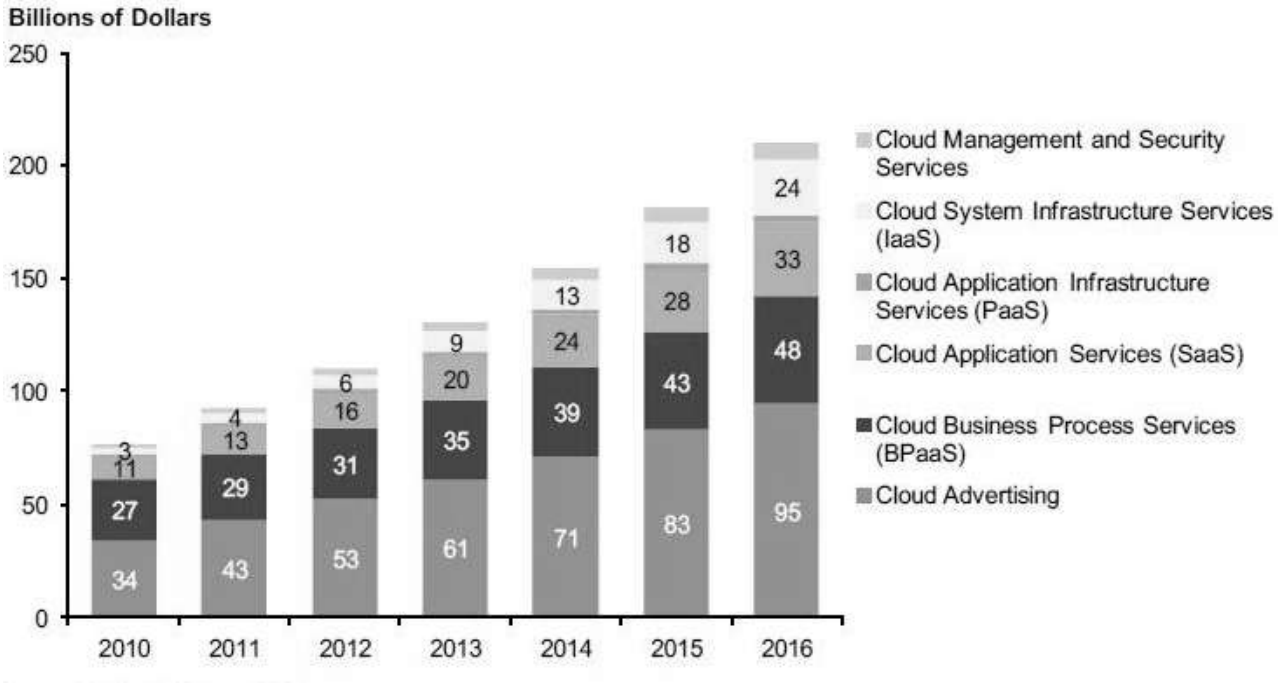

Figure 2 – Public Cloud Services Market by Segment (resource: Gartner, 2013)

Based on Gartner research[14], it can be assumed that the volume of funds invested in cloud services will grow further to the same extents. It also implicates that COTS and individual project oriented SW development methods will be suppressed at the expense of cloud-based services and cloud-based products; such as SaaS distribution model. Summarizing the above, the modern trend of distribution software is SaaS model. An appropriate SW development methodology should be selected as a next step.

FITTING SW DEVELOPMENT METHODOLGY

According to SPA agency and Forrester, major factors in the adaptation of the concept of SaaS to customers following reasons are:

1. 71% availability and reliability
2. 45% the speed of deployment
3. 35% flexible consumption
4. 32% of the simplified payment models
5. 24% reduction of dependence on internal IT (Forrester, 2014)[15]

It follows that the main causes of the transition to the concept of SaaS is speed, flexibility and reliability of service. Customers (ie. consumers) of services expect speed, fixed costs, and defined service levels of service.

While stressing the need for speed and flexibility – openness and a readiness for changes in software as such, it can be assumed that organizations providing SaaS will develop software using agile software

[14] Gartner research of the technological trends for 2014: http://www.gartner.com/technology/research/top-10-technology-trends/

[15] Please refer to https://www.forrester.com/Software--as--a--Service-(SaaS)

development methodologies. This evidenced by publications (Argaval, 2013), which demonstrates advantages of application of Agile development to the company offering SaaS applications.

In view of the findings set out in previous section addressed the author of about 50 major business entities - medium and large IT companies providing different kind of software using the SaaS deployment model of SWs. Respondents were IT or project manager. Firms had to be at least three years on the market and had to provide its software worldwide SaaS. Selection of firms was largely influenced by knowledge of theirs SW product.

During the June – September 2014, author make an individual quantitative research by questionnaire survey, during which addressed 50 major companies in the SaaS, to find out what software development methods are being used. Results of this survey are following:

1. 69% Organizations are using agile methodology do develop their SW within a model of SaaS
2. 44% Organization adopt Scrum as an agile methodology

Scrum is an iterative and incremental agile software development framework for managing product development. It defines a flexible, holistic product development strategy where a development team works as a unit to reach a common goal, challenges assumptions of the traditional, sequential approach to product development, and enables teams to self-organize by encouraging physical co-location or close online collaboration of all team members, as well as daily face-to-face communication among all team members and disciplines in the project (SCM, 2014)

A key principle of Scrum is its recognition that during a project the customers can change their minds about what they want and need (often called "requirements churn"), and that unpredicted challenges cannot be easily addressed in a traditional predictive or planned manner. As such, Scrum adopts an empirical approach—accepting that the problem cannot be fully understood or defined, focusing instead on maximizing the team's ability to deliver quickly and respond to emerging requirements.

Hybridization of Scrum is common as Scrum does not cover the whole product development lifecycle; therefore (Buchalcevová, 2009), organizations find the need to add in additional processes to create a more comprehensive implementation. For example, at the start of the project, organizations commonly add process guidance on requirements gathering and prioritization, initial high-level design, and budget and schedule forecasting. However, the Scrum framework does not explicitly allow for extension points of such a kind; consequently, achieving a more comprehensive software life cycle requires extending the framework rather than instantiating it.

CONCLUSION

According to Forrester and Gartner quantitative research, SaaS model, as a distribution model of upcoming years will be struggling for winning position. Software as a service (SaaS) is not just an alternative to the standard software installation in the business environment (traditional model) where a user has to build the server, install the application and configure it, in upcoming years it will be the most used process to perform long-term excellence services. The upcoming era of SW development and distribution will be evaluated by benefiting the reduced time of implementation, lower costs based on pay-as-you-go model (not only for small and medium segment), scalability and integration, frequency of new upgrades and releases and ability of easy-use proof of concepts also for the critical business applications of the clients.

For the maintaining and for the obtaining of all these benefits and new approaches, agile methodology of SW development, agile change management and agile release management must be taking place within the organization. In upcoming years, significant usage of agile methodology will be implemented within the entire SaaS organizations.

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MULTI-CRITERIA DECISION-MAKING USED IN SELECTION OF THE BEST WEB GIS DEVLOPMENT TOOL

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ABSTRACT

This article is focused on system approach to process of selection of the best solution and the most appropriate development tool in specific problem of Web GIS application. There are used multi-criteria decision-making methods to find the best solution from three specific tools commonly used in creation of Web GIS applications. The selection is based on real applications publishing recycle bins layout in Pardubice, which is created in the following tools: Google Maps API, ArcGIS API and Mapy.cz API.

KEY WORDS

Decision making, AHP, Saaty's matrix, Web GIS, Google Maps, ArcGIS, Mapy.cz

INTRODUCTION

This article demonstrates a system approach to selection of the best development tool in specific field of use. There were created three solutions of the same problem using three different development tools. The problem was publishing of recycle bins layer as a part of Web GIS application created on base of pre-specified requirements and separately using Google Maps API, ArcGIS API and Mapy.cz API (all of them are meant as JavaScript APIs). (Pásler, 2014), (Skopalíková, 2012)

The main part of this article is selection of the best solution which according to specified procedures and criteria means the best tool as well. This article is focused on the methods of multi-criteria decision making integrated and used in the decision process. That contains primarily a choice of evaluation criteria, comparison of solutions according the criteria, methods of weights determination and finally the process of choice itself.

One of the main outputs of this work is recommendation of one tool as the best for the solution of this problem (meant publishing of recycle bins) or solution of the problems of similar kind (publishing of points of interest in general). In addition, this article is focused on presentation of possibilities of integration and application of mutli-criteria decision-making methods in this specific case from more general view. The result of this work besides other things is more general view on the selection process as an Analytic- Hierarchy process (AHP), not only as a process of deriving the weights of criteria (and evaluating of alternatives as well) using quantitative pairwise comparison.

AHP is common used method in process of decision making. However this article shows its use in a specific problem. It leads to the determination of criteria and their weights as well as evaluation of alternatives as an output done by author.

MCDM AND AHP APPROACH

MCDM commonly stands for Multi-Criteria Decision-Making. Together with Analytic-Hierarchy process (AHP) it represents possible system approach and system thinking in process of selection of the

optimal alternative from the set of possible alternatives. Although both terms have very common and AHP is typically seen as one method in MCDM, in some view AHP methodology exceeds MCDM and can be understood as a process, which perceives reality in systematic view very different from simple classifying based on numbers (Ramík , 1999).

These methods are widely used in many issues as well as there are many publications concerning problems of MCDM and AHP which content is beyond the theme of this article. Nevertheless there will be mentioned some significant theoretic aspects desirable in context of the issue.

In the context of system approach it is appropriate to see a decision making problem as a system. There should be defined elements of the system, inputs, outputs, boundary and surroundings of the system. There are several basic elements of multi-criteria decision process, which can be seen as the mentioned parts of the system definition. First of all there is a goal of the decision process. It represents an input of the system, a goal future state of the system after the process is realized. There is a subject and an object of decision-making, where the subject is person or group making the decision and the object represents the environment where the process of decision is made (Ramík, 1999). According to (Křupka, 2011) the subject can represent controlling and feedback factor in the system and object usually represents context and boundary of the system. Furthermore there are criteria, which can be taken as attributes, features or characteristics of the physical measurable nature or subjective vague nature as well. Criteria are often determined on the basis of a goal. In close connection with criteria there are alternatives (or options), which represent a discrete set from which the optimal alternative is selected. In context of the system we can understand criteria and alternatives as the elements, which are created or defined in the process itself. According to Ramík (Ramík, 1999) consequences of alternatives, which are represented as values of criteria, are either definite or dependent on conditions of world (or environment). It can be understood as dependency on states of a system and states of its surroundings. The constancy of the conditions plays key role in determination if it is decision under certainty or uncertainty.

AHP was developed by Thomas L. Saaty in the 1970s as a decision-making method which is based on decomposition of decision problems into a hierarchy of sub-problems. As already outlined AHP method in context of multi-criteria decision making is beyond of only determination of weights. It brings specific approach to decision making combining deductive and inductive (system approach) methods (Ramík, 1999). According to Saaty´s original example of Brandywine River (Saaty, 2001) the main principle of the method consist of the carefully defined situation (it can be understood as definition of elements, relations and surroundings of the system), which is then structured into a hierarchy of levels. Typically there is mentioned three-layer hierarchy where the top level represents goal, the middle level represents criteria and the lowest level represents alternatives. This case is used in this article and can be seen in the figure (Figure 1). However there can be other hierarchies like the one which Saaty mentions, where the criteria are decomposed into another level (Saaty, 2001), or there can be four-level or n-level hierarchy in general, which can represent situation of decision under uncertainty or risk as Ramík mentions (Ramík, 1999). According to Saaty (Saaty, 1987) the three-level hierarchy can be expressed as follows:

$$H = \{L_k\},\ k = 1,2,3 \tag{1}$$

where L_1– the goal layer – represents the optimal alternative chosen form the set of alternatives: $A = \{A_1, A_2, ...,A_n\}$, $L_2 = \{C_1, C_2, ..., C_m\}$represents criteria and the lowest level $L_3 = \{A_1, A_2, \ldots,A_n\}$represents the set of alternatives. Further there is vector $\mathbf{w} = \{w_1, w_2 , \ldots, w_m\}$defined between L_1 and L_2 which is normalized weight vector and which expresses relative significance of criteria and there is also weight matrix $\mathbf{V} = \{v_{11}, v_{12}, \ldots, v_{1n}; v_{21}, v_{22}, \ldots, v_{2n}; \ldots; v_{m1}, v_{m2} , \ldots v_{mn}\}$ defined between L_2 and L_3 which represents numerical expression of evaluation of each alternative according each criteria. By default the higher number means better evaluation. It leads to simple solution of the problem as a selection of the best alternative by multiplication of vector **w** and j-th column of matrix **V** as follows:

$$A_j = \{ w_1, w_2 , ..., w_m\}^T.\{v_{1j}, v_{2j}, ..., v_{mj}\} \tag{2}$$

and choose the best alternative A^* as follows:

$$A^* = MAX\{A_j\} \tag{3}$$

As Saaty proposed (Saaty, 1987), (Triantaphyllou, 2000) the weights of criteria as well as evaluation of alternatives or elements from the same level in general are taken from matrix **S** - the Saaty´s matrix (the designation can differ from author to author but commonly **S** or **A**). Saaty´s matrix is *m*×*m* matrix consisting from elements s_{ij} which are interpreted as estimates of quotients of weights w_i and w_j of i-th and j-th criteria. According Ramík (Ramík, 1999) for the matrix is true the follows:

$$s_{ij} \approx \frac{w_i}{w_j}\ , i,j = 1,2,\dots,m \tag{4}$$

$$s_{ij} = 1 \text{ for } i = j \text{ and } s_{ij} = \frac{1}{s_{ji}} \text{ for } i \neq j \tag{5}$$

The expression (5) implies that the matrix **S** is reciprocal matrix. According Saaty´s proposal the pairwise comparison is based on discrete scale from 1 to 9 (higher number means higher relative significance), which means that the matrix is content from these numbers and their reciprocal numbers. From expression (4) and according to references (Saaty, 1987), (Saaty, 2001), (Triantaphyllou, 2000) the vector of the weights is determined on eigenvector corresponds to maximal eigenvalue (eigen number) of the matrix. According that the vector of the weights can be determined using expression (6):

$$\boldsymbol{S\sigma} = \lambda_{max}\boldsymbol{\sigma} \tag{6}$$

Where $\boldsymbol{\sigma}$ is eigenvector and λ_{max} is the highest eigenvalue. In the expression (6) there could be *m* instead of λ_{max}, if the consistency of the matrix is absolute. According to the facts above and expression (4) there is an option to use a principal of the method of least squares to estimate the weights. There can be used following expressions (7) ,(8) and the method used for instance by Gao (Gao, 2009) to determinate the weights (**w** vector):

$$R_i = \sqrt[m]{\prod_{j=1}^{m} s_{ij}} \qquad w_i = \frac{R_i}{\sum_{i=1}^{m} R_i} \tag{7), (8}$$

The AHP approach implies very significant matter related to the method. It allows not only some inconsistency in process of weight determination, but even quantify the inconsistency. In this context it´s suitable to use Saaty´s words (Saaty, 2012): "*The Analytic Hierarchy Process allows for inconsistency because in making judgments people are more likely to be cardinally inconsistent than cardinally consistent.*" The consistency is expressed by a Consistency Ratio (CR) calculated from Consistency Index (CI). They are calculated as follows:

$$CI = \frac{\lambda_{max} - m}{m-1} \qquad CR = \frac{CI}{RI} \tag{9), (10}$$

RI stands for Random-consistency Index and it is a constant dependent on *m* (order of matrix) which is usually taken from tables. If CR = 0 (λ_{max}=*m*) then the judgments captured in Saaty´s matrix are perfectly consistent. According to Saaty´s suggestion CI should not to exceed 0.1 to the judgments are consistent enough.

