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O B S A H / C O N T E N T

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INTELLIGENT AGENTS IN CUSTOMER RELATIONSHIP MANAGEMENT

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ABSTRACT:
The aim of this paper is to present the applicability of intelligent agents to manage customer relationships. In the article special attention is paid to one of the types of intelligent agents systems, namely, the virtual assistants. There is a general description of the functionality of some virtual assistants and their advantages and disadvantages. The obtained results may be helpful in deciding on implementing such systems on a website and choosing a particular solution.

KEYWORDS:
Intelligent Agents, Virtual Assistants, System, Intelligent Software, Customer Relationship, Management, Internet

I. INTRODUCTION

The fundamental source of variety of the organization, in addition to its clients, is a wide access to a variety of knowledge resources, as well as the use of modern technology in business. In times of the knowledge society, intelligent agents become an interesting option to diversify the process of knowledge management. In traditional information systems there are no mechanisms that would allow the automatic and autonomous acquisition, storage and processing of various types of information. In this type of tasks the technology of intelligent agents may be helpful for the organization.

II. INTELLIGENT AGENTS SYSTEMS

In the organization's activities, involving a particular person to obtain certain information may be inefficient. This may result in receiving the results with time delay and unreasonable generating additional costs. In this case, the person delegated to obtain specific information is forced to suspend his present work for the duration of the task entrusted. Standard systems of information retrieval (as examples of these, we can point out: Internet search engines, Internet comparing engines, search engines in standard databases), although subject to dynamic growth, are often unable to keep up with the information needs of the organization. It seems that to meet these needs, it is necessary to enrich the selected IT systems (e.g. transactional and analytical) with an element of intelligence, perception, and autonomy. This idea is consistent with the concept of an intelligent agent, which has already been proposed in the fifties of the twentieth century [Bradshaw, 1999], [Poole, Mackworth, 2010].

When analysing the literature on the subject, it may be noticed that the term "intelligent agent" (intelligent software, wizards, knowbots, taskbot, userbot, software agent, softbots-intelligent, software robots) has never been given a generally acceptable definition and it has been variously interpreted.

Difficulties with clear interpretation of the term "intelligent agent" result in identifying its common characteristics in order to provide its meaning. A minimum set of features that should characterize an intelligent agent, includes [Franklin, Gresser, 1996], [Bradshaw, 1999],

[Turban, 1998], [Li, Benwell, Whigham, Mulgan, 2000], [Bellifemine, 2007], [Wooldridge, 2002], [Wooldridge, 2007]:

- autonomy, the ability to start / stop operation without user interaction,
- long duration of running in the background of the system, so called "long-lived", it runs continuously, even when a user is not using it [Gilbert, Aparicio, 2000],
- possibility to communicate, communication with other systems and agents to obtain information from various sources,
- ability to cooperate, the cooperation with the user or other agents during the exchange of information,
- intelligence and perception, the ability to perceive and respond to changes in the environment, or between other agents; he controls both his own behaviour and internal states [Wooldridge, Jennings, 1995],
- the possibility of requesting,
- focus on target,
- mobility and adaptability, the ability to move in the network, between different system platforms,
- activities on behalf of the delegating person, the representation of the user.

Also additional attributes of intelligent agents are often pointed out. These are [Gilbert, Aparicio, 2000], [Franklin, 1997], [Etzioni, 1995], [Nwana, 1996], [Sterling, Taveter, 2010]:

- ability to communicate with the user in natural language (or close to natural),
- ability to use symbols and abstractions,
- social skills,
- continuous learning,
- figural character, which is representing an intelligent agent by a character (e.g. an animated human figure or other),
- the expression of emotions, a visual and audio form, which is implemented by a virtual form of intelligent agent.

When describing intelligent agents, it is worth to present one of the main models, which is the BDI model (Beliefs, Desires / Goals, Intentions). In this model, an agent is described by three concepts [Bellifemine, 2007], [Chang-Hyun, Jeffery, 2005], [Chang-Hyun, Chen, Choia, 2004], [Oijen, van Doesburg, Dignum, 2011], [Rao, Georgeff, 1998], [Yadav, Zhou, Sardina, Rönnquist, 2010]:

- Beliefs, which provide information held by the agent, his beliefs about the world (including himself and other factors). They may also include rules of requesting, which leads to the new beliefs formation. Using the term "belief" instead of "knowledge" implies that what the agent acknowledges as real at the given time may change in the future. Beliefs are usually stored in the database (sometimes referred to as "the basics of the belief" or "set of beliefs");
- Goals, representing tasks that can be selected for accomplishing. They also reflect agent's motivational state. An example of a goal may be to find the best deal. A goal is the desire that was adopted by the agent for the active implementation. A set of long-term goals should be consistent;
- representing the tasks that are currently implemented by the agent. In the implemented systems, the intentions mean that the agent starts to perform an action plan. Plans are sequences of the actions (knowledge areas) that the agent can perform in order to achieve one or more of his goals. These plans may also include other plans. This reflects the fact that initially they are only ideas and instructions on how the agent should fulfil them in the course of activities.

When considering the action of intelligent agents, we can distinguish their three main functions, such as [Bartuś, 2010]:

- perception of the dynamic environment conditions,
- impact / response to environmental conditions,
- rational interpretation of what the agent sees, problem solving, drawing conclusions and taking action.

These functions can be written according to the following rules defining the action of the agent at the moment of receiving a signal by the input sensor [Russell, Norvig, 2003]:

Input: perception – input sensors (receptors)
Components: rules – a set of actions
Memory upgrade (memory, receptors)
Choosing the best action (memory)
Memory upgrade (memory, response)
Output: responses – output sensors (effectors).

III. INTELLIGENT AGENTS, VIRTUAL CONSULTANTS, VIRTUAL ASSISTANTS

The Internet has become a convenient tool allowing to quickly and easily browse the offers of different electronics stores and find promotional items. It improved and accelerated comparing prices of the goods searched (in tenders, e.g. by 'comparison making devices'). However, it should be noted that the user, in a huge number of electronic stores found in the Internet, might feel disoriented. An excessive number of electronic offers may discourage him to view potential offers. In order to eliminate information noise and to encourage the customer to do electronic purchasing, organizations began to implement various forms of intelligent agents on their websites. Among the most common forms of intelligent agents there are so-called virtual agents, virtual assistants and chatbots or chatterbots. Such systems are represented by virtual characters (e.g. Ramona [www.kurzweilai.net] , Nomi [www.novomind.com], Fido [www.fidointelligence.pl], Inguaris [www.inguaris.pl], Stanusch [www.stanusch.com]). A characteristic feature of such characters is the possibility of conversation (dialogue) with the user through natural language, which writes the words into special forms [Bontcheva, Wilks, 1999], [Borkowska, 2004]. This is enabled for the virtual assistant by built-in mechanisms of natural language processing, thematically extensive knowledge base and algorithms of requesting. Thus, a virtual assistant becomes an electronic product advising the user (customer) in making a decision. Additionally, due to accumulated knowledge about the Web site and offered products, a virtual assistant may be used as a guide throughout the company's website, which guides the client to different web pages, simultaneously answering his questions. It is able to provide the user (customer) with information about the products and services. Equipped with a module to answer, it helps the employees responsible for customer contact (call centre support). An appreciated feature of the virtual assistant in such solutions is that it "works" 24 hours a day, every day of the year, simultaneously providing answers to many clients.

A chatting agent (the sixties of the twentieth century) called ELIZA, which simulated a patient consultation with a psychotherapist, is considered to be the pioneer of such systems [De Angeli, 2005]. It should be noted that this system had neither sophisticated data processing algorithms (including processing the interlocutor's natural language) nor the knowledge bases, what caused mistakes during conversation, e.g. asking the same questions again or accidentally deviating from the topic of the conversation. However, despite this

weakness, this agent was well fitted to the role of the psychotherapist, as it could maintain the conversation with people and focused the interlocutors' attention.

IV. THE CHARACTERISTICS OF SELECTED VIRTUAL ASSISTANTS USED IN CUSTOMER RELATIONSHIPS MANAGEMENT

Internet users expect the Web sites (including portals, e-shops) to process the data in an efficient way, to respond to their needs and preferences, and to offer services that are intuitive in use. On the other hand, the organizations want their Web sites (including portals, e-shops) to be highly self-service and universal. As a result, the users have difficulty with monotonous navigating through static pages and finding the desired information (e.g. contact details, company's offer, the availability and specification of a particular product). One of the solutions to this problem is to implement to websites a convenient for users communication channel, which is a more and more often successfully used virtual assistant [Hayes–Roth, 2001]. It is observed that the solutions of this type are eagerly absorbed by the market. The main task of the virtual character is to conduct a conversation (even steering the conversation) with the web page user in a natural language. The course of the conversation is usually as follows:

1. virtual assistant greets the user (on the website, the user sees the relevant text of the message, sometimes, in addition, he may hear the voice of a virtual assistant),
2. the user replies, introduces himself or asks a question in the form of a natural language (the words are entered from the keyboard into the form field),
3. virtual assistant generates the answer by text displayed on the website, it can also open new web pages (e.g. web pages with the offers of specific products or their characteristics, a site with a contact form, etc.).

The possibilities of using a virtual assistant on the web pages can be varied. We can indicate that a virtual assistant can be: (1) a sort of showcase of the organization, (2) a consultant who answers the customer's questions related to the company, products, (3) a sales assistant who supports (provides service) the process of electronic sales, (4) the interviewer, (5) a tool for acquiring and storing the information about customers, their tastes, preferences, expectations.

Further in this article, there is a description of two selected virtual assistants. These are products offered on the domestic market. The description concerns such products as Inguaris [www.inguaris.pl] and Fido [www.fidointelligence.pl].

V. INGUARIS – VIRTUAL ASSISTANT

The virtual consultant Inguaris is a product of the Artificial Intelligence company [sztucznainteligencja.pl]. It pays the role of a virtual character (web bot) that communicates with the web page user by natural language in the form of a written text. The functional architecture of Inguaris is a combination of software running on a server and a special dialog box, so called chat window where the user types in the message (Fig. 1). In a typical solution, the software of a virtual consultant is on the Artificial Intelligence company's servers, while his interface (chat window) is installed on the customer's server. Under the agreement, it is also possible to purchase a license on a virtual consultant's server software and to install it on a server designated for it by the customer or on the so-called multimedia kiosk.

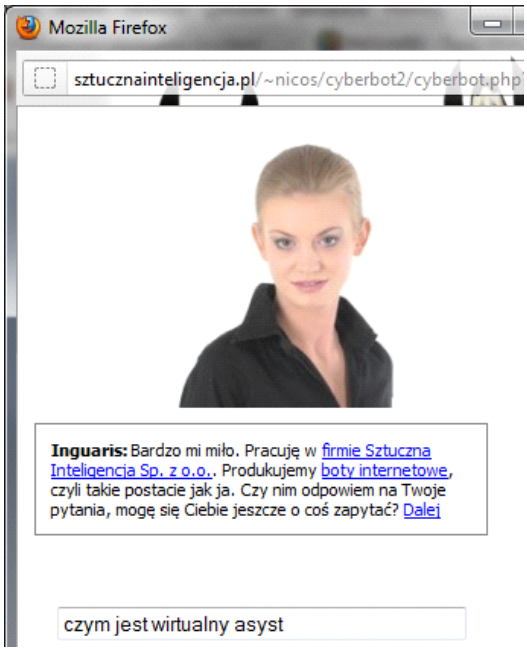

Fig. 1 An example of a window presenting communication with Inguaris

Source: [www.inguaris.pl].

Figure translation:
"*Inguaris*: Pleased to meet you. I work for Sztuczna Inteligencja Ltd company. We produce web bots, which are the characters like myself. Before I answer your questions, may I ask you something? Enter"
Question: "What is a virtual assist"

Knowledge of the virtual assistant Inguaris may concern:

- a subject ordered by the client. The system has no quantitative restrictions; it can accumulate a large amount of data. The critical factor is the time of the knowledge preparation for the demands of the virtual assistant;
- widely understood general knowledge that would allow the system to become more attractive to the interlocutor. Such knowledge is not limited only to statements related to a certain organization. If the customer is interested, a virtual assistant can be provided with this, at no extra charge;
- a set of the so-called emergency responses, which would be used by the virtual consultant in a situation when he does not understand the statement given by the user. An example of these may be a request for a different formulation of the statement as well as asking the question via e-mail (then a proper web-form will appear automatically);
- interest of the virtual consultant. The interest being in the company's offer can be implemented by default, or a unique set of interests can be made for a particular virtual consultant;
- other resources of the organization. This is accomplished by connecting the virtual consultant to an external database. In this case, the knowledge base is integrated with an external database, such as an enterprise service, CRM system, accounting program. The advantage of this solution is downloading by the virtual consultant the information on products directly from the price lists or the catalogues with new offers. This information can be used during a conversation of a virtual consultant with the client;
- definitions retrieved from dictionaries, encyclopaedias, news, catalogues;
- technical assistance on the basis of the knowledge from technical or user directories.

Additional features of the virtual consultant may include:

- the ability to memorize the interlocutor's name;
- knowing the date and time, weather, games results, foreign exchange rates and stock;
- any visualization (pictures, video). Visualization of the virtual consultant can be realized both on the basis of materials supplied by the customer, as well as an order to carry out all the work (photo / video, graphic processing) by the Artificial Intelligence company;
- speech synthesiser (e.g. IVONA [www.ivona.com]), which in real time manner converts the written speech of the virtual consultant into female or male voice;
- chat history window, represented by a dialog box that displays the history of the conversation. It is significant for the customer that at any moment he can return to the previous statements of a virtual consultant or to his own;
- the ability to send electronic mail on a request of an interlocutor. E-mail that is sent to the address given during the conversation, may contain additional information, offers and forms;
- asking questions or answers in the form of hyperlink. Depending on the context of the conversation, it is possible to answer or explain some issues by selecting a highlighted piece of text (or graphics) without a necessity to type it in the dialog box;
- integration with external systems (CMS systems, Internet shops, Instant Messaging, chat rooms, e-mailing systems).

The implementation process of the virtual consultant technology, proposed by the Artificial Intelligence company, can be divided into the following steps:

- identifying the functionality of the virtual consultant,
- providing the customer's knowledge which is powers up the virtual consultant,
- developing the knowledge according to the requirements of the virtual consultant's IT system,
- introducing the knowledge to the artificial intelligence mechanisms,
- activating the virtual consultant,
- testing and complementing the detailed knowledge of the virtual consultant,
- integrating with the final system, such as Web, GG (Gadu Gadu) instant messaging, e-mail processor,
- launching a virtual consultant,
- after-sales support, including a development of the agent's knowledge, conversations analysis, web hosting services.

It seems that the above-described virtual consultants may be predominantly used in the following applications:

- multimedia kiosks,
- FAQ technical support systems on the website,
- advertising of various products on the Internet,
- railway station, bus station and airport information,
- television or radio programme,
- horoscope,
- dictionaries, encyclopaedias,
- product cataloes, e.g. electronic components, spare parts.

Among the advantages that characterize the Inguaris virtual consultant, there are:

- a broad description of the capabilities and characteristics of the virtual consultant on the manufacturer's website,
- a possibility to rent a virtual consultant without a necessity to implement the entire system on the customer's server,
- a possibility to use the general knowledge base and the knowledge base concerning the interest, which can be used by the virtual consultant when communicating with the client,

- more efficient search of the desired information by the user (e.g. when you type "contact, please" a virtual consultant displays complete information on contacting the company).

When analysing the virtual consultant, it should be pointed that this solution also has some disadvantages such as:

- inability to browse (by the user) history of communication (in writing) between the user and the virtual consultant,
- a fact that a virtual assistant communicates with the user only by natural language in a written form, no form of sound on the side of a virtual assistant in the standard version (it is possible to upgrade a virtual assistant with Ivona speech synthesiser),
- statics of a character representing the virtual assistant, the photo of the character changes at the moment approving the content entered by the user.

VI. FIDO – VIRTUAL ASSISTANT

Fido - a virtual assistant - is a product of the Fido Intelligence company [www.fidointelligence.pl]. Fido acts as a virtual character (web bot) that communicates with the web page user by natural language in both the text and the verbal form (audio communication runs one-way. Virtual assistant communicates with the user by means of written text or sound, but a user can use communication only on the basis of a written text). The functional architecture of Fido is a combination of software running on the server with a special area of the website, where a user types in his words that act as a form of communication between the virtual assistant and the user (Fig. 2).

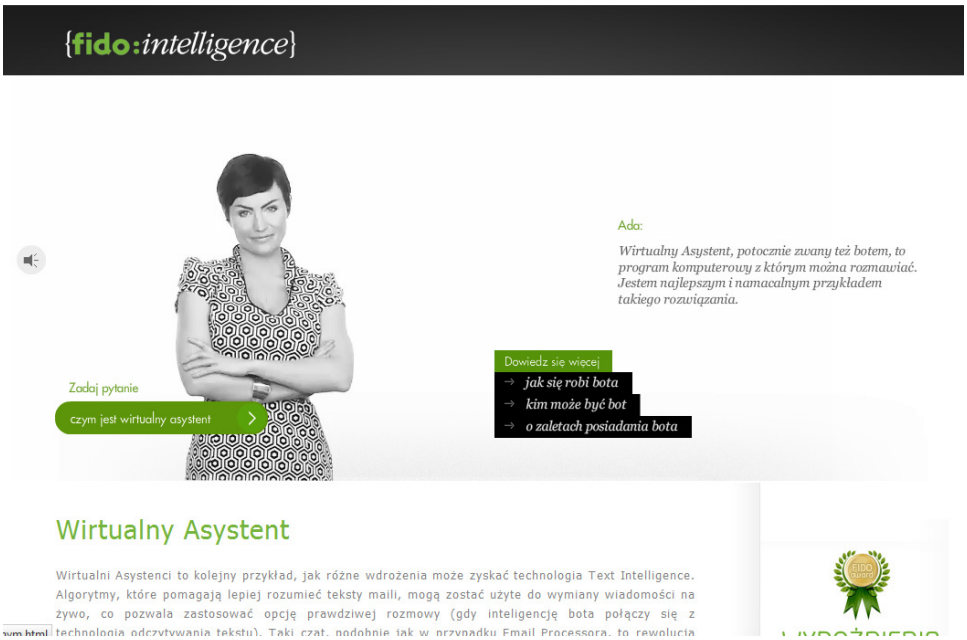

Fig. 2 An example of a window presenting communication with Fido

Source: [www.fidointelligence.pl].

Figure translation:
“Ada: Virtual assistant, also known as a bot, is a computer program which you can talk to. I am the best and proved example of this kind of a solution.”

“Find out more
- how to make a bot
- who can a bot be
- advantages of having a bot”

“Ask a question
What is a virtual assistant”

“Virtual assistant

Virtual Assistants are another example for how varied implementations can a Text Intelligence technology get. Algorithms, which help to understand e-mail text, can be used to live exchange of messages, what helps to use an option of a real conversation (when bot’s intelligence is combined with a text reading technology). This kind of chat, just like in case of an E-mail Processor, is a revolution.”

Fido Intelligence company’s offer, based on natural language processing, is relatively broad. We can mention solutions such as:

- idfine Virtual Assistant, which is a showcase of the organization on the Internet. Features of a virtual personality, such as: appearance, gender, age and style of behaviour, can be selected in accordance with the customer’s requirements. On the basis of accumulated knowledge, it can answer customers' questions. The personality module is responsible for the behaviour of a virtual character. There is a possibility to connect it to the IVONA sound system;
- idfine E-mail Processor, which is used to identify the content of an email and to generate the appropriate responses automatically. In addition, it can sort the mail and forward important questions to consultants;
- idfine Virtual Tutor, it can be embodied in several characters at the same time. His task is to check the knowledge and personal culture of the tested person. It can also perform the analysis of free speech in terms of their substantive and linguistic correctness;
- idfine Mobile Processor, which is used to create systems that provide answers to the questions asked in natural language by means of a SMS sent from a mobile phone;
- idfine Brandmarker, which contacts a potential customer and through a conversation leads him to a website associated with a certain product;
- idfine ActiveStand, the communication with a multimedia kiosk that uses the natural language processing;
- - idfine Chatterbox, which task is to respond to questions asked by the users of instant messaging (e.g. Gadu Gadu). It can help the action on the first line of on-line contact with the customer. The advantage of such solution is a possibility to answer customer questions at any time of day and night;
- idfine E-Content Analyser, which is used to analyse the collected data. This can be done through the categorization of issues, combining the facts and checking data from different sources. The advantage of this solution is a possibility to analyse web form fields of a descriptive characteristics (by the use of natural language processing).

The main areas of the Fido technology are: portals, corporate vortals (intranet), internet shops, e-learning systems, data warehouses, multimedia kiosks, gaming and entertainment systems, electronic systems and email accounts.

Among the advantages of the virtual assistant Fido, there are:

- a convenient form of communication, a virtual assistant communicates with the user through natural language both in the written and the sound form (the text that is displayed in the dialog box, is also read by a virtual assistant);
- a friendly communication interface, as compared with the virtual consultant Inguaris, the communication takes place on the main page of the site, in a place dedicated to this. Additionally, all conversation between the user and virtual assistant is visible (e.g. instant messaging model). Thanks to this, user can at any time view the content of the present conversation;
- more efficient search of the desired information by the user, for example, after typing in "contact, please" the virtual assistant displays the appropriate content on the website and reads all the information regarding the contact with the company;
- the functioning of a virtual assistant who talks about selected by the user options in the menu, and thus informs the user about the content of each page;
- the possibility of voice communication, which is achieved through the use of IVONA.

Among the disadvantages of a virtual assistant, those that should be noted include:

- too brief description of the architecture that Fido works on, located on the website of the manufacturer;
- dictated page layout (about half a page is taken by Fido character along with a field by which a user communicates with a virtual assistant). This makes it difficult to view its contents (for larger amount of text, it is necessary to scroll the contents of the page);
- not the whole conversation is visible on the website, each new path is replaced by a new window, thus the course of conversation cannot be seen (e.g. it is not possible to return to already displayed content without reference to the virtual assistant).

VII. CONCLUSIONS

In summary, the use of the virtual assistants technology by organizations confirms their enormous potential in managing the customer relationships. The given examples of this technology suggest that it may be useful in the following cases:

- supporting the completion of electronic forms by the user (e.g. forms of orders),
- advising, providing information, such as call centres,
- assistance in navigating through pages of the website (e.g. virtual assistant opens pages with the content searched by a customer),
- obtaining information about the clients, directly at the point where they are generated (the clients themselves type in phrases in natural language).

When analysing these examples of the virtual assistants potential, we can point out numerous benefits resulting from their use. These include:

- financial: reducing operating costs (average cost of employing a worker at the same time – 24 h / 356 days a year, would be a cost of three (employees) * 1,500 PLN (national average wage) * 12 months = 54,000 PLN + the cost of necessary infrastructure and work place (to compare, the annual cost for a virtual assistant license is about 25,000 PLN),
- marketing: creating a new source of knowledge about the clients and for the clients, a more attractive website.

However, in order to use the technology of virtual assistants in the customer relationship management to a large scale, further research and development should be directed to the use of different methods of both artificial intelligence and machine learning. Among the main areas, those that should be noted are: natural language processing (analysis of the sentences contents), human - computer communication (including verbal and nonverbal

communication) (interface design), neural networks, fuzzy logic and the multiagent technologies.

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KNOWLEDGE REQUIREMENTS OF SMALL AND MEDIUM ENTERPRISES ON ICT PROFESSIONALS

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ABSTRACT:
SMEs (Small and Medium Enterprises) are expected to be drivers of actual economic situation. It is typical for the Czech economy that number of SME business units represents approximately 99 % of business units in the whole economy and SMEs provide approximately 80 % of all jobs on labor market in our country (Doucek et al, 2012). Similar situation is all over the world. Dependability of the all the economic environment on information and communication technology (ICT) seems to be the second feature of our economic reality. This paper is devoted to the analysis of small and medium enterprises requirements on ICT professionals´ knowledge and skills in conditions of the Czech Republic. The analysis is presented for roles Developer, Administrator and Business Analyst. There is briefly presented methodology and the most important information about basic survey in the paper. The results part contains detailed analysis about companies´ requirements on knowledge (knowledge profile) ICT professionals. This analysis takes into account differences between small and medium enterprises. Detailed analysis is prepared for all of three above mentioned roles.

KEYWORDS:
ICT knowledge, SME, ICT skills, requirements on ICT professionals

1. Introduction

Information and communication technology (ICT) has become ubiquitous in the globalised economy. ICT are one of the most important factors for development and economic increase in the globalised economy in last 20 years. Integration of it into every day's life reasoned our permanently increasing dependency on it. Currently is our community solving following questions: How much are we depending upon ICT? What will it happen after losing ICT support for our processes? Do have companies' different requirements on employees´ knowledge in the context of the companies´ size?

Massive investments into ICT in the last twenty years started economic growth. The growth was shortly interrupted after the dot com boom in 90s. For ICT industry were really exciting years 2000-2008. During this period were realized extensive investments into the ICT and the results of these investments were significant impact into the economic growth (Doucek, 2010; Doucek, Nedomova, Novotny 2010; Delina, Tkac, 2010). It can be exemplified by new goods and services offered on the market or by new channels for their distribution using ICT infrastructure – for example e-shops, e-marketplaces, cloud computing, providing services through model „Software as a Service" etc. (OECD, 2010; Quiang et al., 2003; Carr, 2004). Sudzina, Pucihar and Lenart (2011) identified that the company size impacts the efficiency, i.e. profitability change after ICT systems implementation.

The ICT sector was expected to grow (after 7 % decline in 2009) worldwide between 3-4% in 2010 and for 2011 it is likely strengthen as business investment pick up sharply, unemployment begins to decline and government and private balance sheets start to improve, but with very different performances across segments and markets (Information and Communication Technology, 2010). With improved macroeconomic performance, aggregate investment is now increasing across the OECD area and ICT present the significant and growing share of this investment. Some ICT segments are very dynamic (internet related investment, portable and consumer applications, ERP products etc.), with the major share of venture capital flow. Merge and acquisition activity is also very high. The overall prospects for continuous balanced and sustained growth at a relative high rate are good, but return to the unsustainable annual growth rates of 20–30% of the late 1990s is not expected (Information and Communication Technology, 2010).

Another dimension of this economic growth is characterized by changes in the area of human resources management. ICT like other new areas of human activity depends on one hand on new technologies development and improvement and on the other hand, it is deeply connected with the quality of employees in the sector – on human resources with specific skills (ICT Skills Monitoring Group, 2002), knowledge, abilities and competitiveness (Frinking, E., Ligtvoet, A., Lundin, P., Oortwijn, W., 2005).

Although the global economic crisis was the reason for disinvestment into ICT in 2009 (OECD, 2010), McCormack expects that ICT will generate almost 5.8 million new jobs till year 2013. (McCormack, 2010) We can expect that companies creating these jobs will expect different knowledge structure than in previous years.

2. Problem Formulation

The area of ICT is permanently changing. New information and communication technologies are invented and they evoke needs on innovations of existing processes, procedures and methodologies. Good example of above mentioned new aspects of ICT use, are requirements on skills in area of multimedia in business.

These changes influence companies' requirements on ICTs' professionals' knowledge.

From the perspective of businesses should be continuous adaptation of changes in knowledge that are provided to students by the universities during their educational process. This is closely connected with fact that universities do not know what knowledge companies expect from ICT specialists.

The aim of this paper is to describe and to analyze SMEs´ expectations on knowledge and skills that should have ICT professionals on labor market in order to be attractive for this market segment.

3. Data Collection and Methodology

3.1 Roles

We have defined seven roles in our survey (Administrator of Applications and of ICT Infrastructure, IS Architect, Business Process Analyst/Designer, Dealer - Business Person in ICT Products and Services, Developer, IS/ICT Development and Operation Manager and Lector in ICT). Each of these seven roles was exactly defined by the table presented for example in (Doucek, Maryska et al, 2012).

3.2 Skills Categories and Knowledge Levels

We have been concentrating on the 16 skill categories in our survey.

We have defined (based on similar studies in Europe and world) following 16 skills categories in our survey: MS01 - Process modeling, MS02 - Functionality and customization, MS03 - Management IS/ICT, MS04 - Analysis and design, MS05 - Software engineering, MS06 - Data and information engineering, MS07 - IS/ICT knowledge, MS08 - Operational excellence, MS09 - Team leadership skills, MS10 - ICT market knowledge, MS11 - Organizational management methods, MS12 - Enterprise finance and economics, MS13 - Sales and marketing, MS14 – Mathematics, MS15 – Law, MS16 - Knowledge in specific business sectors. These skills categories are described in detail for example in (Maryska, Novotny et al 2012; Doucek et al 2007).

Each of 16 skills categories were assessed by companies´ representative on one side and universities´ representatives on other side. Universities´ representatives use following non-linear scale described "amount" of knowledge that can students receive during their university studies.

We have defined 6 knowledge levels (Level 0 – No knowledge – Level 5 – Highest knowledge quality and advanced practical skills). (Maryska, Novotny et al 2012; Doucek et al 2007; Doucek, Maryska, Novotny 2012)

3.3 Survey

The set of economic entities existing in the Czech Republic was divided with 2 criterions: number of employees and dependence on ICT.

The first classification criterion (number of employees) divides companies into the 4 groups: 0– 49, 50 – 249 and 250+ employees. Small enterprises are those in the first group. They have less than 50 employees and the category of medium enterprises was defined as corporations with more than 49 employees and less than 250. This segmentation is based on international methodology for description of companies` types. (Evropska Komise, 2006)

The second classification criterion divides companies into three groups on the basis of the level of requirements and dependence of the sector on ICT:

- sectors with the lowest requirements and dependence on ICT (MIT), typical representative of this sector are industries with the low dependence on ICT. These companies can be found in industries as agriculture, hunting, forestry, fishing, mining, quarrying, textile industries, leather and footwear, wood, of wood and cork industries, construction etc.
- sectors with medium requirements and dependence on ICT (SIT – as for example are – trade companies, public administrations, food, beverages, tobacco industries, oil companies, fuel producing sectors, transport and storage, hotels , restaurants etc.), and
- sectors those are completely dependent on ICT (VIT). Typical corporations of this group are finance institutions – banks, insurance companies, telecommunication corporations, subjects providing ICT services, post services, electricity, gas and water supply etc.

Table 1 Sector Map for Business Units in the Czech Republic (2005) (Doucek et al, 2012)

	0	1 – 9	10 – 49	50 – 249	250 – 999	1,000 +	Total
MIT	263,289	49,914	14,270	4,317	369	87	332,246
SIT	697,380	138,555	28,014	6,217	1,164	182	871,512
VIT	49,851	9,590	2,216	710	170	41	62,578
Total	**1,010,520**	**198,059**	**44,500**	**11,244**	**1,703**	**310**	**1,266,336**

We performed a selective survey amongst economic entities. Probability sampling without replacement was performed for the individual strata. The methodology of this survey is detailed described in (Maryska, Novotny et al 2012; Doucek et al 2007).

4. Results

This chapter provides detailed findings about ICT knowledge and skills requirements in SMEs based on perspectives in following two dimensions:

- Number of employees (small and medium enterprises),
- Dependency on ICT (MIT, SIT, VIT sectors).

4.1 Small Enterprises up to 49 employees

Small Enterprise is the special group in economy. They represent main driver of the economy, because they offer 80 % of jobs and represent a little less than 99 % of active business units (Table 1). On the other hand the majority of them are one person show – they do not have employees and only one person (the owner) is active in this subject. Small companies are usually described in the Czech Republic as dynamic companies which can be established during few days and are represented especially by self-employment. They are usually as subcontractors for further bigger companies. On contrary for small companies is more difficult to receive loans from banks and they have also problems to get larger contracts especially from state and public administration sector.

MIT Sector

Requirements on knowledge of ICT professionals in small enterprises in MIT sector industries are presented on Figure 1.

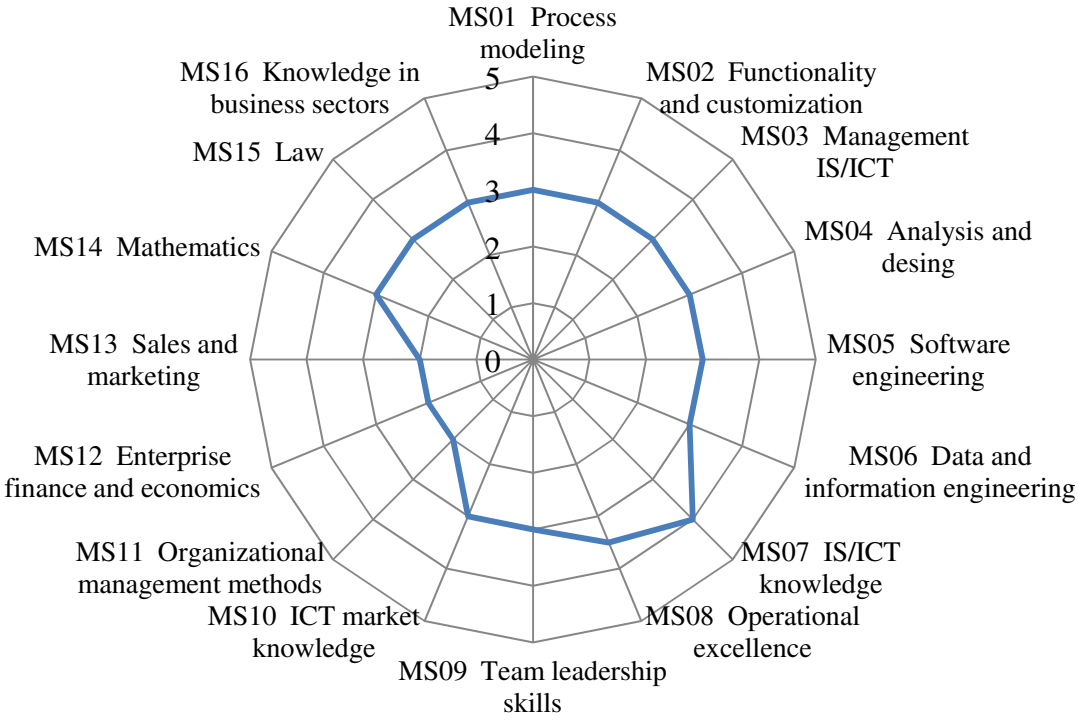

Figure 1 Requirements on Knowledge in MIT

The most important domain in ICT knowledge is the domain "MS07 - IS/ICT knowledge", which represents general knowledge of ICT especially is represented by knowledge about ICT infrastructure (hardware, software, networks etc.) I. Other ICT knowledge are required almost on the same level 3. In "non-ICT" knowledge are required mathematics, which represents logical thinking and approach to problem identification and solving, general knowledge of legal frame "MS15 – Law" and knowledge of appropriate business sector "MS16 - Knowledge in specific business sectors".

SIT Sector

SIT sector disposes with a little difference in requirements. Although is the number of employees relative the same, requirements on ICT knowledge are increasing – especially in domains "MS06 - Data and information engineering" and "MS08 - Operational excellence".

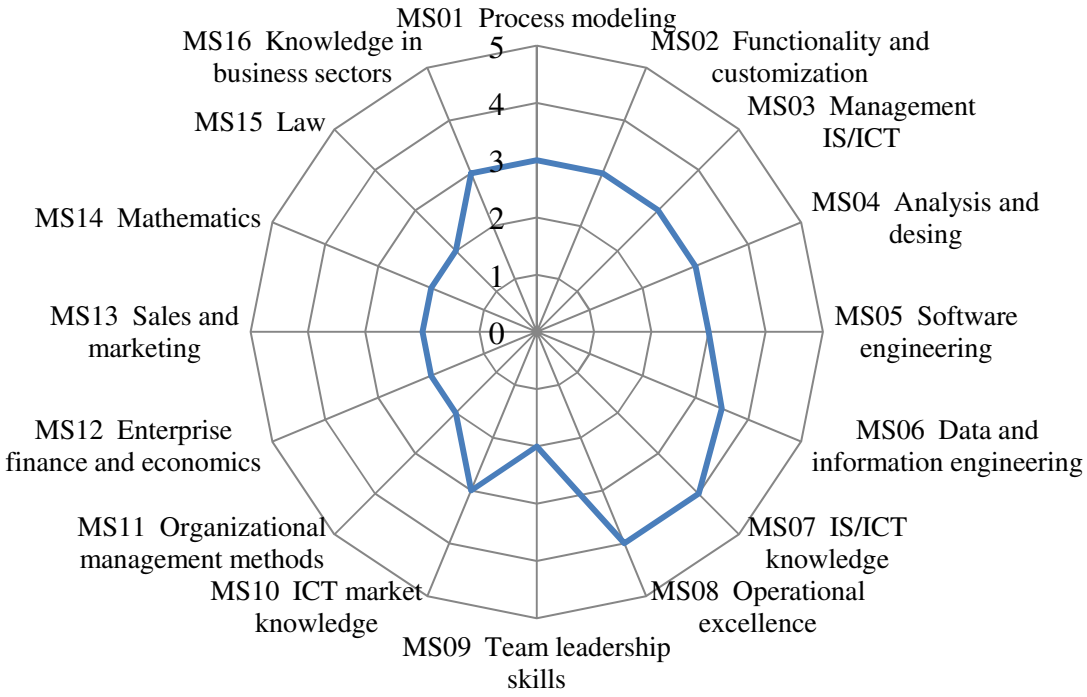

Figure 2 Requirements on Knowledge in SIT

Here is visible higher accent on operational excellence (Domain MS08) and data and information engineering. Requirements on "non-ICT" knowledge are lower than by MIT sector except knowledge of appropriate business – "MS16 - Knowledge in specific business sectors".

VIT Sector

As is visible on Figure 3, requirements on ICT knowledge are rather similar as in MIT sector, but requirements on knowledge in "non-ICT" domains are lower than in MIT sector.

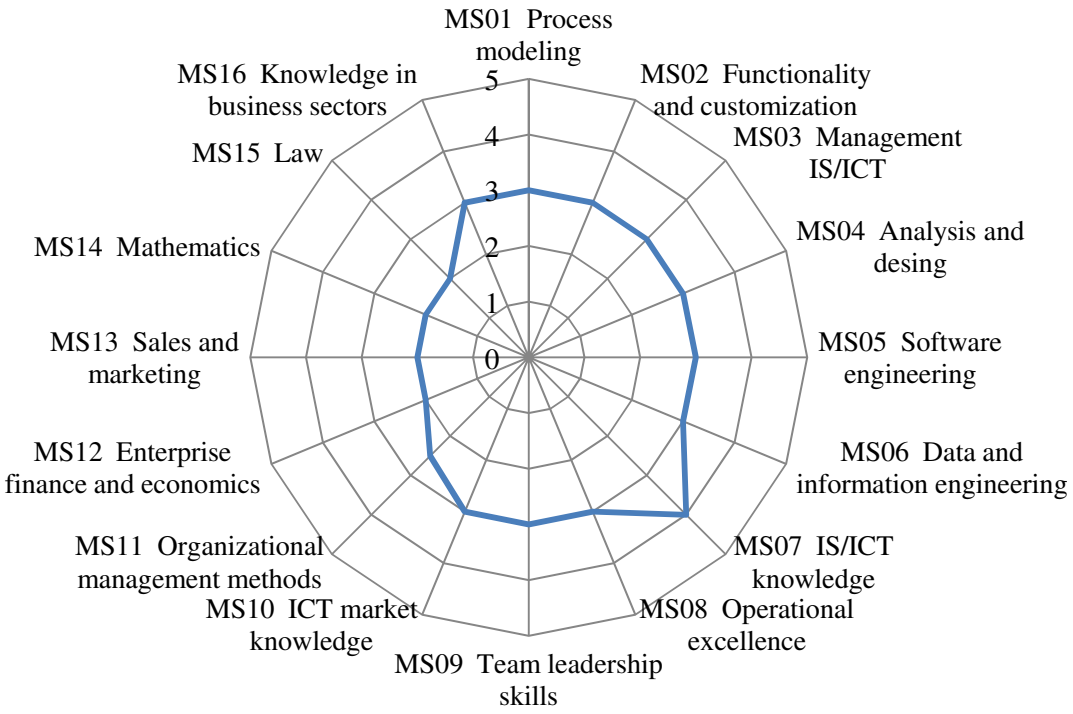

Figure 3 Requirements on Knowledge in VIT

4.2 Medium enterprises 50-249 employees

This group represents a little less than 1 % of active business units on the Czech market (Table 1). These companies has a lot of similar characteristic as a small companies. Those are adaptable to changes in the economic environment. These companies use small companies sometimes as subcontractors if they have bigger projects or contracts etc. On contrary medium companies usually exist for a longer period so they are established, they have credit history so they have easier access to capital and loans. Medium companies have also some negatives aspects. Medium companies have segregated management and the relations among users and employees can be worse than in small companies.

MIT Sector

There are typical higher requirements on ICT knowledge in domains “MS07 - IS/ICT knowledge” and “MS08 - Operational excellence” for medium enterprises.

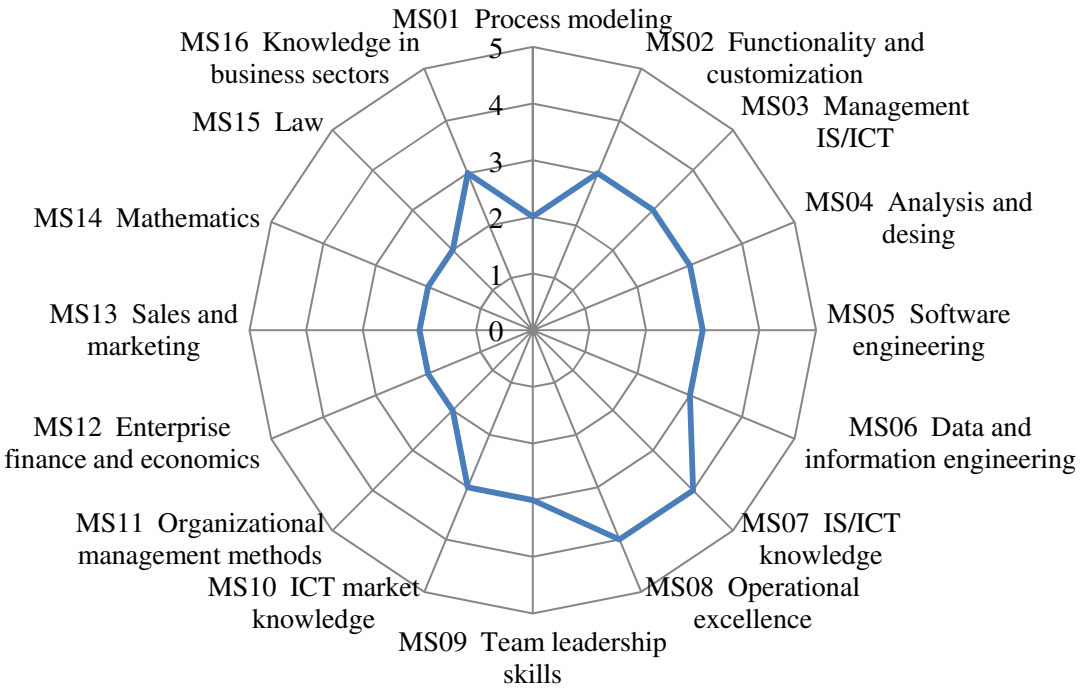

Figure 4 Requirements on Knowledge in MIT

From "non-ICT" knowledge is most attractive the domain oriented on appropriate business knowledge "MS16 - Knowledge in specific business sectors".

SIT Sector

The characteristics of our results is almost similar to MIT ones. It is visible on Figure 5 only one difference – requirements on the knowledge domain MS01 - Process modeling. Expectations on this domain are little higher than by MIT sector.