DEFINING THE ISSUE IN CONTEXT OF AHP

As it was introduced there were built three Web GIS applications dealing with same goal, which is publishing of recycle bins in Pardubice. They were built separately using three JavaScript APIs for building web map applications: Google Maps API, ArcGIS API and Mapy.cz API (further as tools). There were established functional requirements as well as other requirements to form of the applications.

According to that and in the context of AHP approach the goal of the process is set as: choice of the most appropriate tool for this kind or similar kind of applications (further in short as the best tool). The goal can be seen in the highest level of the hierarchy in the figure (Figure 1).

According to Ramík (Ramík, 1999) the next step in a decision process is choice of criteria. The process of selection of criteria is closely related to the stated goal and sub-goals. In relation to this issue the sub-goals could be for instance choice of the tool with the best API (clarity, extensiveness, ...), choice of the tool with the best licensing conditions etc. The process of stating the sub-goals is not necessarily a part

of the process and they are not part of the three-level hierarchy seen in the figure; however it can help to choose criteria. Some goals and sub-goals can be transformed not to the criteria but to the restrictive conditions (Ramík, 1999).

The criteria are determined according to specified issue and parameters, attributes and conditions specified in detail (Pásler, 2014). They can be seen in the figure (Figure 1) as well as in the table (Table 1). AHP method allows using qualitative as well as quantitative criteria.

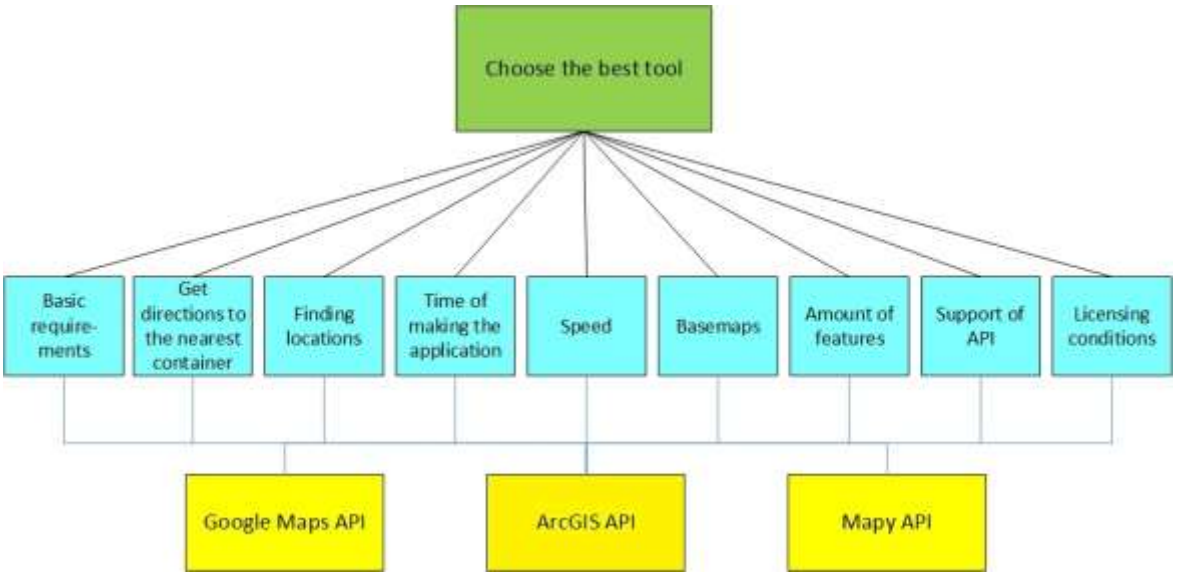

Figure 1 - Hierarchy for choosing the best tool (Author, 2014)

As can be seen in Figure 1 there are three levels – the alternatives in the lowest level, which is connected to the criteria in the middle level and goes to the goal in the highest level. The connections between criteria and the goal can be labeled by the weights of the criteria and the connections between the alternatives and the criteria can be labeled by the matrix of evaluation of each alternative according to each criterion. That is done also by parwise comparison proposed by Saaty and the summarized result can be seen in the table below (Table 3).

According to the definition of the process above and Ramík (Ramík, 1999) there should be defined subject and object as well. In this decision process the subject is the author of the work and object can be an environment of the market with APIs. This decision process is assumed as decision under certainty and the conditions of surroundings are not changing.

SELECTION OF THE BEST ALTERNATIVE

The next step in the process after defining the goal, the alternatives and the criteria is evaluation of the alternatives according to each criterion (Ramík, 1999). It means to set weights of the criteria as well as evaluating of the alternatives. For these tasks there are used formulas and expressions from the previous division. The evaluation of the alternatives is done on the base of verbal pre-evaluation which is combining different scales, verbal evaluation as well as measurements. This is not at fault due to the used method of parwise comparison of the alternatives. The set of the criteria, the pre-evaluation and character of the criteria (maximization or minimalization) can be seen in table below (Table 1).

		Alternatives		
Criteria	**Type**	**Google Maps API**	**ArcGIS API**	**Mapy API**
C1 – Basic requirements	MAX	Fullfiled	Fullfiled	Partially fulfilled
C2 – Get directions to the nearest container	MAX	Functioning	Not implemeted	Functioning
C3 – Finding locations	MAX	Functioning with limitations	Functioning	Functioning
C4 – Time of making the application	MIN	39,25 hours	42,5 hours	31,25 hours
C5 – Speed	MIN	0,748	1,619	0,633
C6 – Basemaps	MAX	Good	Sufficient	Very good
C7 – Amount of features	MAX	Very good	Very good	Sufficient
C8 – Support od API	MAX	Very good	Good	Good
C9 – Licensing conditions	MAX	Good	Very good	Excellent

Table 1 – Set of the criteria and pre-evaluation of the alternatives (Author, 2014)

For the determination of the weights of criteria as well as the evaluation of the alternatives there is used Saaty´s method of quantitative parwise comparison. It means that there is a table built to compare the criteria which is the Saaty´s matrix with the weights calculated (Table 2). To calculate the weighs there is used the method of the highest eigenvalue which is subsequently used to calculate the indexes of consistency. The consistency ratio of this table according to expressions (9) and (10) is equal to 0.077. This means that the matrix as well as the judgments is consistent enough.

	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**	R_i	w_i
C1	1,00	9,00	9,00	7,00	3,00	6,00	3,00	5,00	4,00	4,3954	0,3150
C2	0,11	1,00	1,00	0,33	0,13	0,50	0,14	0,17	0,17	0,2756	0,0198
C3	0,11	1,00	1,00	0,33	0,13	0,50	0,14	0,17	0,17	0,2756	0,0198
C4	0,14	3,00	3,00	1,00	0,20	2,00	0,20	0,33	0,25	0,5893	0,0422
C5	0,33	8,00	8,00	5,00	1,00	7,00	2,00	3,00	3,00	2,8755	0,2061
C6	0,17	2,00	2,00	0,50	0,14	1,00	0,14	0,25	0,20	0,4117	0,0295
C7	0,33	7,00	7,00	5,00	0,50	7,00	1,00	4,00	3,00	2,4706	0,1771
C8	0,20	6,00	6,00	3,00	0,33	4,00	0,25	1,00	0,50	1,1530	0,0826
C9	0,25	6,00	6,00	4,00	0,33	5,00	0,33	2,00	1,00	1,5066	0,1080

Table 2 – Saaty´s matrix and the weights of the criteria (Author, 2014)

The same method is used for evaluating the alternatives according to criteria. It can cause that there are some discrepancies between the table above (Table 1) and the table of final evaluation (Table 3). The alternatives are compared according to every single criterion. That means that there are nine more Saaty´s tables - one for each criterion. These tables are not included in this text and can be found in other work of the author as well as detailed description of the criteria (Pásler, 2014).

		Alternatives		
Criteria	**Weights**	**Google Maps API**	**ArcGIS API**	**Mapy API**
C1	0,3150	0,4286	0,4286	0,1429
C2	0,0198	0,4737	0,0526	0,4737
C3	0,0198	0,1429	0,4286	0,4286
C4	0,0422	0,2297	0,1220	0,6483
C5	0,2061	0,4615	0,0769	0,4615
C6	0,0295	0,3000	0,1000	0,6000
C7	0,1771	0,3234	0,5876	0,0890
C8	0,0826	0,6250	0,2385	0,1365
C9	0,1080	0,1168	0,1998	0,6833
Final score		0,3824	0,3138	0,3038
Placings		1.	2.	3.

Table 3 – Scores of the alternatives and the final evaluation (Author, 2014)

As can be seen in the table above (Table 3) Google Maps API is chosen as the most appropriate tool. To calculate the final score there is every relative score of an alternative according to a criterion multiplied by the weight of that criterion and then summarized. A nature of the result is discussed in the next division. There are several applications which allow to use AHP in decision making process. Some of them are available on the web. However for the calculations done within this work are made in MS Excel primarily due to education reasons and verification the mathematic nature of background of the process.

DISCUSSION

As Table 3 shows the result of the process can be very dependent on the weights of the criteria. There was already mentioned that the set of the criteria was proposed by author as one of the main outputs of this work. Also the weights of the criteria were calculated on a base of author´s priorities. It´s obvious that the result can be different according to different priorities. Therefore the result should be taken as recommendation. It is also possible to take the comparisons according to criteria proposed by author and set new weights following the instruction in this work or using some of the specialized applications. In general this method can be also used to different set of alternatives but most of the criteria proposed in this work are based on done applications and they proceeds from a process of creation of the applications.

According to the discussion above there have to be said that this paper is mostly demonstration of using system approach in the form of applying MCDM to the specific decision problem. It determines the extent in which the results can be generalized. As was mentioned there are other methods used in MCDM especially in weights determining problem, however the AHP method still seems to be most complex and used for this kind of problem and that is the result, why it was used for the demonstration and for the solution of the problem. There is definitely a room for applying any different method of choosing the best alternative (for instance using fuzzy AHP) and for comparison to AHP method. I addition to mentioned there can be chosen a different method for choosing the set of the criteria, it could be for instance based on preferences of users as well as authors (programmers of an application). While there are many creators of Web GIS applications among programmers, there also could be used a questionnaire for getting the preferences of the authors.

CONCLUSION

The main goal of this article is a demonstration of using system approach through an integration of multi-criteria decision making methods in the process of selection of the best tool. It contrasts with the approach, if there was just said: "This application is better looking" or "This tool is the easiest to work with".

There is demonstrated application of AHP during process of finding criteria, determining their significance (setting the weights), evaluation of the alternatives and choosing the most appropriate solution as well. Output of this work can be used not only as a recommendation of one of the tools, but primarily as a proposal of the set of the criteria and their possible evaluation as well as evaluation of the alternatives according the criteria. There is demonstrated that using this approach can help to understand the problem especially the relations between the criteria and the alternatives which can lead to highest possibilities in process of getting other results, when different priorities were used.

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KAREL THE ROBOT

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ABSTRACT

In this paper we bring a brief overview of the Karel programming language, a great but almost forgotten tool to introduce not only children to programming concepts and problem solving. The differences between original idea and Czech implementation are outlined, as well as the comparison to computation theory and modern programming languages. We briefly show the Kopenograms, an easy to understand tool to visualize the algorithms in much easier way than standard flow charts do. In the last chapter we show some simple programs written in Karel.

KEY WORDS

Programming language, Karel, Problem solving, Algorithms, Flow charts, Kopenogram

THE HISTORY

It is now more than thirty years, when Richard E. Pattis introduced new and very simple programming language named Karel (Pattis, 1981). The language got its name in memory and honor to Karel Čapek, Czech writer, who first used the word *robot* in the play *R.U.R - Rossum's Universal Robots*. The concept of the language was to control a small robot Karel in the grid of streets and avenues, avoiding wall collisions and putting beepers on the ground. In former Czechoslovakia the language was soon adopted by Rudolf Pecinovský and Tomáš Bartovský (Vejvoda, 1987) into local environment, changing the streets and avenues into so called *MESTO (CITY)*, which is just a playground consisting of ten squares horizontally and ten or fifteen squares vertically. Each square can be empty, hold either the wall, rendering the square inaccessible, or limited amount of marks (usually up to 9) can be placed on the square. Enabling more than one mark on a square (compared to just one beeper in the original) opens new possibilities and allows programmers to create more sophisticated algorithms such as number addition and/or multiplication in decimal base. The language was implemented on almost all 8-bit comupters available, such as locally produced PMD85, IQ151, as well as well known brands ZX Spectrum or Atari (Synovcová, 1989). Today, the great implementation by Jiri Osoba called *PC-Karel* is available for the Windows platform (Osoba, 2004).

THE PRIMITIVES

In fact, there are only four executive commands in Karel

- *KROK*, to move the robot one *SPEP* forward
- *VLEVO-VBOK*, to *TURN-LEFT* the robot
- *POLOZ*, to *PUT* the mark
- *ZVEDNI*, to *GET* the mark

In just these four commands one may also recognize the concept of the Turing machine, while this time we do not move the tape rather than the robot itself. We can also check the state of the robot, as the

command such as *KDYZ (IF)* is available to check, whether the robot is facing the wall (i.e. to avoid the collision), to check the presence of the marker or the orientation of the robot facing north, south, east or west. The collection of primitives will be complete with *OPAKUJ (REPEAT)* and *DOKUD (WHILE)* commands. It is not the purpose of this paper to give a user guide of the language, however the limited instuctions set compared to the ability to solve very complicated problems id definitely worth to mention.