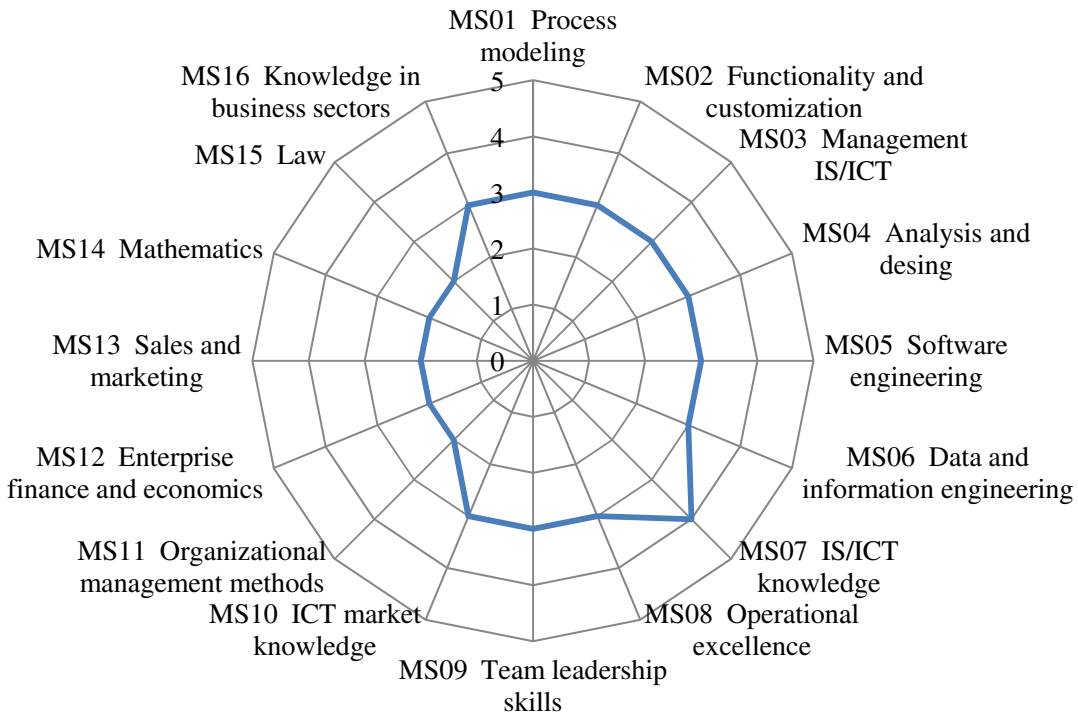

Figure 5 Requirements on Knowledge in SIT

VIT Sector

The VIT sector expectations are rather similar to previous two categories, only knowledge in domains “MS07 - IS/ICT knowledge” and “MS08 - Operational excellence”are lower than by MIT.

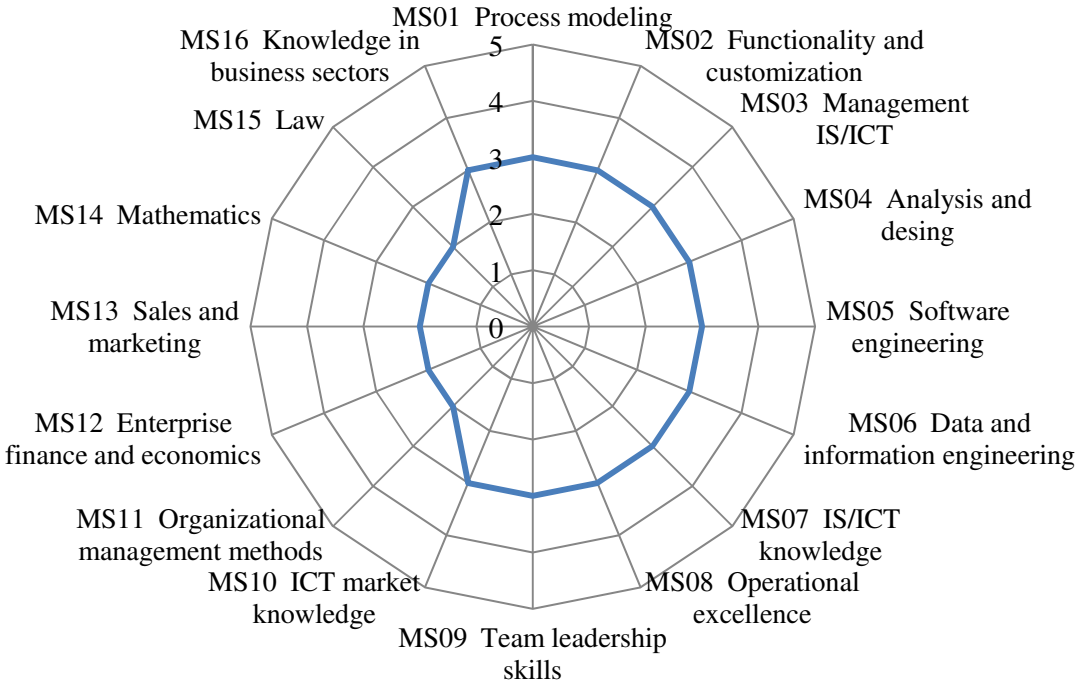

Figure 6 Requirements on Knowledge in VIT

5. Analysis of Differences in Requirements Between Small and Medium Enterprises

This chapter is devoted to description of changes in requirements on analyzed roles in small and medium enterprises. We are compared average and median values in small and medium enterprises.

The Table 2 describes average and median knowledge required by companies in sector MIT and number of employee lower than 50.

We see that required level of knowledge reach value 3 or 4 in ICT knowledge domain (MS02-MS08). There is one exception in the ICT knowledge domains – MS01 which is on the level 2. On contrary requirements are smaller in the "non-ICT" knowledge domain. Requirements reach level 2 or 3) in the he second one group of knowledge domain.

The knowledge level is required in majority of knowledge domain on the same level in small and medium enterprises. There are only two exceptions in knowledge domains "MS01 Process modeling" and "MS08 - Operational excellence". Medium companies require lover level of knowledge domain "MS01 Process modeling" and higher level of knowledge in domain "MS08 - Operational excellence".

Medium and Small enterprises require knowledge in 75% knowledge domains on the same level.

Table 2 Change in Knowledge Requirements between Small and Medium Enterprises in MIT

	Avg (Small)	Avg (Medium)	Change	Median (Small)	Median (Medium)	Change
MS01	2,56	2,41	↓	3,00	2,00	↓
MS02	3,00	2,66	↓	3,00	3,00	→
MS03	2,91	2,84	↓	3,00	3,00	→
MS04	3,00	2,89	↓	3,00	3,00	→
MS05	2,83	2,73	↓	3,00	3,00	→
MS06	2,88	2,84	↓	3,00	3,00	→
MS07	3,60	3,44	↓	4,00	4,00	→
MS08	3,46	3,20	↓	3,50	4,00	↑
MS09	2,32	2,46	↑	3,00	3,00	→
MS10	2,72	3,00	↑	3,00	3,00	→
MS11	2,16	2,35	↑	2,00	2,00	→
MS12	2,12	2,21	↑	2,00	2,00	→
MS13	2,12	2,06	↓	2,00	2,00	→
MS14	2,38	2,43	↑	3,00	2,00	↓
MS15	2,48	2,33	↓	3,00	2,00	↓
MS16	2,96	2,83	↓	3,00	3,00	→

The Table 3 describes average and median knowledge required by Small and Medium enterprises that are defined as companies' with medium requirements and dependence on ICT.

We see that results in Median columns are different. Companies require the same level of knowledge in first five knowledge domains and also in knowledge domain "MS07 - IS/ICT knowledge". Different situation is in knowledge MS06 in which Medium companies are

expecting lover knowledge level than Small companies and knowledge domain "MS08 - Operational excellence" where inverse situation is.

Medium and Small enterprises require knowledge in 75% knowledge domains on the same level.

Table 3 Change in Knowledge Requirements between Small and Medium Enteprises in SIT

	Avg (Small)	Avg (Medium)	Change	Median (Small)	Median (Medium)	Change
MS01	2,68	2,74	↑	3,00	3,00	→
MS02	2,71	3,12	↑	3,00	3,00	→
MS03	2,92	2,87	↓	3,00	3,00	→
MS04	2,64	3,06	↑	3,00	3,00	→
MS05	2,64	2,76	↑	3,00	3,00	→
MS06	2,96	2,99	↑	3,50	3,00	↓
MS07	3,36	3,57	↑	4,00	4,00	→
MS08	3,38	3,34	↓	4,00	3,00	↑
MS09	2,58	2,73	↑	2,00	3,00	↑
MS10	3,04	2,82	↓	3,00	3,00	→
MS11	2,20	2,38	↑	2,00	2,00	→
MS12	2,60	2,19	↓	2,00	2,00	→
MS13	2,24	2,09	↓	2,00	2,00	→
MS14	2,24	2,39	↑	2,00	2,00	→
MS15	2,32	2,11	↓	2,00	2,00	→
MS16	2,84	2,82	↓	3,00	3,00	→

The Table 3 describes average and median knowledge required by Small and Medium enterprises in sector VIT.

The last table presents results for companies which are heavily dependent on ICT. Average requirements on knowledge are smaller in ICT knowledge domain in Medium companies. Results in companies which are highly dependent on ICT are similar to previous types of companies. Requirements are similar in knowledge domains MS01-MS06 and "MS08 - Operational excellence" in ICT knowledge domains and smaller are only in "MS07 - IS/ICT knowledge" where small companies require level 4 and medium companies only level 3.

Medium and Small enterprises require knowledge in 69% knowledge domains on the same level.

Table 4 Change in Knowledge Requirements between Small and Medium Enterprises in VIT

	Avg (Small)	Avg (Medium)	Change	Median (Small)	Median (Medium)	Change
MS01	2,55	2,47	↓	3,00	3,00	→
MS02	3,03	2,98	↓	3,00	3,00	→
MS03	2,99	2,84	↓	3,00	3,00	→
MS04	3,15	2,97	↓	3,00	3,00	→
MS05	2,65	2,65	→	3,00	3,00	→

	Avg (Small)	Avg (Medium)	Change	Median (Small)	Median (Medium)	Change
MS06	3,04	2,85	↓	3,00	3,00	→
MS07	3,42	3,41	↓	4,00	3,00	↓
MS08	3,29	3,21	↓	3,00	3,00	→
MS09	2,72	2,73	↑	3,00	3,00	→
MS10	2,69	2,70	↑	3,00	3,00	→
MS11	2,40	2,13	↓	2,50	2,00	↓
MS12	1,91	1,95	↑	2,00	2,00	→
MS13	1,90	1,75	↓	2,00	2,00	→
MS14	2,31	1,96	↓	2,00	2,00	→
MS15	1,99	2,15	↑	2,00	2,00	→
MS16	3,18	2,81	↓	3,00	3,00	→

6. Conclusions

The fist conclusion that we have got from our survey is, that there are not basic differences between requirements on ICT and "non-ICT" knowledge and skills for SMEs according to the sector of the economy. There are no essential differences in requirements between MIT, SIT and VIT sectors. Other important conclusion is that there were no identified essential differences between small and medium enterprises.

Other very interesting facts were identified differences in ICT knowledge domains. We identified larger requirements on ICT knowledge by small enterprises; on the other hand medium enterprises have higher requirements on "non-ICT" knowledge.

Higher requirements on ICT knowledge for small business units mirror necessity to solve all ICT related problems with lower number of employees. This fact causes demand on more complex educated employees – persons who are able to apply general knowledge about relation of ICT and appropriate business. On the other hand there are not required very special educated employees.

On the other hand, higher requirements on "non-ICT" knowledge for medium business units reflect needs of the team work. In working teams are usually co-operating ICT specialists with business oriented employees in this type of companies. This fact evokes necessity to be able of effective work in interdisciplinary teams and that is why are increasing requirements on communication, presentation, leading skills, economy etc.

7. Aknowledgement

Paper was processed with contribution of GAČR by handling task "P403/11/1899 Sustainability support of SME based on ICT innovation" and the internal task University of Economics, Prague - IGA 409061.

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THE ECONOMY INTELLECTUALIZATION MANAGEMENT IN UKRAINE

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ABSTRACT:
Organizational and economic aspects of management of Ukraine's economy intellectualization have been described. Corresponding terms, a control system, priorities and purposes of management intellectualization have been offered.

KEYWORDS:
Economy intellectualization, Ukraine's economy, organizational and economic aspects of management

1. Theoretical aspects of economy intellectualization management

Changes in production structure which are taking place at the end of XX - beginning XXI centuries in particular, an increasing proportion of non-material production, information technology, increasing competition in the markets, the spread of globalization, have led to the need for changes in theoretical approaches to the problem of economic growth. Non-material factors of production – knowledge, software, information, training system are playing ever more important role in its ensuring. Rapid economic growth is impossible without a developed system of science and higher education, which together form the intellectual capital of the nation and provide a process of intellectualization of the economy.

The development of the above phenomena, despite their importance, has not yet found an adequate theoretical grounding in modern economic science. Accordingly, there is an important economic problem: the existing guidelines of economic policy aimed at promoting economic growth, do not take into account the main modern trends. In Ukraine, this leads to reduction of economic development rates.

Intellectualization is an objective economic process that affects economic growth of the country. As this process can be regulated, its key figures should be analysed to affect its economic growth. This raises the importance of economy intellectualization regulation. Although its theoretical and methodological principles have not yet been developed, it is urgent to investigate this field.

Recently, more scientists in their investigations consider innovation processes and development of national innovation system (NIS) to be the main factor of economic growth. In particular, L.I. Fedulova and I.A. Shovkun, state that "In the last decade, the use of innovative factors in the formation of development strategies in the developed world has become of paramount importance…". This is explained by the influence of trends in the global economy (Fedulova, Shovkun, 2009).

I. Radionova claims that "The account of human capital factor marked a new stage in the growth theory development." The author notes that "human capital is a reflection of knowledge stock, skills, abilities and motivation of employees to productive activities, and may accrue as a result of investment in certain areas: basic education and training system, medicine, information infrastructure" [Radionova, 2009].

V.P. Solovyov has identified the main trends of innovative field development [Solovyov, 2009]:

- growth of not only the importance but also the responsibility of science and education;
- increase of the share of investments in education and personal development in GDP structure;
- changes in the structure of budget expenditures for science about man and society and life sciences;
- rise of inventive activity, expanding the market of intellectual activity products;
- increasing the business potential of innovative activity;
- increase of investment in innovative recovery of the main capital.

A range of studies on this issue have been made by researchers of the State University "The Institute of Economics and Economic Forecasting". The central role in the creation of innovation in this work is given to the field of science (for empirical studies of R & D), which develops new products that are subsequently sold on the market as an innovation that gives impetus to economic growth. In order to develop economy intellectualization principles there must be an appropriate terminology. We understand economy intellectualization management as the process of direct influence on the creation and accumulation of knowledge and skills in the society to apply them according to defined priorities and objectives.

The object of management in this process is the intellectualization of Ukraine's economy. The subject – the development and application of tools and methods to control the activity of creation, storage, processing and transmission of knowledge in the economy.

As an individual case we can consider a process of economy intellectualization at the level of international associations. A striking example is the European Union, where the questions of creation and transfer of knowledge are paid special attention to and properly invested. The advantage of such management is the presence of greater investment and intellectual capabilities, which allows to accumulate high level of necessary resources in the necessary points of development. However, this method of management will be effective only with the efficient support of the governments of the countries within the Union and when points of growth are picked up correctly.

In this study we focused on the macro level, respectively, and the further investigation will be devoted to intellectualization management at the whole country level. To do this, we will point out its functions:

- intellectualization planning of the economy;
- intellectualization of the economy analysis;
- economy intellectualization organization;
- economy intellectualization control.

The first of them comes down to developing a package of measures to promote the economy intellectualization and the system of indicators and the stages of their implementation. The second, based on the developed system of indicators, should help to determine the state and dynamics of intellectualization to provide accurate management information to the authorities.

The essence of intellectualization functions is implemented by executing the plans and measures to develop a process of economy intellectualization in the country. The control function provides a clear control system of fulfilment of plans and measures that can be divided into preliminary, current and final. Preliminary implies initial economy intellectualization state and development of staged implementation of the action plan. Current - a system of phased evaluation of the implementation action plan for development economy intellectualization, as a result of which implemented measures to correct existing deviations are being provided. The final control - evaluation of the final action plan which includes a current difference of the final results from the planned and the system management solutions based on this assessment.

Based on the nature of management, that is, situational – strategic decisions made as potential problems are identified, and target – management method based on the selection of the most important tasks within the given period, which solutions are enhanced by the main efforts of managing organizations, prioritization and management objectives are defined based on the analysis of current problems which restrain the controlled development process.

2. Problems that hinder the development of intellectualization

In determining the major problems hindering the development of intellectualization we analyzed those that are common to most developed countries, including USA, EU, Southeast Asia.

Investment provision

It is one of the major problems of economy intellectualization which is almost equally acute in most countries. The level of investment is one of the main levers to control inflow / outflow of intellectual capital into and out of the sector. It identifies opportunities for realization of innovation and investment projects, etc. Accordingly, the appropriate level of investment determines possibilities of goals and priorities realization in management and its terms. The term "appropriate level" means empirically reasonable value associated with the terms and importance to achieve the set goals.

The development of intellectual potential level

Insufficient level of intellectual potential is one of the main problems hindering the development of intellectualization process. To achieve the set goals in the process of management, it is necessary to have individual, the team that will implement them, and the level of goals will be determined by the level of intellect required for their implementation. If e.g. one of the objectives of economy intellectualization is to create a database that would connect all university libraries of the country, it would require specialists who could technically realize it. The technical parameters of such a database would define the required level of their qualification. Lack of such specialists in the country demands inviting people from abroad, training them etc, which may be in the way of achieving goals on time.

Low level of interconnection between education and science

The abovementioned problem is a specific one, with its acuteness being different for different countries and depending on the structure of education and science systems. In countries where the centers of knowledge creation are generally attached to the universities, this problem is less acute than in cases with the departments isolated from the educational establishment. But quite obvious is the fact that the “depth” of the problem affects the objective accomplishment of intellectualization management because a delayed

transmission of knowledge from the centers of production to the centers of transference hinders achieving goals.

Level of technologies development

This problem is related to problem No. 2 "The Level of Intellectual Potential Development", because the level of intellectual potential alongside the level of investment provision determine the technological potentials of the country, which are decisive in determining the reality and terms of accomplishment of intellectualization objectives. Developing new technologies is a long-term process which requires proficient specialists, investments, time. Hence two conclusions: it's expedient to efficiently use available technologies and to foresee timely the demand to create new ones. In some cases the creation of new technologies requires offsetting of whole technological branches.

3. Implementation of the results of economy intellectualization in the sphere of entrepreneurship

As intellectualization affects the economic processes in the country, the degree of interaction between the centers of knowledge development and exchange with entrepreneurship sphere will determine the level of innovation activeness in economy, which afterwards will result in the rise of their indices. Accordingly, harmonic interaction in this area promotes rapid solution of the objectives in the sphere of intellectualization. After all, investing in intellectualization depends on the results of economy performance: if it does not work effectively, the process of intellectualization would not be properly provided in terms of investments, which will hinder attaining management objectives.

System of management of economy intellectualization

An appropriate management of economy intellectualization should be based on adequate system. It will include state power bodies related to the production, transferring and marketing of knowledge. Taking into account essential differences in the structure of authorities which organize and monitor the work of economy intellectualization areas in different parts of the world, we have suggested the system of economy intellectualization management on the example of Ukraine.

Achieving a high level of economy intellectualization management requires coordination of activities of executive and legislative bodies. To coordinate their efforts it is suggested to set up a common state committee of economy intellectualization. It is expected to pool and organize interaction of other state bodies, regional administration, regional councils, Ministry of Education, Science, Youth and Sports, National Academy of Science of Ukraine.

The activities of the committee should be controlled by public organizations which are designed to ensure publicity and effectiveness of its work. Regional authorities are supposed to organize participation of regional institutions and firms of business promotion, innovations, research and personnel training. MESYS is entitled to implement measures in the system of education, higher education in particular.

The National Academy of Sciences must carry out steps in the framework of academic science. An effective work on economy intellectualization management is supposed to be based on the solutions of a common document, generally of a long-term conception. It should be carried out under the guidance of Economy Intellectualization Committee with the participation of all abovementioned state bodies and public organizations. It should contain the major priorities of economy intellectualization and their implementation

objectives approved at the level of the Supreme Council of Ukraine and adopted for execution. A sample list of its priorities and objectives is given in table 1.

Table 1. Priorities and objectives of management of economy intellectualization

Priority	Objective
Implementation of the system of research and recommendations, competitive on the world market	1.1. Improvement of investment provision of research and development
	1.2. Recruiting and training of talented youth for work in the science areas
	1.3.Developing of effectively functioning regional net of research centres (clasters)
	1.4. Study and implementation of up-to-date innovations of world science and technology, development of international science cooperation
Providing qualitative higher education	2.1. Improvement of investment provision of higher education area
	2.2. Implementing the system of international standards with due consideration of Ukraine's specificies
	2.3. Enforcement of the staff working in higher schools, training young talented teachers
	2.4. Providing qualitative educational services to management systems
Integration of higher education implementation and science spheres	3.1. Development of the process of new knowledge implementation in the sphere of higher education
	3.2. Forming effectively functioning scientific-educational complexes
	3.3. Introduction of a competitive system of state investing allocation, aimed at developing science and education
Enforcement of the role of intellectualization as a development basis of innovation processes in Economy	4.1. Forming a network of intellectual innovation clusters
	4.2.Ensuring the work of institutions investment provision for the process knowledge - innovation transformationl
	4.3. Forming social institutions beneficial for the development of interaction of education, science and business

For its successful accomplishment the concept should have a detailed schedule of measures with the description of annual lists of tasks and names of those responsible for the execution. It should be well-structured and divided into all-state schedule of actions and regional schedule of actions, in which the executors will correspondingly be all-state and regional authorities (as well as unions of higher schools, scientific training complexes, research institutions etc).

Due to the fact that it is the state which is interested in the development of intellectualization process, the principal contribution to investing management should also be executed by the state. For achieving this aim the program-target method seems to be most appropriate. In the state budget of Ukraine the costs for the state provision of economy intellectualization of the country should be allocated. These costs should be directed for committee foundation, payments for the staff, organizational and technological purposes, training, adoption of the state conception of economy intellectualization in Ukraine.

Further development of the management vertical line of economy intellectualization requires involvement of public organizations, which are entitled to carry out public monitoring of its functioning and implementation of the elaborated conception.

4. Conclusions

Taking into consideration the expediency of management process of economy intellectualization and on the grounds of the carried out analysis, a definition of the economy intellectualization management has been suggested, the latter being understood as a process of purposeful impact on creating and accumulating by the society knowledge, and skills of how to apply it according to set priorities and objectives. The functions of this notion have been grounded, these being economy intellectualization planning, economy intellectualization analysis, economy intellectualization organization, economy intellectualization monitoring. A system of management has been carried out. The definition of the policy of management has been given, this being the totality of methods and tools of implementation of economy intellectualization management. The priorities and objectives of the conception have been listed. All this, in its integrity , provides instruments for a state management of economy intellectualization and gives grounds for its effective investing ensuring.

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INFORMAČNÍ PROCESNÍ PORTÁL VYBUDOVANÝ NA ZÁKLADĚ SW NÁSTROJE ATTIS4 V PROSTŘEDÍ FAKULTY EKONOMICKO-SPRÁVNÍ, UNIVERZITY PARDUBICE

PROCESS INFORMATION PORTAL BASED ON SW TOOL ATTIS4 AT THE UNIVERSITY OF PARDUBICE, FACULTY OF ECONOMICS AND ADMINISTRATION

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ABSTRAKT:

Tento příspěvek shrnuje poznatky z implementace Informačního procesního portálu Univerzity Pardubice založeného na SW nástroji ATTIS4, který byl vybudovaný v rámci dodávky „Aplikace pro modelování procesů a řízení dokumentace“, který je součástí projektu CZ.1.07/2.2.00/07.0107 „Implementace moderních řídících postupů s akcentem na řízení kvality a rozvoj procesních řízení“.

Cíle projektu byly:

- připravit SW řešení pro modelování a řízení procesů (BPM),
- navrhnout a zajistit vhodné nástroje pro tvorbu a řízení procesní dokumentace (TD) a vytvořit úložiště řízených dokumentů,
- vytvořit procesní model fakulty,
- vytvořit informační procesní portál (dále také jen IPP) a zpřístupnit tak vytvořený procesní model včetně související procesní dokumentace ostatním uživatelům (zejména zaměstnanci, případně studenti fakulty),
- zajistit, aby byl realizační tým výše uvedeného projektu (resp. jeho dílčí část) schopen vytvořit, udržovat konzistenci a dále rozvíjet procesní model univerzity prostřednictvím výše uvedeného softwarového řešení (BPM), nástrojů pro tvorbu a řízení procesní dokumentace (TD) a informačního procesního portálu (IPP),
- zajistit, aby byl realizační tým výše uvedeného projektu (resp. jeho dílčí část) schopen výše uvedené systémy a nástroje udržovat a dále rozvíjet.

ABSTRACT:

This article sums up the knowledge gained during the implementation of Process Information Portal based on SW tool ATTIS4 at the University of Pardubice, Faculty of Economics and Administration. The portal was bulit up during the delivery of „Application for proces modelling and document management“, which is part of project CZ.1.07/2.2.00/07.0107 „Implementation of modern management practices, with an emphasis on quality management and development of process management“.

Objectives of the project:

- prepare software solutions for modeling and process management (BPM),
- design and provide appropriate tools for the creation and management of process documentation (TD) and managed to create a repository of documents,

- create a process model of fakulty,
- create an information portal (hereinafter referred to as IPP) and make so created a process model including related process documentation to other users (the employees, students,…),
- ensure that the implementation team of the project (or its partial part) will be able to create, maintain consistency and develop a process model of the University through the above-mentioned software solutions (BPM) tools for the creation and management process documentation (TD) process and information portal (IPP),
- ensure that the implementation team of the project (or its partial part) will be able to fit the above systems and tools to maintain and further develop.

KLÍČOVÁ SLOVA
Procesní informační portál, procesní model, modelování procesů, procesní řízení, řízená dokumentace, úložiště dokumentů, univerzita

KEYWORDS
Proces information portal, proces model, proces modeling, proces management, document management, document repository, university

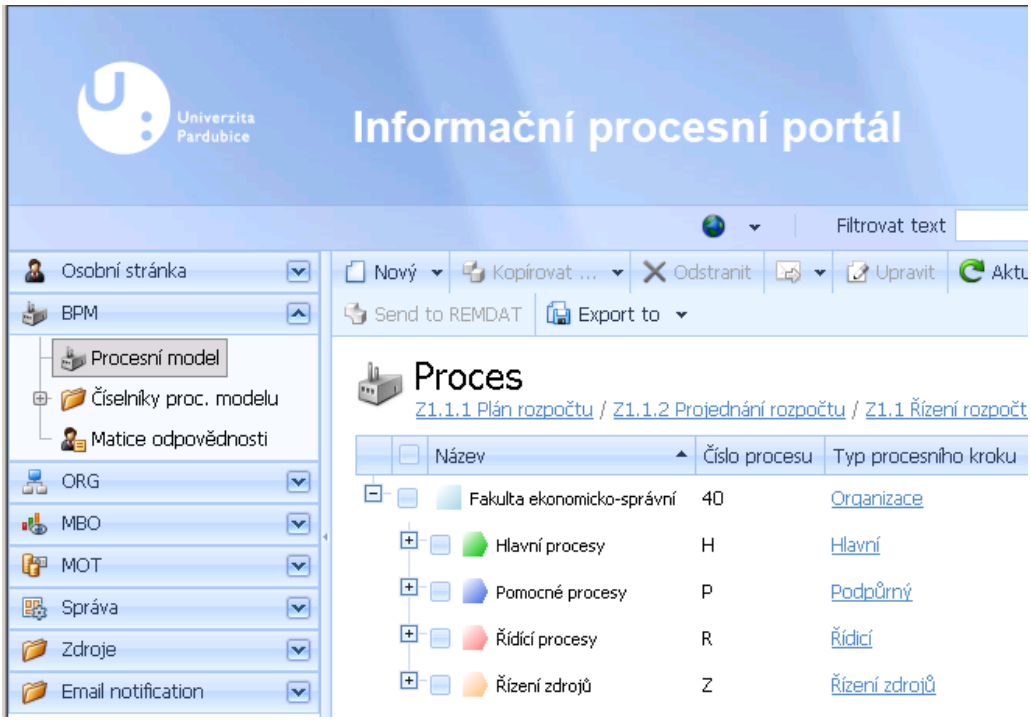
1. SW nástroj ATTIS4

Nejnovější verze SW nástroje ATTIS4 společnosti ATTN Consulting s.r.o. plně pokrylo požadavky projektu, který byl realizovaný obchodním partnerem společností Ders s.r.o. Pro informační a procesní portál byla využita webová část, tzv. tenký klient, kdy uživatelé univerzity přistupují ke všem informacím a částem řešení (procesnímu modelu, procesní dokumentaci) pomocí webového prohlížeče. Plnohodnotný modelář procesů v tlustém klientu sw nástroje ATTIS4 je využitý pro tvorbu procesního modelu Fakulty ekonomicko-správní a ke generování výstupů procesní dokumentace, která je v tomto nástroji dále řízena. Řešení je integrováno s dalšími informačními systémy Univerzity Pardubice. Popis integrační části je uvedený v samostatné části tohoto příspěvku.

2. Informační a procesní portál

Informační procesní portál (dále jen IPP) primárně slouží jako informační podpora pro implementaci „systému řízení kvality a procesů“ Fakulty ekonomicko-správní se schopností tvorby báze znalostí organizace.

Tenký klient aplikace ATTIS4 umožňuje prezentaci informací o existujících procesech (karta procesu) a jejich hierarchii (procesní strom), včetně souvisejících řídících a dalších dokumentů (procesní postupy, vnitřní legislativa, formuláře či vzory dokumentů), zobrazení grafické podoby procesu, linků na související procesní modely, vazeb procesů na procesní role a pracovní místa.



Obr. 1: Procesní strom v IPP s možností zobrazení jednotlivých větví stromu

Obr. 2: Zobrazení grafického diagramu procesu

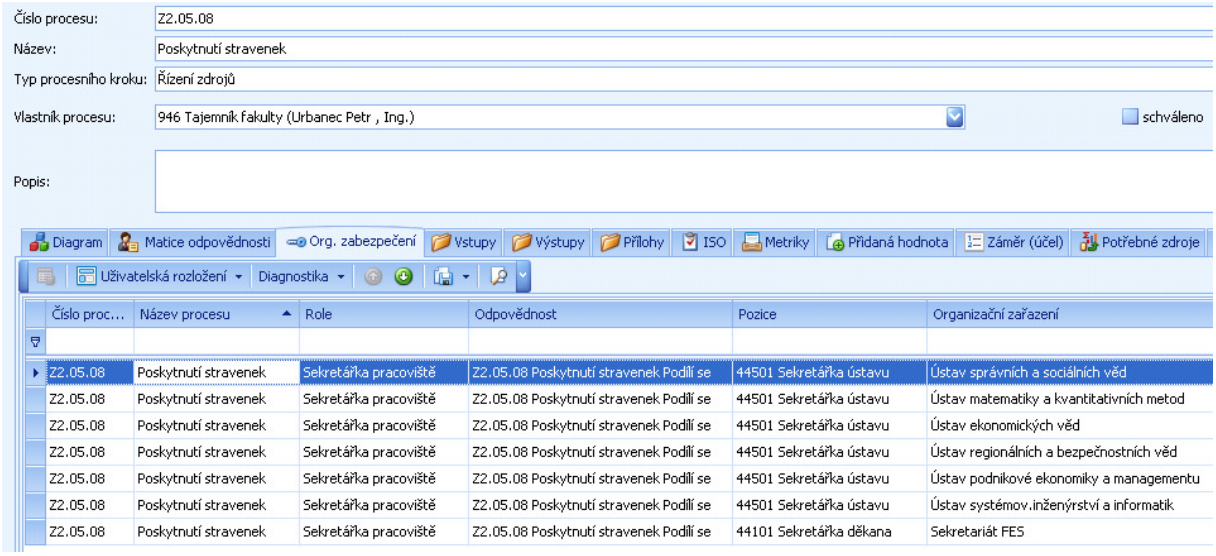
Standardní funkcionalitou IPP je filtrování zobrazení (personalizace) informací o procesních modelech podle vazeb procesního modelu na konkrétní procesní role (a následně konkrétní osoby) a dle příslušnosti uživatele ke konkrétnímu organizačnímu útvaru.

IPP obsahuje funkcionalitu vyhledávání informací o procesech a informací z dalších dokumentů podle různých kritérií, např. podle klíčových slov, umístění procesů v rámci hierarchie a fulltextově.

IPP vytváří ke každému procesu „nástěnku procesu“, která nabízí možnost pořizování libovolných textových nebo obrazových dat běžnými uživateli systému, např. postupy,

doporučení, poznatky nebo podněty na změny procesů v rámci jejich optimalizace. Jedná se o prostředek zpětné vazby. Druhou významnou částí nástěnky je možnost vkládání dokumentů a jejich řízení vlastníkem procesu. Nástěnka procesu je popsána v další části tohoto příspěvku. Portál IPP umožňuje uživateli zobrazit buď informace o všech procesech, ke kterým má přístup (na základě příslušnosti ke konkrétní organizační jednotce), nebo na základě informace o všech procesních rolích, které má tento uživatel přiřazen, zobrazit pouze ty procesy, které jsou s těmito rolemi spojeny.

IPP zobrazuje uživateli všechny procesy, které jsou realizovány na jeho pracovišti, a současně zobrazuje informaci o osobách, které na jeho pracovišti konkrétní procesní role zajišťují.



Číslo proc...	Název procesu	Role	Odpovědnost	Pozice	Organizační zařazení
Z2.05.08	Poskytnutí stravenek	Sekretářka pracoviště	Z2.05.08 Poskytnutí stravenek Podílí se	44501 Sekretářka ústavu	Ústav správních a sociálních věd
Z2.05.08	Poskytnutí stravenek	Sekretářka pracoviště	Z2.05.08 Poskytnutí stravenek Podílí se	44501 Sekretářka ústavu	Ústav matematiky a kvantitativních metod
Z2.05.08	Poskytnutí stravenek	Sekretářka pracoviště	Z2.05.08 Poskytnutí stravenek Podílí se	44501 Sekretářka ústavu	Ústav ekonomických věd
Z2.05.08	Poskytnutí stravenek	Sekretářka pracoviště	Z2.05.08 Poskytnutí stravenek Podílí se	44501 Sekretářka ústavu	Ústav regionálních a bezpečnostních věd
Z2.05.08	Poskytnutí stravenek	Sekretářka pracoviště	Z2.05.08 Poskytnutí stravenek Podílí se	44501 Sekretářka ústavu	Ústav podnikové ekonomiky a managementu
Z2.05.08	Poskytnutí stravenek	Sekretářka pracoviště	Z2.05.08 Poskytnutí stravenek Podílí se	44501 Sekretářka ústavu	Ústav systémov.inženýrství a informatik
Z2.05.08	Poskytnutí stravenek	Sekretářka pracoviště	Z2.05.08 Poskytnutí stravenek Podílí se	44101 Sekretářka děkana	Sekretariát FES

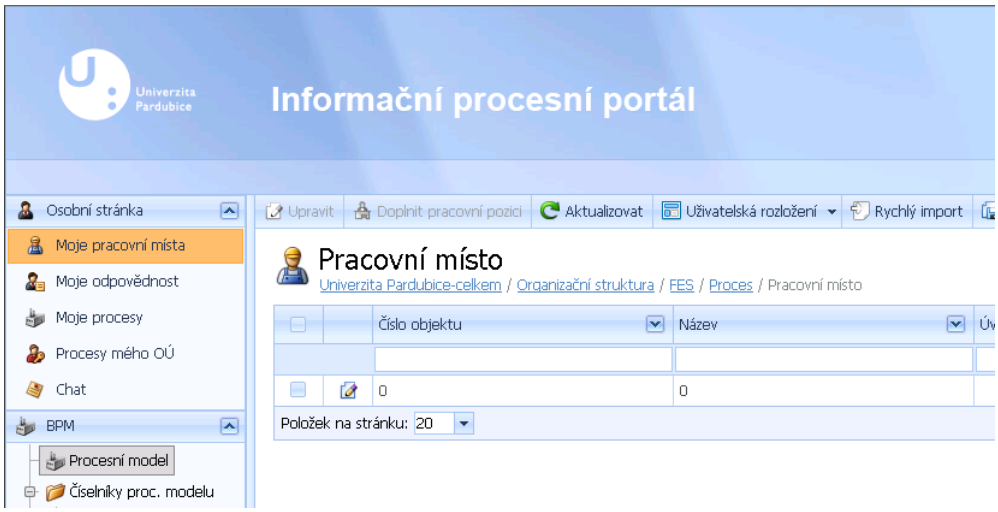
IPP dále zajišťuje uživatelsky konfigurovatelnou e-mailovou notifikaci uživatelů o nově publikovaných nebo aktualizovaných objektech (procesech, dokumentech, obsahu „nástěnky“).

3. Osobní stránky zaměstnanců

V rámci IPP je dostupná pro všechny zaměstnance tzv. osobní stránka, která pro konkrétního uživatele přihlášeného do portálu nabízí personifikaci údajů z procesního modelu a organizačních vazeb.

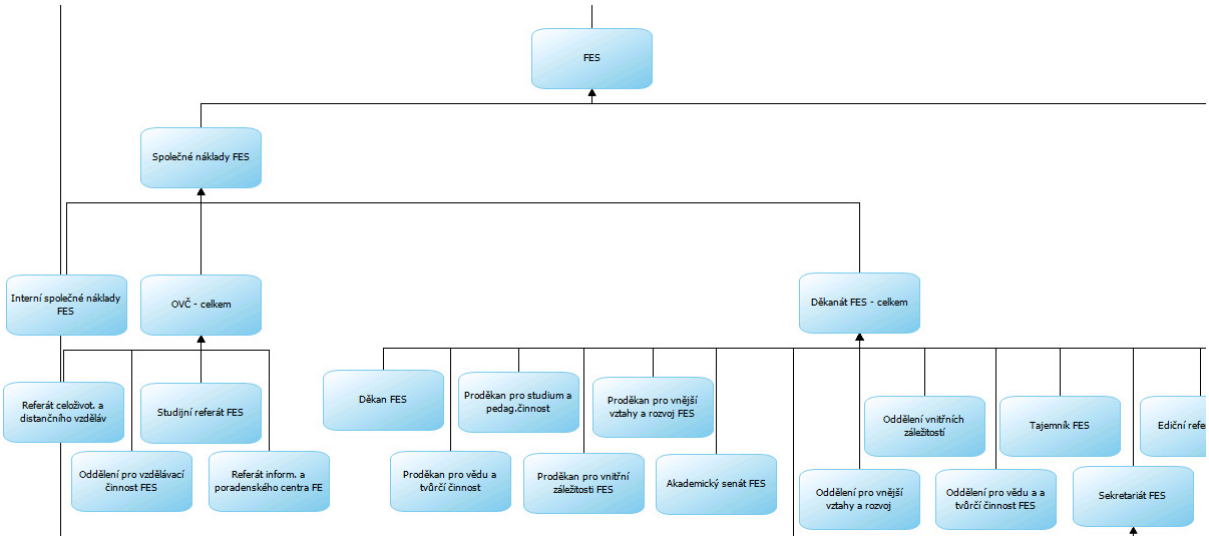
Součástí osobní stránky uživatele jsou tyto informace:

- Moje pracovní místa – seznam a popis pracovních míst
- Moje odpovědnost – seznam odpovědností (činností) uživatele v procesních krocích
- Moje procesy – seznam procesů, kde je daný uživatel vlastníkem procesu
- Procesy mého OÚ – seznam procesů, které jsou vykonávány v rámci mého organizačního útvaru



4. Organizační struktura, organizační vazby

V modulu ATTIS.ORG je znázorněna organizační struktura fakulty, jsou zde uloženy seznamy osob, pracovních pozic, pracovních míst, tedy všechny informace potřebné pro tvorbu organizačních vazeb a organizačního zabezpečení procesů. Celá tato část byla vytvořena integrační částí projektu, kde jsou informace (objekty) získávány z dalších informačních systému Univerzity Pardubice. Organizační struktura je rovněž dostupná uživatelům prostřednictvím portálu IPP.



Obr. 3: Zobrazení části organizační struktury, nákladových středisek

Modul ATTIS.ORG obsahuje řadu číselníků:

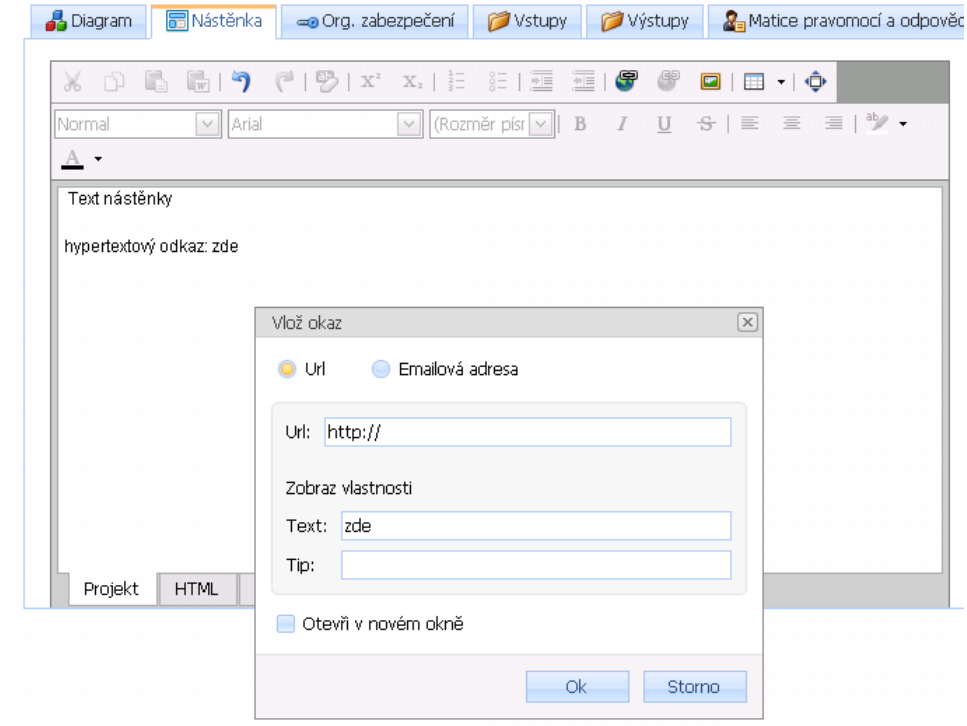
- Seznam organizačních jednotek
- Seznam osob
- Seznam pracovních pozic
- Seznam typů pozice
- Seznam pracovním míst

5. Nástěnka procesu

Nástěnka procesu jako součást IPP slouží k poskytování zpětné vazby uživatelů (zaměstnanců, studentů) k procesům, k návrhům jejich změn, optimalizacím nebo dalším různým podnětům na jejich zlepšení.

Hlavní funkční části nástěnky:

- vkládání libovolného formátovaného textu, hypertextových odkazů a obrázků
- tvorba „podstránek“, na které bude možné z hlavní stránky „nástěnky“ přistupovat pomocí hypertextového odkazu
- nástroj pro vkládání (řízených i „neřízených“) dokumentů (procesní postupy, legislativní dokumenty, formuláře či vzory dokumentů)
- integrace s dalšími informačními systémy Univerzity Pardubice (zejména centrální úložiště digitálních dokumentů)



Obr. 4: Nástěnka procesu

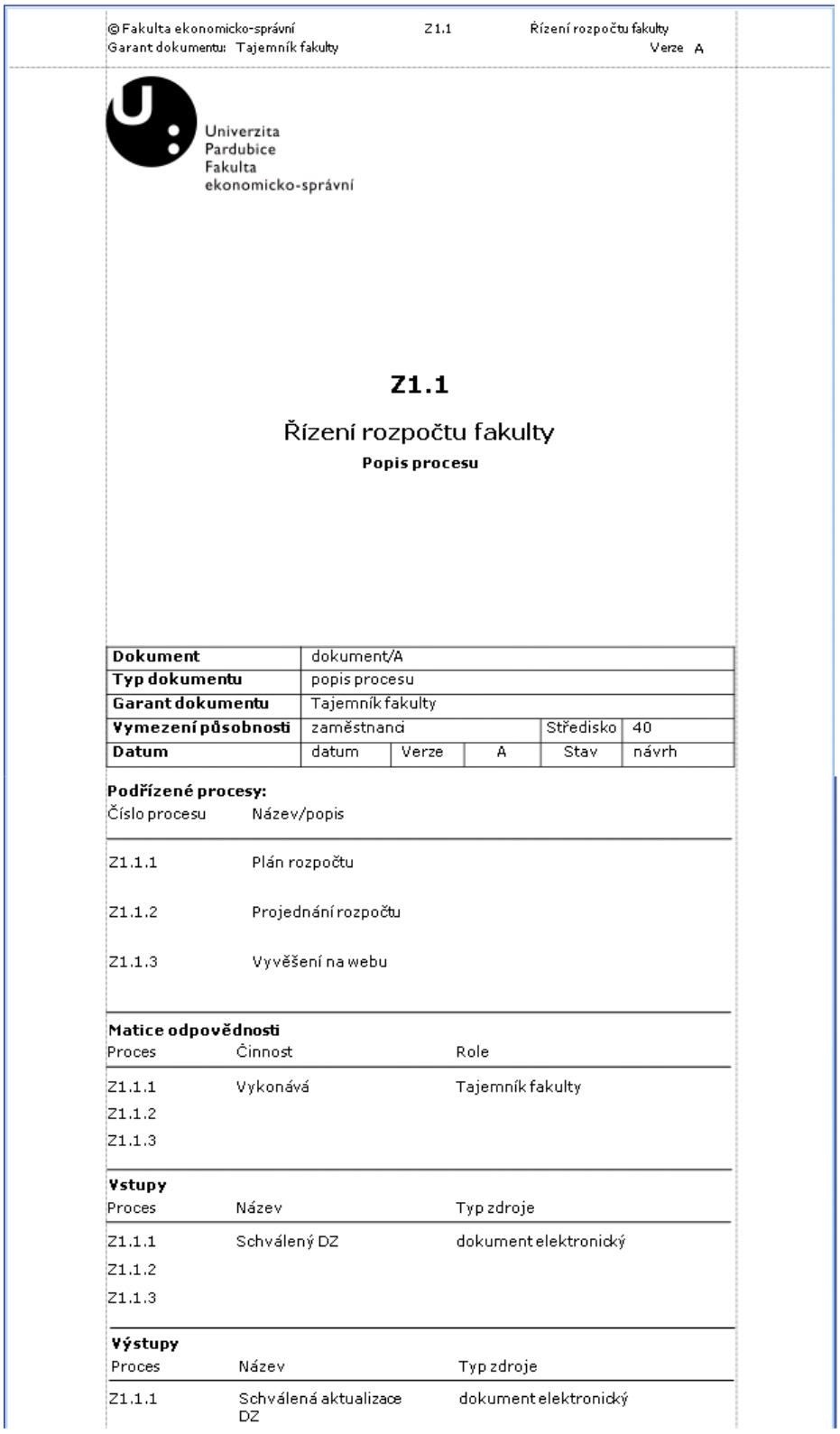
6. Nástroj pro tvorbu procesní dokumentace

Specializovaný modul aplikace ATTIS4 pro tvorbu tiskových sestav a šablon tvoří základ nástroje pro tvorbu procesní dokumentace. V rámci generování sestav dochází k automatizovanému vytváření osnovy řízené dokumentace (popisu procesu, pracovní instrukce) v uživatelsky editovatelném formátu a to pro konkrétní vybraný proces a jeho podprocesy. Uživatelé mají dále možnost doplnit tuto osnovu a uložit ji do finálního formátu, který nebude dále editovatelný (např. *.pdf). Takto doplněný dokument řízené procesní dokumentace je následně vkládaný na nástěnku procesu v IPP.

Procesní dokumentace obsahuje tyto základní části:

- hlavička a úvodní stránka
- popisné atributy procesu (název procesu, nadřazený proces, záměr procesu, cíl procesu, metriky aj.)

- vstupu, výstupy, přílohy procesu
- grafické procesní schema (diagram)
- seznam procesních činností
- matici odpovědnosti pro jednotlivé činnosti v procesních krocích



Univerzita Pardubice
Fakulta ekonomicko-správní

Z1.1

Řízení rozpočtu fakulty

Popis procesu

Dokument	dokument/A				
Typ dokumentu	popis procesu				
Garant dokumentu	Tajemník fakulty				
Vymezení působnosti	zaměstnanci			Středisko	40
Datum	datum	Verze	A	Stav	návrh

Podřízené procesy:

Číslo procesu	Název/popis
Z1.1.1	Plán rozpočtu
Z1.1.2	Projednání rozpočtu
Z1.1.3	Vyvěšení na webu

Matice odpovědnosti

Proces	Činnost	Role
Z1.1.1	Vykonává	Tajemník fakulty
Z1.1.2		
Z1.1.3		

Vstupy

Proces	Název	Typ zdroje
Z1.1.1	Schválený DZ	dokument elektronický
Z1.1.2		
Z1.1.3		

Výstupy

Proces	Název	Typ zdroje
Z1.1.1	Schválená aktualizace DZ	dokument elektronický

Obr. 5: Zobrazení části procesní dokumentace

7. Závěr - Integrační část projektu

Integrační část projektu tvořila podstatnou část implementačních prací a byla důkladně podrobena vstupní analýze projektu.

Řešení portálu IPP je integrováno se systémy:

- centrální registr osob (seznam osob a jejich zařazení na konkrétní systemizovaná pracovní místa v rámci organizační struktury organizace)
- systém pro popis organizační struktury
- systém pro centrální autentizaci uživatelů (ověřování uživatelů)
- centrální úložiště digitálních dokumentů
- registr popisných metadat

Cílem integrace byl automatický přenos vybraných dat a číselníků do portálu IPP. V rámci integrace jsou pravidelně synchronizovány číselníky:

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FUZZY SET SHAPE MULTI-OBJECTIVE OPTIMIZATION APPLIED ON MACROECONOMIC RESEARCH

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ABSTRACT:
This paper deals with design and implementation of fuzzy set shape multi-objective optimization based on evolution algorithms for improving accuracy and interpretability of fuzzy approximation employing Mamdani and Assilian method. Fuzzy sets are represented by trapezoids entered by the user. Approximated function is specified in the form of discrete points, density of which can vary. The paper deals with the minimizing of weighted sum of accuracy and interpretability. For this reason, a simple interpretability index evaluating distinguishability and coverage was introduced and implemented in the optimizing framework. Design approach was proved on the results of macroeconomic research investigating relation between total greenhouse gasses emissions and development of GDP.

KEYWORDS:
Fuzzy approximation, evolution algorithm, differential evolution, multi-objective optimization, marcoeconomic research

1. Introduction

Fuzzy approximation comprises all “soft computing" methods for function approximation. Resulting methods are usually rather simpler but very robust with low sensitivity for condition changes. As other approximations, fuzzy approximation brings inevitably only approximated results. This is brought about by too complex shape of the original function and by vague discretization form of the original function. That is why there is a need to improve results achieved by fuzzy approximation. In this paper, we try to improve the results achieved by utilizing fuzzy IF-THEN rules for real function approximation, by subsequent optimization of fuzzy sets shapes. Optimization that is solely based on accuracy between measured data and approximated function leads to rather chaotic distribution of fuzzy sets representing the data base of the rule base, see [2]. The result is that in a specific part of the application domain more rules are in action while in another part of the application domain no rule is in action. This causes low distinguishability and a low coverage of the application domain as well. This is the reason why multi-objective optimization is employed to improve the challenge.

The structure of the paper is following. In Section 2, the essence of fuzzy IF-THEN rules is given. In Section 3, main features of multi-objective optimization are described. In Section 4, the process of multi-objective optimization is explained and described. Achieved results are illustrated and described in Section 5. In Section 6, achieved results and utilized methods are discussed. Section 7, contains conclusion and further work.

2. Approximation by Fuzzy IF-THEN Rules

Fuzzy IF-THEN rules approximation is handy approach helpful when the precise shape of approximated function is not known or is too complicated and rough estimate is

sufficient for further solution. Fuzzy IF-THEN rules can be comprehended in this way as dependency characterization of approximated function f in several imprecisely specified areas. The result of this approximation is a rough projection of its shape. In practice, functions used to be determined in the table (discretized) form.

f :

x	u_1	u_2	. . .	u_m
y	v_1	v_2	. . .	v_m

where u_i, v_i, $i = 1, ..., m$ are usually real numbers.If instead of elements u_i, v_i, $i = 1, ..., m$ fuzzy sets are used, classical function over sets of fuzzy sets is obtained.
$F : F(U) \rightarrow F(V)$,
where F(U) and F(V) are sets of all fuzzy sets on U and V. If fuzzy function is ultimate it is possible to be expressed in the form of a table

F:

x	A_1	A_2	. . .	A_m
y	B_1	B_2	. . .	B_m

where $A_1,..., A_m \subseteq$ U and $B_1,..., B_m \subseteq$ V. For the fuzzy approximation needs it is required that fuzzy sets $A_1,...,A_m$ and eventually fuzzy sets $B_1,...,B_m$ are created by *fuzzy partition* of U set eventually V set.

Semantic level of interpretation is important to be mentioned as it clarifies theoretical background. In this case, we consider some function $f : U \rightarrow V$ and we suppose that its shape is known either in the form of several points or the user have a rough image about the shape of the function. The user tries to characterize this shape by means of language description. At first the user assigns each $A_i(x)$ formula to appropriate fuzzy set $A_i \subseteq$ U, i = 1,...,m and assigns each $B_i(y)$ formula to appropriate fuzzy set $B_i \subseteq$ V. The user selects these sets in that way so that they cover all u_i or v_j, j = 1,...,m if some points of approximated function are known or at least to cover definition domain and domain of functional values of approximated function f.

2.1 Fuzzy IF-THEN Rules Optimization

Optimization process of approximation by fuzzy IF-THEN rules is based on the modification of the fuzzy sets shape within the domain. Fuzzy sets are represented by trapezoids. The number of trapezoids remains the same for optimization process. The trapezoids can not exceed the domain as well as they have to fulfill *initial condition*, see .

2.2 Differential Evolution

The differential evolution (DE) described in the book [3] has become one of the most popular algorithms for continuous global optimizing problems. But in many cases the efficiency of the search for the global minimum is very sensitive to the setting of its control parameters. One of the means that eliminates this problem is self-adaptive DE. We used tested procedure called differential evolution with competitive control-parameter setting described in the papers [4,5].

3. Multi-Objective Optimization

Multi-objective optimization attempts to simultaneously minimize *K* individual functions. The goal of the optimization is to find
$x = (x_0, x_1, \ldots, x_{D-1})^T, x \in \boldsymbol{R}^D$
to minimize
$f_k(x), k = 1, \ldots K, K \geq 2$
$\boldsymbol{R}^D$ is the D dimensional space of real numbers, see [3]. This task has unambiguous solution only if there is a single vector that simultaneously minimizes all K objective functions. In this specific case, the solution vector, **x**, satisfies the condition
$k \in 1, \ldots, K: x = x^*_k$
where x^*_k is a global optimum of the k^{th} objective function, $f_k(x)$. In practice, objectives are often conflicting. All K objective function extremes do not coincide. For this reason, the best solution is usually a compromise that depends on which objectives are the most important.
There are two principal way of solving multi-objective optimization. Firstly, it is minimization of a weighted sum of objective functions. Secondly, the Pareto-optimization approach can be utilized.
Minimizing a weighted sum of objective functions transforms a multi-objective optimization problem into one with a single objective.
The goal is to find $x = (x_0, x_1, \ldots x_{D-1})^T, x \in \boldsymbol{R}^D$
to minimize
$f(x) = \sum^K_{k=1} w_k, f_k(x), K \geq 2$
The symbol, w_k, denotes the k^{th} objective function weight. Of course, the weights may be assigned by articulation of preferences as a priori, progressive and a posteriori. As we utilize the a priori preference of assigning weights only this method will be shortly described. A priori preference articulation assumes that objective preferences can be ordered and that weight do not change optimization. In this case, objective functions have to be normalized to compensate for the different dynamic ranges. Determining the appropriate normalization scale factor can be difficult because it requires knowing the range of function extremes. Weight selection and normalization make this approach difficult. It requires a number of experiments to find out proper heuristics.
The Pareto-optimization approach to multi-objective optimization can be characterized as a solution around which there is no way of improving any objective without worsening at least one objective. The set of solutions that fulfill declared constraints is called a set of feasible solutions. In general and due to restricted conditions, the space of possible solutions is incoherent and is created by isolated sets of feasible solutions.

3.1 Fuzzy Rule Base System

In the last years, Mamdani-types FRBSs (Mamdani and Assilian 1975) have been extensively and successfully applied to several engineering domains such as classification, regression and control.
Mamdani-types FRBSs consist of:

- A rule base (RB) composed of linguistic IF-THEN rules, where both the antecedent and the consequent parts are fuzzy propositions.
- A data base (DB), which associates a semantics represented by means of fuzzy sets.

The RB is often derived from heuristics knowledge which is usually valid independently. Thus, the RB can be considered as a context-free model. We suppose that the rule base will be

created utilizing functional dependencies among measured data. The number of rules depending on a particular shape of the functional dependencies of measured data (or discretized function). If the functional behavior is linear or even a constant only a single rule used to be sufficient. However, if the functional behavior shows nonlinear course, more rules have to be added. Cycling behavior also reduces number of rules. A challenging constraint, in our case, are accuracy and interpretability. They are confliction objectives. Furthermore, interpretability is difficult to quantify because of its very nature of being a qualitative concept. A rule base has to corresponds to the course of the approximated function. As we plan to approximated two different functions defined by using discretized values we have to determine two different rule base. They will be described in the achieved results section.

3.2 Accuracy and its Evaluation

Let f is a given function and f^A its approximation on the interval [a; b]. The error of approximation is defined such as maximal difference between the original function and its approximation:

$$\varepsilon = \bigvee_{x \in [a;b]} \left| f(x) - f^A(x) \right| \qquad (1)$$

3.3 Interpretability and its Evaluation

There are interesting challenges to the designer to formalize the interpretability problem. Firstly, it is a challenge to define a proper metric to measure interpretability with low computational effort. Secondly, it is hard to find a crisp threshold for the metric so as to separate a good from a bed partition. Utilizing e.g. Jaccard's index does not seem to provide means for remarkable evaluation of fuzzy partitions, see [1]. On the other hand, an ordering indices can be also used to evaluate successfully distingushability and coverage.

Our aim is to introduce a simple technique to handle interpretability of fuzzy partition that can be used for multi-objective optimization. We propose to access coverage and distinguishability by utilizing the membership values of crossing points between a couple of fuzzy sets. In this approach, we discriminate between an adjacent couple of fuzzy sets and a couple whose fuzzy sets are not adjacent. We calculate the ``distance'' between the members of the couple as a difference of their indices. For this reason, we consider a partition $P = \{A_1, A_2, ..., A_N\}$ which comprises N trapezoidal fuzzy sets. If the difference of indices $j - i$ is equals to 1 the fuzzy sets are adjacent, otherwise they are non adjacent.
The crossing point $\hat{x}_i$ between A_i and A_j is defined as the point where the right spread of A_i equals the left spread of A_j. It can be easily observed that the membership value $A_i(\hat{x}_i)$ is a direct measure of the coverage of the partition. The evaluation of the crossing points between a pair of fuzzy sets assesses distingushability and coverage.
As stated above, $A_i(\hat{x}_i)$ is a direct measure of the coverage level achieved by the pair of fuzzy sets (A_i, A_j). Hence, assessing the crossing points of all the pairs of fuzzy sets, we can compute the overall level of coverage of a pertition. On the other hand, $A_i(\hat{x}_i)$ is also a good estimator of the distinguishability of A_i and A_j.

Taking all these observations into account, a *interpretability index* for fuzzy partitions that measures how many couples of different fuzzy sets violates the distinguishability and the coverage constraints expressed in terms of a range of allowed values for $A_i(\hat{x}_i)$.

Interpretability index Φ_{XP} is defined in the following way. Given a partition $P = \{A_1, A_2, ..., A_N\}$ consisnting of N fuzzy sets, the interpretability index is defined as

$$\Phi_{XP}(P) = \Sigma_{i=1}^{N-1} \Sigma_{j=i+1}^{N} \phi_{i,j} \quad (2)$$

with

$$\Phi_{i,j} = \begin{cases} if\,(j-i=1) \begin{cases} 1 \;\; if \;\; A_i(\hat{x}_i) < \varepsilon_{\min} \vee A_i(\hat{x}_i) > \varepsilon_{\max} \\ 0 \;\; otherwise \end{cases} \\ if\,(j-i>1) \quad A_i(\hat{x}_i) * (j-i)^2 \end{cases}$$

where $\varepsilon_{min} \in [0,1]$ and $\varepsilon_{max} \in [0,1]$, $\varepsilon_{min} < \varepsilon_{max}$, are thresholds for coverage and distingushability. Typical values for ε_{min} is 0.25 and for ε_{max} is 0.75. In this approach coverage and distinguishability are explored by exploiting the membership values of crossing points between adjacent fuzzy sets.

4. Application of Multi-Objective Optimization

Our approach to multi-objective optimization is to utilize weighted sum of objective functions. We optimize accuracy and interpretability. We choose this approach as it enables to have, from our point of view, better possibilities to test and check various ways of setting weights of objective functions and to change heuristic that determines evaluation of the interpretability index. Interpretability index express some kind of penalty and the aim is to minimize its value as well as the value of maximal error that is used to express accuracy.

4.1 Normalization

The selected approach requires normalization of the individual objective function values. Accuracy produces a number of values representing maximal error for each member of the population between approximated values and real (measured) values. Interpretability index creates a number of values representing a sum of individual values calculated by equation for each member of the population. It is clear that the two rows of calculated numbers are incompatible to each other and needs some sort of normalization. The essence of normalization is to find out a value both for accuracy and for interpretability that would be used as a divisor for all calculated values and creates the quotient that can be used in the subsequent process of fixing the weights for optimized values. At the beginning, we determine the highest value of the original population as divider. However, there was a high variance of these values. Then we tested an average value but finally we selected median value calculated from the original population for both objective functions separately.

4.2 Weight Selection

We tested two kinds of weights. Firstly, the same weigh was set both for accuracy and interpretability. As the achieved results from the side of interpretability were not satisfactory, we experimentally change the weights till the following ratio: *0.3* for accuracy and *0.7* for interpretability. With this weights, the obtained results comply both the requirements for accuracy and interpretability.

4.2 Fuzzy rule for greenhouse gasses emissions approximation

In year 2005, OECD published Environmental Performance Reviews of the Czech Republic, including recommendations concerning various areas. Regarding economic decisions and sustainable development, one recommendation is the following: further decouple environmental pressures from economic growth, including by reducing the energy and material intensities of economy, making the maximum possible use of the EU greenhouse gas trading system (OECD, 2005, p.24), see [6].
In our research, we focused on the total greenhouse gasses emissions in the Czech Republic in the period 1995 – 2010fuzzy approximation. Next, we fuzzy approximated development of GDP of the Czech Republic in the same period.

Fuzzy rule base created for the total greenhouse emissions is shown in the following statements:

IF *X* is *A1* then *Y* is *B1* AND
IF *X* is *A2* then *Y* is *B2* AND
IF *X* is *A3* then *Y* is *B3* AND
IF *X* is *A4* then *Y* is *B4* AND
IF *X* is *A5* then *Y* is *B3* AND
IF *X* is *A6* then *Y* is *B3* AND
IF *X* is *A7* then *Y* is *B3* AND
IF *X* is *A8* then *Y* is *B3* AND
IF *X* is *A9* then *Y* is *B4* AND
IF *X* is *A10* then *Y* is *B5*

5. Achieved Results

Before every fuzzy approximation, the user has to map language terms into corresponding fuzzy sets. In other words, map a rule base into a data base.

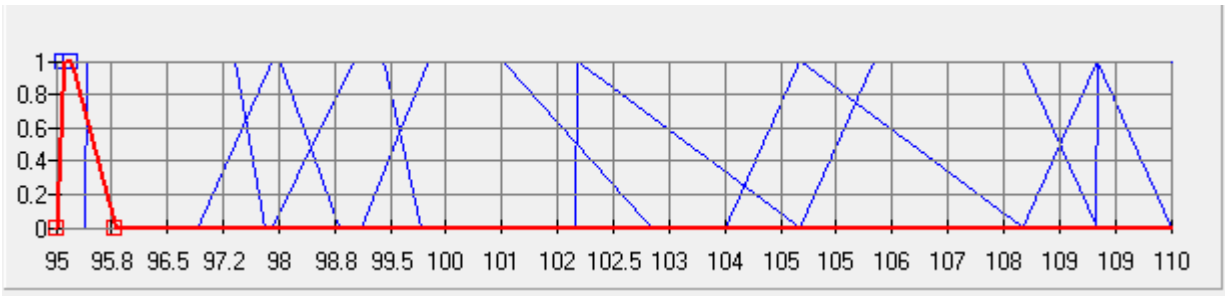

Fig. 1 User's mapping of user terms into fuzzy sets - antecedent axis of the total greenhouses emissions

Fig.1 shows the result of this process for antecedent axix and fig. 2 shows results for consequent axis. The universe for the antecedent axix was 1995 – 2010. As the LFLC system we used for fuzzy computing did not calculate in large numbers we had to convert 1995 into 95 and 2010 into 110. The universe for the fig. 2 is the same as in the figure, 88 – 103. Fig 3 shows achieved results we obtained in fuzzy approximation for the total greenhouse gasses emissions.

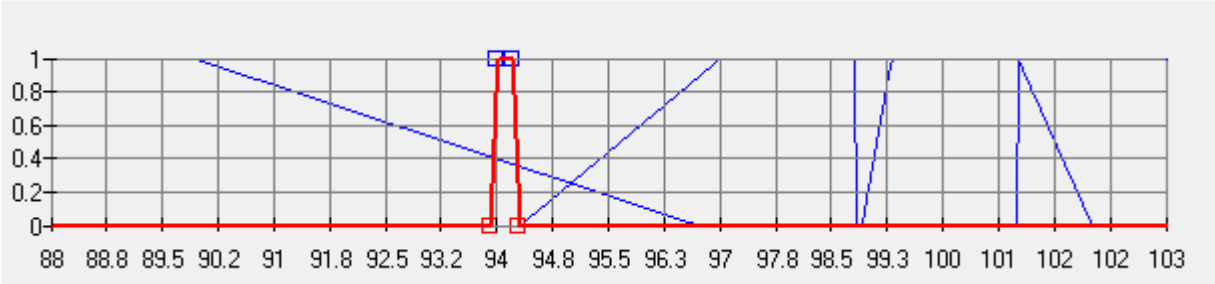

Fig. 2 User's mapping of user terms into fuzzy sets - consequent axis of the total greenhouse gasses

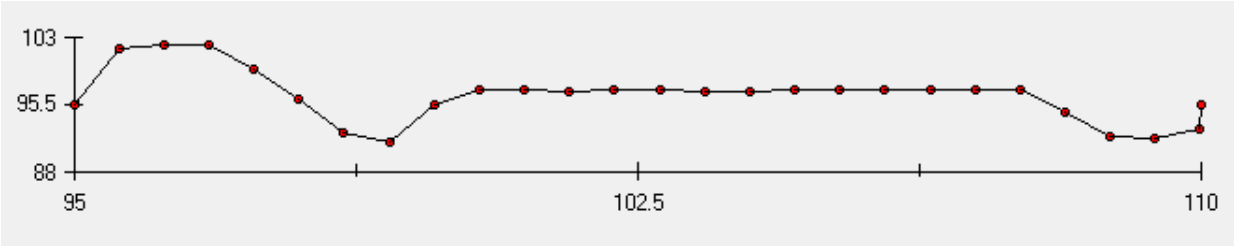

Fig. 3 A course of approximated function representing total greenhouse gasses emissions

Fig. 4 illustrates user's mapping of user terms into fuzzy sets. The figure represents consequent axix of GDP. The universe was modified in the same way as in the fig. 1.

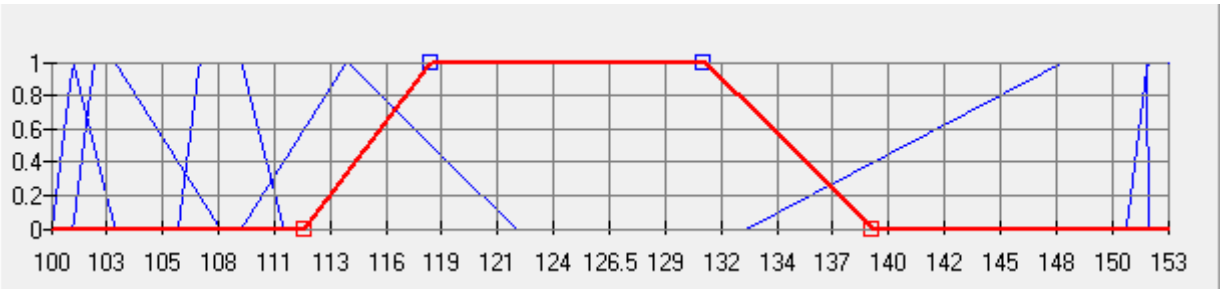

Fig. 4 User's mapping of user terms into fuzzy sets – consequent axis of GDP

Finally, fig. 5 represents a course of approximated function representing the development of GDP.

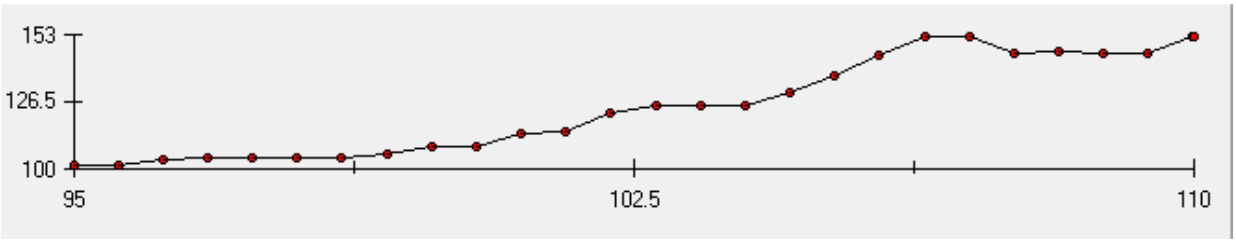

Fig. 5 A course of approximated function representing the development of GDP

6. Discussion

As mentioned above, weighted sum of objective functions offers three different approaches to solve multi-objective optimization problem. A priori assigning weights to objective functions was selected because it is relatively straightforward way of process. Weighted sums of objective functions are not changed during one calculation which enables

to compare achieved results without other erroneous influences to to the process of calculation. We need to testify the proper heuristic for interpretability index determination. Actually, the weights changed from the original setting of 0.5 for both objective functions to 0.3 for accuracy and 0.7 for interpretability. It was caused by the fact that accuracy was approaching quite fast to the desired result while interpretability lags behind the accuracy. Progressive way of assigning weights to objective functions is promising approach but needs determination of rules by which the weights will be changed. We consider this approach for further experiments.

7. Conclusions

The article presents multi-objective optimization of fuzzy sets that are utilized for function approximation given by fuzzy IF-THEN rules. Maximal error objective function was used for accuracy measurement between approximated and real function and simple interpretability index representing a penalty function was introduced to measure interpretability among fuzzy sets in fuzzy rule base system. Achieved results are promising for future research in the area of multi-objective optimization.

Acknowledgements:
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SYSTEM OF ASSESSMENT AND CERTIFICATION OF CIVIL SERVANTS

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ABSTRACT
This contribution presents the algorithm, model and the web-based information system of electronic support to the annual assessment of public servants in accordance with the law and departmental regulations.

KEYWORDS:
Information system, automation process, annual assessment, reference educational, knowledge testing, civil servants

1. Introduction

Automation of the annual assessment and appraisal of civil servants in accordance with the law [1] and departmental regulations is an important way of operational planning and analysis of the work of civil servants, guarantee of unbiased and fair evaluation of their performance, increasing motivation, strengthening of strategic orientation, coordination of actions and performance, promotion of transparency and validity of the passage of the civil service.

2. Analysis

Papers by V.B. Averianov, S.G. Bilousov, S.D. Dubenko, V.I. Melnychenko, N.R. Nyzhnyk, O.Yu. Obolenskyi, O.O. Slusarenko, O.M. Sulimenko and others [2-7] reveal the urgency of evaluating the performance of civil servants reform as a leading indicator of productivity and efficiency of functioning of public authorities and duties as public servants.

It is very important to study the international practices on Civil Servants Attestation and the ways to apply them in the system of public administration of Ukraine. The following foreign scholars exploring this issue should be mentioned: A. Auer, K. Demke, O.V. Soloviova, Yu.M. Starylov, N.N.Tarasov, K.V. Terentiev and others.

However, the issues of automation of annual assessment of civil servant performance processes and their correlation with the final result.

3. Information System of Assessment of Civil Servants

The algorithm of electronic support to the annual assessment of public servants are presented in Figure 1, where: 1 - Start, 2 - Update of the individual plans of civil servants taking into account strategic goals of the department, 3 - Designation of a list of civil servants to be evaluated, 4 – Clarification whether the civil servant is subject to assessment, 5 - Generation and distribution of logins and passwords to undergo evaluation, 6 - Evaluation of the individual plan, 7 - Performance evaluation, 8 - Clarification whether the civil servant holds a managerial position, 9 - Clarification whether it is planned to promote the civil servant to the managerial position after the assessment is completed, 10 - Assessment of achievement

of strategic objectives by the defined criteria, 11 - Assessment of competence, 12 - Evaluation of the human resource management potential,13 - Processing of assessment results, 14 - Outcome, 15 - Unsatisfactory (does not qualify for the position held), 16 - Satisfactory, below the average (needs significant improvement to qualify for the position), 17 - Average level (mostly qualifies for the position, but requires some improvement), 18 - Over the average (requires training to be promoted), 19 - Well above expectations (promotion to the higher position, transferring to the managerial position), 20 - To dismiss from the position, 21 - Training for the current position level, 22 - Training for higher positions, 23 - Premium/bonus assignment, 24 - Transferring to the higher position, 25 - Rewarding the performance, 26 - Appointment of a retesting (different levels of testing for different types of results), 27 - - Analysis of assessment results by means of neural networks, 28- Publication of the results, 29 - Monitoring of the implementation of decisions taken after the evaluation, 30 - End of the cycle of the annual assessment.

The developed models and the algorithm underlie the web-based information system "Annual evaluation of civil servants of the National Bank of Ukraine".

The Information System of Assessment of Civil Servants has client server architecture, implemented in the environment Net and works in OS MS Windows XP and Windows 7. The system is modular and consists of interactive subsystems: Evaluation of civil servants, Reference educational and knowledge testing, Mining of evaluation data using neural network technology.

Subsystem Evaluation of civil servants consists of two software components: AWS of Administration (AdminTool executive program) and AWS of Evaluation process (client's part with the access through web-interface).

AWS of Administration allows creating and editing a multi-hierarchical structure of the organization's departments, keeping records of employees and changing their characteristics according to a career history. It is possible to create job positions and edit their parameters according to the staff schedule along with setting out the level of the hierarchy for different positions, and the ability to edit the user access parameters to the client's part of the system and recover lost passwords.

For convenience purposes, one can treat the assessment process as the object of the assessment system, with stuff and assessment questionnaires regarded as the attributes of the former. For each position, or a group of positions, an individual questionnaire is developed. The questions are developed such so as to make assessment of an employee according to several most important criteria, such as, for example, social and learning skills. Each question adds a certain number of points to the total number earned in the current assessment and must belong to one of the four crisp sets corresponding to the assessment criteria - unsatisfactory, satisfactory, good and excellent. Once all assessment attributes (questionnaire and stuff parameters) are set up and the organization hierarchy is established, or adjusted, the administrator can automatically calculate the expected assessment parameters and start the assessment process. The system administrator is also responsible for the assessment timeframe. The CWS assessment system administrator may review and generate various statistical reports based on assessment results in order to produce a multifaceted analysis of these results.

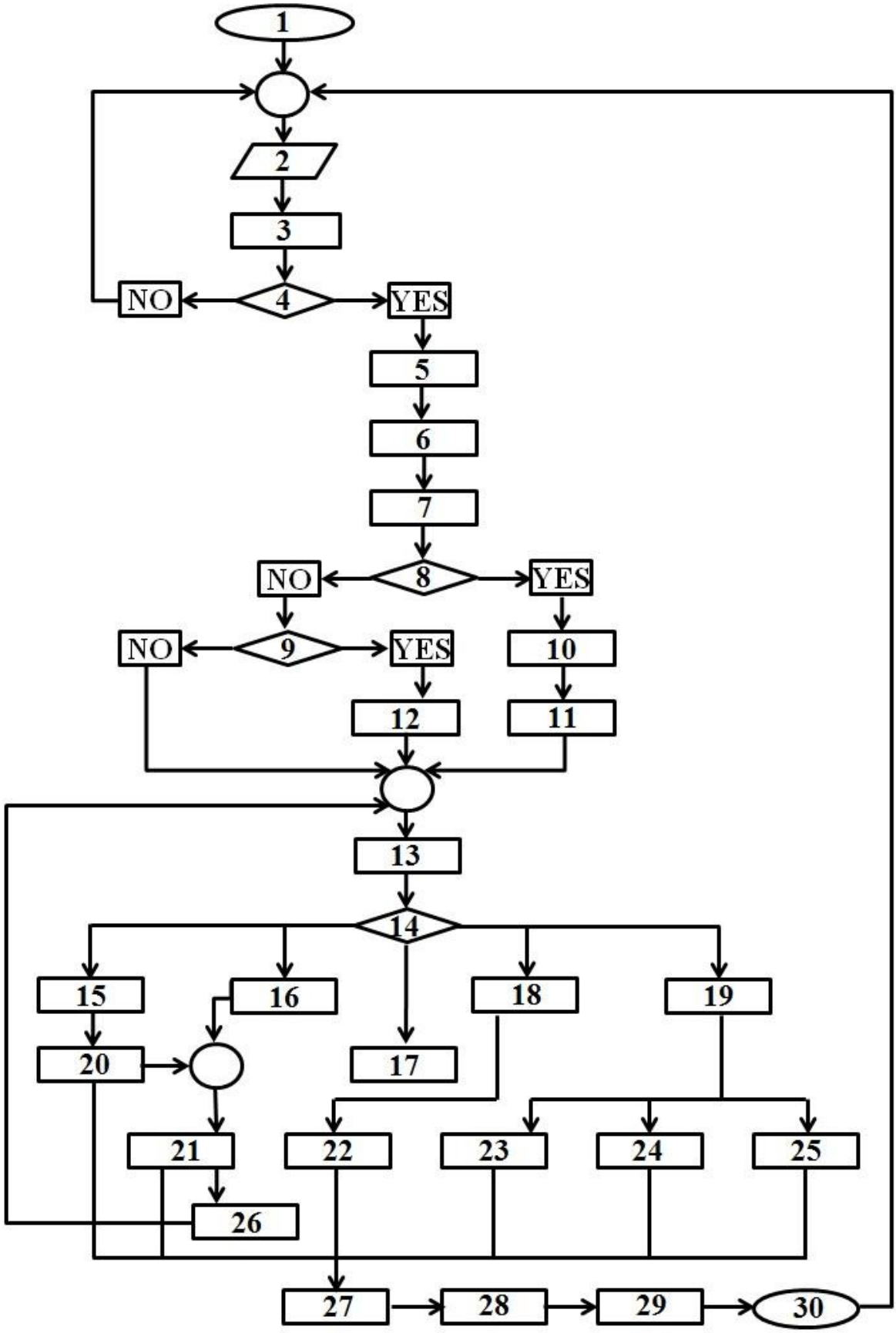

Figure 2: The algorithm of electronic support to the annual assessment of public servants.
Source: Own

3The interface of the system administration program (Figure 2) is tailored to the needs of the user. The multi-window mode helps the user focus on important details and simplify basic data operations as much as possible. Logical checks of the actions performed by the administrator serve to ensure the system's sustainability and help avoid possible mistakes. There are separate interface tabs for each main stage of system configuration, which make the system appear simpler to the user.

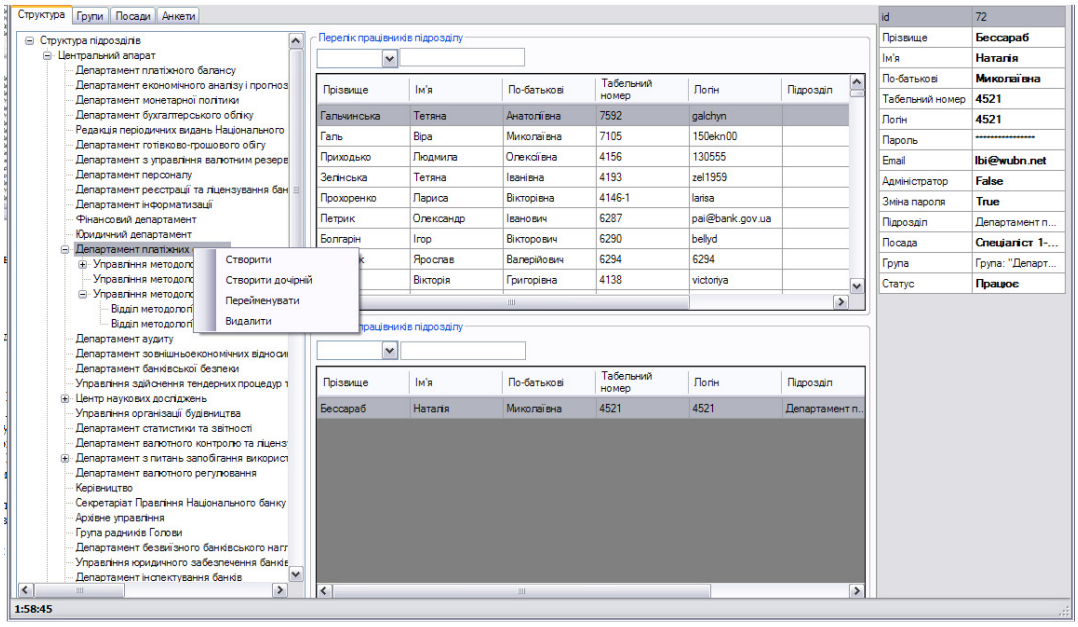

Figure 4: Interface of AWS of Administration.
Source: Own

The software front end is a web-interface (Figure 3) designed for stuff performance assessment by unit managers or employees who perform their duties. Assessment is done according to the criteria developed for various types of work an employee is supposed to do and included in the questionnaire produced for an individual position, or a group of positions. Managers should also keep track of an employee's penalties and incentives and make recommendations for career planning or professional training.

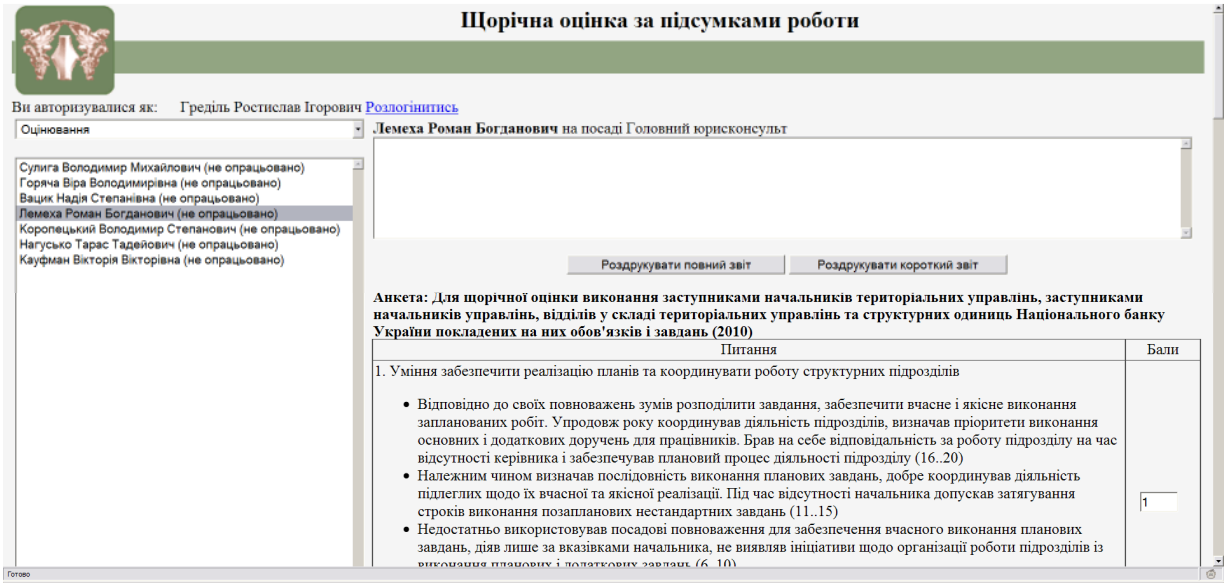

Figure 3: Web-interface of clients.
Source: Own

4. Conclusions

The interface allows the appraiser to review the record of previous assessments and the progress achieved with the current assessment of the group, which it heads. Unit managers can print out a brief, or detailed, assessment statement of their subordinates; the system also gives higher managers access to the statements produced by lower managers. Average employees also have access to the results of their assessment.

The built-in analytical module makes it possible to calculate the overall performance indicators of individual employees or units based on statistical data and expert rules and correlate them with others. Provided there is a large volume of historical data the analyst can predict the outcome of a specialist's appraisal and then evaluate how the actual result corresponds to the expected one. The basis of the analytical module is the neuron fuzzy system, which is capable of working simultaneously with both clear and fuzzy input variables.

Reference educational subsystem contains the following modules: "Legislative acts", "Regulations of Civil Service of Ukraine", "Regulations of the National Bank of Ukraine", "Encyclopedic referential dictionary of Ukrainian legislative terms" and " Knowledge testing". Informational and methodological support of the modules is integrated and complies with active legislation.

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AGILE SOFTWARE DEVELOPMENT USING SCRUM

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ABSTRACT:
Numerous agile methods have appeared in the last 15 years that – in contrast to disciplined approach advocated by the quality models – value individuals and interactions over processes and tools, working software over comprehensive documentation, customer collaboration over contract negotiation, and responding to change over following a plan. Scrum is the most widely used agile method that concentrates mainly on managing software projects. Experience has shown that adopting Scrum improves management of the development process and customer relationships, decreases the amount of overtime, and increases customer satisfaction. The paper provides an overview of the Scrum process. The role of user stories as a means for requirements specification and project planning is described, and different ways of representing and measuring project progress (i.e., velocity tracking, release and Sprint burndown charts, and EVM indexes) are shown using data from a real Scrum project. Finally, the most important factors affecting success of a Scrum project are presented.

KEYWORDS:
Scrum, project management, software development, agile methods

1. Introduction

Agile development methods and practices (Williams, 2010) have been gaining wide acceptance in the software development community. In January 2010 Forrester (West and Grant, 2010) reported results of their Global Developer Technographics Survey, which revealed that 35% of respondents used an agile development process. At the same time Gartner predicted (Murphy, et al., 2009) that by 2012 agile development methods will be utilized in 80% of all software development projects. According to the last State of Agile Survey (VersionOne, 2011) the most widespread agile method is Scrum (Rising and Janoff, 2000; Schwaber, 2004), which is used by 66% of 6042 respondents. The aim of this paper is to describe the Scrum process (Section 2), introduce user stories as a means for requirements description and project planning (Section 3), show different ways of representing and measuring progress (Section 4), and point out most important practices affecting the success of a Scrum project (Section 5).

2. Scrum overview

Scrum starts with the premise that software development is too complex and unpredictable to be planned exactly in advance. Instead, empirical process control must be applied to ensure visibility, inspection, and adaptation. This is achieved through an iterative and incremental development process shown in Fig. 1.

2.1 Scrum roles

Scrum implements this process through three roles: the Product Owner, the Team, and the ScrumMaster. The Product Owner is responsible for representing the interests of everyone with a stake in the project and its resulting system. He maintains the Product Backlog, a prioritized list of project requirements with estimated times to turn them into completed product functionality.

The Team is responsible for developing functionality. Teams are self-managing, self-organizing, and cross-functional, and they are responsible for figuring out how to turn Product Backlog into an increment of functionality within an iteration and managing their own work to do so. Team members are collectively responsible for the success of each iteration and of the project as a whole.