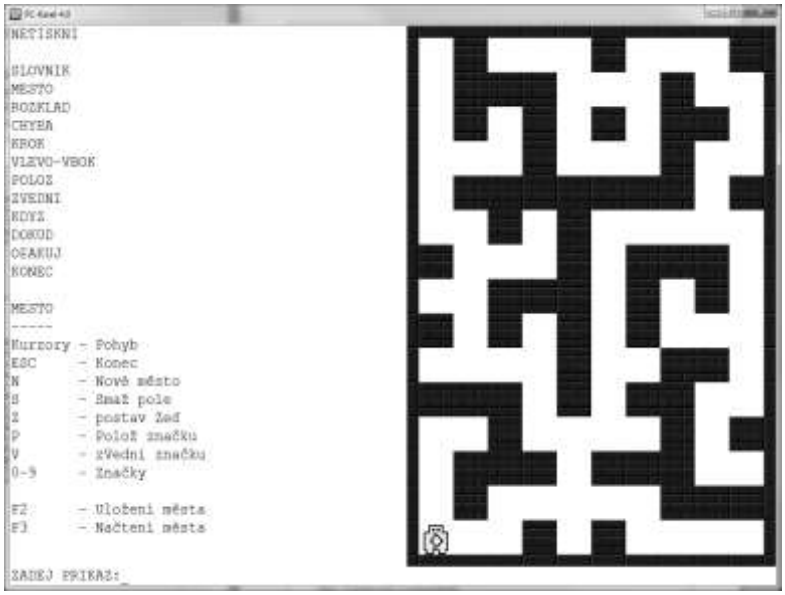


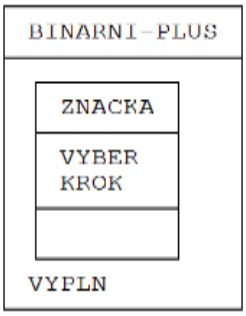
Figure 2 – Karel environment with maze built using inner walls

BASIC TECHNIQUES

As mentioned earlier, the main purpose of Karel is to serve as an educational tool to programming techniques. Without any doubt, the basic principle is always to split complicated tasks into simple ones. Should the robot build the house, the task is split into basement construction, the identical floors and the roof, while the floor is a repeating pattern of windows and walls. This gives the great understanding of both the basic top-down and bottom-up approaches in program development. Another great benefit of Karel is the absence of *GOTO* command, which usually renders the code barely readable. No part of the code can be skipped using jump command, the *IF-THEN-ELSE* construction is used all the time. The procedures and sub procedures are called using the standard program stack, allowing to implement one of the most advanced techniques - the recursion. The presence of recursion allows Karel to solve pretty classical problems such as Eight queen problem or the flood fill - both are standard algorithms from programming courses. Inrerestingly, there are absolutely no variables implemented in the language (as in the Turing machine) the flow of program is strictly controlled by the position and orientation of the robot and the marks count.

THE KOPENOGRAMS

The Kopenograms were invented by Jiří Kofránek, Rudolf Pencinovský and Petr Novák and the name to the diagram was given by initial letters from their surnames, although in later paper all three inventors deny this, stating that the acronym kopenogram means Keep Our Program in Embedded Noted Oblongs for Graphical Representation of Algorithmic Modules (Kofránek et al., 2012). No matter how the name initiated, the Kopenograms, almost forgotten today, still serve as a great tool to visualize the flow of the program in a way much simple than standard flow charts do. Again, it is no purpose of this paper to teach the techniques to create the kopenograms, although the principles are easily adopted even by children at the age of eleven or twelve years. Simply said, each part of the code (called block) is put in the box or group of boxes (rectangles).

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BINARNI-PLUS ZNAMENA
  DOKUD JE ZNACKA
    VYBER
    KROK
  KONEC
  VYPLN
KONEC
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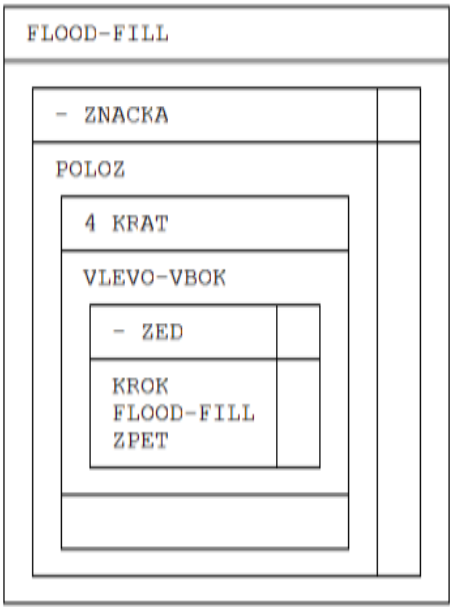


```
FLOOD-FILL ZNAMENA
  KDYZ NENI ZNACKA
    VYPLN
    OPAKUJ 4 KRAT
      VLEVO-VBOK
      KDYZ NENI ZED
        KROK
        FLOOD-FILL
        ZPET
      KONEC JINAK
      KONEC
    KONEC
  KONEC JINAK
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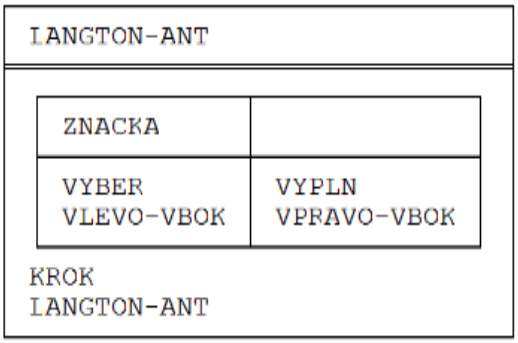