The ScrumMaster fills the position normally occupied by the project manager, but his/her role is slightly different. He/she is responsible for managing the Scrum process so that it fits within an organization's culture and still delivers the expected benefits, and for ensuring that everyone follows Scrum rules and practices.

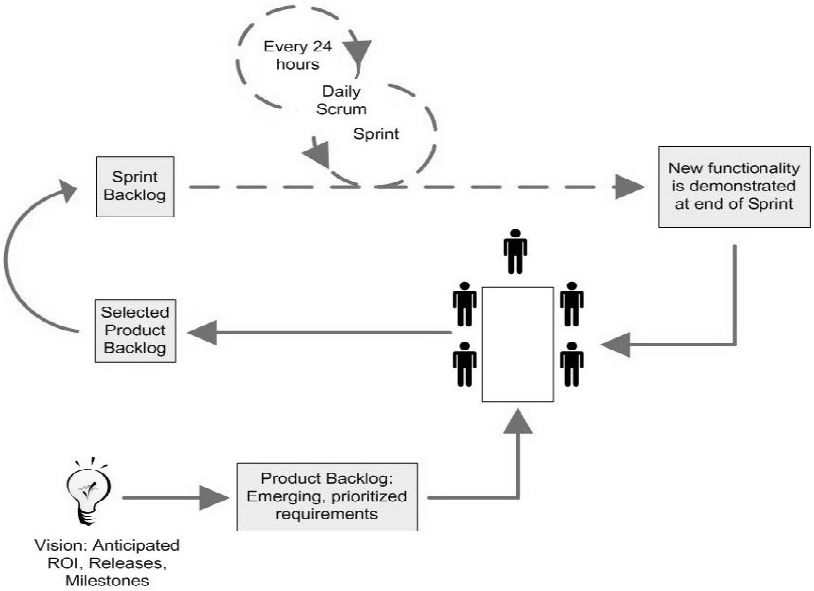

Figure 1 Detailed Scrum flow (Schwaber, 2004)

2.2 Process description

As shown in Fig. 1, a Scrum project starts with a vision of the system to be developed. Then a Product Backlog list is created containing all the requirements that are currently known. The Product Backlog is prioritized and divided into proposed releases.

All the work is done in Sprints. In original version of Scrum (Schwaber, 2004), each Sprint is an iteration of 30 consecutive calendar days; however, shorter Sprints lasting 1 to 4 weeks are often used. A Sprint is initiated with a Sprint planning meeting, where the Product Owner and Team get together to agree upon Product Backlog items to be implemented over the next Sprint.

After deciding what has to be done in the next Sprint, the Team develops the Sprint Backlog, i.e., a list of tasks that must be performed to deliver a completed increment of potentially shippable product functionality by the end of the Sprint. The tasks in the list emerge as the Sprint evolves and should be divided so that each takes roughly 4 to 16 hours to finish.

Every day the Team gets together for a 15-minute meeting called a Daily Scrum. At the Daily Scrum, each Team member answers three questions: What have you done on this project since the last Daily Scrum meeting? What will you do before the next meeting? Do you have any obstacles? The purpose of the meeting is to synchronize the work of all Team members and to schedule any meetings that the Team needs to forward its progress.

At the end of the Sprint, a Sprint review meeting is held at which the Team presents what was developed during the Sprint to the Product Owner and any other stakeholders who

want to attend. After the Sprint review and prior to the next Sprint planning meeting, the ScrumMaster also holds a Sprint retrospective meeting in order to encourage the Team to revise, within the Scrum process framework, its development process to make it more effective and enjoyable for the next Sprint.

3. User stories, release and Sprint planning

Scrum takes a novel, lightweight approach to requirements specification. It is assumed that full, detailed requirements for a software package cannot (and need not) be developed as these requirements will inevitably change over time. Instead, each requirement is recorded as a user story (Cohn, 2004) consisting of three parts: a written description (used for planning and as a reminder), conversations about the story (to flesh out the details), and acceptance tests (to determine when a story is "done"). A story description is formulated in the language of the customer and is intentionally short enough to be hand-written on a paper note card. It serves merely as a reminder for conversations with the customer in order to clarify the story details and document the expectations of the project's users in the form of acceptance tests. The written description typically follows a simple template:

As a <type of user>, I want <some goal> so that <some benefit>.

As such, user stories strongly shift the focus from writing about features to discussing them.

The Product Backlog is simply a set of all user stories currently known. For each story, its priority and effort estimate must be defined. Priority is defined by the Product Owner based on considerations like business value, date needed, dependencies, etc., while the effort estimate must be made by the Scrum Team. Using planning poker (Grenning, 2002), the Team allocates each story a number of story points representing relative effort, i.e., how difficult it will be to complete the story relative to other stories in the Product Backlog. A story point usually (although not necessarily) corresponds to an ideal day of work and often only a predefined set of possible values is used, e.g., 0.5, 1, 2, 3, 5, 8, 13, 20, 40 and 100. The Team should also estimate its initial velocity, i.e., the number of story points that the Team can implement during a Sprint.

These estimates are used during Release and Sprint planning meetings in order to create Release and Sprint plans, respectively. The Release plan is created at the beginning of the project by allocating user stories to Sprints strictly considering their priority and the Team's estimated velocity so that the sum of story points allocated to each Sprint fits within the capacity determined by the velocity estimate. The Release Plan helps the Product Owner and the Team decide how much must be developed and provides an estimate of the approximate duration of a project. It provides a rough content of each Sprint and serves as a guidepost toward which the project team can progress. Without the concept of a release, teams move endlessly from one iteration to the next.

At the beginning of each Sprint the Team re-estimates its velocity and the remaining user stories in order to obtain a more precise Sprint plan, called Sprint Backlog. The Sprint Backlog consists of stories with highest priority having the total number of story points equal to the Team's estimated velocity. The Team further decomposes each story into constituent tasks and assigns responsibility for each task. Each team member individually estimates how many hours it will take to accomplish each task he/she accepted.

4. Performance monitoring

The last State of Agile Survey (VersionOne, 2011) revealed that the loss of management control is one of the greatest concerns about adopting agile. Therefore, continuous monitoring of the development process through appropriate set of measures is

crucial to ensure visibility, inspection, and adaptation. The following measures of progress are usually used: the actual velocity (in comparison to the planned velocity), the amount of work remaining (represented by the Release and Sprint burndown charts), and schedule and cost performance indexes. The first two measures are well known and established measures of agile projects progress. With the purpose of monitoring development costs the earned value indexes were added (Mahnic and Vrana, 2007), since these are not included in other measures.

The use of these measures will be illustrated using data from a real project, which took place during 2011 in the largest Slovenian publishing company (Mahnic, 2012b). The main project's business objectives were to renew the web edition of the company's daily newspaper with the largest circulation and introduce Scrum as the development process to their web applications department. It was expected that the project will be completed in 7 Sprints; however, it lasted 7 months (from May until the end of November 2011) and consisted of 9 Sprints. The number of people working on the project varied slightly from Sprint to Sprint between 6 and 8. The author helped the company in preparations for Scrum implementation and it was agreed that the project will serve as a case study for evaluation of IT management measures proposed in (Mahnic and Vrana, 2007). Consequently, the author observed the project execution and collected appropriate base measures during the first 7 Sprints.

4.1 Velocity

Actual velocity represents the amount of work accomplished in each Sprint expressed in story points. Fig. 2 shows the difference between the planned and actual velocity for seven Sprints that were observed during the study. The planned velocity was estimated by the Scrum Team at the beginning of each Sprint and the user stories were allocated to the Sprint strictly considering the estimate. The actual velocity was calculated at the end of the Sprint by summing up story points for all the stories accepted by the Product Owner.

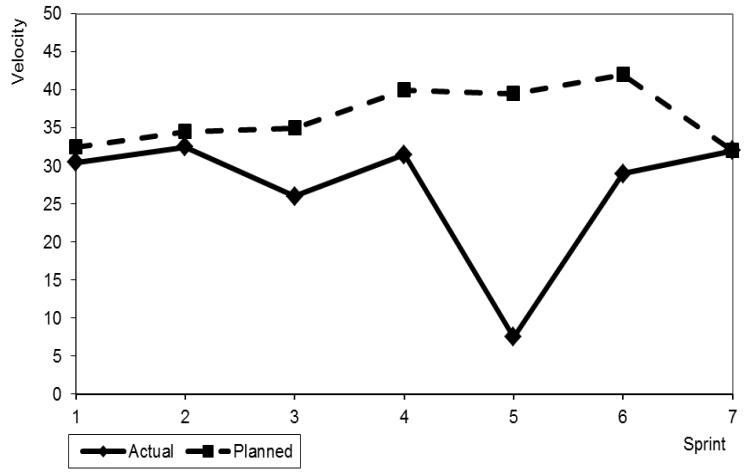

Figure 2 Planned and actual velocity in Sprints 1-7.

The chart in Fig. 2 reveals that the actual velocity was behind the planned velocity for the majority of Sprints. This was understandable for the first Sprint, since there was no previous experience and the planned velocity was estimated by simply assuming a working day (i.e., a story point) to be equal to 6 hours of effective work. The actual velocity was at its lowest in the fifth Sprint due to two new developers added to the development team, who were expected to increase the amount of work completed, but created disruption instead, which decreased the productivity of other team members. A substantial difference between the planned and actual velocity in Sprint 6 was a consequence of too optimistic velocity

estimate. Instead of adapting the estimate to actual achievement in previous Sprints the team succumbed to the pressure of approaching deadline and promised to deliver more functionality than actually possible.

Analysis of velocity revealed two common mistakes that should be avoided in Scrum projects: planned velocity should be estimated considering the actual velocity of previous Sprints and there should be no changes in development team in the middle of the project.

4.2 Release burndown chart

The Release burndown chart shows the amount of work remaining at the beginning of each Sprint by plotting the sum of story points of all unfinished stories in the Product Backlog. It makes visible the correlation between the amount of work remaining and the progress of the Scrum Team in reducing this work. The trend line for work remaining indicates the most probable completion of work at a given point in time.

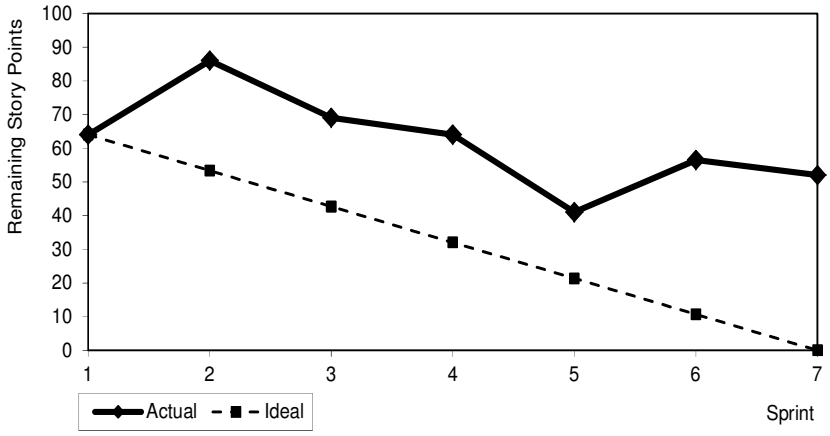

Figure 3 Release burndown chart at the beginning of Sprint 7

The Release burndown chart in Fig. 3 indicates that the Team was not able to reduce the amount of work remaining quickly enough to complete the project in seven Sprints as it was expected at the beginning of the project. The main reason for this were emerging requirements, which were not part of the initial Product Backlog, but were constantly added by the Product Owner during the project. In such cases the Release burndown chart can be used to simulate the impact of removing functionality from the release to get a more acceptable completion date. Using this approach the publishing company reexamined the contents of the Product Backlog and successfully launched a reduced release after 9 Sprints.

4.3 Sprint burndown chart

The Sprint burndown chart is similar to the Release burndown chart, but instead of giving the big picture of the entire release it represents the amount of work remaining that needs to be accomplished till the end of the Sprint. The horizontal axis shows the days of a Sprint, while the vertical axis shows the number of remaining working hours. The chart is updated every day by aggregating the estimates of work remaining for all tasks in the Sprint Backlog, which are collected at the Daily Scrum meeting. The trend line of remaining working hours indicates whether the Team will accomplish the tasks committed by the end of the Sprint.

Fig. 4 shows how the amount of work remaining was changing in Sprint 2 of our case study. In contrast to chart in Fig. 3, this chart shows a more evident falling trend indicating that the development team developed software for almost all user stories planned for that Sprint.

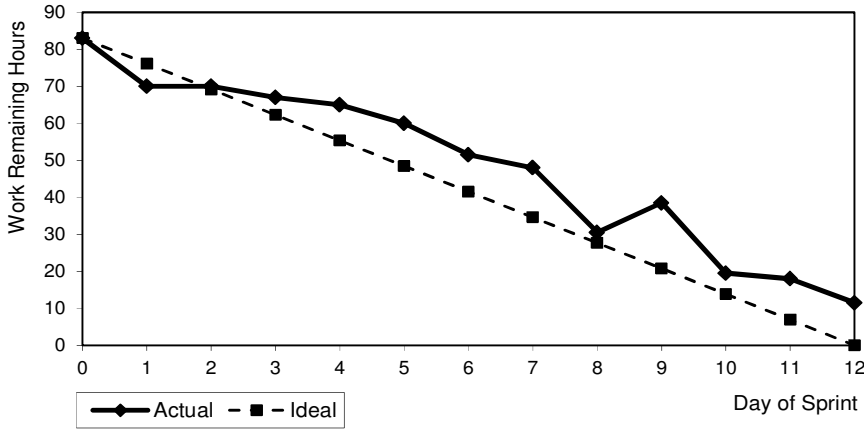

Figure 4 Sprint burndown chart for Sprint 2

4.4 Earned value management

Earned value management (EVM) is not part of Scrum, but is often required as good practice (e.g., by the government projects in the United States). While other studies that explore the use of EVM within Scrum (e.g., Sulaiman, et al., 2006) describe the computation of earned value at the release level, we introduced the computation of EVM indexes at the Sprint level (Mahnic and Vrana, 2007). Our approach provides the values of schedule performance index (SPI) and cost performance index (CPI) on a daily basis, thus enabling immediate response in the case of deviation from the plan, which can be especially useful when longer Sprints are used. Computation of SPI and CPI requires collection of only one additional base measure, i.e., the number of hours spent on each task between two consecutive Daily Scrum meetings.

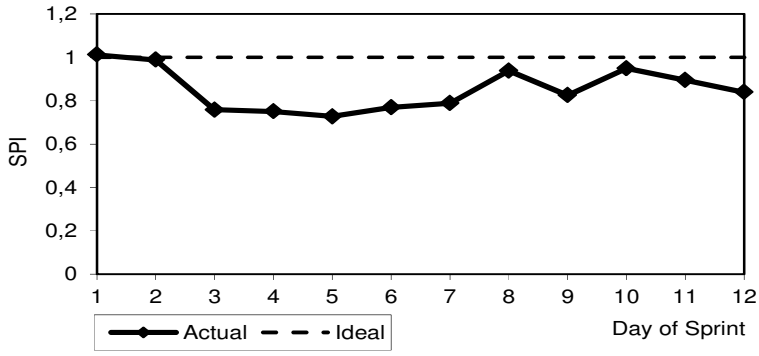

Figure 5 SPI for Sprint 2

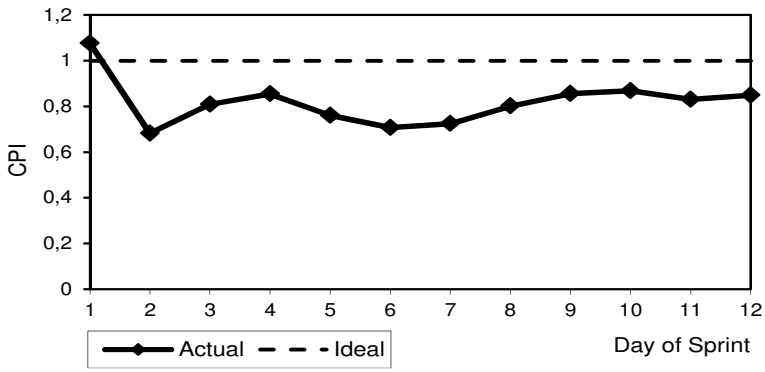

Figure 6 CPI for Sprint 2

Figures 5 and 6 show the SPI and CPI values for Sprint 2 of our case study. The CPI values were computed assuming that the cost of engineering hour was the same for all members of the Scrum Team.

Fig. 5 shows that the Sprint was behind plan (SPI value less than 1) since the third day, thus providing early indication that something went wrong. The Team was again quite close to the plan (target value of 1) on the eighth and tenth day, but finished the Sprint without accomplishing all tasks. Similar information is presented in the Sprint Burndown chart (Fig. 4), where the gap between the actual and ideal amount of work remaining is the smallest on days 2, 8, and 10.

In Fig. 6 the CPI values less than 1 indicate that the labor costs exceeded the plan on the second day and remained too high till the end of the Sprint. However, unlike in SPI and Sprint burndown charts, the CPI on days 2, 8 and 10 was not close to the target value 1, since more working hours were spent than planned.

5. Most important success factors

Although Scrum itself is simple in concept it requires discipline to be successfully implemented in practice. We conducted a survey among Scrum users in Slovenia and abroad in order to obtain their perceptions about Scrum and identify those factors that contribute most to the success of a Scrum project (Urevc and Mahnic, 2012). The survey has shown that the two most important factors affecting the success of Scrum projects are: (1) team-work and communication among team members, and (2) good communication with the Product Owner.

This is in line with agile principles that (1) the most efficient and effective method of conveying information to and within a development team is face-to-face conversation, and that (2) business people and developers must work together daily through the project. These principles emphasize synchronous human communication rather than "talking" through documents, and require a customer representative to be available in order to provide feedback and to answer the questions of the development team. The role of the Product Owner is crucial for the success of a Scrum project since he/she communicates the vision of what is to be developed and defines the criteria by which it will be judged. A nonresponsive Product Owner can cause unproductive work periods, which make iteration planning more difficult or even impossible. Additionally, the Product Owner must be knowledgeable enough about Scrum to be able to write, maintain, and prioritize user stories. On the other hand, the Product Owner must not interfere in the management of teams, redefining the scope or goals of a Sprint once a Sprint has started.

It is also very important to strictly adhere to the concept of "done" and regularly conduct Daily Scrum meetings. A common definition of "done" represents the project's quality statement for user stories. Scrum requires that each Sprint provides an increment of potentially shippable product functionality; therefore, a story can only be considered "done" and accepted by the Product Owner at the end of a Sprint if it is fully tested, integrated, and resistant to user errors. It is preferable to have a small number of completed stories than to have a slightly larger number of stories all incomplete. The definition of "done" should be established at the very beginning and followed strictly throughout the project.

Daily Scrum meetings serve as a means of empirical process control in order to ensure visibility, inspection, and adaptation. They represent one of the most important Scrum practices providing continuous insight into project activities and serving as a means for immediate detection and resolution of possible impediments. The meetings must not be for reporting to the ScrumMaster, but for the team members to inform each other about the current state of the project.

6. Conclusions

We used Scrum in several industrial projects (eg., Mahnic and Drnovscek, 2005; Mahnic, 2012b), as well as within the scope of students' capstone projects (Mahnic, 2010; 2012a), and found it very useful for all parties involved. The use of Scrum improves the communication among the Team members and maximizes co-operation. It also increases their motivation and responsibility for the success of the project. On the other hand, it gives them freedom to maximally exploit their talent and knowledge during each Sprint. They can organize their work by themselves considering their preferences and special knowledge.

From the Product Owner's and ScrumMaster's point of view it is most important that the software development process becomes visible, controllable, and manageable. All impediments are immediately detected during Daily Scrum meetings and can be removed as soon as they emerge. It is also important that each Sprint produces a subset of completely "done" user stories, thus providing customers with regular delivery of increments and frequent feedback on how the product actually works.

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MODELLING AND FORECASTING OF VUB BOND PRICES

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ABSTRACT
We examine the ARCH-GARCH models for the forecasting of the bond price time series provided by VUB bank and make comparisons the forecast accuracy with the class of RBF neural network models. A limited statistical or computer science theory exists on how to design the architecture of RBF networks for some specific nonlinear time series, which allows for exhaustive study of the underlying dynamics, and determine their parameters. To illustrate the forecasting performance of these approaches the learning aspects of RBF networks are presented and an application is included. We show a new approach of function estimation for nonlinear time series model by means of a granular neural network based on Gaussian activation function modelled by cloud concept. In a comparative analysis the presented approach is able to model and predict high frequency data with reasonable accuracy and more efficient than statistical methods.

KEYWORDS
Time series, classes ARCH-GARCH models, volatility, forecasting, neural networks, cloud concept, forecast accuracy

1. Introduction

Over the past ten years academics of computer science have developed new soft techniques based on latest information technologies such as soft, neural and granular computing to help predict future values of high frequency financial data. At the same time, the field of financial econometrics has undergone various new developments, especially in finance models, stochastic volatility, and software availability.

This paper discusses and compares the forecasts from volatility models which are derived from competing statistical and RBF (Radial Basic Function) neural network (NN) specifications. Our motivation for this comparative study lies in both the difficulty for constructing of appropriate statistical (ARCH-GARCH) model (so called hard computing) to forecast volatility even in ex post simulations and the recently emerging problem-solving methods that exploit tolerance for impression to achieve low solution costs (soft computing).

Recently, most developed statistical (econometric) models assume a nonlinear relationship among variables. As example are the exponential and power GARCH models and exponential autoregressive models. These are model-driven approaches based on a specific type relation among the variables. Neural networks and other soft computing techniques, on the other hand, are data driven models and nonparametric models. Unlike in classical statistical inference, the parameters are not predefined and their number depends on the training data used. Parameters that define the capacity of model are data-driven in such a way as to match the model capacity to the data complexity Kecman (2001, p. XXV). In this paper the relative forecasting and approximation performance of nonlinear statistical models ARCH–GARCH, EGARCH, PGARCH and an ARMA model respectively are compared with granular NN models.

The paper is organized as follows. In Section 2 we briefly describe the basic ARCH-GARCH model and its variants: EGARCH, PGARCH models. In Section 3 we present the data, conduct some preliminary analysis of the time series and demonstrate the forecasting abilities of ARCH-GARCH modes of an application. In Section 4 we introduce the architectures of RBF networks. In Section 5 we put an empirical comparison. Section 6 briefly concludes.

2. Some ARCH-GARCH Models for Financial Data

ARCH-GARCH models are designed to capture certain characteristics that are commonly associated with financial time series. They are among others: fat tails, volatility clustering, persistence, mean-reversion and leverage effect. As far as fat tails, it is well know that the distribution of many high frequency financial time series usually have fatter tails than a normal distribution. The phenomena of fatter tails is also called excess kurtosis. In addition, financial time series usually exhibit a characteristics known as volatility clustering in which large changes tend to follow large changes, and small changes tend to follow small changes. Volatility is often persistent, or has a long memory if the current level of volatility affects the future level for more time periods ahead. Although financial time series can exhibit excessive volatility from time to time, volatility will eventually settle down to a long run level. The leverage effect expresses the asymmetric impact of positive and negative changes in financial time series. It means that the negative shocks in price influence the volatility differently than the positive shocks at the same size. This effect appears as a form of negative correlation between the changes in prices and the changes in volatility.

The first model that provides a systematic framework for volatility modelling is the ARCH model of Engle (1982). Bollerslev (1986) proposes a useful extension of Engle´s ARCH model known as the generalized ARCH (GARCH) model for time sequence $\{ y_t \}$ in the following form

$$y_t = \nu_t \sqrt{h_t}, \qquad h_t = \alpha_0 + \sum_{i=1}^{m} \alpha_i y_{t-i}^2 + \sum_{j=1}^{s} \beta_j h_{t-j} \tag{1}$$

where $\{ \nu_t \}$ is a sequence of iid random variables with zero mean and unit variance. α_i a β_i are the ARCH and GARCH parameters, h_t represent the conditional variance of time series conditional on all the information to time t -1, I_{t-1}.

In the literature several variants of basic GARCH model (1) has been derived. In the basic GARCH model (1) if only squared residuals ε_{t-i} enter the equation, the signs of the residuals or shocks have no effects on conditional volatility. However, a stylized fact of financial volatility is that bad news (negative shocks) tends to have a larger impact on volatility than good news (positive shocks). Nelson (1991) proposed the following exponential GARCH model abbreviated as EGARCH to allow for leverage effects in the form

$$\log h_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \frac{|\varepsilon_{t-i}| + \gamma_i \varepsilon_{t-i}}{\sigma_{t-i}} + \sum_{j=1}^{q} \beta_j h_{t-j} \tag{2}$$

Note if ε_{t-i} is positive or there is "good news", the total effect of ε_{t-i} is $(1+\gamma_i)\varepsilon_{t-i}$. However contrary to the "good news", i.e. if ε_{t-i} is negative or there is "bad news", the total effect of ε_{t-i} is $(1-\gamma_i)|\varepsilon_{t-i}|$. Bad news can have a larger impact on the volatility. Then the value of γ_i would be expected to be negative (see Zivot and Wang (2005, p. 241)).

The basic GARCH model can be extended to allow for leverage effects. This is performed by treating the basic GARCH model as a special case of the power GARCH (PGARCH) model proposed by Ding, Granger and Engle (1993):

$$\sigma_t^d = \alpha_0 + \sum_{i=1}^{p} \alpha_i (|\varepsilon_{t-i}| + \gamma_i \varepsilon_{t-i})^d + \sum_{j=1}^{q} \beta_j \sigma_{t-j}^d \tag{3}$$

where d is a positive exponent, and γ_i denotes the coefficient of leverage effects (see Zivot and Wang (2005, p. 243)).

3. An Application of ARCH-GARCH Models

We illustrate the ARCH-GARCH methodology on the developing a forecast model. The data is taken from the commercial VUB bank of the. The data consist of daily observations of the price time series for the bond fund of VUB (BPSVUB). The data was collected for the period May 7, 2004 to February 28, 2008 which provided of 954 observations (see Figure 1 and 3). To build a forecast model the sample period (training data set denoted A) for analysis r_1, ..., r_{900} was defined, i.e. the period over which the forecasting model was developed and the ex post forecast period (validation data set denoted as E) r_{901}, ..., r_{954} as the time period from the first observation after the end of the sample period to the most recent observation. By using only the actual and forecast values within the ex post forecasting period only, the accuracy of the model can be calculated.

Input selection is crucial importance to the successful development of an ARCH-GARCH model. Potential inputs were chosen based on traditional statistical analysis: these included the raw BPSVUB and lags thereof. The relevant lag structure of potential inputs was analysed using traditional statistical tools, i.e. using the autocorrelation function (ACF), partial autocorrelation function (PCF) and the Akaike/Bayesian information criterion (AIC/BIC): we looked to determine the maximum lag for which the PACF coefficient was statistically significant and the lag given the minimum AIC. According to these criterions the ARMA(5) model was specified as

$$r_t = \xi + \phi_1 r_{t-1} + \phi_2 r_{t-2} + \phi_3 r_{t-3} + \phi_4 r_{t-4} + \phi_5 r_{t-5} + \varepsilon_t \quad (4)$$

where $\xi, \phi_1, \phi_2, ..., \phi_5$ are unknown parameters of the model, ε_t is independent random variable drawn from stable probability distribution with mean zero and variance σ_ε^2.

As we mentioned early, high frequency financial data, like our BPSVUB, reflect a stylized fact of changing variance over time. An appropriate model that would account for conditional heteroscedasticity should be able to remove possible nonlinear pattern in the data. Various procedures are available to test an existence of ARCH or GARCH. A commonly used test is the LM (Lagrange multiplier) test. The LM test assumes the null hypothesis H_0: $\alpha_1 = \alpha_2 = ... = \alpha_p = 0$ that there is no ARCH. The LM statistics has an asymptotic χ^2 distribution with p degrees of freedom under the null hypothesis. For calculating the LM statistics see for example, Bollerslev (1986 Eqs. (27) and (28)). The LM test performed on the BPSVUB indicates presence of autoregressive conditional heteroscedasticity. For estimation the parameters of an ARCH or GARCH model the maximum likelihood procedure was used. The quantification of the model was performed by means software R2.6.0 at http://cran.r-project.org and resulted into the following mean equation:

$$r_t = 0.0000748 + 0.06628 r_{t-1} + 0.09557 r_{t-2} + 0.0275 r_{t-3} + 0.0528 r_{t-4} + 0.09795 r_{t-5} + e_t$$

and variance equation (5)

$$h_t = 1.958\ 10^{-8} + 0.1887\, e_{t-1}^2 + 0.8075\, h_{t-1}$$

where e_t are estimated residuals of ε_t from Eq. (4). The volatility was estimated by means software R2.6.0 and is displayed in Figure 1 right.

In many cases, the basic GARCH model with normal Gaussian error distribution (1) provides a reasonably good model for analyzing financial time series and estimating conditional volatility. However, there are some aspects of the model which can be improved so that it can better capture the characteristics and dynamics of a particular time series. For this purpose the Quantile-Quantile (QQ) plots are used. For example, the R system (http://cran.r-project.org/) assist in performing residual analysis (computes the Gaussian, studentised and generalized residuals with generalized error distribution – GED). In Figure 2 the QQ-plot reveals that the normality assumption of the residuals may not be appropriate. A

comparison of QQ-plots in figure 3 shows that GED distribution promise better goodness of fit. This is confirmed by AIC and BIC criterions and Likelihood function.

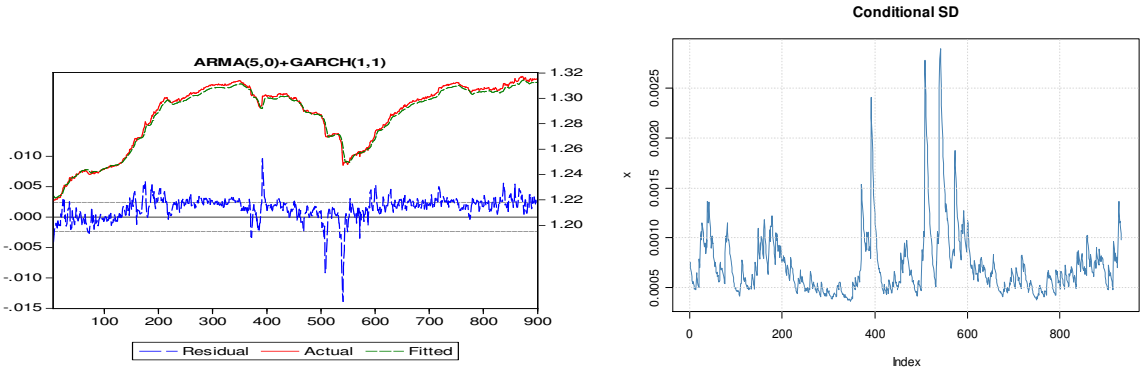

Figure 1 **Actual and fitted values of the VUB fund: ARMA(5,0)+GARCH(1,1) (left). ARCH-GARCH model (5). Residuals are at the bottom. Actual time series represents the solid line, the fitted vales represents the dotted line. The estimated volatility for ARMA(5,0)+GARCH(1,1) process, model (5) (right).**

Finally, for catching the leverage effect, the model ARMA(5,0)+EGARCH(1,1) was estimated. The coefficient for leverage effect γ from equation (2) is statistical significant and equals -0.2099535, and it is negative which means that "bad news" have larger impact to volatility. If we compare the estimated volatility in Figure 1 with the VUB fund in Figure 1, we can see that in period of depression the "leverage effects" and the bad news cause the asymmetric jump in the volatility.

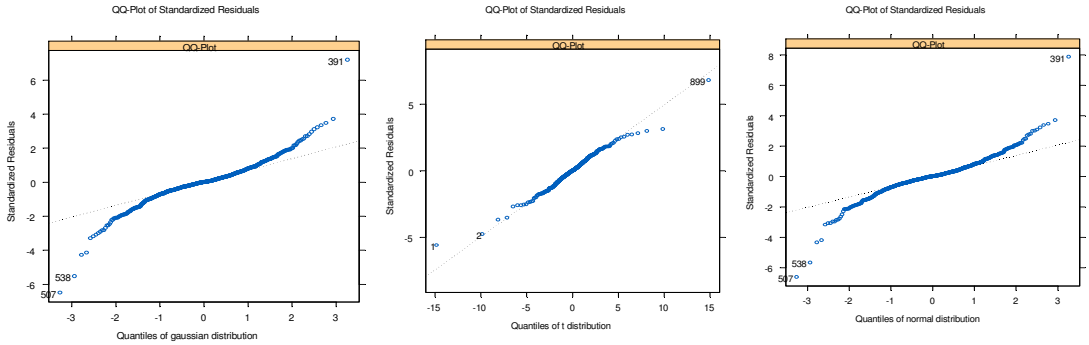

Figure 2 **QQ-plot of Gaussian standard residuals (left), studentised (middle) and generalised(GED) (right).**

As we mentioned above, the estimation of EGARCH and PGARCH models has showed the presence of leverage effects. The assumption of normal error distribution is also violated because the alternative error distributions provide better goodness of their fit. These findings indicate the chance of gaining better results in forecasting with using some of these models. Our suspicion was confirmed by computing the statistical summary measure of the model´s forecast RMSE. As we can see in Table 2 the smallest errors have just the GARCH with GED distribution.

Table 2 Ex post forecast RMSEs for various extensions of GARCH models and granular RBF NN. See text for details.

Model Distribution	AR(5)+ GARCH(1,1)	AR(5)+ EGARCH(1,1)	AR(5)+ PGARCH(1,1)	Granular RBF NN (5-1-1)
Gaussian	0.003461	0.001066	0.001064	0.00700
t-distribution	0.002345	0.001064	0.001063	η = 0.1,
GED-distribution	0.001056	0.001063	0.001062	K=1.25 $\lambda_0(t)$ = 0.005

After these findings we can make predictions for next 54 trading days using the model with the smallest RMSE, i. e. by the ARMA(5,0) + GARCH(1,1) with GED error distribution. These predictions are calculated by means software Eviews (http://www.eviews.com) and shoved in Figure 3.

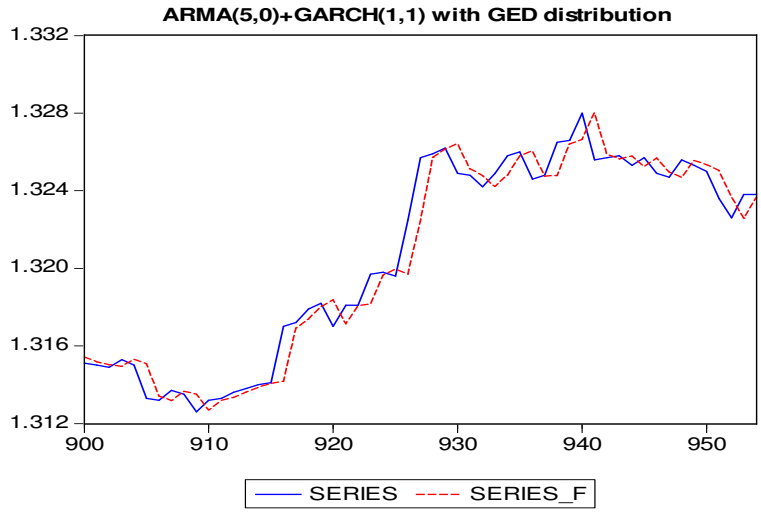

Figure 3 Actual (solid) and forecast (dotted) values of the VUB fund.

4. An Alternative Approach

In this section we show a new approach of function estimation for time series modeled by means a granular RBF neural network based on Gaussian activation function modeled by cloud concept. We propose the neural architecture according to Figure 4.

The structure of a neural network is defined by its architecture (processing units and their interconnections, activation functions, methods of learning and so on). In Figure 5 each circle or node represents the neuron. This neural network consists an input layer with input vector $\mathbf{x}$ and an output layer with the output value $\hat{y}_t$. The layer between the input and output layers is normally referred to as the hidden layer and its neurons as RBF neurons. Here, the input layer is not treated as a layer of neural processing units. One important feature of RBF networks is the way how output signals are calculated in computational neurons. The output signals of the hidden layer are

$$o_j = \psi_2(\|\mathbf{x} - \mathbf{w}_j\|) \tag{5}$$

where $\mathbf{x}$ is a *k*-dimensional neural input vector, $\mathbf{w}_j$ represents the hidden layer weights, ψ_2 are radial basis (Gaussian) activation functions. Note that for an RBF network, the hidden layer weights $\mathbf{w}_j$ represent the centres $\mathbf{c}_j$ of activation functions ψ_2. To find the weights $\mathbf{w}_j$ or centres of activation functions we used the following adaptive (learning) version of *K*-means clustering algorithm for *s* clusters.

The RBF network computes the output data set as

$$\hat{y}_t = G(\mathbf{x}_t, \mathbf{c}, \mathbf{v}) = \sum_{j=1}^{s} v_{j,t}\, \psi_2(\mathbf{x}_t, \mathbf{c}_j) = \sum_{j=1}^{s} v_j o_{j,t}, \qquad t = 1, 2, ..., N \tag{6}$$

where *N* is the size of data samples, *s* denotes the number of the hidden layer neurons. The hidden layer neurons receive the Euclidian distances ($\|\mathbf{x} - \mathbf{c}_j\|$) and compute the scalar

values $o_{j,t}$ of the Gaussian function $\psi_2(\mathbf{x}_t, \mathbf{c}_j)$ that form the hidden layer output vector $\mathbf{o}_t$. Finally, the single linear output layer neuron computes the weighted sum of the Gaussian functions that form the output value of $\hat{y}_t$.

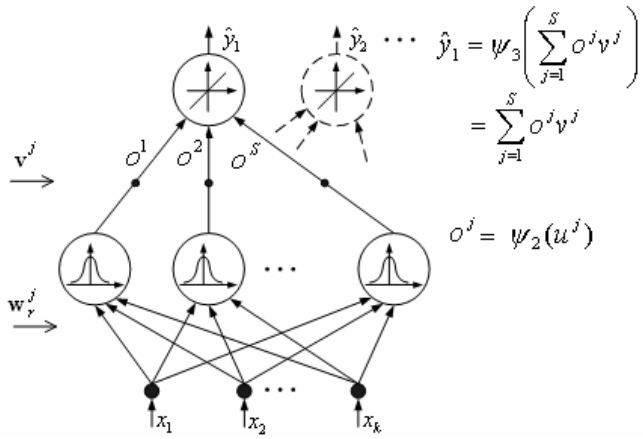

Figure 4 RBF neural network architecture.

If the scalar output values $o_{j,t}$ from the hidden layer will be normalised, where the normalisation means that the sum of the outputs from the hidden layer is equal to 1, then the RBF network will compute the "normalised" output data set $\hat{y}_t$ as follows

$$\hat{y}_t = G(\mathbf{x}_t, \mathbf{c}, \mathbf{v}) = \sum_{j=1}^{s} v_{j,t} \frac{o_{j,t}}{\sum_{j=1}^{s} o_{j,t}} = \sum_{j=1}^{s} v_{j,t} \frac{\psi_2(x_t, c_j)}{\sum_{j=1}^{s} \psi_2(x_t, c_j)}, \quad t = 1, 2, ..., N. \tag{7}$$

The network with one hidden layer and normalised output values $o_{j,t}$ is the fuzzy logic model or the soft RBF network. In our case, the subjects of learning are the weights $v_{j,t}$ only. These weights can be adapted by the error back-propagation algorithm.

Next, to improve the abstraction ability of soft RBF neural networks with architecture depicted in Figure 4, we replaced the standard Gaussian activation (membership) function of RBF neurons with functions based on the normal cloud concept Li & Du (2008, p. 113).

Cloud models are described by three numerical characteristics: expectation (*Ex*) as most typical sample which represents a qualitative concept, entropy (*En*) as the uncertainty measurement of the qualitative concept and hyper entropy (*He*) which represents the uncertain degree of entropy. *En* and *He* represent the granularity of the concept, because both the *En* and *He* not only represent fuzziness of the concept, but also randomness and their relations. This is very important, because in economics there are processes where the inherent uncertainty and randomness are associated with different time. Then, in the case of soft RBF network, the Gaussian membership function $\psi_2(./.)$ in Eq. (8) has the form

$$\psi_2(\mathbf{x}_t, \mathbf{c}_j) = \exp\left[-(\mathbf{x}_t - \mathrm{E}(\mathbf{x}_j)/2(En')^2\right] = \exp\left[-(\mathbf{x}_t - \mathbf{c}_j)/2(En')^2\right] \tag{8}$$

where En' is a normally distributed random number with mean En and standard deviation He, E is the expectation operator.

5. Emprical comparison

The RBF NN was trained using the variables and data sets as each ARCH-GARCH model above. The architecture (5-1-1) of the network, reported in the last column of Table 2, consists of three layers and seven neurons: five neurons in input layer, one in hidden and output layer.

In the granular RBF neural network framework, the non-linear forecasting function $f(\mathbf{x})$ was estimated according to the expressions (7) with RB function $\psi_2(./.)$ given by equation (8). Granular RBF NN assumes that the noise level of the entropy is known. Noise levels are indicated by hyper entropy. It is assumed that the noise level is constant over time. We select, for practical reasons, that the noise level is a multiple, say 0.015, of entropy. The forecasting ability of particular networks was measured by the *MSE* criterion of ex post forecast periods (validation data set). The detailed computational algorithm for the forecast *MSE* values and the weight update rule for the granular network is shown in (Marcek, M., Marcek, D., (2008)). The result of this application is shown in Table 2. A direct comparison between statistical (ARCH-GARCH) and neural network models shows that the statistical approach is better than the neural network competitor. The achieved ex post accuracy of RBF NN (RMSE = 0.00700), but is still reasonable and acceptable for use in forecasting systems that routinely predict values of variables important in decision processes. Moreover, as we could see, the RBF NN has such attributes as computational efficiency, simplicity, and ease adjusting to changes in the process being forecast.

6. Conclusion

This paper has presented the granular RBF neural network based on Gaussian activation function modelled by cloud concept for solving approximation and prediction problems of real financial and economic processes. The neural network is suggested as an alternative to widely used statistical and econometric techniques in time series modelling and forecasting.

The power of the granular RBF NN is tested against some nonlinear high frequency data. A comparative analysis of two empirical studies is executed in order to evaluate its performance. The presented neural network, or soft computing approach, is applied on real data and time series with different models. It is able by using input-output data to find a relevant functional structure between the input and the output.

The importance of having good intelligent forecasting tools for time series is ever more important with increasing number of data when more effort must be devoted to development of efficient data handling and management procedures. The proposed methodology is believed to be helpful in future research and its applications.

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VÝPOČETNĚ NÁROČNÉ APLIKACE S VYUŽITÍM VIRTUALIZACE PRACOVNÍCH STANIC NA BÁZI INTEGRACE TECHNOLOGIÍ MICROSOFT VDI A SUN RAY

COMPUTATIONALLY INTENSIVE APPLICATIONS WITH THE SUPPORT OF PERSONAL COMPUTERS ENVIRONMENT VIRTUALIZATION ON THE BASE OF MICROSOFT VDI AND SUN RAY TECHNOLOGIES INTEGRATION

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ABSTRAKT:

Významným projektem řešeným v tomto kalendářním roce na Ekonomické fakultě VŠB-Technické univerzity Ostrava je pilotní realizace virtualizace pracovních stanic počítačových učeben fakulty založená na bázi integrace technologie *Microsoft Virtual Desktop Infrastructure* s technologií tenkých klientů *Sun Ray*, která výrazně přispěje ke kvalitativnímu zlepšení podpory výukového procesu vyžadujícího nasazení výpočetně náročných aplikací a ke snížení finančních nákladů nutných k provozu počítačových učeben řešitelské fakulty. Všechny provozované aplikace tak budou prostřednictvím technologie tenkých klientů plně dostupné všem studentům fakulty ve výukovém procesu i mimo něj na všech pracovních stanicích i mobilních zařízeních prostřednictvím softwarového emulátoru, příp. hardwarového tenkého klienta *Sun Ray*. Technologie tenkých klientů pak bude nově nasazena ve vybraných předmětech bakalářských a magisterských studijních oborů a rovněž v aktivitách autorizovaného školicího střediska v rámci celosvětového programu *Novell Academic Training Partners* pro výuku problematiky operačního systému *SUSE Linux*.

ABSTRACT:

The pilot virtualization of personal computers environment located at the computer classrooms based on the integration of the *Microsoft Virtual Desktop Infrastructure* technology and *Sun Ray* thin client technology id one of the significant project that is solved at the Faculty of Economics VŠB-Technical University of Ostrava this calendar year. This integration will significantly support the quality of the teaching process that requires computationally intensive applications and the decreasing of the financial costs necessary for the operation of all computer classrooms of the faculty. All computationally intensive applications will be available via the software emulator, resp. hardware thin client *Sun Ray*, for all the student of the faculty during the educational process and also outside of them. The thin client technology will also newly support the chosen subjects of the bachelor and master degree study programmes and also the activities of the authorized training centre in the frame of the whole world *Novell Academic Training Partners* programme for the purposes of the *SUSE Linux* operating system education.

KLÍČOVÁ SLOVA:

Sun Ray, Microsoft VDI, virtualizace, tenký klient, výpočetně náročné aplikace

KEYWORDS:
Sun Ray, Microsoft VDI, virtualization, thin client, computationally intensive applications

1. Úvod

Inteligentní zařízení tenkých klientů na bázi technologie *Sun Ray* (viz [1]) jsou určena pro práci s virtualizovanými pracovními stanicemi, jejichž funkcionality jsou implementovány na straně centrálních serverů. Při svém provozu přitom využívají výhod konsolidace programových prostředků na centrálních serverech a po celou dobu své životnosti nevyžadují prakticky žádnou správu ani hardwarové inovace. Zařízení *Sun Ray* jsou bezestavová, neuchovávají žádná data a nejsou vybavena operačním systémem. Z těchto důvodů jsou mnohem jednodušší, energeticky méně náročná a levněji udržovatelná než standardní pracovní stanice, přičemž veškerou správu uživatelů a inovace programového vybavení lze opět provádět pouze centrálně na straně serveru. Zařízení tenkých klientů *Sun Ray* přinášejí výkon pracovních stanic při nízkých pořizovacích nákladech a umožňují uživatelům současný provoz aplikací nad operačními systémy *Oracle Solaris*, *Linux*, *Microsoft Windows*, *IBM OS/400* a dalšími. Jednou z jejich nejcennějších funkcí je tzv. *Hot Desking*, která umožňuje uživateli prostřednictvím inteligentní karty nebo běžného přihlášení přenášet informace o aktuální relaci z jednoho zařízení tenkého klienta na další. Uživatel tak může pokračovat na jiném zařízení tenkého klienta přesně ve stavu, ve kterém přerušil svou práci, se stejným nastavením, spuštěnými aplikacemi a otevřenými soubory. Funkce *Hot Desking* hraje také klíčovou roli ve scénářích zotavování, kdy lze sítě s technologií *Sun Ray* konfigurovat tak, že při výpadku nebo odstavení jednoho centrálního serveru jsou všichni klienti automaticky přesměrováni na server záložní.

Samotná virtualizace pracovních stanic je pak zabezpečena programovým systémem *Oracle Secure Global Desktop* (viz [2]) provozovaném na straně centrálního serveru, pomocí kterého je prováděna správa aplikací, uživatelů, přístupových práv, apod. Programový systém *Oracle Secure Global Desktop* umožňuje přístup ke službám virtualizovaných pracovních stanic nejen s využitím hardwarových tenkých klientů *Sun Ray*, ale i z prostředí standardních pracovních stanic nebo mobilních zařízení pomocí speciálních softwarových emulátorů nebo webových prohlížečů s instalovanou podporou *Java Virtual Machine* (viz [3]). Technologie tenkých klientů *Sun Ray* je na Ekonomické fakultě VŠB-Technické univerzity Ostrava již druhým rokem úspěšně provozována a využívána studenty na řadě počítačových učeben, v prostorách fakultní knihovny a rovněž v rámci služeb centra Slunečnice, kde jsou jejími uživateli studenti se speciálními potřebami.

V současné době jsou v prostředí serverového clusteru podporujícího provoz technologie tenkých klientů *Sun Ray* instalovány a zprovozněny zejména následující výpočetně náročné programové systémy:

- *SPSS* (viz [4]) je univerzální statistický program pro zpracování datových souborů, datových bází a analýzu dat. Je vhodný pro rutinní a opakovanou práci se soubory dat v návaznosti na informační systémy. Lze jej použít s plnou funkčností pro statistické modelování i popis, OLAP i data mining. Program *SPSS* pokrývá všechny fáze analytického procesu a nabízí prostředky a nástroje pro komplexní analýzu dat. Na Ekonomické fakultě je produkt *SPSS* aktivně nasazen do výukového procesu od roku 1997.
- *ArcView* (viz [5]) je programové prostředí používané v oblasti geografických informačních systémů, které poskytuje rozsáhlé nástroje pro tvorbu map, získávání informací z map, nástroje pro editaci a prostorové operace, tvorbu a správu geografických dat, tabelárních dat a metadat. Na Ekonomické fakultě je pak využíváno

v oblastech výuky spojené s problematikou geografických informačních systémů a socioekonomické geografie.

- *WITNESS* (viz [6]) je přední software pro simulaci a optimalizaci výrobních, obslužných a logistických systémů. Jádro systému *WITNESS* doplňují moduly pro optimalizaci procesů, návrh a vyhodnocení experimentů, prezentaci výsledků simulace, zobrazení v prostředí virtuální reality, výměnu informací mezi nástroji *WITNESS* a *Microsoft VISIO*, propojení s CAD/CAM systémy, dokumentaci modelů a získávání znalostí z rozsáhlých souborů dat. Na Ekonomické fakultě je tento programový nástroj využíván zejména při výuce modelování systémů reálného času a vybraných partiích logistiky.

Na Ekonomické fakultě byl v loňském kalendářním roce rovněž zahájen provoz autorizovaného školicího střediska v rámci celosvětového programu *Novell Academic Training Partners* (NATP), které je koncipováno jako multiplatformní učebna s nejmodernější technikou zaměřená na zajištění výuky specializovaných předmětů. Projekt byl financován s výraznou podporou prostředků získaných prostřednictvím Fondu rozvoje vysokých škol s cílem zásadního zkvalitnění výukového procesu pro posluchače vybraných studijních oborů a přímé podpory jejich uplatnitelnosti na trhu práce. Školicí středisko má nekomerční charakter, celouniverzitní působnost a jeho primárním úkolem je výchova špičkových certifikovaných odborníků v oblasti technologií operačního systému *SUSE Linux* a Adresářových služeb *Novell eDirectory*, certifikace pedagogických pracovníků střediska a vedení výukového procesu ve vybraných předmětech bakalářských a magisterských studijních programů v duchu autorizovaných školicích materiálů firmy Novell pro oblasti certifikací *Certified Linux Administrator* (CLA) a *Novell Certified Administrator* (NCA).

2. Technologie Sun Ray a Microsoft VDI a jejich integrace pro virtualizaci pracovních stanic

Provoz technologie tenkých klientů *Sun Ray* v oblasti výukového procesu vyžadujícím provoz výpočetně náročných aplikací a aktivit autorizovaného školicího střediska v rámci programu *NATP* iniciovaly ze strany pedagogických pracovníků i studentů následující požadavky:

- Zvýšit celkový výpočetní výkon aplikačních serverů centrálního serverového clusteru zabezpečujícího provoz technologie tenkých klientů *Sun Ray*. V současné době využívá kontinuálně služeb centrálního serverového clusteru celkem 160 ks hardwarových tenkých klientů řady *Sun Ray* instalovaných na počítačových učebnách fakulty a v dalších lokalitách. V běžném provozu je pak dále aktivních dalších cca. 100 softwarových tenkých klientů, které ke službám serverového clusteru přistupují z vnitřní fakultní sítě nebo prostřednictvím sítě Internet. Při tomto počtu současně pracujících uživatelů začíná být výkon zejména aplikačních serverů centrálního serverového clusteru nedostatečný.
- Zvýšit stabilitu a zabezpečit veškeré funkcionality programových systémů provozovaných v prostředí technologií tenkých klientů *Sun Ray*. Praktické používání řady aplikací v prostředí technologií tenkých klientů *Sun Ray* ve výukovém procesu odhalilo celou řadu problémů zejména v oblasti jejich stability a nedostupnosti některých funkcionalit, které jsou primárně způsobeny jejich provozem v prostředí operačního systému *MS Windows Server 2008* instalovaném na jednotlivých farmách aplikačních serverů. Implementace řady aplikací předpokládá jejich běh v prostředí operačních systémů instalovaných na pracovních stanicích a interakci s jediným uživatelem, což samozřejmě způsobuje problémy s jejich nasazením ve výukovém

procesu s podporou technologie tenkých klientů. Řešením tohoto problému je pak pilotní realizace integrace technologie *Microsoft Virtual Desktop Infrastructure* s technologií tenkých klientů *Sun Ray*.

- Zabezpečit provoz programového systému *Mathematica* ve výukovém procesu vybraných matematicky orientovaných předmětů všech studijních oborů řešitelské fakulty. V současné době není výuka matematicky a kvantitativně orientovaných předmětů podporována žádným programovým produktem s výjimkou předmětů pro výuku matematické statistiky, kde je využíván program *SPSS*. V souvislosti se zakoupením celouniverzitní multilicence programu *Matlab* byly již před léty prováděny pokusy o jeho integraci do výuky matematicky orientovaných předmětů na řešitelské fakultě, ale s neúspěchem. Tento program se pro výuku budoucích ekonomů ukázal jako nevhodný. Nutnost naučit se jazyk programu výuku spíše zhoršila a také příprava výukových materiálů v *Matlabu* se ukázala pro mnohé pedagogy jako komplikovaná. Proto pedagogové tento programový systém většinově odmítli pro výukové účely nasazovat. Vzhledem k vysokému počtu studentů, kteří budou programový systém *Mathematica* využívat ve výukovém procesu i mimo něj, se jeho provoz v prostředí nasazení výpočetně výkonného serverového clusteru podporující technologii tenkých klientů *Sun Ray* jeví jako naprostá nutnost.
- Zabezpečit provoz prostředí virtualizovaných pracovních stanic ve výukovém procesu i mimo něj pod operačním systémem *SUSE Linux*. Jednou ze základních funkcí autorizovaného školicího střediska v rámci programu *NATP* je vedení kurzů a příprava studentů pro získání certifikací *Certified Linux Administrator* v oblasti správy operačního systému *SUSE Linux*, který není v současné době v prostředí tenkých klientů *Sun Ray* podporován příslušnými licencemi programového systému *Oracle Secure Global Desktop*. Nasazení integrace technologie *Microsoft Virtual Desktop Infrastructure* a technologie tenkých klientů *Sun Ray* však tuto funkcionalitu zabezpečí.

Technologie *Microsoft Virtual Desktop Infrastructure* (VDI - viz [7], [9]) poskytuje obdobně jako technologie tenkých klientů *Sun Ray* možnost centralizace virtualizovaných pracovních stanic, jejichž funkcionality jsou dostupné na straně centrálních serverů. Na rozdíl od technologie *Sun Ray*, jejíž filozofie virtualizovaných pracovních stanic je založena na možnosti spouštění jednotlivých aplikací instalovaných v prostředí serverového clusteru s operačními systémy *MS Windows Server 2008*, *Linux*, *Oracle Solaris*, *IBM OS/400* a dalšími, umožňuje technologie *Microsoft VDI* rovněž uložení celých obrazů klientských operačních systémů řady *MS Windows* a *Linux* spolu s instalovanými aplikacemi a daty. Uživatel virtuální pracovní stanice pak nespouští v jejím prostředí pouze jednotlivé aplikace instalované v prostředí serverového operačního systému, ale má k dispozici svou vlastní instanci příslušného klientského operačního systému s instalovanými aplikacemi, daty, přidělenými uživatelskými právy, atd. Jednotlivé spouštěné aplikace tak běží ve virtuálním prostředí klientského (a nikoliv serverového) operačního systému a jejich provoz je samozřejmě mnohem stabilnější.

Pilotní integrací technologie *Microsoft VDI* s technologií tenkých klientů *Sun Ray* je tedy možno získat řešení virtualizovaných pracovních stanic s následujícími stěžejními vlastnostmi:

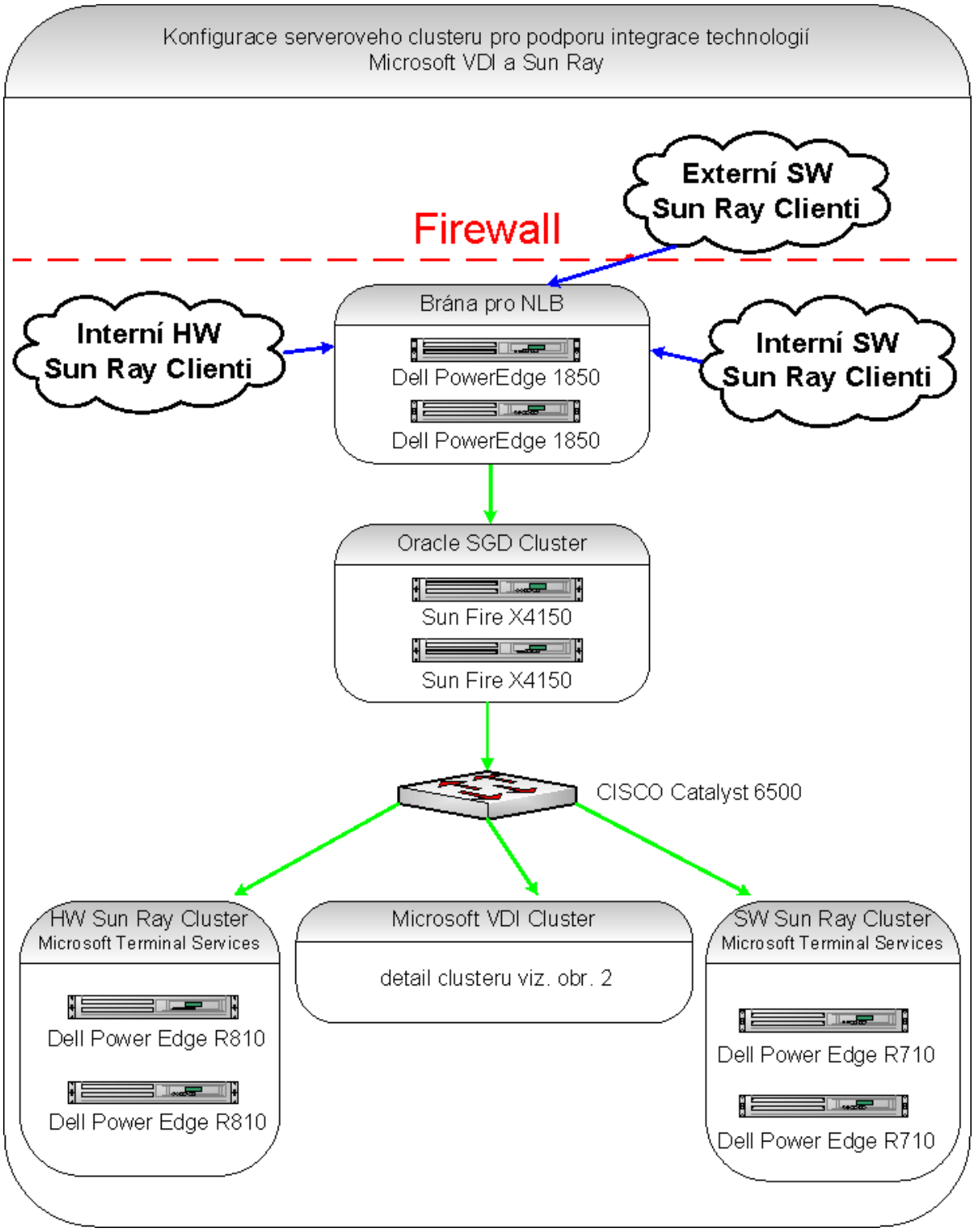
- Řešení umožňuje instalaci obrazů pracovních stanic s klientskými operačními systémy řady *MS Windows* a *Linux* s předinstalovanými aplikacemi, daty, uživatelskými právy apod. (vlastnost *Microsoft VDI*). Tím bude dosaženo mnohem stabilnějšího běhu aplikací v prostředí virtualizovaných pracovních stanic, jejichž provoz v prostředí

serverového operačního systému přináší nestability a omezení funkcionalit. V průběhu řešení projektu bude rovněž realizována instalace virtuálních obrazů pracovních stanic s operačním systémem *SUSE Linux* a jejich provoz v prostředí integrovaného řešení pro podporu výukového procesu autorizovaného školicího střediska *NATP*.

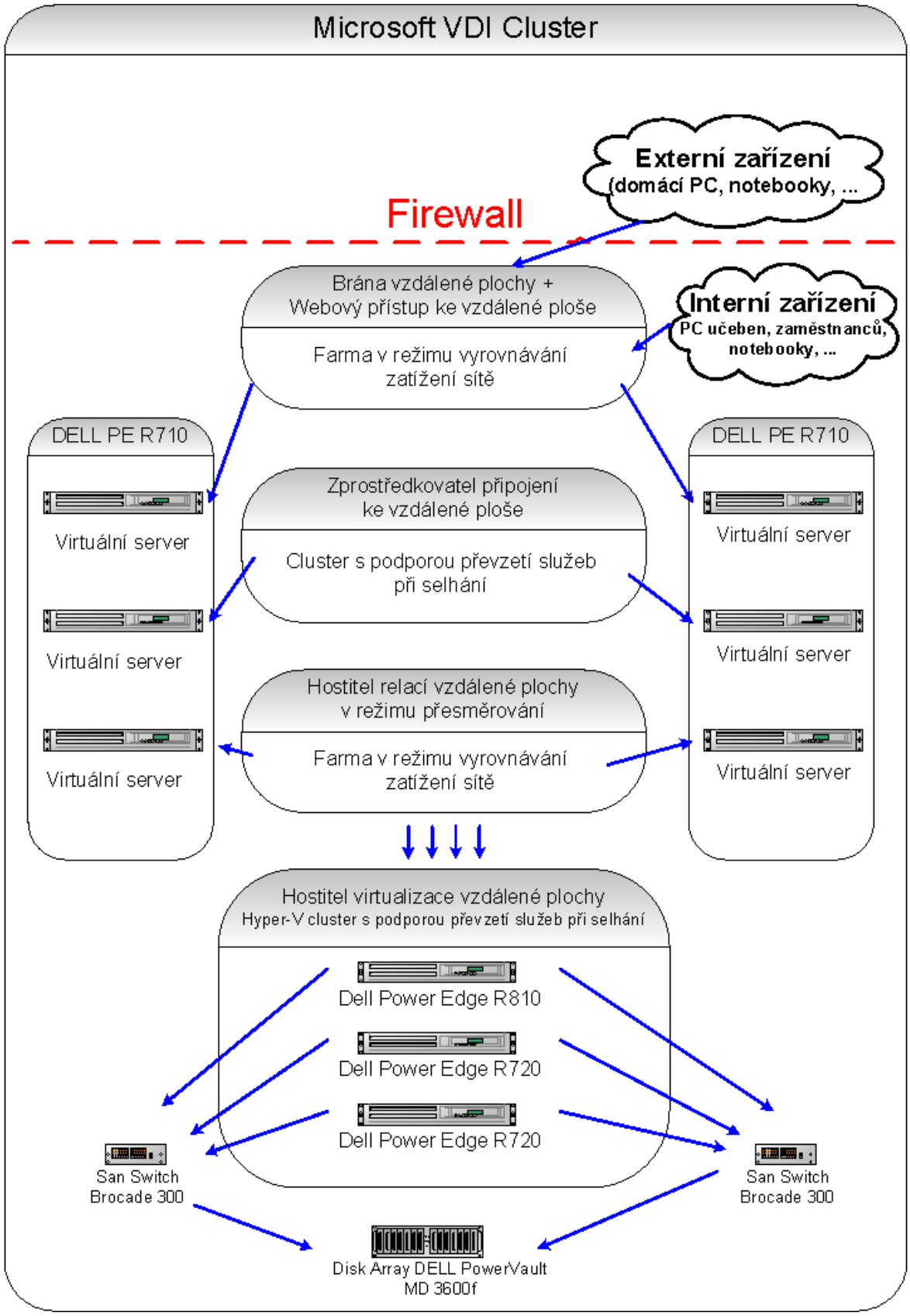
- Řešení umožňuje rovněž provoz samostatných aplikací pod operačními systémy *MS Windows Server*, *Linux*, *Oracle Solaris*, *IBM OS/400* a dalšími (vlastnost technologie *Sun Ray*).
- Řešení umožňuje provoz virtualizovaných pracovních stanic v prostředí hardwarových tenkých klientů *Sun Ray* (vlastnost integrace technologií *Microsoft VDI* a *Sun Ray*).
- Řešení umožňuje vysokou dostupnost virtualizovaných pracovních stanic z libovolné pracovní stanice nebo mobilního zařízení, na kterém je možno provozovat webový prohlížeč s instalovaným prostředím *Java Virtual Machine* bez nutnosti instalace speciálních softwarových emulátorů (vlastnost technologie *Sun Ray*). Samotné řešení *Microsoft VDI* umožňuje přístup k virtualizovaným pracovním stanicím pouze v prostředí pracovních stanic s operačním systémem řady *MS Windows*.
- Řešení umožňuje oddělit síťový provoz pro přístup ke službám virtualizovaných pracovních stanic z hardwarových tenkých klientů *Sun Ray* od přístupu softwarových tenkých klientů (webové prohlížeče, softwarové emulátory) a tím zajistit úroveň kvality služeb hardwarových tenkých klientů *Sun Ray* instalovaných na počítačových učebnách v čase výukového procesu (vlastnost technologie *Sun Ray*).
- Řešení rovněž umožňuje virtualizaci serverových operačních systémů řady *Microsoft Windows Server 2008* a rozložení výkonu na jednotlivé servery clusteru s podporou technologie *Microsoft HyperV* (vlastnost technologie *Microsoft VDI* - viz [8]).

3. Hardwarové a softwarové řešení integrace technologií *Microsoft VDI* a *Sun Ray* na Ekonomické fakultě VŠB-TU Ostrava

Praktická realizace hardwarového řešení integrace technologie tenkých klientů *Sun Ray* s technologií *Microsoft VDI* na Ekonomické fakultě je zobrazena na obr. 1. Samotná technologie *Microsoft VDI* rozšiřuje možnosti v současné době používané technologie *Microsoft Remote Desktop* a to jak v režimu klasické vzdálené plochy, tak v režimu bezešvých vzdálených aplikací na bázi technologie *Microsoft RemoteApp*, což je znázorněno na obr. 2, který detailně zobrazuje konfiguraci serverového clusteru pro podporu nasazení technologie *Microsoft VDI*.



Obrázek 1 Hardwarová realizace integrace technologií Sun Ray a Microsoft VDI



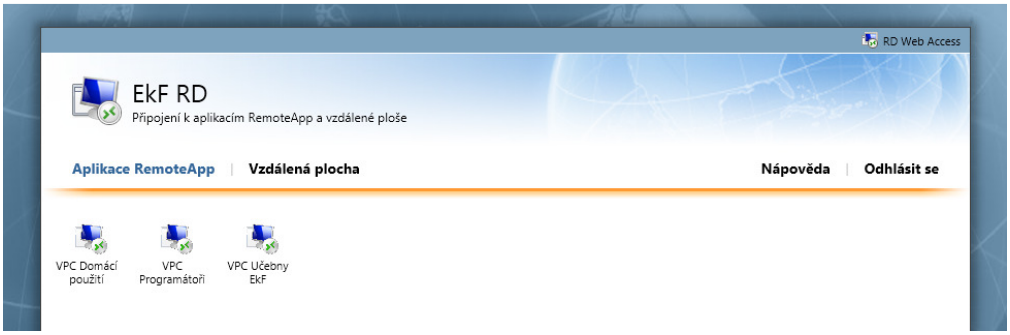
Obrázek 2 Hardwarová realizace serverového clusteru pro podporu Microsoft VDI

Uživatelé mají možnost přístupu k virtuálním strojům s klientským operačním systémem (*Microsoft Windows 7 Enterprise*) a nainstalovanými aplikacemi z prostředí

fakultní počítačové sítě (interní zařízení) i z prostředí svých zařízení používaných mimo tuto fakultní síť (externí zařízení). Uživatel potřebuje k zahájení komunikace splnit pouze podmínku přítomnosti aplikace *Připojení ke vzdálené ploše* na svém zařízení (operační systémy řady *Microsoft Windows*).

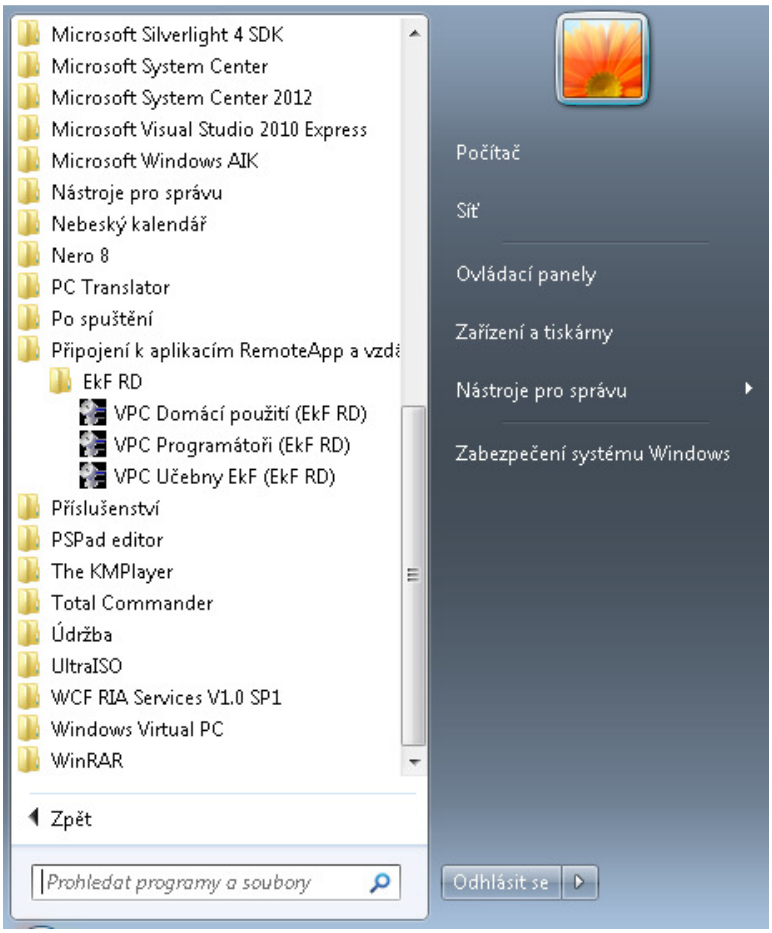
Vybrání vhodného virtuálního stroje pro uživatele a jeho spuštění probíhá dvěma způsoby:

- prostřednictvím webového prohlížeče, kde se uživatel přihlásí k webové aplikaci *Webový přístupu ke vzdálené ploše* a jejím prostřednictvím si vybere virtuální stroj s pro něj vhodným nastavením (viz obr. 3),



Obrázek 3 Výběr virtuálního stroje prostřednictvím webového prohlížeče

- prostřednictvím nabídky *Start* (viz obr. 4).



Obr. 4. Výběr virtuálního stroje prostřednictvím nabídky Start

Po spuštění virtuálního stroje pracuje uživatel ve známém prostředí klientského operačního systému stejným způsobem, s jakým je zvyklý při práci s klasickou pracovní stanicí. V rámci přihlašovacího procesu je mimo jiné rovněž prováděno mapování disků (pevné disky, síťové disky, USB flash disky) a tiskáren zařízení, ze kterých se uživatel připojuje. Uživatel má tedy k dispozici prostředky svého zařízení a navíc využívá výpočetních možností výkonově bohatě vybavených serverů.

V rámci realizace softwarového řešení integrace technologií Microsoft VD a Sun Ray byly využity následující programové komponenty technologie Microsoft VDI:

- ***Brána vzdálené plochy*** a ***Webový přístup ke vzdálené ploše*** umožňuje uživatelům získat přístup k virtuálním strojům z prostředí webového prohlížeče a nabídky start a to jak z interní tak z externí sítě umístěné za firewallem,
- ***Zprostředkovatel připojení ke vzdálené ploše*** podporuje vyrovnávání zatížení relací a opětovné připojení k relaci v serverové farmě,
- ***Hostitel relací vzdálené plochy v režimu přesměrování*** slouží jako prostředník k získání vzdálené plochy virtuálního stroje a jeho předání uživatelskému zařízení,
- ***Hostitel virtualizací vzdálené plochy*** v integraci s technologií *Hyper-V* hostuje virtuální stroje a poskytuje je uživatelům jako virtuální plochy. Každému uživateli je možné přiřadit osobní virtuální stroj nebo můžeme uživatelům poskytnout sdílený přístup do fondu virtuálních strojů.

4. Závěr

Integrace technologie tenkých klientů *Sun Ray* s technologií virtualizovaných pracovních stanic *Microsoft VDI* je na Ekonomické fakultě realizována v tomto kalendářním roce v rámci řešení projektu Fondu rozvoje vysokých škol "*Nasazení výpočetně náročných aplikací ve výukovém procesu s využitím virtualizace pracovních stanic počítačových učeben na bázi integrace technologií Microsoft VDI a Sun Ray*" (FRVŠ 321/2012), který přitom přímo navazuje na výsledky řešení loňského projektu *"Autorizované školicí středisko v rámci celosvětového programu Novell Academic Training Partners"* (FRVŠ 1926/2012). Jeho stěžejním výstupem pak bude dostupnost vybraných výpočetně náročných programových systémů (*Mathematica*, *SPSS*, *ArcView*, *WITNESS* a dalších) a virtualizovaných pracovních stanic s operačním systémem *SUSE Linux* využívaných při výukových aktivitách autorizovaného školicího střediska v rámci celosvětového programu *Novell Academic Training Partners* prostřednictvím hardwarových a softwarových tenkých klientů *Sun Ray* ve výukovém procesu i mimo něj.

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CLOUD COMPUTING VERZUS FUNKCIONALITA VEĽKÝCH ERP SYSTÉMOV Z POHĽADU MALÝCH A STREDNÝCH FIRIEM

CLOUD COMPUTING VERSUS LARGE ERP SYSTEM FUNCTIONALITY RELATED TO SMALL AND MIDDLE FIRMS AND COMPANIES

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ABSTRAKT:

Príspevok pojednáva o novej forme predaja špecializovaných softvérových služieb a služieb IT pomocou modelu Cloud Computing. Pomocou tohto modelu sa dajú predávať služby nielen bežných známych softvérových aplikácií, ako napr. Office, ale aj služby veľkých komplexných ERP systémov. Odberatelia týchto služieb môžu byť jednak veľké nadnárodné koncerny, ale aj malé a stredné podniky. Pre tento typ podnikov má nákup softvérových služieb význam v tom, že môžu používať aj vybrané funkcionality veľkých softvérových systémov, ktoré by si z ekonomických dôvodov u seba nemohli inštalovať. Používaním špeciálnych funkcií týchto ERP systémov (napr. EDI) získavajú podnikateľské výhody, ktoré by ináč nemali.

ABSTRACT:

The paper deals with a new form of sale related to specialized IT and software services with the use of Cloud Computing model. This model enables providing sales of services concerned to not only common and very well known software application, Microsoft Office software package as for instance, however that model may be applied, when providing sales of huge and complex ERP systems as well. A set of large multi-national concerns and small or middle firms and companies may be customers in that business, while the above-mentioned huge, middle or small firms and companies are allowed to buy selected functionalise of components and modules, which create an integral part of the large software systems, which could not be installed within those firm or companies in any case. On the other hand, the firms and companies using the specialized ERP system functions (EDI as for instance) have a lot of business and competitive advantages, which they could not have in any other case.

KĽÚČOVÉ SLOVÁ:

Cloud Computing, ERP systém, funkcionalita, EDI formát, poskytovateľ, CAPEX, OPEX, TCO, CFO

KEYWORDS:

Cloud Computing, ERP system, functionality, EDI format, provider, CAPEX, OPEX, TCO, and CFO

1. Introduction

The paper's introduction will contain an explanation of terms and principles and being applied in the paper's content alone. The main reason is closely related to a set of new terms and expressions found in different information resources (Internet information resources especially) and often created based on marketing point of view, however their semantic content is the same in principle, like in the case of existing, and old or not modern term. When saying " in principle the same meaning", we mean that, the mentioned semantic content may contain very gentle or soft differences closely related to new information and managerial technologies.

The readers of that paper are kindly required to thing more about a newly found term and respect a set of previous semantic relations concerned to that term. This approach plays a role of great importance for readers – experts with long-term experiences within practical utilization of information technology systems. On the other hand, the young students do not know anything about semantic content of previous term or principle and they accept a new semantic meaning of the term automatically. However, it does not mean, that the senior experts should operate with meaning of old terms and principles. I thing, it would not be correct not only because of their not being IN, however because of the branch of specialization point of view as well.

The presented paper deals with problems if a large ERP System outsourcing is or is not suitable from the service provider and customer point of view. In that paper, we are interesting in customers represented by small and middle firms and companies (hereinafter known as SME companies).

We make an assumption, that the provider is an owner a operates wit a Data Centre (DC), where the following components are being installed:

- Communication infrastructure
- Hardware and software platform
- Huge and complex ERP System

On the other hand, the provider employs the following experts in the following roles:

- Engineer responsible for communications – computer network expert
- Hardware – server – expert
- Operation system and basic software administrator
- Database system and basic software administrator
- Application software administrator (the application software is concerned to an appropriate ERP System type)
- ERP System programmer (he/she should be able to work with an appropriate ERP System programming language
- Analyst specialized in appropriate ERP functionalities, e.g. accounting, logistics, financial affairs, etc.
- System architect – he/she prepares solutions related to activation of functionalities for the actual customer
- Internal auditor – he/she should be expert concerned to safety and keeping the valid norms and standards
- Further specialized roles (marketing, as for instance)

If the Data Centre should be operated in non-stop mode (7 day and 24 hours a day, incl. holidays), there shall be a sufficient number of workers providing the above-mentioned roles, two persons for standard roles and three persons and more for selected and specialized roles.

It should be noted, the people filling duties related to the above-mentioned roles, shall be high-qualified experts and the costs for their salaries, education and training, studying materials, conferences and seminars are reach very high values.

Provider offers the ERP system services for sale.
Customer (purchaser) shall buy selected services of the ERP System and he will pay to the provider for those services. Any small, middle or large firm or company is considered to be the customer. On the other hand, the customers may be active in different branches of business or national economy (production, providing services, public sector, etc.) A set of appropriate commercial relations between provider and customer is being regulated with respect SLA treaty.

New marketing ICT outsourcing services are denoted as Cloud computing (CC), while a set of different models are applied for these purposes. In those models, there are observed gentle or principle content differences. The services are not coming from *heaven or dark clouds*, however the concrete provider, his Data Centre and his team of experts are providing and executing them. The terms "software system" and "information system" are often being replaced and this is not correct.

A set of adequate application programs and modules offered by software houses is denoted as the *software system*. In general, it is a product offered by software houses, while SAP Business Suite may represent such software system as well. An appropriate information system may be created, when implementing adequate software system within actual firm or company and it may have its own name and logo too.

2. Functionality (complexity) of ERP Systems versus Requirements of small and middle Firms or Companies and Organizations

A set of standard and specialized functions implemented in the firm or company, where an appropriate system is being implemented is called *software system functionality*. Any firm or company has a set of specific functionality requirements. When considering the software system, the requirements may be classified as standard[1] and specific ones.

Large or huge ERP System disposes of a wide range functionality, which covers requirements postulated by multi-national corporations as well. The ERP systems are considered to be the complex systems, while functionality offered by the system is also considered to be the standard one. On the other hand, in spite of large-scale offer, they are not able to cover all requirements occurring in practice. This area of ERP systems is denoted as a set of specific requirements postulated by the firm, company or institution, while such system may be extended about the required functionality and the functionality may be designed and implemented very quickly. However, this ERP System feature is denoted as "OPEN". It means, the system is being opened and a set of functionalities may be added there. Let us have a look at huge and complex ERP systems in more details as for their operation efficiency.

3. The complex ERP System

Are the ERP Systems designed and implemented for huge multi-national corporations or they may be implemented and operated with an appropriate efficiency within small and middle firms, companies and institutions as well? It is not easy to find the right and

1 The standard requirements may be covered or satisfied via standard functionality, while the specific requirements have to be programmed especially.

exhausting answer to that question. In a lot of cases, there is observed a long-term co-operation between small or middle firm or company and a huge multi-national corporation[2]. However, the communication requirements related to multi-national corporations are serious and small economic subjects are not able to manage them[3]. As a result of that, the small or middle firm or company shall utilize functionality, which create an integral part of a huge ERP System.

However, a purchase of licences for such system and their installation within small firm or company requires a lot of investments and its operation requires a lot of money as well. On the other hand, it is not possible to assure a sustainable system operation from economic point of view too. At present, we have several ways, how a small firm or company may utilize only selected services provided by a huge ERP System, while it pays only for actively utilized functionalities as well. This model may be operated and utilized thanks to providers of specialized services. In a lot of cases, huge multi-national corporations are offering those services, however there are several Slovak firms and companies offering this type of services.

3.1 The service provider's view

It is very suitable for provider of the above-mentioned services, when a number of ERP systems operated within his firm or company is minimal (one is the best) and he is able to satisfy all requirements for his customers with the use of ERP System minimal number. The higher number of customers has the provider, the more efficient is the provider's system operation and the provided services may have a higher quality and may be cheaper.

As a result of that, the providers install huge ERP Systems within their data centres, while they dispose of a large number of functionalities and they are opened for implementation of further specific customer's requirements. First of all, the multi-national corporations are the customers of such providers. At present, the sales of huge ERP System services for small and middle firms and companies are observed. A segmentation of customers is being done not only with respect to the customer's size, however with respect to branch in which the small and middle firms and companies make their business, as well.

3.2 The view of service purchaser and the information system user

As mentioned above, small and middle firms and companies may be customers for ERP service provider as well. On the other hand, they might be also categorized with respect to their business branch. Each of business branches is specific and requires from ERP system other standard functionalities and potential specific solutions too.

The above-mentioned model related to purchase of software services is more suitable for small and middle firms and companies, from economic point of view, when comparing it with ERP System operation within their data centre. There are not necessary to invest own money (capital costs) in order to assure a set of IT and IS systems. The small or middle firm or company is not required in order to have its own IT and IS systems and it is not required to be interested in costs needed for purchase of servers and adequate software systems (TCO) as a result of that. It's true, there are further costs of operation (OPEX) however it is a regular

2 A delivery of services or production components might be an example of such co-operation.

3 The EDI Communication might be an example of such requirement

item, the value of which is agreed within SLA treaty. As a result of that, the financial planning may be simpler and more transparent.

A flexibility of requirements related to purchase of ERP system functionalities postulated by the small or middle firm or company is considered to be further advantage of the above-mentioned model. It may be a real matter, when looking for new customers within small or middle firm or company who have different communication requirements[4]. In that case, the small or middle firm or company may buy further functionality only and need not look for any subsequent solution, an exchange of the complex system, as for instance.

4. Conclusion

A purchase cluster COOP Jednota as an example of co-operation among small and middle firms or companies

A network of small shops within association of Jednota may be considered to be a good example of co-operation among small and middle firms and companies. They are localized not only in cities or towns, however they may be found in small villages as well. These shops are being associated in one node denoted as "the purchase cluster". This cluster is able to operate with economic software enabling to prepare one big order based on a set of small orders issued by small shops and to sent it to selected supplier via EDI format. As a result of that, the distribution of goods is being done directly to the above-mentioned small shops. On the other hand, the invoice issued by the supplier comes into the economic system in EDI format as well, it is being paid at once from one centre and after that divided into small accounts and sent to appropriate small shops, which are considered to be individual legal subjects.

The small shops categorized as small and middle firm or companies applied the specialized functionality of huge central ERP system denoted as EDI format. As a result of that, they may be associated to purchase cluster. There are many unique and special advantages. They have better prices and fewer problems with economic system. They need not have IT experts as full time employees and they may pay their attention to the commerce, which is considered to be their mission statement.

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4 The EDI format per orders and invoices may be a good example.

ZAJIŠTĚNÍ PROVOZUSCHOPNOSTI ICT POMOCÍ ITSCM

ASSURANE OF ICT OPERABILITY BY HELP OF ITSCM

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ABSTRAKT
Význam zajištění stability provozovaných ICT služeb ve firmách stále roste. ITSCM jako součást metodického rámce ITIL představuje moderní přístup řešení této problematiky. Příspěvek se zabývá analýzou faktorů stability ICT služeb, které jsou definovány na základě jejich dopadů v případě kritických situací.

ABSTRACT
The importance of ensuring the stability of ICT services operability in companies growing. ITSCM as part of a methodological framework ITIL represents a modern approach solving this issue. The paper analyzes the factors of stability ICT services, which are defined on the basis of their impact in the event of critical situations using the ITSCM.

KLÍČOVÁ SLOVA
ITSCM – IT Service Continuity Management, ITIL – IT Infrastructure Library, stabilita

KEYWORDS
ITSCM – IT Service Continuity Management, ITIL – IT Infrastructure Library, Stability

1. Úvod

Rostoucí závislost firem na stabilitu provozu ICT služeb klade důraz na kvalitu jejich dodávek na základě požadavků zákazníků a uživatelů. IT Service Continuity Management (ITSCM) je samostatný procesem metodologického rámce ITIL, konkrétně části Service Delivery, který je zaměřen na stabilitu provozuschopnosti těchto služeb. Cílem ITSCM je záruka obnovy provozu technických a programových prostředků v termínech, které je definovány podnikových procesy jako kritické faktory úspěchu, jimiž v prvé řadě jsou [3]:

- poskytování informací a technické podpory všem zaměstnancům organizace,
- aktualizace plánů obnovy provozu v závislosti na změnách ve firmě a jejím okolí,
- pravidelné testování plánů obnovy provozu,
- efektivní proces konfiguračního managementu,
- použití účinných nástrojů.

Výhody firmy z vlastnosti zvýšené provozuschopnosti lze identifikovat v následujících oblastech [3].

- obnova řízení ve firmě,
- vytvoření konkurenční výhody,
- dodržování právních požadavků,
- pochopení podnikových potřeb,
- pozitivní prezentace před zákazníky,
- zvýšení důvěryhodnosti společnosti,
- snížení nákladů na pojištění.

Firma formuluje infrastrukturu IT, která je pak využita při realizaci plánu obnovy provozu v případě výskytu kritických situací tak, aby tyto činnosti byly optimalizovány.

2. Zavádění ITSCM

Implementace ITSCN je v rámci ITIL popsána velmi obecně. Danou implementaci ITSCM je nutné přizpůsobit konkrétním požadavkům firmy, uplatnit tzv. princip "adopt and adapt“. Požadavky uživatelů a zákazníků na provozuschopnost ITC služeb tvoří základ rozvoj informačních zdrojů v oblasti analýzy kritických situací pro stanovení doby obnovy služby. Samotná obnova služby pak vyžaduje zvýšené finanční náklady, což je neefektivní v případě méně důležitých služeb. Vytvoření ITSCN informační databáze lze rozdělit do několika fází:

- *Přípravná fáze* - zpracování organizačního a pracovního rámce realizace projektu.
- *Studium písemných materiálů* – studium informací o provozu ICT služeb.
- *Zpracování požadavků na provoz ICT služeb* - shromažďování informací na obvykle na *základě* rozhovoru se zaměstnanci a odpovědnými manažery.
- *Ověření dat* - konečné údaje jsou zaslány odpovědným osobám k jejich validaci.
- *Vyhodnocení dat* – vložení validovaných dat do databáze, která obsahuje informace o ICT službách, jejich vlastnostech, kvalitě a dostupnosti, požadavky na zařízení spojená s ICT službami.
- *Typologie ICT služby a další postup* - výsledky analýzy jsou využity k popisu ICT služby na základě definovaných nebo monitorovaných funkcí.