```
LANGTON-ANT ZNAMENA
  KDYZ JE ZNACKA
    VYBER
    VLEVO-VBOK
  KONEC JINAK
    VYPLN
    VPRAVO-VBOK
  KONEC
  KROK
  LANGTON-ANT
KONEC
```

Figure 2 – Example of kopenograms (left) and the respective program code (right)

THE PROBLEMS

In this section we will describe several selected problems solvable in Karel, while the solution to first three listed here is presented in the figure 2. Some of the problems were used in the National programming contest that took place in former Czechoslovakia in 1988/89.

1) Create a simple binary counter adding one - the zero and one bits are represented by the empty and full square. Solved in just five lines of *BINARY-PLUS*.

2) Create a so called flood fill algorithm to fill every empty field with marks. This is a well-known recursive algorithm with a very nice solution in Karel. Please note some fields may be blocked by walls (see maze on Figure 1). The solution is presented in kopenogram *FLOOD-FILL*.

3) Create a cellular automata called Langton ant (Langton, 1986). Solved by one simple *IF-THEN-ELSE* structure presented in *LANGTON-ANT* kopenogram.

4) The city is limited to 8x8 size. Solve Eight queen problem, i.e. find the position of chess queens not to thread each other. The position of the queen is represented by the mark.

5) Karel will multiply two decimal number encoded by mark in upper right corner of the city.

6) Karel will perform the vertical/horizontal mirror of the image painted by marks.

Probably the most classical problem for Karel is to find a Karel Capek memorial hidden somewhere in the city and represented by the single block of the wall (see Figure 1 - the memorial is located in the upper part of the city).

CONCLUSION - THE KAREL TODAY

Today, the Karel language is almost forgotten, but still remains a powerful tool to teach basic programming skills. Some new programs of this educational kind were developed (Scratch being one of them, as a mixture of Karel and Logo) but all of them miss the simplicity of the initial Karel ideas. The aim of this paper was to remember the language and its beauty and ease of use. Only a few people are the ambassadors of Karel today and the author of this paper would like to say a really big thank you to all of them. We all should teach our children this language to keep it still alive.

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A RISK ANALYSIS METHOD FOR THE DETERMINATION OF THE EXTENDED ACCEPTABLE TIMEFRAME OF INTERRUPTION IN AN ENTERPRISES' INFORMATION SYSTEM

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ABSTRACT

The likelihood of an unexpected interruption in an enterprises' information system, is a threatening element and simultaneously a challenging issue for enterprises and ICT managers. Modern enterprises and organizations establish cautiously defined risk management policies in order to mitigate or even annihilate the possibility of suffering data loss, financial damage and operational disorder in such circumstances. Even if unexpected information system outage occurs, the business processes and their involved applications should be recovered within reasonable timeframes in order to avoid the above mentioned negative impacts. Business Continuity Plans define Rational Time Objectives and Maximum Acceptable Outage (RTO, MAO) time limits for the recovery of the interrupted systems. The present paper introduces a new method for predicting possible extended MAO (eMAO) timeframe when the system failure is accompanied by extreme situations, which are called Modifiers, and can significantly "modify" or prolong the system restoration procedure. The primary step of the method's formulation is the categorization of these factors according to specific Impact and Probability to occur scales. The second step is the formulation of equations that calculate the risk magnitude of these modifiers, which is entitled Unexpected Recovery Index (URI), and is based on the Composite Risk Index theory of Risk Management (CRI). Moreover, extreme scenarios which define the exact impact of the modifiers on the Recovery process should be determined by the business process managers. The final step is the estimation of the eMAO and the Maximum accepted value $eMAO_{MAX}$. The estimated eMAO will be dependent on the above recovery scenarios, which include the co-existence of an emergency event (modifier) with an unexpected information system outage. The URI and eMAO values are a standard method aimed to assist business managers in estimating extended information system outage when no former data of equivalent crisis events is at their disposal.

KEY WORDS

Risk Analysis, Composite Risk Index, Unexpected Recovery Index (URI), Extended Information System Interruption, Business Continuity Plan, Maximum Acceptable Outage (MAO), Extended Maximum Acceptable Outage (eMAO)

INTRODUCTION

Information technology (IT) has brought a new era for society as well as the industry. Today, organizations are required to use IT in order to maintain the business operations and keep the competitive

advantage in the market (Martin et al. 2011). Since, modern business processes are fully dependent on information technologies, complex software applications and multiple corresponding business functions, speedy restoration of services for critical organizational processes in the event that there are operational failures due to natural or man-made disasters, (Rao et al. 2009) is considered to be an imperative task.

One of the key issues of the modern enterprises and organizations is the development and the establishment of an efficient and effective Risk Management policy. In particular, Risk Analysis, supports managers in understanding the negative impacts of adverse events (in terms of costs or underperformance) and likelihood of negative consequences (Borghesi et al. 2013).

Risk management is the identification, assessment, and prioritization of risks followed by coordinated and economical application of resources to minimize, monitor, and control the probability and/or impact of unfortunate events or to maximize the realization of opportunities. In ideal risk management, a prioritization process is followed whereby the risks with the greatest loss and the greatest probability of occurring are handled first, and risks with lower probability of occurrence and lower loss are handled in descending order. Furthermore, one of the main principles of risk management is that is should be part of the decision making (Ciobanu et al, 2011). Moreover, according to International Standardization principles (ISO 31000, 2009), can also provide input for making decisions where the options involve different types and levels of risk assumption, mitigation, reduction, and avoidance while it is characterized by two basic features:

- the severity of the possible adverse consequences;
- the likelihood (probability) of occurrence of each consequence (Borghesi et al. 2013).

The method introduced in the current paper aims to assist business managers, who are not computer oriented, in obtaining decisions regarding the recovery time of the critical information systems with which they execute all their daily operations, in case of technical outage. The decision making process should be implemented considering scenarios which involve the emergence of crisis events throughout the system restoration after failure. The method is developed in order to provide business managers with realistic information about system recovery timeframes. The aforementioned timeframes are considered within the IT Risk Management Policy with a more specific focus on Business Continuity Plan (Business Standard Institute, 2008). The selected time is defined via the Maximum Acceptable Outage (MAO) (Business Standard Institute, 2012)

A special notice at the MAO timeframe is devoted in this article. The more precise the definition of MAO value is achieved by the business managers, the more reasonable data will be obtained by ICT experts who formulate the final IT Business Continuity Plan. It is thus a method which implies more precise risk management policy in terms of secure, efficient and effective system recovery in case of unexpected outage.

PROBLEM

The currently formulated contribution attempts to solve the following issues:

ISSUE 1: What could happen if an emergency situation occured simultaneously with an information system outage? Would the failure timeframe be modified and prolonged?

ISSUE 2: Which are the possible modifiers of this timeframe which is defined as MAO? Could we classify them according to their impact and possibility of occurence?

ISSUE 3: Is there any standard method in order to mitigate the above risk, when enterprise management has no previous experience of additional crisis events during a system recovery procedure?

ISSUE 4: Can we estimate the additional time from MAO which is demanded to restore the information system in such conditions? Which is the upper limit of this additional.

The formulation of the present method is implemented according to the sequential provision of ansewrs to the above stated issues. In this context, the decision making process for managers regarding the timeframe of system recovery, even if severe crisis scenarios follow system outage, will be undoubtedly assisted.

METHOD

The main idea which generates the proposed method is the risk analysis, mitigation and avoidance of overlapping MAO Timeframe, due to the appearence of an additional crisis situation during the information system recovery process, as well as the Extended Maximum Accepted Outage (*eMAO*) estimation. Under this assumption, the system recovery process may be significantly delayed and the MAO value that has been defined by the risk management of the enterprise, maybe modified due to the given extreme scenario. It is consequently indispensable to consider Extended MAO value, which will be calculated according to the rules of the proposed contribution.

COMPOSITE RISK INDEX (CRI)

The current contribution is based on the Composite Risk Index (CRI) theory of risk management, which in turn stems from stems from the most widely accepted formula for risk quantification (Ciobanu et al, 2011):

$$RISK\ MAGNITUDE = RATE\ (or\ PROBABILITY)\ OF\ OCCURENCE\ \times\ IMPACT\ OF\ EVENT \quad (1)$$

Similarly, the *Composite Risk Index (CRI)* is calculated according to the following formula:

$$COMPOSITE\ RISK\ INDEX = IMPACT\ OF\ RISK\ EVENT\ \times\ PROBABILITY\ OF\ OCCURENCE \quad (2)$$

According to the Composite Risk Index theory, the Impact is marked with a scale from 1 to 5, where 1 is the minimum impact value and 5 is the maximum impact value. Moreover, the probability of occurrence is also marked with a 5-level scale, and value 1 refers to the minimum probability, while 5 refers to the maximum probability of occurrence. As a result, it can be easily realized that the minimum value for CRI is 1 and the maximum value of CRI is 25.

UNEXPECTED RECOVERY INDEX (URI)

MODIFIERS AND *URI* EQUATIONS (DIFFERENTIATIONS FROM THE CRI): For the estimation of the Unexpected Recovery Index (URI), a modification of the CRI model was implemented by the author. URI model is formulated in terms of 6 categories of *Unexpected Recovery Factors (URFs)*, which are called *Modifiers.* The aforementioned factors were initially defined in the Business Continuity Testing Points (BCTP) method (Podaras and Zižka, 2013). Each factor is marked according to a 4-level scale of impact values. The Modifier types are *Weather Conditions*, *Network Availability, Staff Availability, Urban Conditions, Disaster Types* and *Timely Information Distribution.* According to our model, scenarios which should be developed, consider the possibility of occurence of crisis events that invlove all the aformentioned categories, simultaneously with an information systém failure. A negative influence of these modifiers can significantly prolong the RTO as well as the MAO Timeframe.

RISK ANALYSIS: The calculation of the URI value shall be oriented to the specific 4-Level scale. As a consequence, according to the newly introduced model, minimum impact value is 1 while maximum impact value is 4 for each *Modifier*. For Possibility of Occurrence of each unexpected factor the same scale is implemented.

The second differentiation from the CRI model, is the inclusion of the *Modifier Impact* notation. Modifiers are the Unexpected Recovery Factors that simultaneously occur along with the information

system outage. Since all of the above analyzed six additive and unexpected modifiers may emerge and significantly prolong the system recovery procedure, the equation should calculate the sum of all factors' impact multiplied by possibility of occurrence of each factor.

Considering the Composite Risk Index methodology, the derived equation for estimating the Unexpected Recovery Index (URI) for each Modifier is the following:

$$URI = MI \times P \quad (3)$$

where, MI = Modifier Impact and P = Possibility of Occurrence

According to Equation (3) and data obtained by Table 1, the minimum and the maximum URI values regarding each factor are: $URI_{MIN} = 1$ and $URI_{MAX} = 16$.

PROBABILITY / IMPACT	1	2	3	4
	URI			
1	1	2	3	4
2	2	4	6	8
3	3	6	9	12
4	4	8	12	16

Table 1 – The 4-level scale for Impact and Probability of Occurrence of each MODIFIER

However, according to the model, the Total URI value is calculated as a sum of all emerging URF modifiers. Consequently the total URI value should be provided by the following equation:

$$URI = \sum_{i=1}^{6} (MI \times P) \quad (4)$$

where, MI = Modifier Impact and P = Probability of Occurrence

IT SYSTEM RECOVERY SCENARIOS

According to the new model there exist 2 basic scenarios with regard to the emergence of unexpected factor(s) as modifier(s) to the initial systém outage scenario of a business function recovery process. The scenarios are formulated according to the aspect of many system operators who prioritize severe incidents for troubleshooting based on their impact to end – users and applications (Philippa et. al., 2011)

BEST CASE SCENARIO: According to the Best Case Scenario, apart from the system outage, the slightest Probability (Probability = 1) the recovery team will face the emergence of 6 URFs (Modifiers) and in their softest form (Impact Value = 1). In this case, according to Equation (4) the URI value will be equal to 6 ($URI_{MIN} = 6$)

WORST CASE SCENARIO: On the other hand, according to the *Worst Case Scenario,* the highest Probability of Occurence (P = 4) that URF modifiers should emerge during an unexpected outage, and in their most severe form (Impact Value = 4) is considered. In this circumstance, the Maximum Total URI value is 96.

CALCULATION OF EXTENDED MAXIMUM ACCEPTABLE OUTAGE (EMAO)

For the final formulation of the method, it is accepted that the Time Deviation from the MAO value defined by the Risk Management is equal to the MAO value. This is also proved by the following reasoning:

According to the Worst Case Scenario, in the occasion when an information system failure is accompanied by severe form of all 6 modifiers, the URI value is equal to 96. The Equation which provides the time deviation of system recovery in all circumstances will be provided by the following formula:

$$MAO\_D = MAO \times \frac{URI}{100} \quad (5)$$

where, MAO_D = Deviation from defined MAO Value.

Thus, according to the Worst Case Scenario the Equation will be written as:

$$MAO\_D = MAO \times \frac{96}{100} \cong MAO \times \frac{100}{100} = MAO \times 1 = MAO \quad (6)$$

As a consequence, the Extended Maximum Acceptable Outage (EMAO) value will be provided by the following formula:

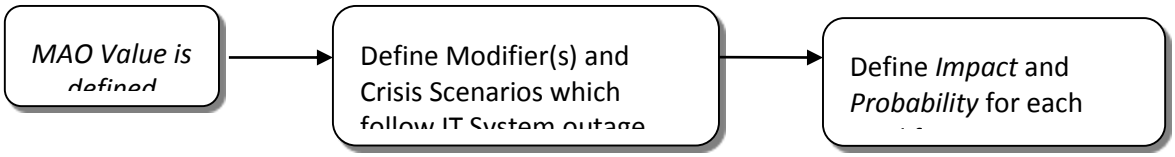
$$eMAO = MAO + MAO\_D = MAO + MAO \times \frac{URI}{100} = MAO \times \left(1 + \frac{URI}{100}\right) \quad (7)$$

Another Equation that can be derived is the following:

$$eMAO_{MAX} = 2 \times MAO, \quad (8)$$

which means that, a reasonable time period of exceeding the MAO value is double the MAO timeframe.

As a result, the *decision making process* regarding information system recovery after outage, which is followed by an additional crisis event, should be implemented according to the following schema:



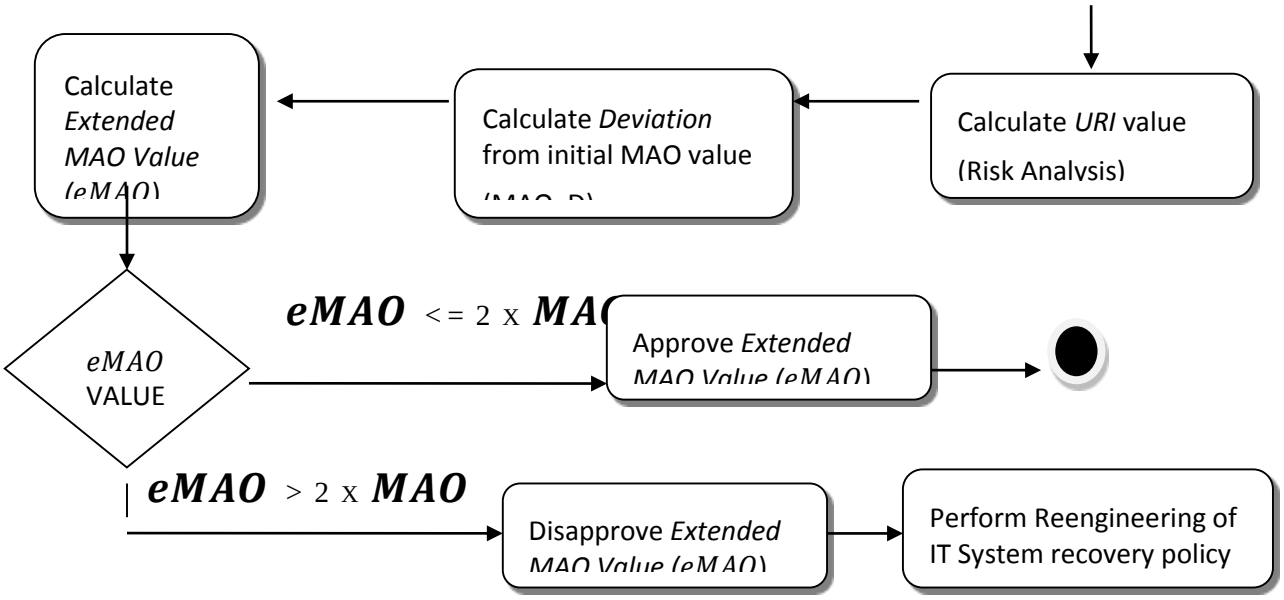


Figure 1 – Decision making proces regarding Extended MAO Timeframe

For better understanding of the model, a practical example is also provided.

PRACTICAL EXAMPLE

Crisis Scenario 1: An electricity failure triggers an information system outage, which supports online transactions with suppliers. Through the system, critical operations are supported, and the determined by the Business Continuity Team RTO value Maximum Acceptable Outage (MAO) value is the following:

MAO= 10 Hours. According to the executed recovery exercise scenario, apart from the system outage, some critical situations may occur, and the above stated MAO value may be exceeded. The Impact values of the Modifiers (MI) and their corresponding Probability of occurrence (P), according to the scenario are the following:

MODIFIERS	MI Value	P Value
Non extreme, Weather Conditions (Heavy Rainfall), Medium Impact	2	2
Good Network Availability, Low Impact	3	2
Extreme Urban Conditions (Big Traffic), High Impact, IV = 3, P=3	3	3
Flood Disaster Types, Medium Impact, IV3, P= 2	3	2
Timely Information Distribution (Information not deleivered immeadiately), Medium Impact, IV = 3, P=1	3	1
Maximum Staff Availability, Low Impact	4	1

Table 2 – Scenario of emergency events (modifiers) which may follow unexpected IT system Outage

According to our Model, the requested task that has to be implemented is the calculation of the extent to which the MAO value will be exceeded.

The first step is the calculation of the URI value (Eq. 6).

URI = (2 × 2) + (3 × 2) + (3×3) + (3×2) + (3×1) + (4×1) = 4 + 6 + 9 + 6 + 3 + 4 = 32

If MAO Value is 10 hours (MAO = 10), the recovery time deviation from MAO is the following:

$$MAO\_D = MAO \times \frac{URI}{100} = \text{MAO} \times \frac{32}{100} = 10 \times \frac{32}{100} = 3{,}2$$

As a result, the extended MAO Value will be derived via the following calculation

$$eMAO = MAO + MAO\_D = 10 + 3{,}2 = 13{,}2 \text{ Hours}$$

The aforementioned result, enables us to consider that according to the specific scenario the Extended Maximum Accepted Outage is 13,2 Hours. This means that the system should be recovered within the specific timeframe.

The calculated recovery timframe is accepted, since it less than the double MAO value (<=20), which is the maximum accepted value of MAO ($eMAO_{MAX}$).

CONCLUSION – FUTURE WORK

The method presented in the present article is a new and simple approach for business managers to implement more detailed risk analysis of various crisis scenarios that can negatively influence the process of an information system restoration after outage, and, accordingly, determine whether and to what extent the Maximum Acceptable Outage (MAO) timeframe is exceeded, due to the emergence of these critical situations. The method is still under development, and yet practical feedback from IT risk analysts and business continuity managers has not been obtained. However the method's approach to calculating time deviation from MAO values, is close to ultimate precision since extreme scenarios with situations that may follow a sudden system outage and an a developed mathematical model are both at the disposal of business managers. MAO value is initially defined by the business continuity management of the enterprise. These events are charatcterized as *Modifiers*, since they modify the MAO timeframe, and are classified according to the type of the crisis event., their impact and the probability of occurence. The Risk Analysis implemented with regard to six basic types of crisis scenarios, namely *Weather Conditions, Network Availability, Staff Availability, Urban Conditions, Disaster Types* and *Timely Information Distribution*, is based on the Composite Risk Index (CRI) theory of Risk Management. The delineated contribution introduces the Unexpected Recovery Index value which is estimated in a similar way. This value is utilized for calculating approximate time deviation from the MAO value as well as the Extended Maximum Accepted Outage ($eMAO$), in the case that a crisis scenario follows IT system failure. According to our method, the $eMAO$ is accepted only in the case that it is less than or equal to the $eMAO_{\text{MAX}}$ timeframe, which is defined as double the MAO value. Future work related to the introduced contribution is the design and development of a user friendly software application which will support the delineated decision making process for the business managers who lack IT skills. Moreover, a similar approach is proposed for the determination of Extended Rational Time Objective (eRTO). Finally, the inclusion of the approach in future editions of International Standardization (ISO) documents is also a big challenge for the authors who work and perform research in order to finalize the formulation of the contribution.

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ABSORPTION OF CHANGES INTO INFORMATION SYSTEM

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ABSTRACT

The paper deals with the kinds of changes its absorption into the system and the influence on the information system for socio-economic system. The change will be implemented by project and for the success is necessary to manage information in the project and also by place the result of project into the real operation of the system. Attention is drawn to the relationship changes to chaos. It analyzed the change, in terms of existing information system (change is urgent, planned, forced unforced, external and internal), and in terms of changes in the project (methodology and project procedures).

KEY WORDS

Change, planned change, sudden change, forced change, unforced change, chaos, information management, dynamic balance, absorption changes.

INTRODUCTION

The environment in which it develops current socioeconomic system (hereafter the system) is characterized by constant change, which is necessary to learn to recognize and manage. The paper deals with the kinds of changes the absorption and impact on the information system for system. Change is the realization of the project and for success you need to manage information in project and all interfaces in/out the system.

Change always has a goal and that goal is achieved depends on aim definition, analyze change, risk and information management. Schedule an effective way to target and manage its progression is dependent on information management. Is particularly important initial analysis, the type of change (planned, sudden, forced and unforced, ...).

Problems arising in changes in practice suggests that the ideal state in the implementation of any project and was probably not even be reached. The obvious intention of each project that was conceived and developed systematically, the emphasis is on the principles of systems thinking and systems approach. Implementation problems, however, show that human thinking or transmission of the information is not perfect.

THEORETICAL BASES

System changes are rapid and often unpredictable, and in the terminology used term "chaos" (Peters 1987). Chaos and order are central theoretical concepts in recent years, even in the sciences. Chaos is a kind of order, predictability of the relationship of cause and order is limited. The result is that some parts of the system behave stochastically and this random of behavior persists even if we collect more information (Rihova, 1996). In (Sahal, 1981) is introduced term "phenomenon untidiness" proving that the complex relationships require a bit of a mess, which is able to induce adaptation process eventually need to change.

The model of chaos introduces the idea that chance, changing of conditions and creativity can enter into a complex system at any point and change the course of its behavior. To anticipate change and react to it has the system more efficient option and can affect change if there is (Sanders, 1998).

One of the topics in organizational theory is to emphasize the "resistance to change" (Kotter 2012). In particular, the influence of information technology is changing the entire industry and individual organizations. Coping / absorption of changes are extensive areas - from management "recipes" with certain norms to the efforts of analytical and theoretical approaches to understand the complex process of changes. For an explanation of the changes have been developed different approaches (Kotter, 2008). In these approaches are described as behavioral (mostly derived from the psychology of interpersonal relationships and social psychology), structural (based on organizational linkages and organizational charts) and cultural (organizational climate, company culture, relationships) The basis of all these approaches, however, information management, and therefore care on information is a priority and the basis for the implementation of change and balance system - updated data with relevant information content is delivered to individual elements / workers. Apart from the technical system, the behavior of the lifetime is not changed (the project planning and managing technical system).

It is appropriate to differentiate the planned changes and sudden changes. Further, a change is described as a process or as a strategy implementation.

The success rate of absorption changes in the system requires an understanding and interest of all parties - stakeholder management (Eskerod, 2013). Changes / Projects unsupported internal environment have no hope of success.

ANALYSIS AND ABSORPTION OF CHANGES IN INFORMATION SYSTEM

Absorption of changes can be understood as future shock that changes cause (eg. the start of productive operation of a new information system). Assumption is a high degree of interactivity and information sharing in system so as to be able to absorb the shock in the future time of transition. Minimizing the shock is the best serious initial analysis that will lead to balance of system operation and optimum capacity utilization of resources (human, technical, technological) in relation to customers

Even in "the ordinary equilibrium" systems must in today's extremely turbulent environment (movement rate of the euro, oil prices, energy prices all species, changes in VAT, ...), to overcome a number of totally non-standard situations and deal with changes.

Change is a complicated phenomenon. In terms of management and implementation of changes in the information system we will discuss in the text two situations:

a) information system is implemented and needs to be changed / modify

b) information system is created – project is defined and implementing procedures and terms of changes within the project (methodology, procedures for negotiating, approving,…).

CHANGES INTO THE EXISTING INFORMATION SYSTEMS

The information system is already created, but there may be circumstances that affect information system.
Basically there are two kinds of changes:

- Planned (expected change in the system, approved) and
- Sudden (forced by legislation, error, ...).

For the certain systemization of changes is suitable the additional categorization of changes (Table1):

- forced,

- unforced,
- external,
- Internal.

Changes may be in various combinations and in the text we will discuss some examples:

	Forced	**Unforced**	**External**	**Internal**
Planned	Legislation	Organizational development, system optimization, process, strategic change	Mergers	Change of the process
Sudden	Sanction, correction of the errors		Hostile takeover	Error of function

Table 1 – Table of changes – examples (source author)

In practice can occur a various combinations of conditions mentioned changes and also the exceptions. According to the type of change is managed and implemented by the absorption process. Recommendations for changes in the absorption system can be summarized as follows:

- Involve the people - the basic way to succeed in the implementation of change is the involvement of people. Especially if in the organization is a long history of failed attempts to implement the changes.¨
- Communicate, communicate, communicate. The lack of communication frustrates any effort to implement the changes. Good communication requires understanding.
- Influence and inform - Implementation of changes related to influencing and informing people correctly carried out a stakeholder management.
- Analysis of interfaces in the system.

Examples of the combinations in information system.

Planned - Forced: legislative change is a classic example of a forced, but not sudden changes because of this change knows several months in advance (although there may be exceptions). Planned - unforced: we can plan a implement changes by system optimization, strategic objectives, implementing decisions, changes in organizational structure and ownership changes (merger, sale of part of company ...).

Sudden - forced changes: elimination of errors in the system, sanctions against another country, hostile takeovers, banks, etc ....

External - internal classification is based on the fact, where the change was established.

Examples of possible combinations in terms of factual:

Legislative changes - are mostly external, planned, forced, but may be abrupt (eg. Sanctions against any state companies must incorporate into their information systems). Strategic decisions - are internal, planned, unforced, in terms of ownership or organizational decisions of the company, but in the case of a hostile takeover - a change of external forced a sudden Factual error in the system - internal, forced a sudden, but to compensate for other procedures (eg. The staff, alternative processing, ...) - internal, forced but planned (eg. Change to the next accounting period).

Management and implementation of the absorption changes is dependent on the type of change. From experience we know that this is often not the case. The error that should be addressed in a comprehensive change is solve as the sudden change ("patch") and some changes for patch are solve the complete replacement of the system. This is caused by not sufficiently an initial analysis of the type of change or reflect the different interests a relationships working groups or individuals.

To absorb the changes into the system is examining whether to investigate the process of changes or implementation of changes. It is important to distinguish whether success leads to the idea of the exact process for introducing changes (procedural steps and ideas of managers) or way to implement changes in the environment (removing the braking force or sudden changes in context). Sometimes it is difficult to accurately distinguish and process implementation especially sudden changes (Table 2).

Change	Process of change	Implementation of change
Planned	Logical steps	Removing the braking forces
Sudden	Political efforts of certain groups	Context effect of interest

Table 2 – Characterization of approaches to the organizational changes (source: author)

CHANGES IN PROJECT

During the project implementation (preparing of the changes), there are changes in time, scope, resources. These changes are set out various procedures in general or corporate methodologies (PRINCE2, PMI, MSP, IPMA, Chester, ABAP, ...). Procedures describe the change - recorded, approved and funded and implemented. After completion of project, the project takes absorption into the system, which is also a big change (planned, internal), but that they belong to the categories described in the previous section and in ensuring the interfaces to other systems inside and outside of the system with the lowest possible shocks and mastering stability. A prerequisite is a thorough analysis of the transient situation and training of personnel.

Mastering all the tools, techniques, methods and approaches that project management offers even guarantee success, it is important to understand the basic philosophy of project management and have experienced specialists.

CONCLUSION

According to the type of change is governed by the type and executes absorption - come to the seemingly trivial observation that according to control and implement changes in the absorption process. But in practice it is not a trivial matter. Missing just this basic analysis, system approach and not reflecting the change to all the necessary connections. It is important to emphasize that the analysis of the type of change is the safest way for her successful absorption.

It should also be noted that the system can take only so much change, how the system can absorb. If you need more, then we need to change people's skills and their motivation to work.

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DEALING WITH COMPLEXITY IN COMPUTATIONAL IMMUNOLOGY

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ABSTRACT

Natural immune system is complex biological system deeply investigated in the computational immunology. Complexity of the immunity is given by the existence of many immune cells interacting with each other and relations with other complex systems. Models and simulations can help with exploring nature of specific immune processes and offer the guidelines for influencing behaviour of the natural immune system. The aim of the research is to develop the simulator of the lymph node for investigation of the immune response and what-if analysis application. It is necessary to use suitable approach for modelling and simulation behaviour of the lymph node. The paper investigates the usefulness of system approach for modelling the lymph node. It answers the question if it is possible to use systems thinking and how it is possible for this application domain.

KEY WORDS

Complexity, immune system, lymph node, computational immunology, CoSMoS process, systems thinking.

INTRODUCTION

Conventional analytical thinking is based on separation of individual parts of the system and which are investigated separately from each other. The whole system is only the sum of its parts. This approach corresponds to the reductionism and mechanistic approach. System thinking investigates the system as a whole, i. e. in broader view where interactions between individual parts (entities, subsystems) and patterns of behaviour are studied. System is perceived in its complexity, not only as a collection of its parts. This approach is applied for complex systems analysis where huge of components and interactions between them are located. Natural immune system (NIS) is one of the most complex and adaptive information systems managing the homeostasis in the inner environment of the living system. Nonlinear and dynamic nature of this system causes that the behaviour is hardly predictable. NIS can be perceived as ambient system, because it does not have the centre for coordination or cooperation of its activities. It is highly interconnected with other complex systems, especially endocrine, nervous and reproductive system. This system is also robust, because it does not have tendency to fail due to the small disturbances due to the principle of redundancy. Amazing complexity of the NIS attracts the biologists, chemists, medical doctors, veterinarians and computer scientists. Computational immunology studies the immunity with the usage of mathematics, physics, statistics or computer science for deeper understanding of the NIS behaviour. The aim of the paper is to present the approach for immunity investigation where immune processes occurring in the lymph node are going to be modelled and simulated in the lymph node simulator.

COMPUTATIONAL IMMUNOLOGY

Computational immunology (CI) is the sub-area of computational biology. The main aim of this research area is to better understand the inner life of the NIS for finding out efficient strategies which can be used

for influencing the behaviour of the NIS. Evolution of CI is long and colourful. Continuous immune networks were the first attempt how to model specific aspects of the NIS. Beginning of CI is dated in 1974 when Nobel price winner N. K. Jerne proposed the idiotypic network theory explaining possible activation of NIS without the presence of dangerous antigens (objects initiating the immune response). NIS can be stimulated also by molecules (epitopes) which are on the surface of antibody molecules. These can be detected as antigens by the NIS (Jerne, 1974a). N. K. Jerne mainly mentioned philosophical aspects of idiotypic network behaviour in the paper (Jerne, 1974a). N. K. Jerne formalized dynamic behaviour of lymphocytes and antibodies without pathogens in the same year. Interactions between these "immune objects" resulted in the formation of immune network (Jerne, 1974b). Differential equations were used for modelling dynamic of this network.

Actual progress of CI can be evaluated by scientific literature. The content can be classified according to the investigated process (occurring in concrete scale of organization in biological (sub)system), used approach and final output of research study. Different scales of organization are studied with the usage of top-down and bottom-up approaches. Top-down approaches investigate complex systems in the global macroscopic perspective. Aggregate characteristics are in the centre of the interest. Differential equations and Petri nets are typical examples of top-down approach. These approaches are often used for investigation processes occurring in molecular level, especially for analysis of biological networks (metabolic signaling pathways, pathways of signal transduction or gene regulatory networks) (Hofestädt, 1994), (Ciliberto, et al., 2003) or (Sackmann, et al., 2006). Bottom-up approaches are focused on individual entities of complex system existing in the local microscopic level. Cellular automata and agent-based systems are main representatives of bottom-up approaches. These ones are mainly used for investigation processes occurring in the cellular (Celada and Seiden, 1992), (Zhang, et al., 2009), (Masoudi-Nejad and Meshkin, 2014) and tissue level (Walker, et al., 2004), (Santos, et al., 2004). Agent-based systems and cellular automata are useful for modelling clustering behaviour and investigation of emergence phenomena, but agent-based systems are able to represent more details of complex system in comparison to cellular automata.

CASE STUDY

Lymph node (LN) is a secondary lymphoid organ playing the role of filtration system of the lymph. The lymph is the fluid circulating in the lymphatic system. This substance can contain dangerous antigens which can be detected by various immune cells in the lymph node. Lymph node is one of the best explored immune organs in case of humans and mice, but several questions remain open. Main aim of the research is to investigate immune response in the LN with the simulator of the lymph node where what-if analysis is going to be applied. The simulator is going to be developed with the usage of the CoSMoS process (Complex Systems Modelling and Simulation) - infrastructure used for exploration of complex systems with modelling and simulation (Andrews, et al., 2010), (Andrews, et al., 2011).