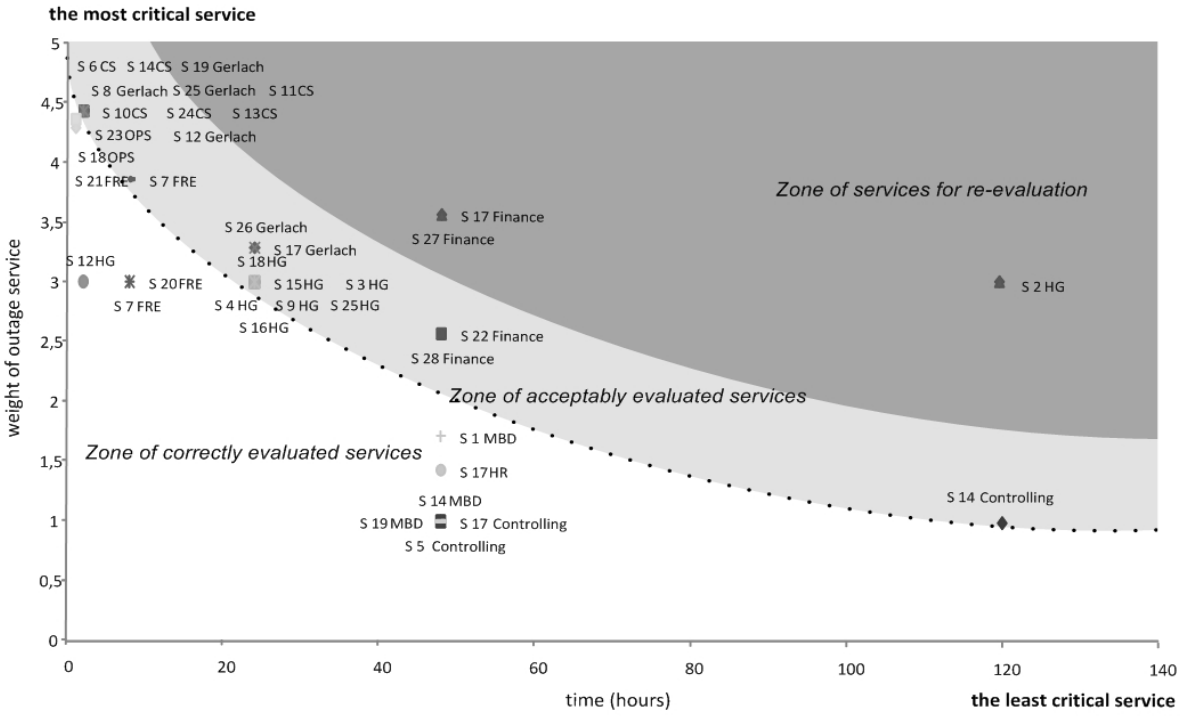
Při analýze ICT služeb je nutné definovat vlastnosti a požadavky, které budou hodnoceny uživateli a zákazníky. Obvykle jsou vytvořeny dvě skupiny:

- Požadavky na ICT služby:
  - realizace služby uvnitř firmy,
  - doba obnovy služby (minimální a v plném rozsahu),
  - zařízení, které služba využívá,
  - typ informačního vstupu a jeho formát,
  - typ informační výstupu a jeho formát.
- Vliv nedostupnosti ITC služby na:
  - business procesy,
  - reputaci z hlediska externího zákazníka,
  - reputaci z hlediska interního zákazníka,
  - finance.

Získané údaje o ICT službách lze formalizovat pro jednotlivé služby pomocí tzv. "Service Card", které mohou být uloženy v počítačové databázi. Tento způsob zpracování získaných informací umožňuje rychlou orientaci v základních informacích o jednotlivých službách. Servisní karty jsou obvykle zpracovány pro každou firemní jednotku zvlášť. Všechny karty by měly být součástí ICT katalogů služeb dle ITIL.

3. Ověření a prezentace získaných dat

Dopady kritických situací na ICT služby mají klíčový dopad na provoz firemních procesů. Na základě získaných informací lze předvídat průběh křivky kritických ICT služeb [1]. Obrázek č. 1 zobrazuje graf, který popisuje pro každou službu ICT vztah mezi požadavky na maximální možnou délku nedostupnosti služby a úrovní významu dopadu jejich nedostupnosti. Úroveň významu dopadu nedostupnosti ICT služeb lze odvodit z váženého průměru získaných hodnot na základě provozu firemních procesů, lze také možné použít aritmetický průměr hodnot významu jednotlivých služeb ICT.



Obr. 1: Kritické úrovně ICT služeb Zdroj [2]

V grafu na obrázku č. 1 lze identifikovat tři zóny:

- *Zónu správně vyhodnocených služeb* - tato zóna je prezentována bílou plochou a službám, které jsou umístěny v této oblasti, odpovídá pravidlo, že s rostoucím významem ICT služby, je doba obnovení služby kratší.
- *Zónu přijatelně hodnocených služeb* - tato zóna je prezentována světle šedou oblastí a služby, které v ní umístěné přibližně odpovídají pravidlu, že s rostoucím významem ICT služby je doba jejího obnovení kratší. Rozsah této zóny závisí na nastavení tolerance.
- *Zónu služeb pro přehodnocení* - zóna má tmavě šedou barvu a zahrnuje v sobě služby, které neodpovídají výše popsanému pravidlu (je nutné přehodnotit význam těchto služeb a časů jejich obnovy.

4. Závěr

Tímto způsobem lze vytvořit konkrétní kritické skupiny, kdy každá ICT služba může být přiřazena k určité skupině. Dané skupiny obsahují ICT služby, které mají podobné nebo stejné požadavky na využití času a také jejich význam pro provoz podnikových procesů je podobný. Útvar zajišťující ICT služby na základě identifikovaných a popsaných skupin může vytvářet strategie pro kvaltu ICT.

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UPLATNĚNÍ KONCEPTU BUSINESS INTELLIGENCE 3.0 V ŘÍZENÍ MALÝCH A STŘEDNÍCH FIREM

THE APPLICATION OF BUSINESS INTELLIGENCE 3.0 CONCEPT IN THE MANAGEMENT OF SMALL AND MEDIUM ENTERPRISES

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ABSTRAKT:

Oblast Business Intelligence je jednou z dynamicky se rozvíjejících oblasti aplikace informačních technologií, která má za cíl dopomoci k získání konkurenční výhody pomocí specializovaných softwarových nástrojů a funkcionalit. Rozvoji v této oblasti je přikládán mezi experty velký význam a nelze se divit, že je také vyvíjen značný tlak na rozvoj funkcionalit směrem k vyšší intuitivnosti, relevanci výstupů a využití funkcí podobných rozhraní oblíbených sociálních sítí. Článek se zabývá diskuzí potenciálu BI nástrojů nové generace, označovaných jako BI 3.0, pro řízení malých a středních podniků, které mají pro ekonomiku České republiky, potažmo Evropské unie velký význam. Článek zahrnuje také pohled na charakteristiky nástrojů BI 3.0 jako je proaktivita a vyšší propojení na externí subjekty s ohledem na jejich význam pro řízení malých a středních firem a jejich možné využití prostřednictvím modelu SaaS.

ABSTRACT:

The Business Intelligence field is one of dynamically evolving fields of information technology application. Its goal is to help gain competitive advantage using specialized software tools and functionalities. There is large amount of emphasis placed on the development in this field among experts and not surprisingly there is also significant pressure exerted on the development of functionalities leading towards higher intuitiveness, relevance of information outputs and use of functions that stem of popular social network's interfaces. The paper deals with the discussion of potential of next generation BI tools, recognized as BI 3.0 for the management of small and medium enterprises (SMEs), which are very important for economics of the Czech Republic, as well as economics of the EU. The paper incorporates also a view on BI 3.0 tools' characteristics like proactivity and higher integration with external subjects with respect to their importance to the SME's management and their possible use by leveraging the SaaS model.

KLÍČOVÁ SLOVA:

Business Intelligence, koncept BI 3.0, MSP, konkurenční výhoda, SaaS

KEYWORDS:

Business Intelligence, BI 3.0 concept, SME, competitive advantage, SaaS

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1. Introduction

The business world is changing. Firms are in an everyday danger of being overwhelmed by their competition the next day they falter behind the effort of being at the top of their business field. Beside new and unorthodox business practices they also need more sophisticated information technologies to achieve competitive advantage. Industry leading research and expert groups (Gartner, Forrester, TDWI) see a great potential in an iterative shift of paradigm in the Business Intelligence (BI) field that is going up in recent few years.

Although many problems concerning wider adoption of BI were identified (e.g. flexibility of BI tools, proper alignment of BI with business strategy, relevance of information outputs due and data quality problems, agility of BI projects) and providers constantly try to deliver better and lively BI solutions that benefit from best practices, there are still issues and shortcomings that lurk from the depths of the very principles of traditional BI. The list below comprises generalization of references in professional sources that discuss shortcomings of traditional BI:

- lack of complete intuitiveness of BI tools,
- lack of ability to get wider context of information beyond traditional structured data seamlessly (leveraging external and also internal unstructured data sources),
- lack of ability to get data that is highly relevant to one's job requirements,
- lack of intuitive and collaborative functionalities integrated in the BI tool.

The latest year review of BI market development by Swoyer (2011) from TDWI stated that last year was in a sign of continuing socialization of BI. This trend was clearly inevitable since the evolution of internet communication (especially thanks to social networking sites like Facebook, Twitter and Google+ and professional networks like LinkedIn or Naymz) that was heavily influenced by development of intuitive web 2.0 interfaces and rich internet applications that users easily got used to. Truckloads of data that reside in these sources are ripe source of insights based on human thought (not just algorithmically processed data) and containing information on customer sentiment, opinions and their customer profile. Social networking sites are however not the only source of potentially useful information (despite the fact that it stems from current and potential customers) but also blog and newspaper information and website articles and data that are present on our competitor's websites.

As for small and medium enterprise (SMEs) their categorization, as seen by the European Commission, is summed up in table 1.

Table 1. Qualification of SME (European Commission Recommendation 2003/361/EC)

Enterprise category	Headcount	Turnover		Balance sheet total
medium-sized	< 250	≤ € 50 million	**or**	≤ € 43 million
small-sized	< 50	≤ € 10 million		≤ € 10 million
micro-sized	< 10	≤ € 2 million		≤ € 2 million

The reason why there so much emphasis placed on SMEs today is that according to Tvrdíková (2011) for example in the EU they make 99% of all companies (approximately 23 million companies) with 75 million employees. SMEs are commonly mentioned as irreplaceable for their ability to react to changes quickly, absorb free labor power and are also recognized as important source of innovation. Their role therefore should not be impeached.

The aim of the paper is to present a discussion of the value of next generation BI 3.0 software tools for management of an SME and raising their competitive advantage.

2. The evolution of Business Intelligence

The first era of BI that started in early 1970s (so called BI 1.0) with advent of early Management Information Systems brought core concepts of functionalities of BI that are still in use in many today's BI implementations. These systems however offered canned mainframe reporting capabilities and need of manual report development that took even a month to process and deliver. But it was a first step in automating decision-making jobs of business stakeholders (mainly analysts and senior management) with pioneer software vendors like IBM and SAS.

The second core concept that the first era of BI brought with it was the introduction of the Executive Information System (EIS). EIS brought revolutionary means of visualization and analysis of key business information although still being static (in terms of real-time access to data and ability to create reports "on-the-fly") and lacking direct connection to strategic decision-making, today represented by scorecard features. According to Scott (2011) the change driver in this era was that end users wanted direct access to the data to construct complex queries in real-time as their investigation directed the need and that Windows facilitated the development of WYSIWYG reporting tools.

The second era of BI that started in early 1990s (so called era of BI 2.0) brought not only the introduction of the notion Business Intelligence (by Gartner's analyst Howard J. Dresner) but also the enterprise scale implementations of Business Intelligence along with presence of a central data warehouse supplying expert users and analysts within management with preformatted reports. This era was in sign of development in the field of key technological and process elements of today's BI, like data integration, dimensional modeling, data quality and data governance and many others. Although there is continuing penetration of this era's influence even into today's BI solutions we can witness several changes that affected users' opinions on how the BI tool should work and how they should be delivering insights. Latter development of Web 2.0 concepts started new era of internet communication which was in sign of the socialization of the Web and collaboration of users while searching for information.

2.1 The introduction of the BI 3.0 concept

By 2005, as new requirements, development methodologies and even pioneers of unorthodox adaptation of modern information technologies in the field of BI came up, the paradigm of BI started to slowly shift to a new, so called BI 3.0 era.

The third era of BI is characteristic by general feeling that even analysis should be collaborative (not only singular) effort. There is common sense that analytics should go beyond reliance on structured data available in internal sources but should use also external, mostly unstructured data in various formats (social media posts, free form web content, images and video files). Scott (2011) sums up 5 core characteristics of next generation BI tool to fully support philosophy of the BI 3.0:

1. proactive,
2. real-time,
3. integrated with business processes,
4. operational (be available even to line workers),
5. extended to reach beyond the boundaries of the organization (to suppliers, partners, customers, and government agencies) to improve information delivery and decision support functionality for all.

Proactivity encompasses use of intelligent agents and networks that fulfill their role by predicting possible threats and warning the user at the right time. Real-time means that users can access key insights wherever they are and when they need it (mostly enabled by modern mobile technologies). Integration with business processes, operativeness and extension beyond boundaries of organization implies that the BI can be used merely by everyone and that integration with external stakeholders is imperative for successful and proactive optimization of key business processes.

Nevertheless there is no reason why standard BI functionalities like enterprise reporting, traditional structured-data-based OLAP functions or data mining using historical data should be deprecated in the BI 3.0 paradigm. They still can have their strong position but the BI 3.0 paradigm's philosophy is to raise the added value of BI tools' architecture by anchoring collaborative style of information search and analysis, with intuitive and self-service user interface that delivers timely and highly relevant insights to anyone who is properly authorized and needs them.

According to Chatter (2011) there are 3 prerequisites for software tools to be recognized as a BI 3.0 tool and that are mandatory to allow purposeful and meaningful leveraging of aforementioned 5 characteristics of next generation BI tools:

- **be social** (leveraging the power of collective intelligence in BI by empowering the BI tool's interface with social-network-like functionalities of discussion based analytics for the search of information and collaboratively creating insights and analytical reports),
- **be relevant** (automatically delivers relevant insights that users really need according to their situation and user profile),
- **be fully self-service** as a critical feature (intuitiveness and literally no instruction manual needed while ensuring robustness and richness of analytical functionalities).

Although Forrester Research's head researcher James Kobielus recognizes this new category of software as the BI 3.0, according to Cabiro (2011) it can be also found by different names: Data Discovery, Advanced Visualization, Visual Analytics, Business Discovery, Self-service Business Intelligence (depending on the vendor). Vendors that state they offer BI 3.0 functionalities in their software suites are mainly Panorama (Panorama Necto), Kapow (Kapow Katalyst) and DOMO (DOMO Executive Management Platform). However according to Swoyer (2011) even big-name vendors (e.g., IBM Corp., MicroStrategy Inc., Oracle Corp., and SAP AG) moved to incorporate at least social media-like features into their BI suite offerings.

3. Business Intelligence 3.0 and competitive advantage of SMEs

Characteristics that are presented in the next generation BI tools fit not only in the large company's environment but especially into the environment of the SME. Although BI 3.0 are referred to as a whole new paradigm of work with the BI, the core characteristics follow requirements of modern IT reliant management. BI 3.0 is closely related to competitive intelligence process where mostly unstructured data is used to follow the intelligence cycle of planning, collecting, analyzing and distributing key information about competitors, customers and generally the market environment to decision-makers (Murphy, 2005).

Social prerequisite and corresponding social media analytics are widely discussed themes today since social networks offer vast opportunities for analysis of customer sentiment (Ministr, Ráček and Fiala, 2011) as well as possibility to analyze and monitor opinions and marketing moves of competition through social network or using other sources of textual

information (web page content, internet newspapers, blogs). Since social networking sites commonly contain vast amounts of data they are referred to as one of main sources of so called Big Data (data of high volume and with high velocity of creation). Social networks are mostly easily understandable mediums and users should be able to understand social features even in a BI tool and leverage them purposefully.

On the other hand **relevance** is imperative for elimination of outcome volatility while carrying out a time-consuming searching for and collection of data for further analysis which can be cumbersome work even for a large company (with vast resources to finance extensive analysis of competition and market environment in general). For example Molnár and Střelka (2011) present a framework for adoption of competitive intelligence by the SME and the framework is meant to support the aforementioned process and enable success and gain of competitive advantage. With an integrated BI software tool the process can have better outcome with result of shortening the whole process and making it more efficient. Relevance goes along with having **real-time** delivery capability since real-time accessible and trusted and relevant information can be used readily for an important decision-making task without the need for verification of its relevance.

Being **self-service** as a critical feature with no instruction manual needed and intuitive interface is an excellent starting point especially for SMEs that did not want to use BI mainly due to the need of extensive learning to use new software while they still struggle with Microsoft Excel. Nevertheless this fact is applicable to all situations since training costs are commonly high (depending on the scale of the implementation and the size of the company) Self-service capability can lower training costs and make the BI tool more affordable for SMEs with strained budget. Being self-service is also important for incorporation of the **operational** characteristic since line workers (but not only them) have limited time to learn how to use properly new software so they surely appreciate highly intuitive interface.

Importance of **proactivity** characteristic is especially apparent in case of SMEs, since their business can be influenced (or even jeopardized) by bad decisions even more than the large company that would probably be able to saturate sales loses and fully recover from consequences of a bad business decision.

Integration and extension of BI to external organizations, partners, government agencies etc. could bring huge relieve, for example when monitoring regulations and law enforced standards or simply monitoring competitors' actions. The problem of information ownership and security however still lingers here. It is either up to setting processes of maintaining information security or using specialized software that however can be very expensive and BI tools usually cannot completely handle this matter.

Murphy (2005) states that ethics of information gathering is one of key prerequisites of successful competitive intelligence and is also a challenge that needs to be taken care of because, according to Molnár and Střelka (2011), companies often work with information publicly available on the Internet which also falls under copyright and personal information security regulations. And because law enforced penalties for breaking general rules of personal and public information handling can be very destructive for any business (not only for SMEs) it is up to the provider of BI 3.0 software to take care of this matter in the first line.

Agreeing with Tvrdíková (2011) cloud computing and Software-as-a-Service (SaaS) delivery model offers great opportunity for SMEs to gain access to modern information technologies and improve quality of their information system (and also embed useful BI functionalities into their business processes). This applies also to the field of implementation of standard and also innovative BI tools. All attributes of the BI 3.0 combined in an integrated application environment delivered on-demand (subscription based delivery), embracing social

media like interface (discussion based analysis, searching for people to collaborate with through data, combining knowledge of people with data into insights, sound ideas and decisions) pose an interesting concept of leveraging modern technologies and competitive intelligence processes and thus offering possibilities to improve competitive advantage of SMEs (as well as large companies).

4. Conclusion

The paper dealt with characteristics of new paradigm of BI software that incorporates social features and collaboration into decision-making, emphasizes relevancy of information delivery and self-service as a critical feature of next generation BI tool. The paper also dealt with the discussion of what potential of this new generation of BI brings to SMEs that especially in the EU build 99% of all enterprises active in the EU territory. The BI 3.0 is closely related to the competitive intelligence and its processes and features and BI 3.0 offers opportunity of bringing competitive intelligence capabilities even closer to SMEs. All this in an integrated application environment, more likely delivered through the SaaS model, due to on-demand nature and better scalability of the BI software implementation. Further research could aim to provide more insight into the implementation of BI 3.0 tools into working competitive intelligence environment and assessment of possible drivers of adoption of BI 3.0 and competitive intelligence framework combined.

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VYUŽITÍ MICROSOFT EXCELU PŘI VÝUCE VÝVOJOVÝCH DIAGRAMŮ

USING OF MICROSOFT EXCEL IN EDUCATION OF FLOW CHARTS

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ABSTRAKT:
Vývojové diagramy jsou na Ekonomické fakultě VŠB-TU Ostrava využívány k výuce algoritmizace již mnoho let. Mnoho let byl také k praktickému ověření správnosti vývojových diagramů používán jejich přepis do programovacího jazyka Turbo Pascal. Výuka programovacího jazyka Turbo Pascal však byla asi před 10 lety zrušena a to hlavně z důvodu morální zastaralosti tohoto programovacího jazyka. Od té doby jsou vyučovány pouze vývojové diagramy bez jakéhokoliv ověřování. Tento přístup je ale chybný. Vývojový diagram je příliš abstraktní na to, aby student beze zbytku pochopil význam všech příkazů, které ve vývojovém diagramu použil. Vývojový diagram by měl být pro jeho lepší pochopení nějakým způsobem simulován na počítači. Tento příspěvek by měl ukázat několik možností, jak by mohl být moderní tabulkový kalkulátor, jakým Microsoft Excel je, využitelný při výuce vývojových diagramů.

ABSTRACT:
Flow charts have been used for teaching algorithmization at the Faculty of Economics of VŠB-TU Ostrava for many years. For many years their transcription into Turbo Pascal programming language was used to check if the flow charts practically work. Teaching the Turbo Pascal programming language was cancelled approximately ten years ago mainly because the language was out of date. Since then, only flow charts without any checking have been taught. But this approach is wrong. A flow chart is too abstract for the students to completely understand the meaning of all the commands that they have used in their flow charts. That is why I think that flow charts should be simulated in a certain way on computer so that it would be more understandable. This article should present several possibilities of using Microsoft Excel, which is a modern spreadsheet, for teaching the flow charts.

KLÍČOVÁ SLOVA:
Vývojový diagram, Microsoft Excel, Visual Basic for Application, programovací jazyk, souhrn, kontingenční tabulka

KEYWORDS:
Flow Chart, Microsoft Excel, Visual Basic for Application, Programming Language, Total, Pivot Table

1. Úvod

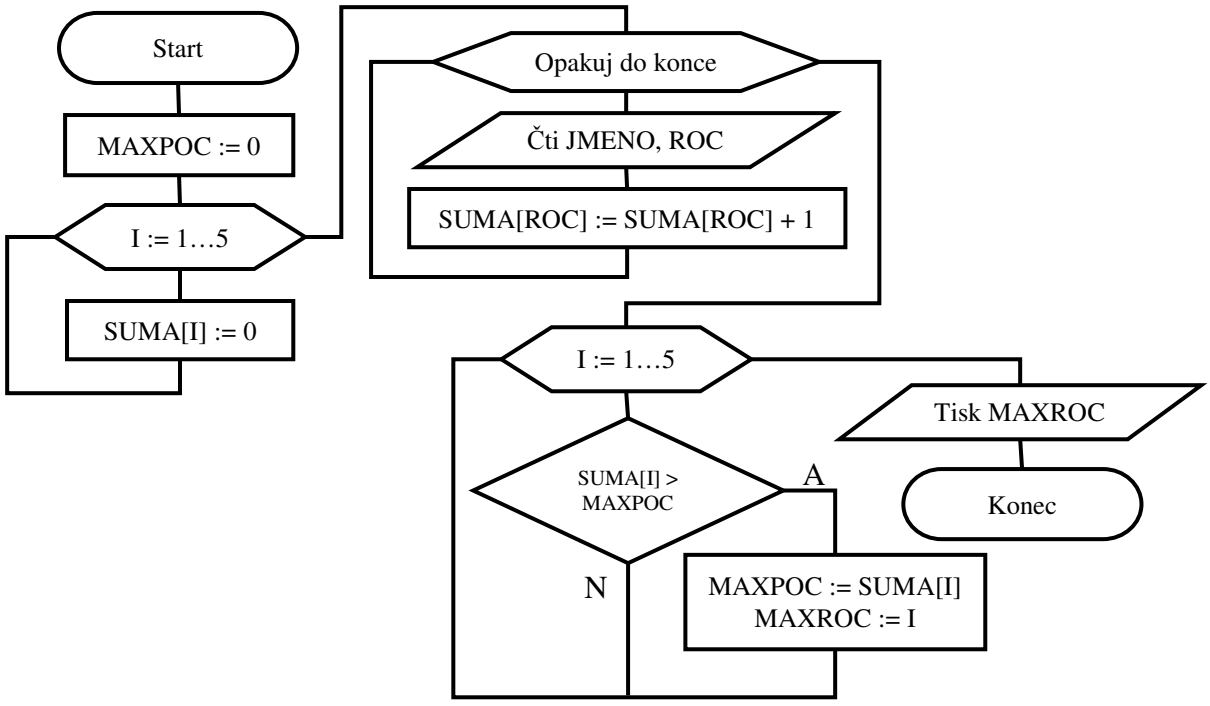
Vývojové diagramy jsou na Ekonomické fakultě VŠB-TU Ostrava využívány k výuce algoritmizace již mnoho let. Mnoho let byl také k praktickému ověření správnosti vývojových diagramů používán jejich přepis do programovacího jazyka Turbo Pascal. Praktická demonstrace vývojového diagramu pomocí nějakého jednoduchého programovacího jazyka je podle mého názoru při výuce vývojových diagramů velice důležitá, protože samotný vývojový diagram je příliš abstraktní na to, aby student zcela pochopil význam příkazů, které

do vývojového diagramu zakreslil. Výuka programovacího jazyka Turbo Pascal však byla asi před 10 lety zrušena a to hlavně z důvodu morální zastaralosti tohoto programovacího jazyka. Od té doby jsou vyučovány pouze vývojové diagramy bez jakéhokoliv jejich ověřování na počítači. Podle mého názoru je to ale chyba. Přemýšlel jsem proto, který programovací jazyk, případně jaký jiný způsob by bylo vhodné použít pro praktické ověření vývojových diagramů a jako nejvhodnější prostředek jsem nakonec zvolil tabulkový kalkulátor Microsoft Excel, jehož použití za tímto účelem jsem si již také prakticky na několika cvičeních ověřil a nutno říci, že vždy s kladným ohlasem.

Využití tabulkového kalkulátoru Microsoft Excel k ověření správnosti vývojového diagramu je vhodné zejména z následujících důvodů:

- Microsoft Excel je dostupný, rozšířený a známý tabulkový kalkulátor, takže odpadá nutnost instalace a učení se speciálního vývojového prostředí.
- Sešity Microsoft Excelu lze automatizovat pomocí programovacího jazyka Visual Basic for Application. Je zde tedy dostupný relativně jednoduchý programovací jazyk pro přepis vývojových diagramů případně k vytvoření podpory pro jiný způsob ověřování vývojových diagramů pomocí Microsoft Excelu.
- Použití tabulkového kalkulátoru Microsoft Excel by mělo být pro studenty ekonomie zcela samozřejmé, takže pochopení základů práce s makry by mělo být pro studenty pouze přínosem.

V následujících kapitolách bude popsáno několik způsobů, jak lze Microsoft Excel při výuce vývojových digramů využít. Pro lepší pochopení bude vše demonstrováno na jednoduchém příkladu nalezení jednoho extrému, např. nalezení ročníku s nejvyšším počtem studentů v souboru studentů obsahujících dva údaje: JMÉNO a ROČNÍK. Předpokládá se existence 5 ročníků. V tomto jednoduchém příkladu se nachází jak některé základní příkazy jako rozhodování nebo cyklus, tak některé elementární algoritmy jako nulování pole nebo nalezení jednoho extrému v poli, viz následující obrázek:



Obrázek 2 Vývojový diagram demonstračního příkladu

Tento soubor si lze představit i jako sekvenční, ale pro studenty bude určitě pochopitelnější v případě Excelu jeho tabulková podoba, viz následující obrázek:

	A	B
1	Aleš	1
2	Jana	2
3	Petr	3
4	Martin	2
5	Pavel	4

Obrázek 3 Cvičný soubor dat pro ověření vývojového diagramu

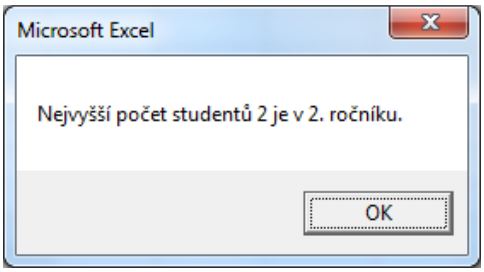
2. Využití programovacího jazyka Visual Basic for Application

První možností, jak využít Microsoft Excel při výuce vývojových diagramů, je využít programovací jazyk Visal Basic for Application (VBA), pomocí kterého lze automatizovat sešity Microsoft Excelu, a to bez jakýchkoliv pomocných funkcí, které by usnadňovaly odkazování se na objekty Excelu, jako jsou listy nebo buňky, z procedur VBA. Procedura VBA řešící demonstrační vývojový diagram by mohla vypadat např. takto:

```
Option Base 1
Option Explicit

Sub Algoritmus1()
    Dim Radek As Range
    Dim Jmeno As String
    Dim Roc As Integer
    Dim Suma(5) As Integer
    Dim MaxPoc As Integer
    Dim MaxRoc As Integer
    Dim I As Integer

    'Inicializace proměnných
    MaxPoc = 0
    For I = 1 To 5
        Suma(I) = 0
    Next I

    'Čtení souboru
    For Each Radek In ActiveSheet.UsedRange.Rows
        Jmeno = Radek.Cells(1)
        Roc = Radek.Cells(2)

        Suma(Roc) = Suma(Roc) + 1
    Next Radek

    'Vyhledávání ročníku s nejvyšším počtem studentů
    For I = 1 To 5
        If Suma(I) > MaxPoc Then
            MaxPoc = Suma(I)
            MaxRoc = I
        End If
    Next I

    'Tisk výsledků
    MsgBox "Nejvyšší počet studentů " & MaxPoc & " je v " & MaxRoc & ". ročníku."
End Sub
```

Obrázek 4 Procedura VBA řešící demonstrační vývojový diagram

V této proceduře jazyka VBA jsou nejdříve deklarovány veškeré potřebné proměnné, po té jsou potřebné proměnné inicializovány na výchozí hodnoty, následuje čtení záznamů z aktuální oblasti aktivního listu sešitu a nakonec nalezení výsledných hodnot a jejich tisk v podobě funkce MsgBox, viz následující obrázek:



Obrázek 5 Funkce MsgBox s výsledky

Použití syrového programovacího jazyka VBA bez dalších pomocných funkcí má samozřejmě své výhody, ale také nevýhody. Mezi výhody tohoto postupu lze kromě výhod samotného Microsoft Excelu uvedených výše zařadit:

- Kromě tabulkového kalkulátoru Microsoft Excel student nic víc nepotřebuje, programovací jazyk VBA i s vývojovým prostředím je v Microsoft Excelu vždy obsažen. Jen je nutno pro použití maker použít jako formát sešitu ne .xlsx, ale .xlsm.
- Základní řídící příkazy jazyka VBA (*If Then Else*, *For Next* a další) mají relativně jednoduchou syntaxi a pro studenty by neměl být velký problém pochopit jejich použití.
- Ačkoliv jsou pole jazyka VBA indexována od indexu 0, lze pomocí volby *Option Base 1* modulu nastavit VBA pro indexování polí od indexu 1, což více odpovídá způsobu použití polí ve výuce vývojových diagramů na Ekonomické fakultě.
- V nejjednodušším případě není nutno použité proměnné deklarovat, VBA pro tyto proměnné použije datový typ Variant. Tento způsob ale může způsobovat těžko odhalitelné chyby, proto je spíše naopak vhodné deklarace všech použitých proměnných vynutit volbou *Option Explicit* modulu VBA.
- Vývojové prostředí programovacího jazyka VBA barevně zvýrazňuje syntaxi jazyka, čímž přispívá k zpřehlednění programu.

Mezi nevýhody tohoto způsobu použití Microsoft Excelu patří zejména tyto:

- Studenti kromě prostředí Microsoft Excelu musí alespoň na základní úrovni zvládnout vývojové prostředí programovacího jazyka VBA, což není zcela triviální.
- Syntaxe programovacího jazyka VBA se trochu liší od syntaxe příkazů vývojových diagramů, tak jak jsou vyučovány na Ekonomické fakultě. Např. přiřazovací příkaz vychází ve vývojových diagramech z jazyka Pascal, a proto používá operátor „:=“. Programovací jazyk VBA zde používá „=“. Také v případě polí jsou ve vývojových diagramech používány hranaté závorky, kdežto programovací jazyk VBA používá kulaté závorky. Jsou to ale vesměs jen překonatelné drobné rozdíly.
- Aby student mohl v kódu programovacího jazyka VBA použít data uložená v listu sešitu Microsoft Excelu, musí se nějakých způsobem na buňky obsahující daná data odkázat, což předpokládá také znalost takových objektů VBA týkajících se Microsoft Excelu z knihovny Microsoft Excel Object Library jako je Worksheet, Range apod. a to již není tak triviální. Výuka těchto objektů pak zbytečně odvádí pozornost od samotného jádra algoritmu.

A zejména poslední jmenovanou nevýhodu řeší následující kapitola.

3. Zjednodušení přístupu k souboru dat pomocí pomocných funkcí

Jak již bylo řečeno, použití objektů VBA týkajících se Excelu z knihovny Microsoft Excel Object Library umožňující odkazovat se na sešity, listy nebo buňky Excelu je problém a to zejména z následujících důvodů:

- odvádí pozornost od samotného jádra algoritmu,
- těchto objektů je mnoho a pro jejich efektivní použití je nutné je znát i s většinou jejich vlastností a metod, což není možné ve vymezeném čase zvládnout.

Řešení tohoto problému spočívá v odstínění studenta od těchto objektů pomocí předem vytvořených jednoduchých proměnných nebo funkcí VBA, které by bylo možno umístit do šablony Microsoft Excelu. Student by pak svůj algoritmus řešil v sešitě vytvořeném na této šabloně, čímž by se tyto funkce staly pro studenta dostupnými. Základní šablona by mohla obsahovat pouze jeden modul např. v nejjednodušší podobě s následujícími proměnnými a funkcemi:

```
Public Radek As Range

Public Function Tabulka() As Range
    Set Tabulka = ActiveSheet.UsedRange.Rows
End Function

Public Function Udaj(PoradoveCislo As Integer) As Variant
    Udaj = Radek.Cells(PoradoveCislo)
End Function
```

Obrázek 6 Pomocné funkce uložené v šabloně Microsoft Excelu

Přepis demonstračního algoritmu do programovacího jazyka VBA by pak mohl vypadat např. takto:

```
Sub Algoritmus2()
    Dim Jmeno As String
    Dim Roc As Integer
    Dim Suma(5) As Integer
    Dim MaxPoc As Integer
    Dim MaxRoc As Integer
    Dim I As Integer

    'Inicializace proměnných
    MaxPoc = 0
    For I = 1 To 5
        Suma(I) = 0
    Next I

    'Čtení souboru
    For Each Radek In Tabulka
        Jmeno = Udaj(1)
        Roc = Udaj(2)

        Suma(Roc) = Suma(Roc) + 1
    Next Radek

    'Vyhledávání ročníku s nejvyšším počtem studentů
    For I = 1 To 5
        If Suma(I) > MaxPoc Then
            MaxPoc = Suma(I)
            MaxRoc = I
        End If
    Next I

    'Tisk výsledků
    MsgBox "Nejvyšší počet studentů " & MaxPoc & " je v " & MaxRoc & ". ročníku."
End Sub
```

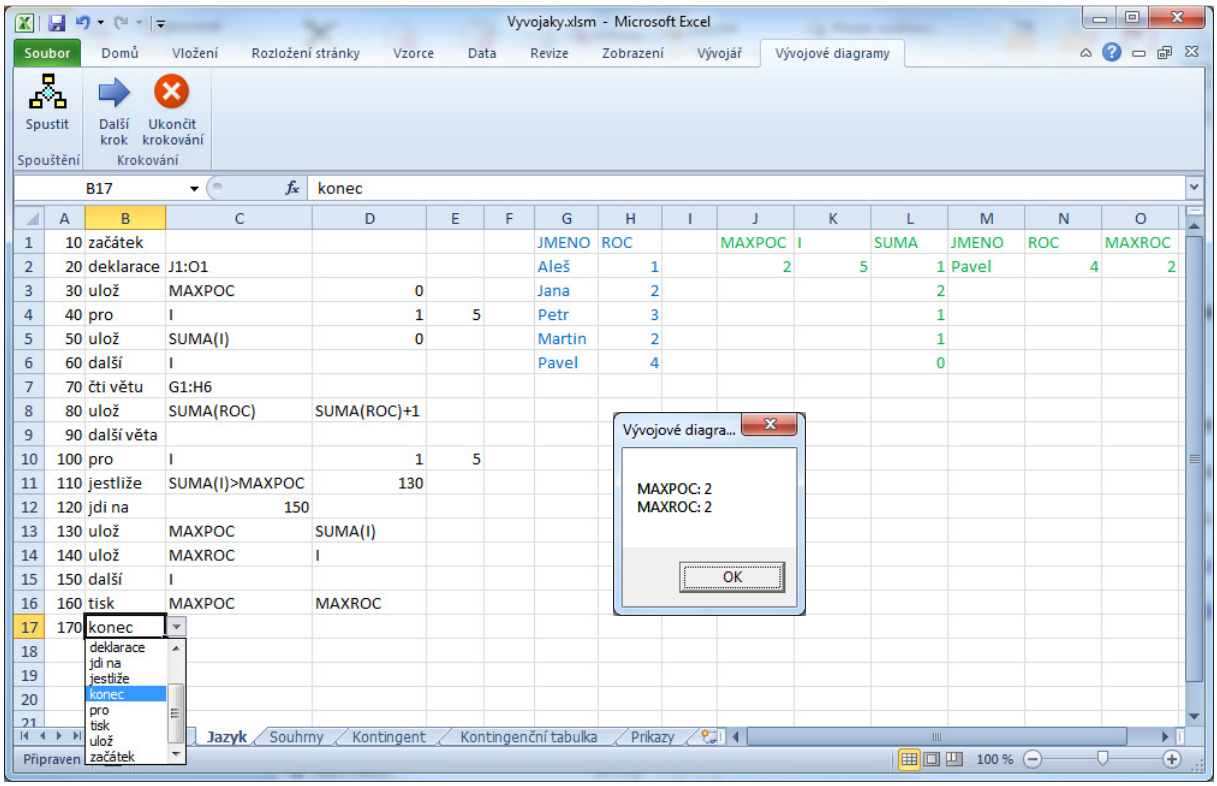
Obrázek 7 Procedura VBA řešící demonstrační vývojový diagram s použitím pomocných funkcí

Jak lze vidět ve výpisu kódu výše, program obsahuje již jen přepis algoritmu vývojového diagramu, aniž by bylo nutno používat jakékoliv speciální objekty programovacího jazyka VBA. Také deklarace proměnných již využívají pouze jednoduché datové typy jako String nebo Integer. Program je tedy pro studenta přehlednější a pochopitelnější.

Nevýhodou tohoto přístupu je nutnost použití šablony Microsoft Excelu s předpřipravenými proměnnými a funkcemi, takže tuto šablonu je nejdříve nutno studentům nějakých způsobem rozdistribuovat. Již tedy nestačí jen samotný tabulkový kalkulátor Microsoft Excel. Stále je také používán programovací jazyk Visual Basic for Application, který, ač používán pouze v nejjednodušší podobě, je stále programovacím jazykem se svou syntaxí příkazů, která se může zdát studentům Ekonomické fakulty příliš složitá. I tuto nevýhodu lze ale vyřešit a to vytvořením vlastního programovacího pseudojazyka, jehož návrh je představen dále.

4. Použití vlastního programovacího pseudojazyka

Při návrhu vlastního programovacího pseudojazyka je možno vyjít z původního programovacího jazyka BASIC a principiálně jej přizpůsobit pro použití v Microsoft Excelu pro potřeby ověření funkčnosti vývojových diagramů. Pro pochopení návrhu tohoto programovacího pseudojazyka bude asi nejlepší jej představit na použitém demonstračním příkladu, viz obrázek:



Obrázek 8 Použití vlastního programovacího pseudojazyka

Do návrhu vlastního programovacího pseudojazyka by bylo vhodné zahrnout následující vlastnosti:

- Příkazy tohoto jazyka (viz sloupec B v obrázku výše) mohou být v českém jazyce. České příkazy jistě přispějí k snadnějšímu pochopení a použití těchto příkazů.
- Příkazy tohoto jazyka (viz sloupec B v obrázku výše) je možné pro usnadnění jejich zadávání vybírat ze seznamu dostupných příkazů. Tento seznam je omezen pouze na

příkazy potřebné pro implementaci vývojových diagramů, takže je mnohem menší než seznam možných příkazů jazyka VBA.

- Většina příkazů tohoto jazyka má své vlastní pevně dané parametry uváděné v dalších sloupcích za daným příkazem (viz sloupce C až E v obrázku výše).
- Stejně jako v programovacím jazyce BASIC jsou řádky s příkazy číslovány (viz sloupec A v obrázku výše), aby bylo umožněno přeskočit např. pomocí příkazu „*jdi na*“ na vybraný příkaz. K číslování příkazů by bylo teoreticky možno využít také číslování řádků Excelu, ale není to příliš vhodné, protože při přidání dalších příkazů někam doprostřed programu by bylo nutno přečíslovat všechny další příkazy skoku uvedené za tímto nově vloženým příkazem.
- Cvičná data by mohla být uvedena ve zvláštní oblasti dat (viz sloupce G a H v obrázku výše). Na tuto oblast dat by se pak mohl odkazovat např. příkaz „*čti větu*“, který by v cyklu prošel všechny věty souboru a postupně je ukládal do definovaných proměnných.
- Stejně tak použité proměnné by měly být uvedeny ve zvláštní oblasti buněk (viz sloupce J až O v obrázku výše). Aby Excel věděl, kde je tato oblast buněk, je nutno použít na začátku programu např. příkaz „*deklarace*“. Program pak ukládá své výsledky přímo do buněk pod uvedenými proměnnými. Protože Excel při zápisu do buňky sám rozezná, zda se jedná o text nebo číslo, není nutné při deklaraci proměnných vůbec uvádět datové typy proměnných, což použití tohoto jazyka ještě více zjednoduší.
- Spouštění programu je možné vyřešit např. vlastní kartou na pásu karet Excelu, která by byla dostupná spolu se vším obslužným kódem ve speciální šabloně. Tato karta by obsahovala tlačítka potřebná pro ovládání programu. Programem by mohlo být možno také krokovat, kde by Excel mohl vždy pro daný krok přímo vybrat buňku s vykonávaným příkazem, což by mohlo vést k lepšímu pochopení napsaného programu.

Výhodou použití vlastního programovacího pseudojazyka je zejména jeho jednoduchost oproti použití programovacího jazyka VBA. Studenti mohou také zůstat ve známém prostředí tabulkového kalkulátoru Microsoft Excel a nemusí se učit žádné nové prostředí. Nevýhodou je zase pouze nutnost distribuce šablony obsahující veškerou podporu pro tento vlastní programovací pseudojazyk.

5. Ověření získaných výsledků pomocí souhrnů nebo kontingenčních tabulek

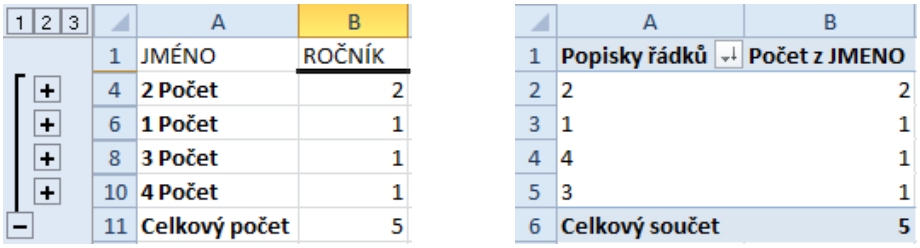
Pro lepší pochopení vývojových diagramů většina pedagogů používá krokování vývojovým diagramem s křídou na tabuli s použitím malého souboru cvičných dat, s jehož pomocí dojde k nějakým výsledkům. Správnost těchto výsledků je možno za pomocí Microsoft Excelu ověřit. Stejně tak lze ověřit pomocí Microsoft Excelu výsledky získané pomocí vývojových diagramů přepsaných do programovacího jazyka VBA nebo vlastního programovacího pseudojazyka (viz výše).

Vývojové digramy jsou na Ekonomické fakultě VŠB-TU Ostrava využívány k zápisu zejména těchto typů algoritmů:

- nalezení jednoho extrému (maxima nebo minima) ze vstupního souboru nebo z prvků pole,

- nalezené dvou nebo tří extrémů,
- nalezení všech hodnot jednoho extrému.

Z principu se jedná o příklady, kdy je nutné data nějakým způsobem seřadit a seskupit a po té v těchto datech nalézt potřebné extrémy. Microsoft Excel pro tyto typy úloh nabízí nástroje, jako jsou souhrny nebo kontingenční tabulky, viz následující obrázek:



	A	B
1	JMÉNO	ROČNÍK
4	**2 Počet**	2
6	**1 Počet**	1
8	**3 Počet**	1
10	**4 Počet**	1
11	**Celkový počet**	5

	A	B
1	**Popisky řádků**	**Počet z JMENO**
2	2	2
3	1	1
4	4	1
5	3	1
6	**Celkový součet**	**5**

Obrázek 9 Souhra a kontingenční tabulka aplikovaná na cvičný soubor dat demonstračního příkladu

Z obrázku souhrnu i kontingenční tabulky je patrné, že v případě našeho demonstračního příkladu stačilo pouze data seskupit podle Ročníku, v daných skupinách spočítat počet Jmen a tyto počty seřadit sestupně.

6. Závěr

Tento článek si kladl za cíl demonstrovat, že lze i tabulkový kalkulátor Microsoft Excel s úspěchem využít k výuce vývojových diagramů. Jedná se zejména o jeho využití k přepisu vývojových diagramů do programovacího jazyka Visual Basic for Application nebo vlastního programovacího pseudojazyka. Využít jej lze také ale ke zjištění správných výsledků ze souborů cvičných dat určených k simulaci vývojových diagramů a to zejména pomocí souhrnů nebo kontingenčních tabulek.

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COMPETING WITH BUSINESS INTELLIGENCE

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ABSTRACT:
A contemporary organizations competes in a business environment that is characterized by a massive influx data. A critical component for its success is ability to take advantage of all available information. This challenge becomes more difficult with the constantly increasing volume of information. Last years many organizations turn to Business Intelligence (BI). It is said that it can help them to take competitive advantage in the marketplace.
The main purpose of this paper is to present BI as an effective tool for competing. The structure of the paper and research methods (the analysis of literature and the case studies) have been subordinated to this goal. Firstly, an overview of the subject literature on BI has been conducted. Then, the idea of Competitive Business Intelligence (CI) has been described. Next, the issue of maturity models for BI has been explored. Finally, the examples of organizations competing with Business Intelligence have been discussed.
The research results presented in this paper provide the organizations (their managers, business analysts, employees) with valuable guidelines to be followed, while using BI to compete in the marketplace.

KEY WORDS:
Business Intelligence, Competitive Business Intelligence, maturity models, competing, business success

1. Business Intelligence

The term Business Intelligence (BI) is often used as a broad category of technologies, applications, and processes for gathering, storing, accessing, and analyzing data to help users make better decisions (Wixom, Watson, 2010). More generally, BI can be understood as a process providing better insight in a company and its chain of actions.

From a historical perspective, BI is a popularized, umbrella term introduced by Howard Dresner of the Gartner Group in 1989 to describe a set of concepts and methods to improve business decision making by using fact-based support systems (Power, 2007). BI involves collecting, storing and presenting data, and managing knowledge by means of employing different analytic tools. Intelligent data analysis is usually obtained by OLAP (On-Line Analytical Processing), data mining and data warehouses techniques (Liautaud, Hammond, 2002).

With the passing of time, the term BI has been understood much more broadly, namely, as a connecting factor of different components of decision support infrastructure (Baaras & Kemper 2008) and providing comprehensive information for policy makers (Negash, 2004). Hence, many definitions of BI focus on the capability of an enterprise to improve business efficiency and to achieve higher business goals. It is said that BI provides a means to obtain crucial information to improve strategic decisions and, therefore, plays an important role in current decision support systems (Inmon, 2008).

It is noted that although BI is frequently defined in the literature, there is no universal explanation of BI (Clavier, Loriet and Loggerenberg, 2012). The overview of different BI definitions is presented in table 1.

Table 1 The overview of BI definitions

Author	Definition
Adelman, Moss (2000)	An umbrella term to describe the set of software products for collecting, aggregating, analyzing and accessing information to help organization make more effective decisions
Alter (2004)	An umbrella term for decision support
Azvine, Cui, Nauck (2005)	BI is all about capturing, accessing, understanding, analyzing and converting one of the fundamental and most precious assets of the company, represented by the raw data, into active information in order to improve business
Business Objects (2007)	A system that provides different information and analysis for employers, customers, suppliers in order to make more effective decisions
Chung, Chen, Nunamaker (2005)	Results obtained from collecting, analyzing, evaluating and utilizing information in the business domain
Power (2007)	An umbrella term to describe the set of concepts and methods used to improve business decision-making by using fact-based support systems
Eckerson (2003)	A system that takes data and transforms into various information products
Glancy, Yadav (2011)	BI focuses on supporting a variety of business functions, using the process approach, and advanced analytical techniques
Hannula, Pirttimaki (2003)	Organized and systematic processes which are used to acquire, analyze and disseminate information to support the operative and strategic decision making
Jordan, Ellen (2009)	BI is seen as a critical solution that will help organizations leverage information to make informed, intelligent business decisions to survive in the business world
Jourdan et al. (2008)	BI is both a process and a product, that is used to develop useful information to help organizations survive in the global economy and predict the behavior of the general business environment
Lonnqvist, Pirttimaki (2006)	A managerial philosophy and tool that helps organizations manager and refine information with the objective of making more effective decisions
Moss, Atre (2003)	An architecture and a collection of integrated operational as well as decision support applications and databases that provide the business community easy access to business data
Negash (2004)	A system that combines data collection, data storage and knowledge management with analytical tools so that decisions makers can convert complex information into competitive advantage
Olszak, Ziemba (2003)	A set of concepts, methods and processes that aim at not only improving business decisions but also at supporting realization of an enterprise' strategy
Reinschmidt, Francoise (2000)	BI is an integrated set of tools, technologies and programmed products that are used to collect, integrate, analyze and make data available
Watson, Wixom (2007)	BI describes the concepts and methods used to improve decision making using fact based systems
Wixom, Watson	BI is a broad category of technologies, applications, and processes

(2010)	for gathering, storing, accessing, and analyzing data to help its users make better decisions
White (2004)	An umbrella term that encompances data warehousing, reporting, analytical processing, performance management and predictive analytics
Williams, Williams (2007)	A combination of products, technology and methods to organize key information that management needs to improve profit and performance

The analysis of different articles, papers and reports show that BI is mainly identified with:

- tools, technologies, and software products. BI is used to collect, integrate, analyze and make data available (Reinschmidt and Francoise, 2000). It includes: data warehouse, data mining and OLAP (On-line Analytical Processing). Data warehouse is a key technology, integrating heterogenic data from different information sources for analytical purposes (Inmon, Strauss and Neushloss, 2008). Hence, it is assumed that the main tasks to be faced by BI include: intelligent exploration, integration, aggregation and a multidimensional analysis of data originating from various information resources (Sauter, 2010);
- knowledge management. BI is the capability of the organization to explain, plan, predict, solve problems and learn in order to increase organizational knowledge (Wells, 2008). BI is assumed to be solution that is responsible for transcription of data into information and knowledge (Negash and Grey, 2008);
- decision support systems. BI is considered as a new generation of decision supports systems. They differ from previous management information systems in, first of all, their wider thematic range, multivariate analysis, semi-structured data originating from different sources and multidimensional data presentation (O'Brien, Marakas, 2007; Wells, 2008; Negash, 2004; Baaras, Kemper, 2008);
- dashboards. Dashboards are the becoming the preferred method for delivering and displaying BI to users. They are more visual and intuitive, and typically provide linkages that enable immediate action to be taken (Ballarat et al, 2006);
- new working culture with information - BI constitutes an important upturn in techniques of working with information (Liautaud and Hammond 2001). It means specific philosophy and methodology that would refer to working with information and knowledge, open communication and knowledge sharing (Negash and Grey, 2008). The BI users must know more than just technology - business and soft skills are needed too;
- process. The process constitutes of activities to gather, select, aggregate, analyze, and distribute information (Jourdan, Rainer and Marschall, 2007). Some of these activities are the responsibility of the BI staff, while others are the joint responsibility of the BI staff and the business units (Wixom and Watson 2010);
- analytics and advanced analyses. The term "analytics", introduced by Davenport and Harris (2007), means "the extensive use of data, statistical and quantitative analysis, explanatory and predictive models, fact-based management to drive decisions and actions. Analytics are a subset of what has come to be called BI: a set of technologies and processes that use data to understand and analyze business performance" (Davenport and Harris, 2007);
- Competitive Business Intelligence (CI). Another subset of BI is CI. Its goal is to provide a balanced picture of the environment to the decision makers (Sauter, 2010). CI is the analytical process that transforms scattered information about competitors

and customers into relevant, accurate and usable strategic knowledge on market evolution, business opportunities and threats (Sauter, 2010).

The next section of this article is devoted to the issue of Competitive Business Intelligence.

2. The Issue of Competitive Business Intelligence

According to many authors (Akram, 2011) Competitive Intelligence is considered as a critical part of the contemporary organization, however, it cannot be judged as an innovative concept, as it has been applied by many glittering organizations for decades. The development of different ICT, first of all BI tools, has resulted in the popularization of this term.

McGonagle and Vella (2007), one of the advanced authors introduced a definition to the term Competitive Intelligence as "a formalized, yet continuously evolving process by which the management team assesses the evolution of its industry and the capabilities and behavior of its current and potential competitors to assist in maintaining or developing a competitive advantage".

According to Sauter (2010) CI is a subset of BI and its goal is to provide a balanced picture of the environment to the decision makers. It supports strategic decision making, and that requires a reasonable assessment of direction of the future and guidance from that assessment to outperform competitors. In particularly, CI must provide (Sauter, 2010):

- "A mechanism to provide an early warning of threats and opportunities: what are competitors, customers, and suppliers doing? How will it help or hurt business?
- Support for the strategy development process: What are the current trends in the marketplace? What strategies will help the decision makers capitalize on those trends?
- Assistance with instilling a sense of urgency and motivation toward action: What does the sales force know that headquarters decision makers do not know? How would this exchange of pertinent information affect business decision making?
- Support for strategic and operational decision making: What should the company do to compete effectively during the next five years? What changes would help us run the business better today?"

BI is the activity of monitoring mostly the internal business processes, while CI is focused on the monitoring of external environment and uses public resources to locate and develop information on competition and competitors. CI is the natural exploit of the increasing availability of commercial databases world-wide, the on-line mass media and the development of cutting edge information technologies: BI and knowledge management (Albescu, Pigna, Paraschiv, 2008).

According to Steyl (2012) BI can not replace CI and visa versa. Both has its place and both is of the utmost importance for the success of any organization. BI is the management of a company's internal data. This includes: the Extract, Transform and Loading (ETL) of this data in a well designed data warehouse in order to extract and present the data as intelligent information. This will help any business make better decisions based on its own historic information and can therefore project possible future trends. CI is the gathering and analysing of intelligence about the behaviours of the various market's actors in order to make certain decisions based on market trends. Since competitors are a part of the market, the collecting of information on competitors that enables to monitor their behaviour in order to pinpoint their weak/strong points will form part of CI.

Teo and Choo (2001) stated that competitive intelligence is a set of practices or formalized processes in organizations aiming to gather relevant information about competitors to stay one step ahead in middle and long range planning.

By reviewing the literatures, it is concluded (Akram, 2011) that the Competitive Business Intelligence systems can be assumed to contain different kinds of activities proposed at observing competitors, and collecting different types of information such as human resource, marketing policies, and operation management. Additionally, Competitive Business Intelligence may contain activities that aim to collect, process, analyze, transfer and display information, in the required format to decision makers to enhance decision making process.

3. Business Intelligence maturity models

The effective development of BI in the organization should be based on scientific theories. It seems that theory of maturity models gives the good foundation.

The term of maturity describes a "state of being complete, perfect or ready. To reach this a desired state of maturity, an evolutionary transformation path from an initial to a target stage needs to be progressed" (Lahramnn et al, 2011). Maturity models are used to guide this transformation process. They help define and categorize the state of an organizational capability (Watson, Ariyachandra, Matyska, 2001). Maturity model for BI helps organization to answer for these questions: where in the organization is most of the reporting and business analysis done today?, who is using business reports, analysis and success indicators?, what drives BI in the organization?, which strategies for developing BI are in use today?, and what business value does BI bring? (Hribar Rajteric, 2010).

A high number of maturity models for BI has been proposed (Larman, et al; 2011; Hagerty, 2011;Watson, Ariyachandra, Matyska, 2011; Eckerson, 2004). Table 2 gives an overview the identified BI maturity models.

Table 2 Overview of BI maturity models

Name of the model	Description
TDWI's Business Intelligence Model – Eckerson's Model Eckerson (2004)	This model focuses mainly on the technical aspect for maturity assessment. It constitutes of 6 maturity levels and uses a metaphor of human evolution: prenatal, infant, child, teenager, adult and sage
Gartner's Maturity Model for BI and PM Burton (2009), Rayner (2008)	The model is a mean to assess the maturity of an organization's efforts in BI and PM and how mature these need to become to reach the business goals. The model recognizes 5 maturity levels: unaware, tactical, focused, strategic, pervasive
AMR Research's Business Intelligence/ Performance Management Hagerty (2011)	The model is described by 4 maturity levels: reacting (where have we been?), anticipating (where are we now?), collaborating (where are we going?), and orchestrating (are we all on the same page?). It is used to assess the organization in the area BI and PM
Business Information Maturity Model Williams (2003)	The model is characterized by 3 maturity levels. The first level answers the question „ what business users want to access", the second "why the information is needed", the third "how information put into business use"
Model of Analytical Competition Davenport, Harris (2007)	The model describes the path that an organization can follow from having virtually no analytical capabilities to being a serious analytical competitor. It includes 5 stages of analytical competition: analytically impaired, localized analytics, analytical aspirations, analytical companies, and analytical competitors

Information Evolution Model, SAS SAS (2011)	The model supports organization in assessing how they use information to drive business, e.g., to outline how information is managed and utilizes as a corporate asset. It is characterized by 5 maturity levels: operate, consolidate, integrate, optimize, innovate
Model Business Intelligence Maturity Hierarchy Deng (2011)	The model was developed in knowledge management and constitutes of 4 maturity levels: data, information, knowledge and wisdom
Infrastructure Optimization Maturity Model Hribar Rajteric (2010)	The model enables a move from reactive to proactive service management. It aids in assessing different areas comprising the company infrastructure. The model is described by 4 maturity levels: basic, standardized, rationalized (advanced), and dynamic
Lauder of Business Intelligence (LOBI) Cates, Gill, Zeituny, (2005)	The model describes levels of maturity in effectiveness and efficiency of decision making. IT, processes and people are assessed from the perspective of 6 levels: facts, data, information, knowledge, understanding, enabled intuition
Hawlett Package Business Maturity Model The HP (2011)	The model aims at describing the path forward as companies work toward closer alignment of business an IT organizations. It includes 5 maturity levels: operation, improvement, alignment, empowerment, and transformation
Watson's Model Watson, Ariyachandra, Matyska (2011)	The model is based on the stages of growth concept, a theory describing the observation that many things change over time in sequential, predictable ways. The maturity levels include: initiation, growth, and maturity
Teradata's BI and DW MM Miller, Schiller, Rhone (2011)	Maturity concept is process-centric, stressing the impact of BI on the business processes The model has 5 maturity levels: reporting (what happened?), analyzing (why did it happen?), predicting (what will happen?), operationalizing (what is happing?), and activating (make it happen).

One of the most popular BI maturity models is Gartner's Maturity Model for Business Intelligence and Performance Management (Rayner, 2008). It describes a roadmap for organizations to find out where they are in their usage of BI. It provides a path for progress by which they can benefit from BI initiatives. The model recognizes five levels of maturity: unaware, tactical, focused, strategic, and pervasive. The assessment includes three key areas: people, processes, and metrics and technology (Burton, 2009, Hribar Rajteric, 2010). The first level is often described as "information anarchy". It means that there is a lack of awareness and need in organization to collect, process and analyze the information. Data are not complete, incorrect and inconsistent and organization does not have defined metrics. The uses of reporting tools are limited. The second level of BI maturity means that the organization starts to invest into BI. Metrics are usually used on the department level only. Most of the data, tools, and applications are in "silos". Users are often not skilled enough in order to take advantage of the BI system. At the third BI maturity level (focused) the organization achieves its first success and obtains some business benefits from BI, but it is still concentrated on a limited part of the organization. Management dashboards are often requested at this level. Their goals is to optimize the efficiency of individual departments or business units, but are not related to the broader organization goals. At the strategic level, organizations have a clear business strategy for BI development. They include BI into critical business processes and use

it for strategic and tactical decisions. The application of BI is often extended to customers, suppliers and others business partners. Sponsors come from the highest management. At the last BI maturity level, BI plays pervasive role for all areas of the business and all corporate culture. BI provides flexibility for adopting to the fast business changes and information demand. The users have access to information and analysis needed for creating a business value and influence business performance. The usage of BI is available to customers, suppliers, and other business partners.

Another interesting BI maturity model is the model introduced by Eckerson (2004). It includes six levels, called: Prenatal, Infant, Child, Teenager, Adult and Sage. Maturity is being evaluated trough eight key areas: scope, sponsorship, founding, value, architecture, data, development and delivery. The Prenatal phase lasts until a data warehouse is created. Reports are usually built into operational systems and limited to that individual system. At the Child level the organizations bay their first interactive reporting tools, which are used to drill data. Regional data warehouse are build, but they are not linked to each other. The Teenager level means that organization recognizes the value of consolidating regional data warehouse into centralized data warehouse. Such infrastructure enables to perform enterprise-wide analysis, bridging the border of individual departments gaining new knowledge. At this level customized dashboards are introduced. The main characteristics of the Adult level are: centralized management of BI data sources, common architecture of the data warehouse, fully loaded with data, flexible and layered, delivery in time, predictive analysis, performance management, and centralized management. Key performance indicators and business performance are used to compare the actual state with the strategic goals of the organization. At the Sage level, business and IT are aligned and cooperative. BI provides services with high added value, bringing high business value and competitive advantage. Highly customized reports and key performance indicators are applied. For faster development of different Bi solutions service oriented architecture (SOA) is used (Hribar Rajteric, 2010).

"Each of the BI maturity models suggests that BI capabilities within an organization grow from simple report use to usage with greater sophistication and complexity. Thus it follows a maturity or stage model that would first provide limited integration and data access to grater information and awareness resulting in organizational transformation and business agility to combat competitive forces" (Schick, Frolik, Ariyachandra, 2011).

Moving from one maturity level to another requires changes in all of the characteristics that make up these stages. Achieving the highest BI maturity level is particularly complex and requires changes in management vision, founding, data management, and more (Wixom and Watson, 2010).

4. Example of organizations competing with Business Intelligence

There are more and more organizations, that try to compete and take competitive advantage trough BI.

Wixom and Watson (2010) described some organizations that provide example of using BI to support organizational transformation. For example, Harrah's Entertainment decided to implement BI-based customer relationship management and innovative Total Rewards Program that rewarded customers for their stay and play at Harrah's properties. To implement this strategy, Harrah's created a BI infrastructure and applications. Many of the applications help analysts better understand Harrah's customer, identify their place in a customer lifetime cycle and identify customer segments for marketing campaigns.

Another interesting example of organizations that use BI for making organizational transformation is Continental Airlines. Continental after good experiences in using

conventional BI decided to apply real-time BI applications. They aimed first of all to improve the operational decisions. Operations mangers combined plane data with marketing data about high value customers and began making decisions about thinks like flight delays and gate changes that optimized customer service interactions.

Norfolk Southern, one of the four largest freight railroads in the United States, to improve its services for customers decided to implement BI with a one terabyte data warehouse to store data about railcars, shipments, human resources, and other key transactions. BI applications allowed customers to inquire about their shipments using a web interface. "The users can access current data, which is updated hourly, or they can look at three years of history of their transactions. Norfolk Southern has calculated that 4 500 reports are delivered to users daily and that would require 47 people to send out today's volume of reports using the old manual processes" (Wixom, Watosn, 2010).

An interesting case of the organization was presented by Schick, Frolick and Ariyachandra (2011). Monster Worldwide is a pioneer in the online job search industry. The organization, in order to state at leadership position on this dynamic changeable market, decided to implement BI. BI was slated to become the new competitive advantage for the company. Monster's BI framework relies on 10 progressive steps or components. As Monster progresses through each step, the degree of derived knowledge intelligence and competitive advantage increases. The progressive steps for the framework listed sequentially are: (1) data, (2) standard reports, (3) ad hoc reports, (4) query drilldown, (5) alerts, (6) statistical analysis and data mining, (7) forecasting, (8) predictive modeling, (9) optimization and (10) innovation. BI has created a new competitive advantage for Monster that would propel the company into eventual economic recovery.

5. Conclusion

This paper has explored the possibility of BI using to compete on the marketplace. It has been argued that in order to achieve the high competences in BI (and consequently the high business success), organizations should use the theory of BI maturity models. It describes a roadmap for organizations to find out where they are in their usage of BI. It provides a path for progress by which they can benefit from BI initiatives.

The discussed cases of organizations have confirmed that BI may be an effective tool in competing in the marketplace. It has allowed to make fundamental changes and running new business (e.g., establishing new co-operation, acquiring new customers, launching new products and services). Additionally, BI has resulted in increasing the quality of decision making (at all levels of management), improving business processes and operational efficiency.

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TOWARDS HUMAN PERCEPTION OF RELATEDNESS: A FUZZY SEMANTIC RELATEDNESS MEAUSURE

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ABSTRACT:
The goal of this study is to present a concept of a fuzzy semantic relatedness measure that was derived on the basis of human perception of relatedness and a fuzzy set theory. The fuzzy semantic relatedness measure is perceived as a linguistic variable that can take one of the following values: lack of relationships, weak relationships, neutral, strong relationships, synonyms. These values are treated as fuzzy sets with membership functions that can be defined with the use of different semantic relatedness measures. It seems that the concept of the semantic relatedness measure could be incorporated in information retrieval and information filtering systems.

KEYWORDS:
Semantic relatedness measures, fuzzy sets, linguistic variables

1. Introduction

Information society benefits greatly from the development of new communication technologies but at the same time is suffering from information overload. In general, there is no problem with accessing information but the vital issue became selecting the information that is needed, required, relevant or useful to a user. These kind of issues are tackled in the realm of information retrieval and information filtering domains (Manning, Raghavan, & Schütze, 2008; Abramowicz, 2008). In general, information retrieval deals with ad hoc user information needs whereas information filtering meets constant information needs. Traditional information retrieval and information filtering is based on so-called keywords matching that means it checks syntactic compatibility of words. However, the effect of this method of retrieval is characterised by lack of precision which manifests itself in returning information that is irrelevant to the needs of a user (e.g. a problem with homonyms - words that have different meanings depending on the context: looking for information on "mouse," we get the results concerning an animal and a computer device). On the other hand, not all relevant information is retrieved (so called poor recall): searching for information on the "books" user does not get information about the "short stories", "stories". Therefore, syntactic matching ignores the meaning of words, i.e. semantics. Current information retrieval and information filtering systems incorporate semantics. The crucial role in these systems is played by semantic similarity and semantic relatedness measures that were constructed in order to simulate human perception of similarity and relatedness between words or documents.

A fuzzy set theory that was designed to model human perception of vague terms and phenomena has already found applications in modelling information retrieval systems, e.g. in (Ogawa, Morita, & Kobayashi, 1991) a fuzzy information retrieval system was presented that is based on a key words similarity matrix, in (Huang & Kuo, 2010) a similarity between documents that are represented by fuzzy sets is defined. However, to the best knowledge of the author there is no formal definition of a general fuzzy semantic relatedness measure.

In the next section the concept of semantic relatedness is presented that is vital in information retrieval and information filtering systems. Next, the basis of fuzzy set theory is

outlined. Finally, the proposition of a fuzzy semantic relatedness measure is described, together with a discussion of its possible future applications.

2. Semantic relatedness measure

In general, similarity measure (sim) for objects from a set O (a set of words, documents, graphs, …) is a function that takes values from an interval [0,1]:

$$\text{sim: } O \times O \rightarrow [0, 1] \tag{1}$$

and satisfies the following condition: $\forall\ x,y \in O\ \ \text{sim}(x, y) \leq \text{sim}(x,x)$ and $\text{sim}(x,y)=1$ if and only if $x=y$.

Semantic similarity reflects lexical relations between words such as synonyms (e.g. car, auto) or hypernyms ("is a", e.g. house, building). Semantic relatedness is a more general term than semantic similarity; it encompasses more kinds of lexical relations, e.g. meronyms ("a part of", e.g. wheel, car), antonyms (e.g. hot, cold), associations (e.g. student, university). Hence, two words can be in some kind of a semantic relationship but it cannot be said that they are semantically similar (have similar meaning), e.g. university and rector). Semantic distance is defined as the inverse of semantic relatedness (Budanitsky & Hirst, 2006). A semantic relatedness measure (SRM) can be defined in the same way as a similarity function; for a pair of objects it associates a number from an interval [0,1] (equation 1) that reflects the strength of semantic relationships or in other words strength of similarity in meaning or some kinds of relationship in meaning. The value 1 of this measure means that two objects (words, documents) have identical semantic meaning.

Measures of semantic relatedness can be divided into:

- vector-based measures (e.g. Latent Semantic Analysis (Deerwester, Dumais, Furnas, Landauer, & Harshman, 1990)),
- graph-based measures (Rada, Mili, Bicknell, & Blettner, 1989; Leacock & Chodorow, 1998; Hirst & St-Onge, 1998; Wu & Palmer, 1994),
- information theory – based measures (Resnik, 1995; Lin, 1998),
- gloss-based measures (Lesk, 1986),
- hybrid approaches (Jiang & Conrath, 1997; Pirró & Euzenat, 2010; Wojtinnek & Pulman, 2011).

The above mentioned approaches were applied to different language resources, e.g. Wordnet (Budanitsky & Hirst, 2006; Menendez-Mora & Ichise, 2010), Wikipedia (Ponzetto & Strube, 2007; Zesch, Müller, & Gurevych, 2008; Gabrilovich & Markovitch, 2007)), and WWW (Gracia & Mena, 2008).

3. Fuzzy sets

In a description of phenomena, not only of an economic nature, sets appear for which it can be strictly defined whether an object belongs to these sets or not, e.g. a set of companies that are quoted on the Warsaw Stock Exchange. These kinds of sets are called crisp sets. However, sometimes sets appear for which it cannot be strictly judged whether some object belongs to these sets or not. For example, if we would like to define a set of companies that have high earnings. If a company achieved 1 million of earnings, does it mean that it belongs to this set or not? If we decide that it belongs to this set then what about a company that achieved a half million of earnings? In order to describe those types of collections Zadeh (1965) introduced a concept of a fuzzy set. A fuzzy set is defined by a membership function

that determines the degree of belonging of an element to this set. A formal definition of these kinds of sets is shown in equation 2. Sets with strictly defined elements belonging to the set (crisp sets) can be treated as special cases of fuzzy sets – with a membership function taking a value of 0 or 1.

$$A = \{(x, \mu_A(x)): x \in X\} \quad (2)$$

where:

A – a fuzzy set defined in a universe of discourse X

μ_A – a membership function, $\mu_A: X \rightarrow [0,1]$

An example of a membership function for a fuzzy set „high earnings" is presented in figure 1. It illustrates our own, subjective perception of high profits: if a company made a profit of one million we do not consider them too high (the value of the membership function is close to 0), and if it generated four million we consider its earnings as rather high (a value of the membership function is about 0.8), but if it made six million we recognize it as belonging to a set of companies with high earnings (for the 6 million earnings the membership function reaches a value of 1).

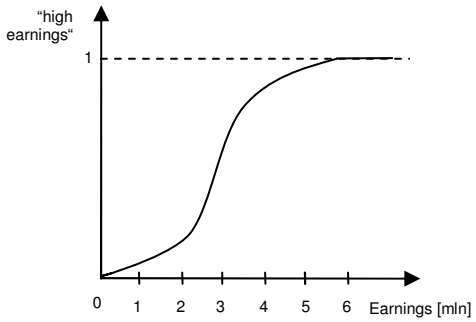

Figure 5 An example of a membership function for „high earnings".

Depending on the application area, the value $\mu_A(x)$ of the membership function can be interpreted as (Dubois & Prade, 1997):

- degree of similarity of the object x to prototype elements of A; approach used in cluster analysis, regression analysis, fuzzy control systems,
- degree of preference where A can be interpreted as a collection of preferred objects with different degrees; approach used in fuzzy linear programming, decision analysis,
- degree of uncertainty where the value of the membership function defines the degree of possibility that a parameter *p* has value *x* provided that the only thing we know is that "p is A"; approach used in expert systems and artificial intelligence.

In this study the membership function will be interpreted in terms of the first meaning: a degree of similarity.

The fuzzy set theory proposed by Zadeh gave foundation to a wide range of research areas, e.g. fuzzy logic, fuzzy logic reasoning. Fuzzy logic rules allows us to construct models and implement systems that use imprecise and vague information that cannot be modelled in other way. Especially it can be useful for modelling human perception of different phenomena as humans often use imprecise rules and categories (Zieliński, 2000).

Based on the concept of fuzzy sets, Zadeh (1975) defined a concept of an linguistic variable (equation 3), which is useful in describing a kind of variables that values takes words or sentences in natural or artificial languages.

$$LV = (N, T(N), U, S, M) \quad (3)$$

where:

LV – a linguistic variable

N – a name of a variable

T(N) – a collection of possible linguistic values for N

U – a universe of discourse

S – a syntactic rule that generate terms in T(N)

M – a semantic rule that for each value of a linguistic variable x assigns its meaning M(x) that is defined by a fuzzy subset of U. This fuzzy subset is characterised by a compatibility membership function: $c:U \rightarrow [0,1]$

An example of a linguistic variable is shown in next section. In fact, a proposed fuzzy semantic relatedness measure is a linguistic variable.

4. Proposition of a fuzzy semantic relatedness measure

In practical applications more important than the actual numeric value of semantic relationships measure is a subjective assessment of the semantic relationships. People can judge/perceive the degree of semantic relationships in terms of "lack of relationship", "weak", "neutral", "strong relationships", "synonyms", whereas the characteristics of each category can be defined individually by a user. It should be noted that it is difficult to define the boundaries of measurement ranges of semantic relationships for each category. That is why, in order to encode a human perception of a measure of semantic relationships, the author proposes a definition of the semantic relationships as a linguistic variable whose values comprise the adapted concepts of a five-point Likert scale (equation 4).

$$(FSRM, T(FSRM), U, S, M) \quad (4)$$

where:

FSRM – a fuzzy semantic relationships measure

T(FSRM) – a collection of possible values of a fuzzy semantic relationships measure

T(FSRM)= lack of relationships + weak relationships + neutral + strong relationships + synonyms

U – a universe of discourse; a set of words or documents for which semantic relatedness will be assessed

S – a syntactic rule

M – a semantic rule; M(x,y)- a meaning of (x,y) (a fuzzy subset of U) – a fuzzy set that is defined by a compatibility function which assess a semantic relatedness measure (SRM) between x and y: $\forall (x,y) \in U \;\; M(x,y)=SRM(x,y)$

The relationship between the fuzzy semantic relatedness measure and its compatibility function: a semantic relatedness measure is depicted in Figure 2. Examples of memberships function for fuzzy sets: “lack of relationships“ and “strong relationships“ are shown in Figure 3.

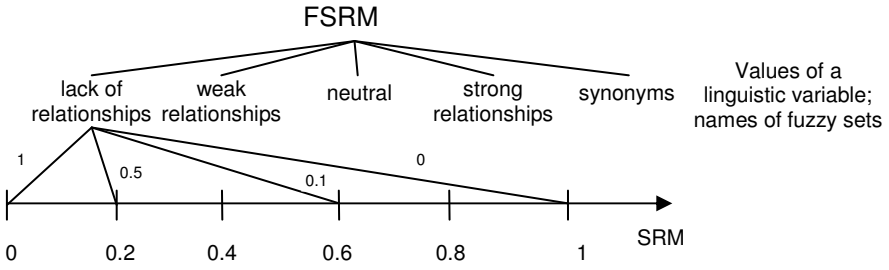

Figure 6 A fuzzy semantic relationship measure as a linguistic variable.

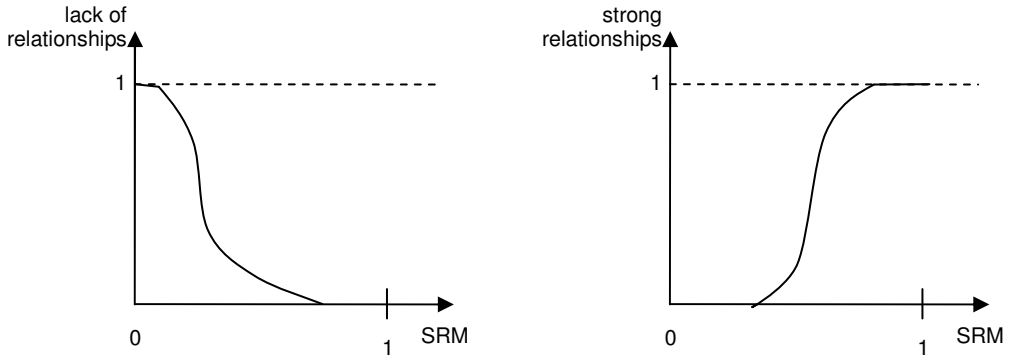

Figure 7 Examples of membership functions for fuzzy sets: "lack of relationships" and "strong relationships".

Membership functions that define values of the fuzzy semantic relatedness measure can be defined with the use of different semantic relatedness measures (see section 2).

5. Areas of applications and future research

The main question that arises is: What are the benefits of the fuzzy approach to semantic relationship measure? The proposed fuzzy semantic relatedness measure could be used in the systems that have to simulate human perception of semantic relatedness. For humans it is difficult to tell whether the semantic relatedness between two concepts or documents equals to 0.5 or 0.6. It is much easier to judge and reason in categories of "strong", "weak" relatedness. That is why it seems plausible to try to use this measure and incorporate fuzzy logic in systems that simulate human behaviour and reasoning. Especially, it seems to be reasonable to seek potential applications in an area of information filtering where there is the need of judging whether some input data (information, documents, emails, ...) are relevant to user profile; in a formal way whether the measure of semantic relationship between input data and user profile is high enough to justify to treat input data as relevant. The main premise for building this kind of systems is the need to help the user, and particularly to automate the process of human reasoning; fuzziness seems to help in this task. Hence, the future research will concentrate on design on an information filtering model that uses the fuzzy semantic relatedness measure.

6. Conclusion

In the paper a fuzzy semantic relatedness measures was defined as a linguistic variable whose values represent human perception of relatedness. Values of this variable are coded as fuzzy sets that can be defined individually by a user. The based variable that can be used for defining these fuzzy sets is a semantic relatedness measure. It seems that the fuzzy semantic

relatedness measure might find its application in systems that simulate human reasoning, e.g. in information filtering systems. Therefore, this area will be a subject of future research.

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BUDOUCNOST SOCIÁLNÍCH SÍTÍ

THE FUTURE OF SOCIAL NETWORKING

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ABSTRAKT:
Fenomén sociálních sítí v současné době vládne internetu a pravděpodobně zůstane významný i pro pár následujících let. Nicméně, jak jsme nedávno viděli na případu úpisu akcií Facebooku (FB), je růst omezen hned několika faktory. Článek se bude zabývat některými z nich, snaží se identifikovat jejich hrozby, a nastíní možnou budoucnost.

ABSTRACT:
The phenomenon of social networks is currently ruling the Internet and it will probably remain significant for a couple of following years. However, as we recently saw the case of Facebook (FB) IPO, the growth is limited by several factors. The paper will tackle some of them, tries to identify their threats, and outline their possible future.

KLÍČOVÁ SLOVA:
Sociální sítě, Facebook, Twitter, LinkedIn, statistiky, hrozby, předpověď

KEYWORDS:
Social networks, Facebook, Twitter, LinkedIn, statistics, threats, forecast

1. Úvod

Fascinující růst popularity sociálních sítí v podstatně ve všech koutech dnes již globalizovaného světa je záležitostí posledních 5-6 let. Služby jako Facebook, Twitter, částečně i profesní LinkedIn se staly pro většinu uživatelů vedle klasických obecně použitelných služeb na internetu, jako je vyhledávání nebo pošta, nejčastějším místem pobytu v internetovém prostředí - nezřídka i v profesní roli. Uplynulý vývoj lze charakterizovat několika rysy:

- Jsou zde velcí hráči (předně Facebook, Twitter) s počty uživatelů těsně pod miliardu, ale celosvětově nejde o dominanci jednoho dodavatele. Tím je situace podobná jako na srovnatelně globálním trhu vyhledávacích služeb - i zde dominuje Google, dokonce ještě markantněji, ale jsou regiony (Rusko, Čína, téměř až dodneška i Česko se Seznamem).
- V uplynulých letech směřoval vývoj v oblasti služeb Webu 2.0 - tedy vysoce interaktivních aplikací funkčně přístupných přes webový prohlížeč, ale stejně pohodlně obsluhovatelných jako aplikace instalované na počítače – k ústupu od webu jako publikační platformy (každý může sdílet snímky, profily, blogy, přispívat na wiki stránky) k médiu komunikačnímu.
- Nové služby komunikaci také samy mění. Odpovídají především na obecný trend zrychlování, „neformalizace“ a přesunu na mobilní platformy. U Twitteru je to dotažené do extrému - posílají se zprávy o max. 160 znacích (podobně jako SMS), komunikace je velmi stručná, jen k jádru věci. Vše ostatní je odkazované a uložené jinde. Komunikovat lze ale tudíž odkudkoli, bleskově, typicky z mobilního

zařízení. Tzv. Arabské jaro v Egyptě vrcholící pádem H. Mubaraka bylo poháněno právě touto rychlostí a jednoduchostí.

- Sociální sítě začaly být atraktivní i pro firemní uživatele - ať už směrem k zákazníkům, tak dovnitř firmy.

2. Sociální sítě dnes

Počty uživatelů Facebooku a dalších hlavních aktérů jsou impresivní: již na začátku 2012 dosáhl Facebook počtu celosvětově 800 mil. aktivních uživatelů při nárůstu 100 mil. Za poslední rok. Twitter je vzhledem ke své povaze, zkratkovitosti, hutnosti a neformálnosti záležitostí spíše mladých, přesto měl k začátku roku 100 mil. aktivních uživatelů. Zajímavá jsou čísla u profesní sociální sítě LinkedIn se 64 mil. uživateli jen v Severní Americe [1]. Poslední vysoké hodnotě se nelze divit – ukazuje se, že LinkedIn je při navazování B2B kontaktů 4x účinnější než obecný Facebook nebo Twitter [2]. Ve Spojených státech nicméně jako třetí po FB a Twitteru figuruje Pinterest – elektronická nástěnka s obligátními možnostmi „lajkování“, následování atd. –, který je u nás téměř neznámý, nemaje ani českou jazykovou mutaci.

Za povšimnutí stojí, že výše uvedená čísla nemusejí být maximální, o nichž se v souvislosti s tou či onou sítí hovoří: statistiky se liší zahrnutím buďto jen aktivních (co to ale znamená?) nebo všech registrovaných. Při maximalizaci bychom mohli hovořit až o 900 mil. u FB, 550 mil. u Twitteru a 150 mil. u LinkedIn. USA jsou rovněž ve významně jiné situaci ve využívání mobilních prostředků pro sledování televize a multimédií, což dále ovlivňuje módy používání sociálních sítí.

Katherine Rushton v prestižním The Telegraph interpretuje vývoj [7] na přelomu roku 2011 jako signál pomalu se měnících poměrů. Podíl největší ze sítí, Facebooku, na počtu návštěv sociálních sítí z Británie klesl meziměsíčně o více než procento a drží se jen těsně nad 50 %. Tehdejší odhady, pro zajímavost, hovořily o možné tržní kapitalizaci Facebooku na úrovni až 100 mld. USD. Skutečnost byla jen o něco více než poloviční - aktuálně cca 52 mld. [6] Tržní kapitalizace obra z branže vyhledávání – Google – je stále podstatně, více než 4x vyšší, ale Facebook přes pokles stále drží vysokou „cenu“: poměr ceny akcie k výnosům je oproti Googlu dvojnásobný. Obě společnosti neplatí dividendy, čili zájem o ně se opírá pouze o očekávání budoucích výnosů, nikoli o jejich historii.

3. Hrozby pro sociální sítě

Existuje celá řada ohrožení, která mohou – a pravděpodobně i budou – znamenat snížení tempa růstu zejména velkých hráčů na trhu sociálních sítí. Některá jsou přitom taková, že jedni ztrácejí, zatímco jiní získávají.

- Facebook na jaře 2012 čelil poklesu objemu zobrazené reklamy v USA i přes výrazný nárůst počtu denních uživatelů jednoduše proto, že stále více z nich čte Facebook z *mobilních zařízení*, kde je pomyslná „reklamní plocha“ podstatně menší. Reklama bude muset být cílenější.

- Sociálně sítě dnes vnímají možné *legislativní zásahy a regulace* [4] jako vysoké potenciální riziko. Zatímco tradiční technologické firmy nebývaly v tomto ohledu příliš vnímavé - jednoduše šly nezávisle na za svým - Facebook od počátku s vlivem státu kalkuloval, o čemž mj. svědčí angažmá bývalého vysokého úředníka jako COO. Zásahy by pravděpodobně nevedly ke zničení velkých, ale jistě k omezení jejich vlivu a dost možná další expanze, kdyby se například jednalo o omezení nakládání s osobními údaji, případně nutnost masivně shromažďovat a úřadům poskytovat data, např. o pohybu uživatelů podobně, jako musejí činit mobilní operátoři.

- S hlavními sociálními sítěmi, speciálně Facebookem, jsou doslova pupeční šňůrou propojeni poskytovatelé *návazných aplikací*, typicky her. Logicky tak akcie hlavního reprezentanta této skupiny, společnosti Zynga, kopírují v růstu a poklesu Facebook [3]. Případné vážnější problémy FB se tak rychle odrazí v úpadku napojených služeb. Firmy jako Zynga by v principu dokázaly poměrně rychle technologicky migrovat jinam, ale toto nelze s jistotou říci o množině uživatelů nezbytné pro fungování jejich herního či podobného podnikání.
- Pro ty největší je samozřejmě podstatné, zda se jejich tržní podíly na dílčích trzích přehoupnout přes magické hranice, typicky zda a kdy získají relativní či dokonce absolutní většinu trhu. V tomto - již lokálním - boji rozhodují *regionální či národní odlišnosti*: zatímco Brazilec má na sociální síti v průměru 481 kontaktů, Japonec pouhých 29, [1]. Je jasné, že nabídka dalších služeb a aplikací musí být nutně rozdílná, jinak velký poskytovatel riskuje, že ho lokální firma nepustí dále.

4. Možný vývoj

Předvídání je vždy nejisté, ale významné trendy lze vypozorovat [5]. Není asi pravděpodobné, že by se vbrzku objevily služby sociálních sítí s převratně novými vlastnostmi: spíše půjde o mix stávajících nápadů [8]. Významnější průlomy přijdou až ve chvíli, kdy se využije nějaké další, modernější zařízení (např. v něčem zásadně lepší smartphone, chytrý domácí spotřebič) nebo bude obohacena infrastruktura (třeba nové identifikační možnosti). Při dnešních obřích velikostech sociálních sítí není dlouhý růst jednotlivých sítí realistický. Stejně tak ale donekonečna neporoste ani trh jako celek, neboť počet sítí, s nimiž jednotlivec aktivně interaguje, je rovněž limitován – jsou to reálně, každodenně, dvě tři sítě.

Dají se čekat komplexnější služby dostupné na webu: ve skutečnosti se postupně naplňují vize Tim Berners-Lee, který předvídal před deseti lety sémantický web umožňující řešit složitější úlohy sestávající z řady dílčích (online proveditelných) úkonů – např. řetězec naplánování, vyhledání, nákup, použití. Co se rovněž mění, je názor na ochranu soukromí: obecně jsou starší uživatelé opatrnější v tom, co se o nich na internetu ví. Mladí už méně, ale zůstává otázkou, zda se vnímání posune, až dospějí.