APPLICATION DOMAIN

Complexity of the LN appears in various layers of the LN and in interactions with other complex systems. The LN is composed of three layers – cortex, paracortex and medulla (Murphy, 2014). Each layer contains specific immune cells maintaining homeostasis of the LN. Cortex mainly contains B-cells. B-cells are white blood cells producing antibodies or playing the role of memory cells (Coico and Sunshine, 2009). They enter into the LN through the high endothelial venule (HEV) (Abbas, et al., 2011). B-cells are in the interaction with follicular dendritic cells (FDCs) in the cortex. FDCs are producers of communication molecules (chemokines) influencing behaviour of B-cells. Paracortex is mainly populated by T-cells, fibroblastic reticular cells (FRCs) and dendritic cells (DCs) (Katakai, et al., 2004). T-cells can eliminate antigens, regulate different immune functions or stimulate immune cells, e. g. B-cells. FRCs influence behaviour of T-cells similarly as FDCs influence behaviour of B-cells, but FRCs use different chemokines for this purpose (Bajénoff, et al., 2006), (Lammermann and Sixt, 2008). T-cells also enter into the LN through the HEV. DCs present antigens to T-cells for their stimulation. They enter into the LN through the afferent lymph. Medulla mainly contains phagocytic cells – macrophages (Abbas, et al., 2011). These cells are able to eliminate dangerous antigenic particles and

present them for B-cells and T-cells. Efferent lymph is used for leaving immune cells from the LN (Murphy, 2014).

SYSTEMS THINKING FOR DEVELOPMENT OF THE LYMPH-NODE SIMULATOR

It is obvious that lymph node contains a lot of players and interactions between them. It is necessary to apply systematic approach for lymph node simulator development. It is really difficult to see "big picture" of NIS immediately. System approach is not applied in the initial phases of modelling the lymph node, but conventional analytical (mechanistic) thinking is used. Analytical thinking is used for receiving manageable level of complexity for modelling the LN. The main goal is to find starting point where the model development will be initiated. If the manageable starting point is not selected, some information about immune process can be forgotten and not included into the model. Difficult question is how to find starting point. If the developer of the model does not have background in immunology, it cannot be expected that the useful model will be created. Teamwork is necessary in this case. Immunologists can help with starting point identification. Figure 1 depicts the process of location the starting point. The LN is composed of three layers – cortex, paracortex and medulla. One layer will be selected for investigation. The most examined and entrance layer is selected – paracortex. This is the crucial layer, because HEV is the important entry point of the LN for B-cells and T-cells. This part of the LN can be perceived as complex information system. The most important immune cells are selected on the basis of immunologist(s) recommendation. System decomposition is applied, i. e. the simpler and simpler interactions with less and less immune cells are selected. Figure 2 depicts concrete immune cells occurring in all parts of the LN. Investigation of the T-cell movement is detected as the starting point with the usage of top-down approach and recommendation of immunologist. Similar approach can be applied for cortex and medulla investigation, see Fig. 2.

Complexity of the NIS emerges from the fact that everything is related with everything in the NIS. Conventional analytical thinking is not sufficient for deep investigation of the lymph node with simulation and modelling. Systems thinking have to be applied for receiving "big picture" of the LN, because complex, emergent and dynamic properties of the system cannot be explained only with the mechanistic approach. One part of the LN influences other part of the LN. Interactions between different immune cells have to be investigated because immune cells influence the whole and the whole influences these immune cells. The LN is going to be investigated iteratively from the starting point – random movement of the T-cells in the LN (from down to up). The next iterations add higher complexity into the model, see Fig. 1. The next immune cells and interactions between them are going to be integrated into the model for receiving global view on this complex system.

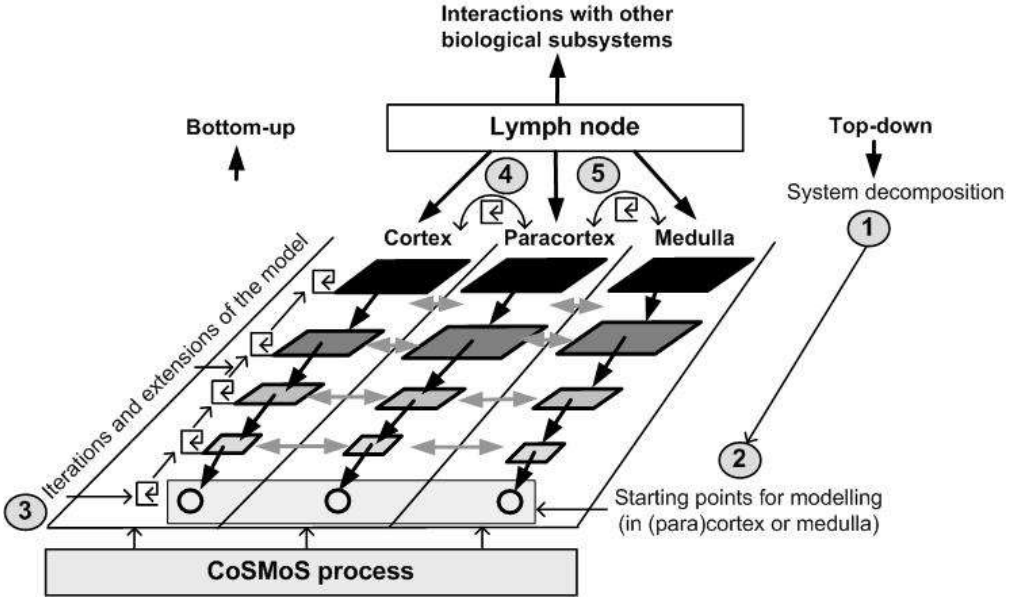

Figure 1 – Analytical and systems thinking approach for lymph node simulator development – general view

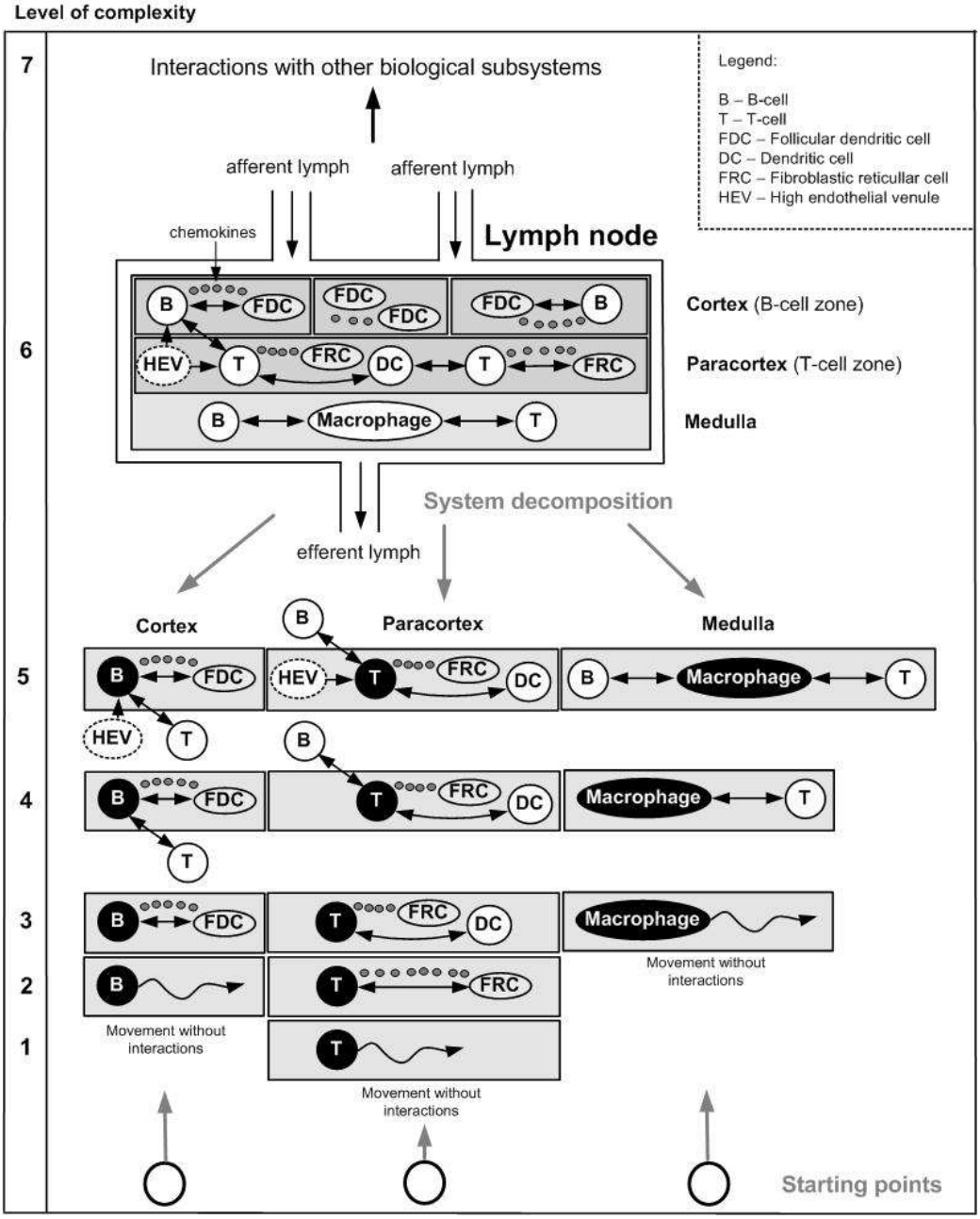

Figure 2 – Analytical and systems thinking approach for lymph node simulator development – detailed view

DISCUSSION AND CONCLUSION

Application of traditional analytic and system approach is demonstrated for the simulator of the lymph node development. Complexity of the lymph node is really huge. The lymph node can be perceived as smaller version of the natural immune system as a whole. The Fig. 1 and Fig. 2 indicate that the research of the lymph node and immune response is focused only on the layers of the lymph node. Lymph node should not be interpreted and modelled as the isolated system. The LN is a part of complex lymphatic network consisting of other LNs. We can see compactness of the lymphatic system in system perspective, but if we try to model only the part of the NIS, we have to decompose the system into simpler parts. If we do not do that, we will be lost in the network of complexity. The paracortex is going to be in the centre of research interest in the initial phases of the immune processes simulations. Random movement of T-cells is the starting point for modelling and simulation of the lymph node. Interactions with other immune cells are going to be integrated in the next iterations. System approach is inevitable

for managing complexity of the investigated system, but data decide whether the model can be developed.

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SOCIAL RESPONSIBILITY OF THE BANKS IN THE CZECH REPUBLIC

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ABSTRACT

This article is dedicated to the application of the themes of social responsibility in the banking sector in the Czech Republic. On the base of using the recommendation of internationally recognized standards ISO 26000 the author made the general analysis and evaluation of the obtained data in the searched area (social responsibility), with primary aim to detect the current state if and at all the czech banks apply the recommended topics of social responsibility in their business, and if so, that in which range.

When preaparing this thesis the author used the methods of collection, analysis, evaluation and synthesis of relevant information, that is available to the interest area. By the surveyed banks have primarily used the information, which the banks published within its website.

KEY WORDS

Social responsibility, organizational governance, human rights, labour practices, the environment, fair operating practices, consumer issues, community involvement and development

PREAMBLE

In recent years across the world occur in different types of organizations for awareness of the need for socially responsible behavior, which aims to be contribute to sustainable development, health and social welfare. Individual organizations are also in the context of its behavior more exhibited into greater oversighting by the various stakeholders, including customers or consumers, workers and their trade unions, members, communities, NGOs, students, financiers, donors , investors, companies and other commercial organizations. From the perspective of social responsibility have a major impact on the organization following key areas: reputation of the organization; organization's ability to attract and retain workers or members, customers, clients or users; maintaining the morale, commitment and productivity of workers; view of investors, donors, sponsors and the financial community; and relationships with organizations, government, media, suppliers, partners, customers and the society in which the organization operates.

These selected factors form the part of the current context of social responsibility and contribute to the fact, that the organizations were required to increasingly demonstrate its social responsibility, especially in current period. The subject of this paper is presentation of conclusions, that comming from executed analysis and evaluation of the state of implementation of the themes of social responsibility in the czech banking sector. The analysis in given area have done in September 2014 with the aim to determine whether and how czech banks implement the issues of social responsibility into their business.

From the perspective of a systems approach the using of this theme of social responsibility as an essential character trait for a demonstration of organizational behavior to their surroundings (in this case organization means bank). At the same time, this paper is also a mirror into information management of individual banks, that try to inform about their activities conducted in the area of social responsibility to the general public and other interested parties for them, especially only by using the internet.

For the purposes of this research the author used a non-binding rules of international standards ISO 26000 - guidance on social responsibility of organizations and that applied to the czech banking sector. The performed analysis was focused on all banks operating in the czech market, ie. 45 subjects - banks. For this purpose the author used a list of individual banks, which is freely available on the website of the Czech National Bank. The research was also based on the analysis (including consequential evaluation of obtained data) in seven basic topics, that defines the standard ISO 26000 (designated for social responsibility): organizational governance, human rights, labour practices, the environment, fair operating practices, consumer issues, community involvement and development.

Each of these topics according to ISO 26000 includes further specific sub-questions, which the author compared with current data and informations provided by the banks on their websites related to corporate social responsibility area. If a particular bank on its website presented the point of social responsibility to the relevant question, than received for this activity one point, if not, received a zero. The totals for each sub-questions are then converted to percentages. Structure of this paper expanded below correspond with one particular topic and its dividing to the sub-questions and fully correspond to the structure of the standard ISO 26000 (obtain all issues and their sub-questions defined by the norm). The goal of the analysis is definitely not to be quantify the social responsibility of banks in a given topic, or its sub-questions.

STATE OF SOCIAL RESPONSIBILITY IN BANKS IN THE CZECH REPUBLIC

The text below fully dedicated to the conclusions of the analysis, including evaluation of the data obtained in the application of social responsibility in the banking sector in the Czech Republic. The structure of particular topics corresponds with the recommendations defined by ISO 26000.

ORGANIZATIONAL GOVERNANCE

The first analyzed issue was the topic of organizational governance. Organizational governance is the system by which an organization makes and implements decisions. Depending on the type of organization, these objectives may be defined by the organization's members, owners, constituents or others. Organizational governance in the context of social responsibility has the special characteristic of being both a core subject on which organizations should act, and a means to increase the organization’s ability to implement socially responsible behaviour in respect of the other core subjects.

This area is common to all analyzed subjects, precisely because of their decision to implement social responsibility. From a total of examinated 45 banks for the implementation of individual topics of social responsibility decided only 19 banks, that is 42.22 % of all.

HUMAN RIGHTS

The second analyzed area was the issue of human rights. According to the general definition the human rights are the basic rights, to which they are entitled to all human beings, because they are human beings with inner desire for freedom, peace, health and happiness. There are two wide categories of human rights. The first category concerns civil and political rights, and the second concerning economic, social and cultural rights.

For the purposes of the performed research the author used partial classification for this theme defined by the standard of ISO 26000, that are following areas: due diligence, human rights risk situation, avoidance of complicity, resolving grievances, discrimination and vulnerable groups, civil and political rights and fundamental rights at work.

DUE DILIGENCE

In the context of social responsibility among to the due diligence of the fact, that the organization conscientiously and methodically considering the actual and potential negative impacts of their activities

and manage them so as to minimize or eliminate the risk of social harm or damage to the environment, including non-infringement of human rights. The topic of due diligence have attention in 42.11 % of examinand banks.

HUMAN RIGHTS RISK SITUATION

This is an aktivity, that can have a negative impact on children, addressing corruption, the use of supply chain in accordance with the law, ensure safety and protection of property. This topic solves 26.32 % of the banks.

AVOIDANCE OF COMPLICITY

The bank shall not commit willful violations or aiding human rights abuses, whether on its own benefit, or silent complicity. The theme of avoiding complicity did not declare any bank.

RESOLVING GRIEVANCES

In this area, the bank should have set the basic mechanisms for dealing with complaints. The basic attributes of these mechanisms constitute legitimacy, accessibility, predictability, fairness, law compliance and transparency. Resolution of complaints is for banks dominant theme and form 73.68 % under their social responsibility.

DISCRIMINATION AND VULNERABLE GROUPS

The discrimination is when are chosen certain individuals or certain groups so, that they are denied equal treatment or opportunities as others and when this selection is based on prejudice and not on a legitimate mason. The basic attributes of discrimination constitute such items as race, skin color, gender, age, nationality or nationality, ethnic or social origin, caste, marital status, sexual orientation, health status, such as HIV positive, political affiliation. The issue of discrimination is concerned with 68.42 % of the banks.

CIVIL AND POLITICAL RIGHTS

In the banking environment this is particularly the right to personal safety and also freedom of opinion and freedom of expression, the right to protection against acts of unlawful interference with his privacy, family, home or correspondence, right to privacy, access to public services and the right to participation in elections. Solution in civil and political rights is dedicated into 36.84 % of the banks.

ECONOMIC, SOCIAL AND CULTURAL RIGHTS

This theme of social responsibility in the environment of the bank is focused on non-discriminatory access to health care, education, work, food, religion and culture, and real opportunities to participate without discrimination in decision-making. In the area of human rights have this topic for the banks importance in 42.11 %.

FUNDAMENTAL RIGHTS AT WORK

Fundamental rights at work based on the recommendations of the International Labour Organisation (ILO) and includes this particular areas: freedom of association and the effective recognition of the right to collective bargaining, elimination of all forms of forced or compulsory labor, the effective elimination of child labor and elimination of discrimination at work. Fundamental rights at work actively solves 42.11 % of the banks.

LABOUR PRACTICES

The third analyzed area consisted of basic practices of banks in the area of labor relations, that belong to all policies and practices relating to the work carried out within the bank or on its behalf. This area

includes the issue of employment and labor relations, working conditions and social protection, social dialogue, health and safety at work and human resources development and training in the workplace.

EMPLOYMENT AND EMPLOYMENT RELATIONSHIPS

Creation of employment and labor relations are crucial for banks, because its solves both, the obligations of employees and employers, and as such its forms the basis for the successful operation and management of the bank. Therefore, this area received a lot of attention of the banks, which reaches to 52.63 %.

CONDITIONS OF WORK AND SOCIAL PROTECTION

The content of this theme is the part of the bank's security of basic working conditions for its employees (working hours, rest periods , holidays, reconciling work and family life, etc.), including social protection in cases of occupational injury, illness, motherhood, parenthood, old age, unemployment, disability or any other financial hardship. In this topics are the banks on the level of 57.89 %.

SOCIAL DIALOGUE

The social dialogue between employers and employees inside the bank leads to a better understanding of both sides and also creates the basic conditions for the prosperity of the bank itself. From the perspective of the bank's this topic exposure amounts to 63.16 %.

HEALTH AND SAFETY AT WORK

Applications of internal processes to ensure the health and safety of employees is for the banks the another important topic in the implementation of social responsibility. Responsible practices using in the bank in protecting the health and safety can reduce overall costs, improve morale and increase productivity. Solving this area is concerned with 52.63 % of the banks.

HUMAN DEVELOPMENT AND TRAINING IN THE WORKPLACE

In the area of human resources development and training in the workplace banks have interest in facilitating education, training and lifelong learning for employees. Basic benefits for the banks in the implementation of this process are motivation, efficiency, productivity and overall employee performance. The involvement of banks in this topic reaches 84.21 %.

THE ENVIRONMENT

The next analyzed topic was the environment. The banks are actively involved in environmental protection. Specific topics are formed by preventiv of pollution, sustainable resource use, climate change mitigation and adaptation to climate change and environmental protection, biodiversity and restoration of natural habitats.

PREVENTION OF POLLUTION

In the field of the prevention of pollution the banks involved specifically in the areas of its immediate effects on the environment, ie. emissions to air, emissions to water, production of solid and liquid waste and other pollution from its activities, products and services. This topic is also highly encouraged by the banks and reach 52.63 %.

SUSTAINABLE RESOURCE USE

The banks in this area are focused on the sustainable use of resources, especially more responsible use of electricity, fuel, raw materials, land and water, and combining or replacing non-renewable resources with renewable resources. Sustainable use of resources constitute 42.11 % interest of the banks.

CLIMATE CHANGE MITIGATION AND ADAPTATION

This abstract theme, including for example greenhouse gas emissions is not yet much accepted of the banks and constitute only 5.26 % of thein interest.

PROTECTION AND RESTORATION OF THE NATURAL ENVIRONMENT

The banks in this area seeks to promote socially responsible activities to protect and restore the natural environment and its ecosystems, especially restoring and creating natural habitats. Overall the involvement of the banks in this topic counts 68.42 %.

FAIR OPERATING PRACTICES

Fifth analyzed areas became the issue of ethics in business of the banks. Base area of interest consists by fight against corruption, responsible political participation, fair competition, promotion of social responsibility in the value chain, respect for property rights.

ANTI–CORRUPTION

In this area the banks are focused on identifying the risks of corruption, implement and maintain policies and procedures, that prevent corruption and extortion. Other affected areas are support staff training, contract agents and contractors of corruption. This area is covered by the banks in the amount of 36,84 %.

RESPONSIBLE POLITICAL INVOLVEMENT

The banks are within their capabilities also involved in the promotion and development of public policies to be in this area completely transparent and completely avoid political influence. In view of the well-known apolitical role of the banks, the issue is perceived on the low level counts 5.26 %.

FAIR COMPETITION

In the context of a legitimate competitive struggle in the banking sector, the banks must conduct its activities in accordance with the laws of competition and cooperate with the competent authorities, including the social context in which they are operating (eg. abuse poverty to achieve an unjustified competitive advantage) This area reaches 36.84 % of the banks interest.

PROMOTING SOCIAL RESPONSIBILITY IN THE SPHERE OF INFLUENCE

The banks consider the impacts of the sale of its products and services, including the impact of its activity on the market. The banks are trying to be in the marketing chain responsible for compliance with applicable laws, regulations, and its own impact on society and the environment. In this area, however, the banks amount only 15.79 %.

RESPECT FOR PROPERTY RIGHTS

The right to property is a human right recognized by the Universal Declaration of Human Rights. These rights include both physical property and intellectual property. The banks in this issue implement such policies and practices, that promote respect for property rights and traditional knowledge. The total commitment of the baks amounts to 26.32 %.

CONSUMER ISSUES

The sixth analyzed topic is associated with the provision of banking services in the context of the health and safety of consumers. It includes issues of fair marketing, provision of relevant and undistorted information and fair contractual practices, health and safety of consumers, sustainable consumption, customer service, support and resolution of claims and disputes, protection of personal data and privacy of consumers, access to basic services and education and awareness.

FAIR MARKETING, INFORMATION AND CONTRACTUAL PRACTICES

The banks are trying in this area primarily provide clear and sufficient information about prices, terms and costs associated with their offered services (loans, credits and other banking services). As shown, this area of interest are not so dominate for the banks and make up only 5.26 %.

PROTECTING CONSUMERS HEALTH AND SAFETY

Protecting the health and safety of consumers includes providing products, that are safe and which in their use or consumption do not pose unacceptable risk to consumers. In this topic the banks focuses on the area of vulnerable groups of potential users of their services. This theme consists 31.58 % of banks interest.

SUSTAINABLE CONSUMPTION

The sustainable consumption is consumption of products and resources at a rate of consistent with sustainable development. Sustainable consumption also includes concern for ethical behavior regarding animal welfare . In this area the banks engaged at 15.79 %.

CONSUMER SERVICE, SUPPORT, AND DISPUTE RESOLUTION

Customer services, support, complaint handling and dispute of resolutions there are mechanisms, which the bank uses to address the needs of consumers when the products are purchased or delivered. Such mechanisms include warranties and guarantees, technical support regarding using, as well as conditions of return, repair and maintenance. Customer services constitute a significant item in the social responsibility of the banks and amounts to 57.89 %.

CONSUMER DATA PROTECTION AND PRIVACY

Data protection and privacy of consumers have to protect consumers' rights to privacy by limiting the types of informations, that are collected and the wals, in which the informations are collected, used and safeguarded. By definition, this area is very carefully monitored by the banks. Protection of personal data and privacy of consumers constitute 47.37 % in interest of the banks.

ACCESS TO ESSENTIAL SERVICES

The banks supports the projects of various organizations, which are aimed at ensuring and respecting the right to satisfaction of basic needs, but also necessary needed services such as the right to electricity, gas, water, or telephone. In terms of access to this basic services the banks are involved in 57,89 %.

EDUCATION AND AWARENESS

The banks supports any initiatives regarding education and awareness. They focus on supporting disadvantaged consumers in both rural and urban areas, which in some cases include low-income consumers and consumers with low or zero literacy. In the area of `education and awareness` are the banks involved in 42.11 %.

COMMUNITY INVOLVEMENT AND DEVELOPMENT

Last analyzed topic of the social responsibility is one of the key terms for the banks. The banks are aware of their position within the company and also try in this area contribute to its development. The cornerstones in this area consists of community engagement, education and culture, job creation and skills upgrading, technological development and access to technology, creation of wealth and income, health and social investments.

COMMUNITY INVOLVEMENT

The community involvement means for the banks not only provide financial assistance, but also the active development of various forms of non-profit organizations to support various civic groups. The community involvement topic consists of 57.89 % for the banks.

EDUCATION AND CULTURE

In the area of education and culture are the banks one of the leaders, who do their best to ensure all social and economic development. Culture is an important component of community life and identity of its society, that the banks are fully aware. In this interesting area are the banks involved up to 89.47 %.

EMPLOYMENT CREATION AND SKILLS DEVELOPMENT

For the area of jobs creation and skills development, the banks are trying to use their position in the overall financial sector, which also means, that not only they themselves are the bearers of these opportunities, but they can also help to others organizations. The topic amounts to 42.11 % for the banks interest.

TECHNOLOGY DEVELOPMENT

For the requirements of contemporary life is symptomatic the using of information and communication technologies, which are also a valuable basis for many other economic activities. The banks in this trend contribute to improved access to these technologies through training, partnerships and other events. The proportion of bank´s involvement in the field of information technology is 47.37 %.

WEALTH AND INCOME CREATION

The banks are one of the main drivers in creating wealth in the economy. They participate in the creation and implementation of programs for business development, together with the support of the employment of women . Part of this topic is also compliance with tax obligations by the banks as a necessary condition to ensure that governments can generate revenue and use it to solve critical development challenges. Creating wealth and income is not yet for the banks primary interest and that the favored form is only 10.53 %.

HEALTH

The health is a fundamental component of social life and a recognized human right. For this area the banks are doing a lot in the form of contributing to health promotion and prevention, including promotion of public health. The topic of health remains for the banks on the high level, that counts 52.63 %.

SOCIAL INVESTMENT

In this area the banks involved in the form of investment of financial resources to support infrastructure or other programs designed to improve the social aspects of community life, such as sanitation, supply of safe drinking water, health, housing and food security. Social sentiment of the banks in this topic achieve amount in 78.95 %.

CONCLUSION

On the base of performed analysis in addressing specific topics of social responsibility in the czech banks can be done the following conclusions:

1. in the area of human rights , the banks most involved in the issue of the resolving grievances
2. in the area of labour practicies dominates human development and training in the workplace
3. in the environment there are areas of protection and restoration of the natural environment

4. in fair operating practices there are anti-corruption and fair competition
5. in consumer issues there are areas of consumer service, support, and dispute resolution, and access to essentials services
6. and finally in community involvement and development completely dominated the issue of education and culture.

As a inside effect of performed analysis can also be made secondary conclusion to the question: which bank in its program under the organizational governance the most apply the themes of social responsibility? The answer is the following "ranking“:

1. Československá obchodní banka a.s.
2. Raiffeisenbank a.s.
3. Komerční banka a.s. a Česká spořitelna a.s.

The above mentioned four banks account for 36.24 % of all engagement in social responsibility area from a total of 19 examinated banks.

In view of the fact, that this is a primary research application of social responsibility within the Czech banking sector, is possible in the future to perform additional monitoring to continuous observing of further developments in this area.

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USE OF CLOUD TECHNOLOGIES IN REALIZATION OF MASTERS – FINANCIERS TRAINING

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ABSTRACT

The article is devoted to usage of cloud technologies in higher education sphere. Cloud computing helps to create flexible business-models for satisfaction of business requirements, and to lower expenses for an infrastructure. They provide a high level of safety in the financial sphere in which appendices are business - critical and are regulated by some standards. These technologies also guarantee integrity of the data, and also provide flexibility of management. In the nearest future it is expected the increasing of demand at a labour market on the experts having skills of work with them.

KEY WORDS

Cloud computing technologies, information systems, training of masters-financiers at universities.

INTRODUCTION

Cloud technologies today have found practical application in activities of many companies working in various branches of social and economic sphere. Financial and insurance establishments, investment funds, telecommunication firms, trading networks and the industrial enterprises actively use opportunities of the quite new service given by leading manufacturers of the software and the telecommunication companies.

Cloud computing helps to create more flexible business-models for satisfaction of business requirements, to lower expenses for an infrastructure. For the enterprises which structure is distributed in the large territory, introduction of cloud technologies is a fine opportunity to reduce time for expansion of an infrastructure in new branches, and also a way to provide a high degree of service quality for clients in all regions.

THE BASIC TEXT

The attitude of business to such technologies, understanding of their competitive advantage literally for last two - three years has radically changed. As the leading experts of corporations Oracle ERP Application Business Group and Longitude Research consider, the modern financial organizations armed with actual knowledge, new methods and means for teamwork, are not anymore limited only to optimization of charges, but, as an alternative way consider receiving and granting of the valuable information for all business. First of all, financial directors of the large companies believe in perspective of wide application of cloud technologies.

In particular, as show results of the poll carried out by Oracle, Accenture together with Longitude Research, more than quarter of financiers in the world (28 %) already use cloud technologies for support of processes of budgeting, planning and forecasting, and other 34 % of respondents have intention to use cloud technologies within the next year. The organizations now even more often address to financial heads for the help in decision-making on IT-investments management. The overwhelming majority (70 % of respondents) believe that cloud calculations will improve structure and methods of a finance management in their companies.

Only a small number of practical financiers say that the factor, braking introduction of cloud technologies in their organizations, is the absence of corresponding support by the company bosses. The main obstacle it is considered lack of qualification and full absence of special knowledge of the given area at the personnel of the company.

The basic deterrent factor for wide application of cloud technologies is the opportunity to lose control over the data crucial for business. However this problem has being solved by experts more than one year. During this time it is developed a lot of technical and organizational measures which are used at construction of an infrastructure of the cloud, allowing to lower similar risks. Thus high efficiency of operation and management of information systems in cloud environments, and also new opportunities for business stimulate financial institutions to more decisive actions in use of these technologies.

In our opinion, for the universities which are carrying out training of masters - financiers, there is a sense to react operatively to inquiries of employers as to necessity of formation at graduates of corresponding knowledge, skills in work with the cloud technologies which are actively penetrating into financial sphere.

For example in a bank branch the technologies working with individual clouds are most claimed. It is caused by that they can provide a high level of safety in the financial sphere in which appendices are business-critical and are adjusted by some standards. These technologies guarantee integrity of the data, and also provide flexibility of management, allocating according to demand the necessary quantity of resources. The most important appendices can be placed in an individual cloud during a fairly short time.

But nevertheless the decision on creation of even an individual cloud is made uneasy as already at a stage of its designing the modernization of business-processes of the organization is necessary. The greatest effect such introduction can bring at the organization of work of IT-service by a principle of internal outsourcing. And it cannot always be realized within the framework of organizational-administrative structure. Cloud technologies can bring the greatest effect at the organization of work of IT-service by a principle of internal outsourcing.

In curriculums of training of both bachelors and masters-financiers, as a rule, it is provided studying of a plenty of subjects connected to some extent with application of modern information-communication systems and technologies in economy and finance. Studying programs on the given disciplines can be rather in due time corrected in view of growing needs of a labour market, for example, due to reduction of the teaching material displaying only historical or organizational aspects of development and the subsequent application of ICT means.

Such actions will allow actualizing a professional knowledge and skills of bachelors and masters-financiers, raising their competitiveness on labour markets. The probability to get prestigious work with a worthy wage level after graduating the university also grows. Besides it will promote the general development of financial sphere which functioning is more and more moving to information space.

Today practically each employable citizen every day deals with various devices: smart-phones, tablets or notebooks, which are connected by various ways to the mobile Internet. Many people also actively use post services or services of every possible social networks. And they are also some kind of the simplified cloud technologies.

There were discussions concerning cloud technologies in the scientific literature for a long time. First there were only separate articles which authors were narrow experts in the field of information technologies. Enthusiastic responses of admirers of any innovations further have followed. Then a lot of skeptical articles of financial analysts have appeared. Today it is already possible to ascertain, that all «preparatory» phases of practical introduction of cloud technologies have been gone by the market. And the technology itself, has finished a coil of hype interest which is obligatory for everything new, and has passed to area of normal and daily work which brings real advantage. Now it is necessary to expect corresponding transition to cloud technologies of many services and software products.

It is necessary to note, that software corporation «1C», which is widely known among experts of Ukraine, Russia and the countries of the former USSR in the field of the finance and book keeping by

its software products which allow to automate complex analytical and synthetic activity, has focused last version of a platform «1C: The Enterprise 8.3» exactly on use of cloud technologies.

For more than twenty years of leading in the market of programs for automation of work of bookkeepers and financiers the firm «1C» has never mistaken in an estimation of prospects of any direction of economic information systems development. Therefore, it is quite logical to predict in the near future an excessive demand at a labour market on graduates of the universities having skills of work with «clouds». Increase of such demand will be promoted also by a wide circulation of so-called mobile cash boxes, a various sort of mobile shops, i-boxes and other.

In 2014 the enterprises of all segments of the market are actively enough put money in development or introduction of applied programs which allow to achieve the maximal mobility of their employees. The understanding of mobility for the realtor or the insurance agent considerably differs from understanding of mobility for the head of a marketing department, the bookkeeper or the direct-sales representative. But without dependence from specific branch of work of the various companies all of them will follow the general tendency in this direction.

Taking into consideration all facts given above, it is necessary to note, that cloud technologies are only one of examples of the big and dynamical set of a various sort of innovations which introduction in practice of work of financiers will define the need for formation of corresponding knowledge and skills at graduates of economic universities.

SUMMARY

Teachers of higher educational institutions, first of all, should constantly carry out monitoring of a situation concerning such introduction of information-communication technologies in economic and financial spheres. Secondly, it is necessary for them to improve regularly their own mental potential, passing real training in leading financial corporations. By this way, exactly can be provided the necessary degree of quality of training of bachelors and masters-financiers at universities.

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SOCIAL MEDIA IN POLITICS – CASE OF ROMANIA

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ABSTRACT

New forms of media have always affected politics and political campaigns. The most recent form of new media, which is still evolving now, is social media. Using social networking tools, politicians are able to target their "friends" or "followers" with messages directly to them. Furthermore, it allows them to target the younger voters who are extremely active on social media websites. This new campaigning technique has quickly proven to be an integral part of all future elections (Obama 2008 Campaign) and now they move "eastwards". The paper discuss the case of Romania and its political system.

KEY WORDS

Social media, US elections, 2008

INTRODUCTION

Nowadays, web social media are an inherent element of society and discourse. There is a large variety of web social media solutions suitable for all needs. (Pavlicek 2013) These solutions, or technologies, intended for distribution through social interaction, are built around very accessible and scalable publishing techniques. It is argued that social media promote a more democratic spread of information and knowledge, as well as a shift the role of the individual from consumer to producer of content. Through social media, a person can become an active participant and take more control over the information or content he or she is interested in, leading to user generated content and making the web an open platform for expression. In broad terms, social media tools are readily accessible for free or at low cost and allow people to access or publish information in real time for different target audiences that can quickly interact with the content, for example through commenting or editing (Pedro Sebastiao, 2014).

Digital technologies have proven to be a valuable resource in campaigning and voting processes. One notable example is the 2008 U.S. presidency elections, when the Barack Obama campaign successfully employed digital marketing strategies and social media and changed the way we view political communication. Furthermore, more recently, in the 2012 elections cyber politics played a key role in the campaign of both Barack Obama and his opponent Mitt Romney (Romero, 2014).

This paper aims to focus on the use of social media in politics and explore its role and advantages in this area. The first part of the paper will provide a brief literature review and theoretical approach of the subject. The second part will be dedicated to a more practical approach namely an overview of the use of social media in politics in Romania and a discussion of some examples when social media, and particularly Facebook, which is the most used social network in Romania, played an important part in elections campaigns.

SOCIAL MEDIA AND POLITICS

As in many other areas of society, the internet and social media have also been used in politics as a means to disseminate information, advance a particular message and engage the voters. On the one hand, these can be valuable tools to promote and increase the participation and engagement of individuals in the political life. They have the potential to decrease the distance between politicians and citizens, and

leverage the power and involvement of the latter in policy-making. On the other hand, there are concerns regarding inequalities in the access to the web and social media (in certain less democratic countries there is censorship and restricted access) and the lack of interest in political matters of the people that are able to use them. In other words, although these technologies have the potential to transform the nature of political action by empowering people and enabling them to deepen their participation, their impact is closely tied to the willingness and interest in politics of the people. In effect, when there is a strong interest and dedication to a particular cause, the impact of social media can be extremely powerful. This is supported by recent examples of social media being used as a platform to mobilize people into actions. In some cases, like Occupy Wall Street or the Arab Spring, the impact of these actions or movements had significant consequences for national politics and society. (Pedro Sebastiao, 2014) However, such political power opens questions such as responsibility or ethics.(Sigmund 2013)

With the onset of the internet political parties and actors have sought ways to benefit from having an online presence. By using the internet, they could, for example, promote and ease communication with their members and supporters, or spread their message during campaigns and compete in a more effective manner with their opponents. There has been since a reasonable expectation that the use of the internet will lead to greater communication between politicians and citizens. Still, it may be argued that in reality this communication has been mostly one-sided, with the politicians providing information to the public. However, the onset of Web 2.0 can be seen as a new opportunity that can facilitate the interaction between political parties and individuals. Social network tools enable parties to interact with the public. (Calderaro, 2014)

According to Chadwick (cited in Calderaro, 2014), there are three main aspects regarding the possible influence that the use of the internet can have on the political arena. Firstly, it has the potential to level the playing field, meaning that it allows minor political groups and new parties with limited resources to reach a larger audience of supporters and better compete with established parties. This can lead to a higher degree of pluralism, a broader variety of available information and a better opportunity for citizens to form an opinion on different political issues. Secondly, the internet can increase the communication and interaction between people and political leaders, shift the power more in favor of the people who can be better informed and can exercise more control over politicians. In addition, political parties can benefit from lower coordination costs of their members and easier management of campaign events and fundraising. Lastly, he points out that despite the fact that the use of the internet is an available tool for all parties, there is still the danger of inequality. This is because parties with more resources can have better websites and access to more qualified staff that can manage their online presence and implement more elaborate, integrated, offline and online media campaigns. Regarding this, Calderaro (2014, p.6) proposes that "the Internet could improve pluralistic competition if those parties with less resource could learn to use the Internet as effectively as their more well-off counterparts. The opposite scenario, of not being online, could be fatal to these poorer parties".

As Dıaz Romero (2014, pp.30) points out "New technologies—Internet, mobile phones, tablets—have the capacity to strengthen civic society and consolidate democracy around the world." Without a doubt, these technologies have intensified debate and active participation of citizens by providing an interactive digital platform for discussion of any and all issues of interest that contributes to public opinion formation. Governments, public institutions and political parties are increasingly establishing websites and social media accounts to inform the public provide access to official documents and make announcements. This can lead to increased transparency and accountability.

THE USE OF FACEBOOK IN ROMANIAN POLITICS

Facebook represents, according to Pătruţ (2014, p. 245) a "virtual stage, [where] political actors display their competence, consolidate their fame, mobilize their volunteers and attack their political opponents, encourage donations and debate some sensitive issues of the society. It is more than reasonable to say by now that Facebook can be a highly efficient means for citizens and politicians to communicate. Pătruţ (2014) argues that Facebook is the most efficient online tool to connect people that belong to an offline community, that share a common interest. In the political area, in particular, it can be a powerful communication channel allowing politicians to spread their message to potential supporters and get

feedback from citizens. She identifies some of the main advantages of using Facebook for political communication:

- it provides an alternative source of information,
- it strengthens the interaction, as well as the direct communication between politicians and community members,
- it contributes to the increase in political participation of members, particularly in times of campaigns for elections,
- it fulfills the need of individuals to be part of an online community and participate in discussion groups and
- it is a very powerful means to mobilize supporters.

Facebook started to be used as a political communication tool in Romania during the parliament elections in 2008, and the presidential elections in 2009. However, it was mainly used in order to promote a particular political leader or candidate, through posts and photos, and direct interaction with followers or online friends was kept to a minimum (Pătruţ, 2014).

FACEBOOK USE IN ROMANIAN ELECTIONS CAMPAIGNS

THE 2012 ROMANIAN PRESIDENTIAL IMPEACHMENT REFERENDUM

On July 29, 2012 a referendum was held in Romania regarding the impeachment of the then President of Romania, Traian Basescu. There were several accusations that were brought forward as justification of the impeachment including the following: exercising competences belonging to the Prime Minister and replacing the Government in decision making, repeatedly violating the fundamental rights and freedoms of citizens established through the Constitution and infringement of the principle of separation of power in the state, to name a few. The impeachment was not successful in the end, even though people voted in favor of it the result was not validated due to the insufficient vote turnout. During the period before the 2012 referendum, both sides, namely the one in favor of the impeachment and the one supporting Traian Basescu, used social media, particularly Facebook, as a campaign tool. (Andrei, 2012; Pătruţ, 2014)

Pătruţ (2014) provides a comprehensive analysis regarding the use of Facebook in the political context of the 2012 Romanian referendum. This is achieved through a study based on content analysis and functional analysis of a selection of Facebook pages created during the referendum campaign to either support the President, Traian Basescu (e.g. "By the side of our president") or in favor of his dismissal (e.g. "Fed up with Basescu"). The functional analysis focused on three discursive functions, which indicate the level of preference that voters might have for a particular candidate, namely acclaims, attacks and defense. The study looked at the types of materials the two sides posted on Facebook, the evolution over time of the posted information, the involvement of the two groups and the degree of interactivity in the communication.

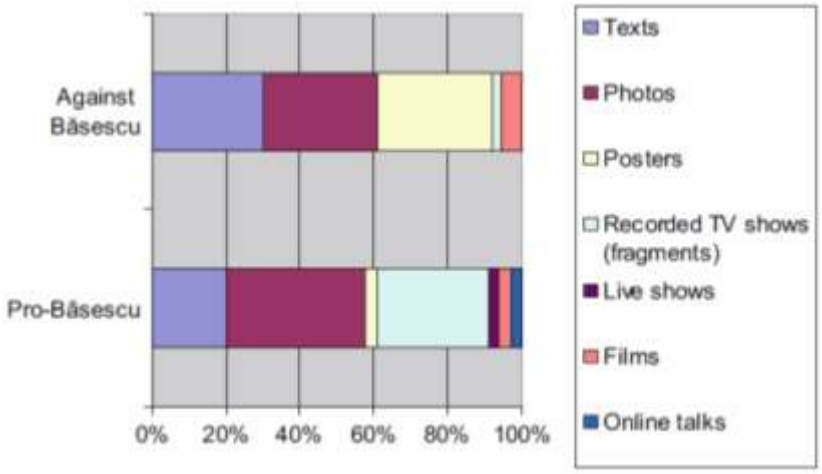

Fig. 1 The content of Facebook pages (Pătruț, 2014, p. 251)

The pages in favor of the dismissal contained 208 posts and the ones supporting Basescu 59 posts. On both sides a variety of materials were embedded including texts, photos, videos, posters and other media, as illustrated in Fig. 1. The findings revealed a higher degree of persuasiveness in the activity of the side against the president that employed 257 attacks. Regarding the intensity of the posting activity over time, the results showed that the peak for the side supporting the dismissal was reached in the final days of the campaign with increasing attacks against Basescu, as well as messages urging people to go to vote. As shown in Fig. 2, the pro-Basescu Facebook activity started going down during the middle of campaign period. This can partially be explained by the fact that at that moment Basescu started appealing to people not to vote because that would validate what he considered a coup d'état of the opposing party. In terms of interactivity, the posts on the pages supporting Basescu were shown to be more efficient as despite being fewer than on the opposite side, they resulted in more likes, comments and shares. The study concluded that based on the "interactivity displayed on the pages of both groups (supporters and opponents of the president), especially through likes, comments and shares, [...] a greater involvement of the Romanian internet users in supporting a political cause" can be observed (Pătruț, 2014).

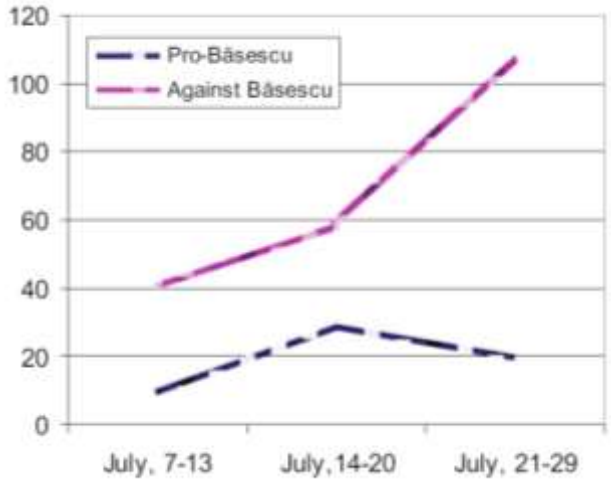

Fig. 2 The evolution of the number of posts—beginning, middle, and end of the campaign (Pătruț, 2014, p.253)

THE 2014 ROMANIAN PRESIDENTIAL ELECTIONS

Klaus Iohannis became the President of Romania after he won the second round of the presidential elections organized on November 16, 2014. The information he chooses to provide on Facebook about his background provides an insight regarding the public image he promoted during his campaign. It outlines his career and professional accomplishments and his goals for Romania: "to bring it toward the right path, to transform it into an authentic state, subject to the rule of law, prosperous and dignified". There is no information regarding his personal life or interests, emphasizing his focus during the campaign. During the campaign both the cover photo and his profile photo contained slogans like: "Getting things done" and "The Romania of things well done".

His opponent in the second round of elections was Victor Ponta, the Prime minister of Romania. On his Facebook page he stated that is was born and raised in Romania, he is married and has two children whom he describes as his biggest accomplishment. He mentions that sports are his life passion and that he used to be a national champion in basketball and racing. Regarding his view for the future of Romania, he says that the country should "claim its rightful place in the world and not regard itself as a victim because it has the highest potential in this region of Europe". As opposed to Iohannis, Ponta opted to focus on more personal aspects of his profile, like family values and interests rather than professional ones. Also, the cover and profile photos do not contain any message, but rather focus on portraying the candidate as a family man (Ponta, 2014)

"You wrote history! For the first time, the online made the difference!" (Iohannis, 2014) Klaus Iohannis wrote on his Facebook cover photo on November 16, 2014, when he won the Romanian presidential elections. By doing this, he was acknowledging the role played by social media in his political campaign and subsequent victory.

In an online interview by Pescaru (2014) Tanase Tasente, a researcher in the field of political communication, argues that Iohannis's victory was due largely to the fact that campaign strategists realized the value of social media. He points out that Klaus Iohannis was the only candidate who fully took advantage of this means of communication because he understood that it is important to let fans be the ones promoting his image and knew how to mobilize the online community. During his campaign, Iohannis reached over 1 million Facebook fans, while his opponent had over 700.000. However, Victor Ponta's page was less effective in spreading his political message to all network nodes. According to Tanase, social media is changing the way that politics is made in Romania.

According to Alexandru (2014), the ability of social media to mobilize people hes been more than proven during the 2014 presidential elections as " Mr. Klaus Iohannis became not only the first man in state, but also the first political leader in Europe that exceed the threshold of 1 million Facebook fans". He credits Iohannis's communication strategy for the amazing results of the Facebook campaign stating that it "understood very well the target audiences and used the appropriate elements through which true interaction was achieved, leading to the creation of emotional and intellectual connections between Mr. Iohannis and his fans".

CONCLUSIONS

Social media is increasingly proving its value as a communication tool in politics, and strategy and expertise in posting the right content and interacting with the target group is not just useful not, it is becoming a necessity. Political parties and actors cannot afford to not use social media because people are starting to rely more and more on them as a source of information and it would give their competitive a considerable advantage. Social media is playing an important role nowadays in public opinion formation and politicians need to understand its importance. Moreover, in the past websites were used as a means of political communication with information and messages being made available for citizens. However, that is no longer enough. There needs to be more interaction between politicians and voters and social media can narrow this gap.

Facebook is one of the most popular social networking sites, in Romania especially and, as previously demonstrated in this paper, it can be a very efficient means for political communication and mobilization

of supporters. This is supported by the example of the Barack Obama successful campaign strategy, which benefited greatly from using Facebook. However, Facebook has also played a key role in political campaigns in Romania. During the 2012 referendum for the impeachment of the President, Facebook played an important part in the political debate and both sides used it in order to promote their point of view. Later during the 2014 presidential elections, one of the candidates, Klaus Iohannis, extensively used Facebook as a key tool in his campaign strategy. After his victory, he publicly acknowledged through a Facebook post that the Facebook online community of supporters was instrumental for his success. He went on to have over a million Facebook fans, more than any other European political leader at that time. Clearly, the social media has changed political communication and its role in political campaigns in general, and in Romania in particular can be expected to become more and more significant.

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- Authors must certify that the manuscript has not previously been published elsewhere.
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- Authors must notify us of any conflicts of interest.
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