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SOCIÁLNÍ INTRANET JAKO BUDOUCNOST V PODNIKOVÉ KOMUNIKACI

SOCIAL INTRANET AS A FUTURE OF CORPORATE COMMUNICATIONS

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ABSTRAKT:
Tento článek je zaměřen na aktuální vývoj a možnosti na poli sociálních intranetů, které nacházejí své možnosti uplatnění u firem, úřadů a vzdělávacích institucí. S postupným rozšiřováním principů sociálních sítí do firemních intranetů, souvisí nutné změny, které vyžadují důkladné plánování a řízení. Lidé, kteří využívají sociální sítě ve svém osobním životě, mohou svou znalost a zkušenost přenést do firemní komunikace. Vedení společností by mělo rozumět, jaké přínosy mohou mít sociální intranety, a musí hledat nové myšlenky u svých zaměstnanců, firemních partnerů nebo zákazníků. V rámci článku je dále popsána základní pravidla pro implementaci sociálního intranetu a pohled na pravidla a procesy, které takovouto implementaci provází.

ABSTRACT:
This article is focused on recent development and opportunities in the field of social intranets that increasingly affect the daily operation of thousands of companies, offices or educational institutions. With the gradual expansion of the principles of social networks to corporate intranets, the changes that require careful planning and management should be related. People, who use social networks in their personal lives, can through their knowledge and experience very easy transfer corporate communication. Management companies should understand what benefits social intranets can have, and must find new ideas for their employees, business partners or customers. The article also describes the basic rules for the implementation of social intranet and the basic view at the rules and processes that accompany such an implementation.

KLÍČOVÁ SLOVA:
Intranet 2.0, sociální sítě, podnik 2.0, řízení znalostí, sdílení informací, on-line komunikace

KEYWORDS:
Intranet 2.0, Social Networks, Enterprise 2.0 , Knowledge Management, Information Sharing, On-line Communication

1. Úvod

Sociální sítě každý den využívají milióny lidí na celém světě. Tento fenomén patří k jednomu z důsledků Webu 2.0 a pro firmy je často označován termínem Enterprise 2.0. Enterprise 2.0 je koncept, v jehož rámci integrujeme nástroje a technologie Web 2.0 do podnikových procesů, čímž podporujeme spolupráci zaměstnanců, partnerů, dodavatelů a zákazníků a zapojujeme je do nově vzniklých sítí lidí s potřebou přístupu k obdobnému typu informací. [1]

V rámci výše zmíněných pojmů, je důležité také vymezit pojem sociálního intranetu, kterým se bude tento článek zabývat především. V některých zdrojích je také uváděn pojem

Intranet 2.0, který je dle mého názoru shodný se sociálním intranetem. Sociální intranet je volně definován jako: Intranet, který nabízí větší množství sociálních nástrojů a aplikací pro většinu firemních zaměstnanců, aby je mohli použít jako prostředek pro sdílení znalostí s ostatními zaměstnanci. Sociální intranet mohou představovat blogy, wiki, diskuzní fóra, sociální sítě, nebo kombinací těchto či jiných sociálních nástrojů, které jsou alespoň zčásti přístupné na hlavním intranetu nebo domovské stránce firemního portálu. [2]

Právě základní funkce služeb a online aplikací, které jsou v rámci sociálních sítí využívány, mohou nabídnout zajímavé možnosti podnikové sféře. Ve svém důsledku mohou sociální sítě nahrazovat stávající řešení intranetu, které již není schopno nabídnout funkce a služby řešící nové požadavky a potřeby zákazníků nebo obchodních partnerů. S přihlédnutím k podstatě sociálních médií, je důležité dát zaměstnancům odpovědnost a umožnit jim podílet se na rozvoji této moderní formy komunikace a sdílení informací a znalostí.

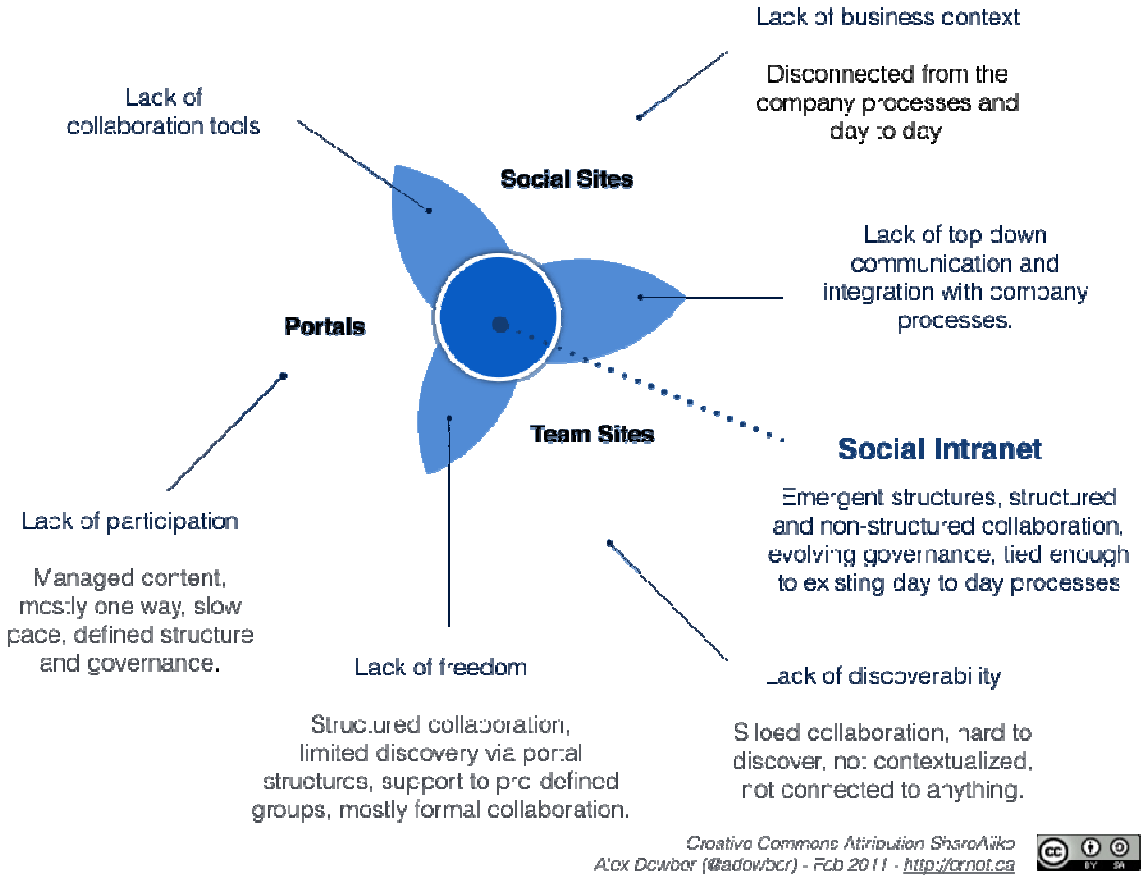
Sociální média však mohou být obrovským přínosem v každodenní praxi pracovního procesu. Mohou zvyšovat kvalitu komunikace a spolupráce jak mezi zaměstnanci uvnitř firmy, tak s externími pracovníky i s klienty. A v neposlední řadě také s vedením: pomocí sítí se nabízejí nové a kreativnější způsoby, jak systematizovat snahu získávat znalosti a nápady od podřízených. Nástup sociálních médií dále silně podporuje úsilí o "otevřené inovace" tím, že umožňuje společnostem vytvářet komunikační kanály se zákazníky a partnery, kteří byli v minulosti těžko dosažitelní a nebylo možné s nimi trvale a cíleně komunikovat. Zapojením zaměstnanců do procesu zařazování těchto médií do praxe se zvyšuje i jejich zainteresovanost a možnost všech druhů alternativních forem zaměstnání, jako je např. práce z domu. Města a obce, které využívají sociální sítě, chtějí jejich prostřednictvím rozšiřovat a zatraktivňovat svou komunikaci s informačně zdatnějšími občany a dostat se hlavně k mladší generaci občanů. Sociální sítě, zvláště ty, které jsou profesionálně zaměřené, ukazují, jak mimořádně užitečný nástroj jsou při získávání obchodních kontaktů a při náboru potenciálních zaměstnanců.

2. Vývoj v oblasti moderních intranetů

Pro základní pochopení možností, které nabízejí sociální sítě a aplikace ve firemních intranetech, je důležité rozpoznat jednotlivé typy uživatelů. Tito uživatelé se totiž budou podílet na tvorbě nebo konzumaci obsahu intranetových portálů, a je důležité jim v realizovaných řešeních vycházet vstříc. Základní typologie uživatelů sociálních sítí má podle [5] šest základních skupin.

1. Neaktivní - v sociálních médiích nedělají nic. Nečtou je, nezajímá je to, nebo o nich ani nevědí.
2. Diváci - čtou blogy, poslouchají podcasty, dívají se na videa druhých, čtou on-line fóra, čtou recenze a hodnocení zákazníků.
3. Účastníci - pečují o svůj profil v sociálních sítích, navštěvují sociální weby (blogy, Twitter, Facebook, Google+, LinkedIn aj.).
4. Sběratelé - používají RSS zdroje, on-line hlasují o oblíbenosti stránek, stránky označují tagy (štítky) například na Delicious.com.
5. Kritici - publikují recenze a hodnocení produktů a služeb, komentují články na blozích jiných lidí, přispívají do on-line fór, přispívají či editují články ve wiki.
6. Tvůrci - publikují svoje blogy a webové stránky. Tvoří a na webu publikují, video, audio či hudbu. Píší a publikují články a příběhy na webech jiných lidí.

V současné době se nacházíme ve stádiu poměrně radikálních změn v přístupu k podnikovým aplikacím a jejich využívání. Uživatelé jsou stále častěji konfrontováni s novými rozhraními a formami výměny a sdílení informací. Pozadu v tomto trendu nezůstávají také firemní intranety. Budování nových intranetových řešení je více zaměřeno na sociální sítě. Hlavním faktorem je vzájemné vytváření obsahu a autonomní samostatností v jeho formách připojení uvnitř i mimo organizaci. Jak popisuje obrázek č. 1, tento trend již postupně nastal a bude se prosazovat ve stále větší míře. Cílovým stavem je pak sociální operační systém, který nabídne bezbariérové propojení mezi podnikovými aplikacemi a sociálními sítěmi.



Obrázek 10 - Propojení sociálních sítí, portálů a týmových stránek Zdroj: [4]

Na základě prováděných výzkumů [7], existuje pět základních trendů, které jasně dominují v implementacích nových intranetových řešení.

1. Intranet se stává vstupní branou do pracovního webu (základní rozhraní pro obsah, služby, nástroje a aplikace, které lidé potřebují ke své práci). K základnám potřebám podniků a zvyšováním produktivity se přidává možnost komunikace.
2. Intranet se stává týmovou platformou, a to díky možnostem jeho rozhraní při řešení podnikových projektů, společně s budováním komunikačního rozhraní pro vzájemnou spolupráci zaměstnanců. Až 10% organizací tvrdí, že celý jejich intranet umožňuje vzájemnou spolupráci.
3. Intranet se stává platformou pro téměř "real-time" komunikaci, podílí se na zvýšení rychlosti kterou lidé komunikují a pracují zároveň. Až 40% procent lídrů, v případě implementace sociálních médií do intranetu, potvrdilo plné využití micro-blogovacích služeb.
4. Intranet je nyní nezávislé prostředí, které svou dostupnost rozšířilo mimo firemní zdi a kancelářské počítače. V rámci výzkumu 90% organizací potvrdilo, že je technicky

možné přistupovat do intranetu z domova a 30% firem tvrdí, že pro mnoho zaměstnanců, kteří pracují z domova, je to již běžná praxe. V rámci mobilních platforem až 7% firem optimalizovalo intranety pro přístup přes mobilní zařízení, jako jsou chytré telefony.

5. Intranet se stále více přímo zaměřuje na lidi. Je to platforma, kde se mohou lidé vyjádřit přímo k publikovanému obsahu, komunikovat s ostatními uživateli nebo začít budovat sítě a komunity. Tyto sítě je možné budovat mezi zaměstnanci nebo s firemními zákazníky a partnery.

2.1 Problémové oblasti

V současné době je vnímání hodnoty ze sociálních médií především založeno na měkkých ukazatelích. V rámci podniků stále přetrvávají obavy ve způsobu získání zpětné vazby efektivnosti a využívání sociálních medií na intranetu. V žádném případě nelze hovořit o propracovaných metodikách měření návratnosti investic nebo stanovení profitu. Nejčastější problémy vyplývají ze zkušeností firem, které již do svého intranetu podporu sociálních sítí začlenily:

- Je těžké měřit sociální média prostřednictvím externích nástrojů, protože neexistuje podpora od ICT, pokud jde o integraci těchto nástrojů do intranetu.
- Editor sociálních médií zpracovává report identifikující nejčastěji diskutovaná témata. Velmi složité vykazování relevantnosti obsahu a informací na portále.
- Sociální média byla spuštěna jako pilotní projekt, tj. bez širší diskuse o strategii. Proto je teď těžké začít měřit jejich celkovou efektivitu.
- Firmy měří poměr počtu návštěvníků k počtu diskutujících, a tak vyhodnocují popularitu jednotlivých témat nebo diskusních skupin.

U řady firem v České republice, také přetrvávají obavy z nasazení sociálních aplikací a jejich finančního přínosu pro společnost. Loňský průzkum společnosti Manpower, který zjišťoval, jak zaměstnavatelé v ČR a dalších 35 zemích vnímají přínos sociálních sítí, ukázal, že v ČR jsou sociální sítě vnímány především jako hrozba. Zaměstnavatelé se obávají buď ztráty produktivity zaměstnanců, nebo ztráty pověsti. [3]

Většina manažerů si již dnes uvědomuje, že je nutné sociální sítě minimálně monitorovat. Většina pochyb je možné shrnout do níže popsaných bodů.

- Nejistota ohledně skutečného přínosu pro společnost – neexistující metriky pro výpočet ROI nebo ekonomické výhodnosti využívání sociálních síti na intranetových portálech.
- Bezpečnost dat – velké riziko úniku citlivých informací a dat. Vzhledem k povaze fungování sociálních sítí existuje velká pravděpodobnost rychlého rozšíření takových to informací.
- Riziko snížení produktivity (ztráta času) zaměstnanců – neexistující možnost monitorovat zaměstnance v rámci přispívání na sociální sítě. Velmi tenká hranice mezi osobním životem a firemní kulturou.
- Jazykové bariéry a nestabilní prostředí – některá rozhraní moderních on-line aplikací nemusí být připravena v českém jazyce. Toto je také spojeno s nestabilitou uživatelského prostředí, které je u on-line aplikací a sociálních sítí velmi proměnné.

3. Implementace nových řešení

V rámci sociálního intranetu je možné rozpoznat dva základní přístupy implementace nových aplikací a služeb do struktury stávajících intranetů.

Rychlá implementace - nutno najít způsob, jak překonat rizika spojená s implementací nejen nových nástrojů, ale i příslušných podnikových procesů.

Pomalá implementace - riziko ztráty zaměstnanců očekávajících, že inovace budou reflektovány i v interní komunikaci. Ztráta zákazníků, kteří jsou zvyklí na denní užívání nástrojů Webu 2.0.

Zkušenosti firem přinášejí důkaz o tom, že klíčová hodnota pro společnost spočívá v odbourávání bariér plynoucí např. z oficiální firemní hierarchie. Jednotliví zaměstnanci mohou generovat pro společnost přidanou hodnotu i mimo jejich hlavní obor činnosti. Další možností je tvorba a popis Wiki akronymů a specializovaných výrazů, které pomáhají novým zaměstnancům rychle se zorientovat ve společnosti a zapojit se do projektů.

Zajímavou zkušeností z implementace je fakt, že zaměstnanci se mnohem spíše zapojí do diskusí, pokud z toho vidí přímou výhodu.[8] Velikým rizikem je nízká angažovanost zaměstnanců a vedoucích pracovníků při tvorbě obsahu a jeho následné aktualizaci. Hlavním důvodem tohoto neúspěchu je realizace těchto projektů bez jakékoliv strategie, cílů a téměř bez jakéhokoliv obsahu. Obsah je v rámci sociálních médií velmi důležitý prvek. Pokud chtějí firmy nalákat zaměstnance nebo své partnery na spolupráci v rámci sociálního intranetu, musí pro ně připravit kvalitní obsah a tento patřičně udržovat.

Martin Onofrej [6] považuje sociální sítě za vhodnou platformu pro názory samotných zaměstnanců. Doporučení pro komunikaci ale zní:

- stanovte jasná pravidla,
- podporujte rozmanitost názorů a nekompromisně ochraňujte kvalitu,
- nepodporujte anonymitu,
- umožněte vnášet i citlivé témata,
- podporujte egostav dospělý.

3.1 Aplikační platformy a služby

Asi nebude velkým překvapením, že Microsoft SharePoint tvoří hlavní hnací sílu sociálního intranetu. Jak uvádí [2], ve skutečnosti 56% organizací s intranetem 2.0 využití SharePoint jako základní platformu. Dalšími nejčastějšími platformami jsou sociální sítě Facebook a Google+ (pro intranet 2.0 používány jako soukromé skupiny), dále pak WordPress a Blogger. Velkým hráčem do budoucnosti může být také sociální síť pro podniky Yammer.com, která si klade za cíl oslovit především podniky a začlenit se do firemní infrastruktury.

V praxi neexistují žádní komerční dodavatelé softwaru, kteří mají dvouciferný podíl na trhu s podnikovým sociálním software. Nejbližším obchodní konkurentem Microsoft SharePointu je IBM Connections s 6% respondentů na trhu. Právě výše zmíněný software IBM Connections 4.0 využívá mikroblogy, wikis, komunity i aktivity pro spolupráci s klienty, partnery nebo zaměstnanci. Platforma postavená na bázi sociálních sítí nabízí především kompatibilitu napříč celou organizací. Její hlavní předností je možnosti monitorovat a v reálném čase izolovat relevantní data z konverzací, postů a nahrávaných souborů. Toto online řešení umožňuje společnostem dosáhnout shody s firemními směrnicemi a zároveň pracovat rychlostí, která je charakteristická pro sociální sítě [10].

4. Závěr

Intranety umožňují zaměstnancům komunikaci v reálném čase (web-conferencing, micro-blogging, live-blogging, atd.). Hlavní výhodou nově integrovaných služeb a aplikací je skutečnost, že přístup k těmto novým médiím je umožněn odkudkoliv - mimo budovu zaměstnavatele nebo z mobilních zařízení. Především mobilní zařízení jsou velmi vyhledávanou platformou pro aktualizace informací nebo jejich získaní ve chvíli potřeby.

Stále platí, že ve většině podniků není vrcholové vedení dostatečně aktivní v prosazování sociálních médií do struktur firemního intranetu. Firmy si musí uvědomit, že úspěšné zavedení nástrojů a aplikací sociálních sítí se nerealizuje přes noc. Pilotní projekty mohou být krátkodobou záležitostí, ale adaptace sociálních sítí sebou přináší také změny ve firemní politice a kultuře. Tyto změny jsou vždy běh na delší trati. V této chvíli neexistuje jasná odpovědět, co se týká délky implementace sociálních prvků do intranetových řešení. Lze však předpokládat, že na základě stávajících zkušeností, je implementace sociálních médií do interní komunikace záležitostí na 3-5 let! [9] Z tohoto důvodu, jakékoli otálení může představovat velké problémy v konkurenceschopnosti v budoucích obdobích.

Je potřeba si uvědomit, že hlavní rolí interní komunikace je zajistit informovanost zaměstnanců o dění ve firmě. Pokud jim nebudou důležité informace sděleny prostřednictvím oficiálních kanálů, domyslí si je a vznikají tzv. „chodbovky“. Pro firmy je důležité se v sociálních médiích soustředit na nejpočetnější skupiny diváků, a uspokojovat jejich potřeby a touhy po autentických příbězích uvnitř společnosti, ze kterých vyrůstají pozoruhodné nápady nebo produkty. Kritici a tvůrci se přidají sami. Největší riziko spočívá v nezapojení se do sociálních sítí vůbec. Rezignace na komunikaci nebo alespoň monitoring sociálních sítí vede vždy k finančním ztrátám.

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THE INTERNET DATA ACQUISITION TECHNIQUES FOR POLICE NEEDS

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ABSTRACT:
The paper describes techniques which can be used for objects, persons and events search on the Internet. It describes tools for monitoring and downloading Internet content, management and retrieval of stored data, data analysis and results presentation. Utilization of these tools is discussed in context of use by the Police.

KEYWORDS:
Internet search; downloading content; unstructured data analysis, social networks, forums

1. Introduction

This paper presents software tools for monitoring, identification, categorization and downloading content from various Internet sources, developed by the authors of this article in cooperation with other IT professionals from academic and commercial spheres. This is an extensive set of library functions designed to identify different entities, their relationships and their impact on the surrounding world in the Internet.

Originally, these tools were created to meet needs of commercial companies, such as for marketing purposes in social networks and discussion forums. There were used to identify discussions related to individual products, to measure the sentiment (satisfaction) of the individual panelists and to select competitive products. It turned out, that developed functionality is so strong that it can be successfully used for needs of the police in searching for information about objects, persons and events that occur in the web content.

In practice this means that, for example when tracing stolen artworks, these tools must be able to monitor structured or semi-structured data, such as auction houses offers, e-commerce and advertising, as well as unstructured data, such as discussion forums and social networks. The obtained information obtained should then be saved to newly created workspace, which will be further examined by analytical and retrieval tools.

Although it is mostly about working with text data, there is also a solution for identifying objects in 2D, 3D images and video, where the tool recognizes all objects and their fragments. Parts working with text data are able to work with texts in various European languages.

2. Basic architecture

Our solution consists of four main parts, namely:

- Monitoring and the Internet content downloading tools,
- Tools for management and retrieval of stored data,
- Data analysis tools,
- Tools for presentation of results.

The whole system works in following schema: Selected Internet addresses are automatically tracked, and if the tool finds any interesting data, the data are stored on the local server. This data are analyzed and the results are compiled in reports for end users.

3. Monitoring and the Internet content downloading

There is no single universal technique for the Internet data acquisition. Data acquisition procedure must be chosen according to the site from which the data are acquired. Simply we can say that other techniques are used in the case of social networks and other for the rest of the Internet, such as advertisements and discussions. For debates, advertising, and other similar sites it proceeds in a way that the component, typically a single forum, is downloaded completely, or all new posts are downloaded in a sufficiently short time period and stored on the server. To do this, we use Web Harvest or Heritrix, which is more universal in use. But for most servers is fully sufficient Web Harvest technology. As an extreme approach in case you can't use either of the above, we can mention saving each page using a special plug-in in the form of images and their subsequent conversion into text format using OCR.

The situation is different in case of social networks – techniques of Harvest Web or Heritrix don't work here. There is generally necessary to obtain content using special plug-in that automatically go through either the public or private part of the network, to which has access only the specially set up user profiles. Successful technique is also online tracking and storing news and short messaging users in some types of networks.

In addition to these procedures the other data (not obtained by above mentioned techniques) can also be added to the database. Examples of such data are mail imports or data from passive traffic monitoring probes in telecommunications networks. Large data sets are generated by combining above presented sources – and from these data sets valuable data can be obtained during proper analysis.

4. Management and stored data retrieval

Given that the data are extensive, they should not be stored in conventional relational databases. Depending on the nature and quantity of acquired data, but also on the amount of available resources, we use for this purpose dedicated servers. Most often these are Autonomy IDOL and Apache Solr.

The advantage of using these tools is their capacity, speed and the ability of indexing unstructured data. At the same time using these tools solve our initial filtering of data even before it is made with your own analysis. In terms of analysis, this means that the data is normally first processed to functions, which are integrated in Autonomy IDOL or Apache Solr, which carry out the first stage of analysis. And on this narrow set of data are applied our specialized analysis algorithms.

5. Data analysis

We created analytic functions which typically work with a partially reclassified data, which in practice means that the data are often reclassified by time, source and type. At the level of database work could be applied more analytical functions, such as filtering of selected word or author, but this isn't usually used - we leave it to later phases of the analysis, which is performed using our custom tools. The reason is that the filter has to be calibrated according to the domain areas, which is not applicable for commercial products.

Basic tasks in the analysis of the selected data are:

- recognize the entity sought, i.e., subject, person, or event,
- Recognize relationships between identified entities,
- Recognize relationships of identified entity or group of entities to the surrounding world.

These tasks are solved by using our custom analysis tools. In practice, a combination of libraries of functions that helps to solve basic analytical cases, that are described in the following paragraphs.

5.1 Content analysis and entity identification

Content analysis is an essential task. The aim is to identify key terms, which appears in the text. This analysis is necessary to solve some basic problems. It is necessary to recognize the language in which the text is written, there are individual parts of the text, which may have already been processed by use of dictionaries and rules of the language. In this section, it is also necessary to deal with any typos and colloquial expressions. Subsequently, they are separated from the text of the word carrying the semantic information. Roughly speaking, it is a combination of selected nouns and adjectives, verbs and numerals. Along with this, a study of synonyms, based on which are expressions of the same meaning replaced by one chosen representative. From there it is then derived theme of individual texts, which may take forms such as keyword list.

In a case that there is a search for entity in the text - on the basis of the reference sample, the reference sample is compared to the identified content. The result has form of a reference to the place, where the sought entity occurs - the number (percentage) expressing the degree of conformity of the sought and found data sample.

5.2 Video data analysis

For image analysis we use external libraries of our partners. Contrary to the classical image recognition techniques we don’t use as input for these analyses only wanted picture, but we also enter semantic textual information that describes what is in the picture and what is sought in the scanned image. Image recognition algorithms can work better (because of this more detailed information) to split the scene and recognize the wanted subject with higher accuracy than without the semantic information in the input. Input semantic information has different structures depending on the wanted subject domain and data sources. Typical use case is a tracing of stolen artworks, which usually have available both - verbal description and also photos of the sought subject.

5.3 Social links analysis

In a case where the person identified in the data, either as authors or persons, of who are mentioned, one of the key tasks is to recognize the relationships between them. Internal "social" network of persons is reconstructed from different sources of person’s records. For each person are registered subjects in connection with which it is mentioned, and persons with whom they are in relationship. The relationships between entities are further distinguished in types of relationships and their intensity. Time is recorded as a separate parameter with all these data - this allows us to see how the subject of interest develops in a specific person the in time, or in which way are developed relationships between a group of people. Based on this, a person can be segmented into groups or to provide metrics indicating the proximity of individuals. This functionality can be part of a tool for uncovering organized crime.

5.4 Authorship analysis and identification

Persons appearing on the Internet using a variety of pseudonyms and often act completely anonymously. Under these conditions it is very important to recognize that multiple identities stand for the same person. This can be partly recognized from structured data, such as the same phone number or email, but in most cases this information is not available. Data from monitoring of individuals may be used for these purposes - it is monitored by the intensity, duration and frequency of activity of individual pseudonyms. In case that multiple pseudonyms exhibits very similar behavioral characteristics are then run more analysis functions, which are designed to determine the likelihood, that it is the same person.

Another technique used in the identification of persons is an analysis of their written texts. Here we examine the similarity of vocabulary, frequent occurrence of the selected word combinations, the same spelling and typographical errors, like typos. From that we derive the probability that the text was written by the same person. Use for these functions can be found in combating child pornography on the Internet.

5.5 Sentiment analysis

Sentiment analysis is performed by using our custom tools that are able to work with multilingual data. Basic principle of the analysis is the search for specific word combinations that indicate the type and degree of sentiment in the domain area.

Analysis of emotions was originally developed for marketing data analysis, however, it has its place also in the area of police analysis. In this particular case is examined the degree of aggressiveness and determination for appropriate action. Positive and negative speeches with concrete actions are observed, which has its uses for example in fight against extremism.

6. Presentation of analyzes results

The results of analyzes are presented in two basic forms. Either in the form of a graph, or in the form of the detail of the record found. Graphs are used mainly to visualize the development of a phenomenon over time (line and bar graphs), visualization of the percentage of different types of entities (pie charts) or for visualization of relationships (network diagrams). The daily police practices of these diagrams are important especially network diagrams visualizing networks of suspicious persons. Other types of graphs are more suitable for visualizing trends and statistics for selected period.

In practice, the police working with more detail sought entity, whether a person or an object. The benefit is the fact that the record is compiled exactly for the entity, aggregates attributes from multiple sources and at the same time shows the time when the individual attributes were recorded and level of their credibility.

7. Conclusion

Functions described above are currently produced in the form of library functions and are subject to testing. It turns out that systematic monitoring of the Internet can obtain data, which are nearly unavailable to other investigative methods.

Our tools save time, reduce number of people needed for the investigation and also reduce the technical requirements for investigators in the field of IT, but also in other fields such as knowledge of artworks.

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PODSTATNÉ FAKTORY VLIVU ICT NA EKONOMIKU

THE MAJOR ICT FACTORS IMPACT ON THE ECONOMY

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ABSTRAKT:
Informační a komunikační technologie (ICT) stále více pronikají do fungování ekonomiky. A to jak na mikro, tak na makroekonomické úrovni. Jejich rostoucí důležitost s sebou nese zvyšující se nároky na vývoj, implementaci a správu. Penetrace ICT do všech sektorů ekonomiky vedla k úvahám, které srovnávají vliv ICT s vlivy, které v minulosti významným způsobem změnily fungování ekonomiky. Podstatná zůstává aplikace ICT do chodu firmy a schopnost udržet jejich užití v efektivní rovině. To vyžaduje určité změny v chápání fungování organizace.

ABSTRACT:
Information and communication technologies (ICT) are increasingly penetrating into the economy. Applies both at the micro and at macroeconomic level. Their growing importance carries increasing demands on the development, implementation and management. Penetration of ICT in all sectors of the economy has led to the considerations which influence ICT compared with effects which significantly changed the economy. The important issue is the application of ICT in the running of the company and the ability to maintain their effective use. This requires some changes in the understanding of the functioning of the organization.

KLÍČOVÁ SLOVA:
Ekonomika, Informační a komunikační technologie, ICT, inovace

KEYWORDS:
Economy, Information and Communication Technology, ICT, innovation

Vývoj ekonomiky procházel ve své historii několika fázemi, které měly své charakteristické rysy. Roli ICT se snažili někteří autoři zachytit a popsat tak jejich vliv v chodu ekonomiky. Tyto studie vznikaly zejména v období devadesátých let 20. století, tedy v době bouřlivého vývoje ICT. Také v současnosti jsou neustále sledovány trendy vycházející z vývoje technologií. Jsou vyhodnocovány jejich dopady na fungování firem a institucí s cílem zůstat konkurenceschopný.

ICT a ekonomika

Nejvíce pozornosti bylo věnováno tzv. teorii New Economy o které hovoří několik autorů. ICT přináší takový rozsah změn v hospodářství, že mění výrazným způsobem jeho fungování. Nejde tedy pouze o odklon směrem k sektoru služeb na úkor tradičních sektorů ekonomiky. Klotz uvádí, že podstata New Economy je: „market model based on digital networks in which special properties of digitised goods play a central role.“ (Klotz, 2000, p. 4). V souvislosti s vývojem technologií v dalších oblastech (zejména doprava, logistika apod.) se tak mění pravidla fungování v ekonomických systémech. Důraz na jednotlivé změny ve fungování ekonomiky pak přináší řadu komplementárních názvů jednotlivých teorií (často dle daného autora).

Kelly (Kelly, 1997) zdůrazňuje síťové efekty, které jsou podle něj zdrojem růstu. Hovoří o Network Economy. Množství produktů, lidí, kteří sdílejí službu, způsobují zvyšující se hodnotu, kterou následně získávají. Příkladem je penetrace telefonů, kdy se můžeme dovolat širšímu počtu účastníků, pokud budou telefon užívat. V této souvislosti zmiňuje možnosti tvorby cenové politiky těchto služeb.

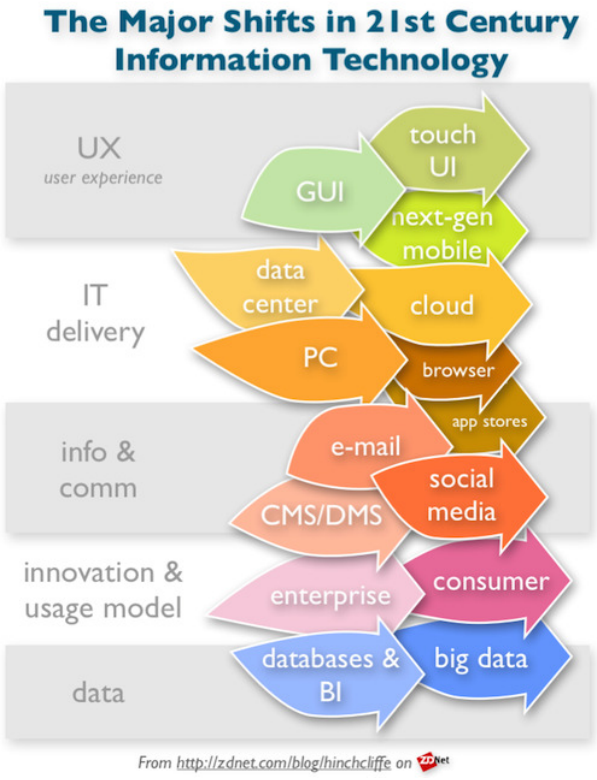
Jiní autoři hovoří o Digital Economy, Information Economy nebo Knowledge Economy. Zde je zdůrazněna klíčová role ICT, resp. informačních, digitálních statků. Důraz je kladen na intelektuální produkci statků což virtuální svět vytvořený pomocí ICT umožnil na zcela nové kvalitativní úrovni. Powell definuje Knowledge Economy jako: „The key components of a knowledge economy include a greater reliance on intellectual capabilities than on physical inputs or natural resources, combined with efforts to integrate improvements.“ (Powell, 2004, p. 201).

Nutno dodat, že změny, které autoři shrnují, nevycházejí vždy pouze z informačních technologií. Tyto však hrají dominantní roli. Pokud shrneme základní faktory, ze kterých autoři vycházejí, pak to budou: **inovace**, **digitální podstata statků** a **síťové efekty** (komunikace, sdílení, apod.). V tomto směru je však nutné uvést tak způsob jakým se tyto charakteristiky v ekonomice projevují. Zejména jde o kvantitativní rozsah (geografický i míra zapojení ICT do všech oblastí) a rychlost (jak ve smyslu vývoje, tak ve smyslu působení).

Dodejme, že v současnosti je ICT připisován poměrně významný podíl na tvorbě HDP (navíc stále rostoucí). Tyto studie vyčíslují podíl ICT sektoru na GDP v evropských zemích cca na úrovní pěti procent. Viz (Doucek a Hanclova, 2011) nebo (Červenka a kol 2011). Studie zároveň ukazují důležitost ICT zejména na mikroúrovni, kde generují hlavní přínosy. Lze konstatovat, že vhodné využití technologií ve firmách a institucích se pak následně odrazí také na makroúrovni.

Vliv ICT v současnosti

Také v současné době jsou popisovány vlivy ICT na ekonomiku, resp. jednotlivé sektory. Autoři se snaží zachytit zejména poslední vývoj technologií. Wittig používá v (Wittig, M., 2010) označení Cloud Economy, kde zdůrazňuje rostoucí roli virtualizace. Jako základní charakteristiky uvádí: online sociální sítě, respektování principů sociálních sítí v obchodních modelech, dostupnost ICT zdrojů, vše online, důležitost komunikace a spolupráce. Hinchcliffe (Hinchliffe, 2011) vymezuje zásadní změny v oblasti navíc také v souvislosti s vývojem koncových zařízení a zdůrazňuje význam obsahu.



Obrázek 11 Hlavní trendy dle (Hinchliffe, 2011)

Transfer přínosů technologií do ekonomiky jejich aplikací ve firmách a institucích je podmíněn neustálými inovacemi. Autoři se shodují na dominantních trendech v horizontu nejbližšího období. Tyto jsou z pohledu hardwaru podmíněny zejména vlivem rozvoje počítačových sítí a variabilitou koncových zařízení. 1) Síťové technologie jsou motorem vývoje v posledních dvou dekádách. Podstatné jsou tři oblasti vývoje. Jde o rozvoj v oblasti LAN sítí a s ním související možnosti propojení jednotlivých koncových zařízení. Důležitý je také vývoj v oblasti WAN, kde byla vytvořena robustní infrastruktura Internetu a velký pokrok v přístupových sítích. Důraz bude kladen na real time aplikace. 2) Uživatelé dostali do rukou širokou plejádu koncových zařízení (notebooky, smart phones, tablets). Vše se společným jmenovatelem – mobilita a možnost připojení k Internetu. Takto dochází k masivní produkci dat, což je doprovázeno možnostmi jejich uložení (nezávislost na místě a rostoucí velikost uložišť).

Níže sumarizuji hlavní faktory, které budou hrát klíčovou roli pro nasazení ICT.

- Soulad mezi podnikovou a ICT strategií. S rostoucím významem ICT roste dle Antlové (Antlová, 2008) také nutnost správného sladění podnikové strategie a ICT strategie. To platí také pro provázanost ICT strategie na další dílčí strategie firmy. Význam ICT bude výraznější pro stále více firem. Podniková strategie musí být podpořena ICT.
- Komunikace. Dle (Dewett, 2001) je rozvoj v komunikaci největším přínosem využití ICT ve firmě. S kontinuálním rozvojem komunikačních možností je nutná jejich implementace ve firemní struktuře. Komunikační možnosti vycházející z ICT podporují změnu v chápání zákazníků a jejich role ve fungování firmy. Zákazník a jeho názory musí být součástí řízení. Otevírají se cesty jak nové komunikace se zákazníkem nebo pro získání názorů zákazníků.

- Změna v myšlení (na všech úrovních firemní struktury). Neustále hledání inovací. Potřeba porozumět významu ICT ve firmě. Dynamika prostředí není nutné zlo, ale možnost pro získání výhody. Je možný rozpad odborníků na ICT do jednotlivých útvarů, neboť ICT přestávají být doménou úzké skupiny specialistů. Probíhá vytvoření více úrovní tzv. „ICT specialistů“, kde role nedávno vyhrazené pro specialisty přebírají pracovníci jednotlivých útvarů.
- Zpracování dat. Připravenost na různé zdroje dat a jejich vyhodnocování. (Hinchcliffe, 2011) hovoří o potřebě změny chápání dat ve smyslu využití a zpracování.
- Organizační aspekty fungování firmy. ICT vytváří prostor pro inovaci organizačních struktur. Má vliv na úroveň formalizace procesů, centralizaci (decentralizaci) řízení, role jednotlivých specializací, velikost útvarů apod. (Dewett, 2001). Výrazně se bude projevovat v útvarech, které jsou orientovány směrem k vnějšímu prostředí (marketing).
- Implementace technologie. Důraz na zkrácení doby potřebné pro přijetí technologie. Byl naznačen rozsah změn, které vyplývají z povahy vlivu ICT na fungování ekonomiky (jak na mikro, tak na makro úrovni). Proto je nutné, aby podnikové strategie akceptovaly tento vývoj a korelovaly s možnostmi technologií.

Uvedený výčet trendů, které jsou motivovány vývojem technologií je a bude jistě více. Lišit se bude také jejich skutečný dopad. Již v současnosti je evidentní změna v sektoru služeb, kde jsou změny velmi silné. Achrol a Kotler hovoří u oblasti marketingu o tzv. real-time marketingu (Achrol a Kotler,1999, p.150). Jiné, zejména tradiční sektory ekonomiky budou dotčeny méně. Rozlišit však je potřebné vliv na chod firmy jako takové a vliv, který prostřednictvím ICT je vyvíjen na firmu z externího prostředí. Těmto vlivům pak není možné se vyhnout, ačkoliv firmy ICT k vnitřnímu fungování nepotřebuje.

Uvedená problematika je zkoumána také v České republice. Zde je možné odkázat např. na autory (Voříšek, 2006) nebo (Basl, 2009).

Vývoj vede k zamyšlení, zda budeme schopni udržet krok v oblasti aplikace nových technologií. Rozdíly v akceptaci technologií jsou také různé v jednotlivých věkových skupinách populace. Schopnost učit se a orientovat se v novinkách, které s sebou nesou soudobé technologie u starších lidí klesá, přitom je společným zájmem, aby i tito lidé byli schopni využívat tyto možnosti. Oblast řízení a implementace ICT (a v širším kontextu technologických novinek obecně) bude mít rostoucí význam pro využití potenciálu, jež tyto nabízí. Aktivně se řeší zejména požadavky na absolventy VŠ viz (Voříšek, 2007) nebo (Doucek, 2010).

Další otázkou zůstává ekologický kontext ICT. Vlivy na životní prostředí jsou v rozsahu v jakém se ICT používá nezanedbatelné. Použití technologií by tak mělo být chápáno také v souvislosti s trvale udržitelným rozvojem. Tématem se zabývá např. (Benowitz, 2010).

Závěr

Příspěvek si kladl za cíl poukázat na změny, které budou muset akceptovat firmy a instituce, pokud si budou chtít udržet své postavení na trhu (s různými dopady dle působení dané organizace). Tyto změny vycházejí v současné době z rozvoje ICT a rostoucí důležitosti v rámci infrastruktury trhu. ICT mění prostředí ve kterém se tyto organizace nacházejí a vytváří tak na jedné straně příležitosti dalšího rozvoje, na druhé straně představují hrozby pro ty firmy, které nedokážou využít jejich potenciál.

Nejde o detailní rozbor těchto vlivů, ale o vyjmenování těch faktorů, které mohou být klíčové v chodu dané organizace a o upozornění na důsledky vývoje ICT.

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ENTERPRISE ARCHITECTURE AS IMPORTANT COMPONENT OF IMPLEMENTATION OBJECTIVES OF BUSINESS ORGANISATION

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ABSTRACT:
Article defines enterprise architecture and its position in the organization. Besides to setting standards, procedures and documentation used technologies, facilitates cooperation and constructive conflict resolution in order to ensure a consistent approach to implementing business strategy of the organization. There are listed the four basic domain enterprise architecture including roles and types of architects. The main benefits of enterprise architecture are not only in the actual implementation of enterprise architecture, but the implementation of new projects and implementation of IT strategy.

KEYWORDS:
Enterprise Architecture, TOGAF, standard, strategic framework, shared infrastructure, management of portfolio, Enterprise development , Enterprise Business Architecture, Enterprise Information Architecture, Enterprise Technology Architecture, Enterprise Technology Architecture, Enterprise Application Architecture

1. Introduction

Information technology have become in a very short time an integral part of the lives of organizations, change constantly and offering new possibilities in data processing.. It is also a conceptual plan, design, implement and operate to serve for decision support and achieve business goals.

2. The concept o enterprise architecture

Today's view of the enterprise architecture, according to Gartner [2] is a look at the process by which translate business vision and strategy of the organization into an effective organization change, through the creation, communication, and improving the key principles, principles and models that describe the future state of the organization and to its development. Range includes people, processes, information, technology, and of their relations between themselves and the outside environment

Enterprise Architecture is not only to establish standards, procedures or documentation technology used, nor does aim to substitute business strategy, portfolio management, business process management or strategic planning, but it is a process facilitating collaboration and constructive solution of conflict with the aim to ensure a uniform approach to implement the business strategy of organizations.

3. The position of enterprise architecture

Currently, the design and creation of enterprise architecture are the responsibility of the "Enterprise architects" who do not have decision-making power over all critical enterprise-cal issues and in terms of the whole organization is their role primarily advisory. Functional enterprise architecture takes the necessary decisions in cooperation IT with other relevant areas. Enterprise architects must actively cooperate with the implementation teams and the architect is to create a "further and further standard", but rather the identification of areas in which business strategy requires interoperability.

Considering the importance of the role of enterprise architecture in the organization would be ideal, if the Enterprise architect (Chief Enterprise Architect) reports directly to the General Director (CEO). However, the reality today is that in most cases the Enterprise Architect reports to the Information Director (CIO). Fig. 1 according to [3] shows the results of a survey of the Enteprice architects: What percentage reports directly to the CIO or CEO.

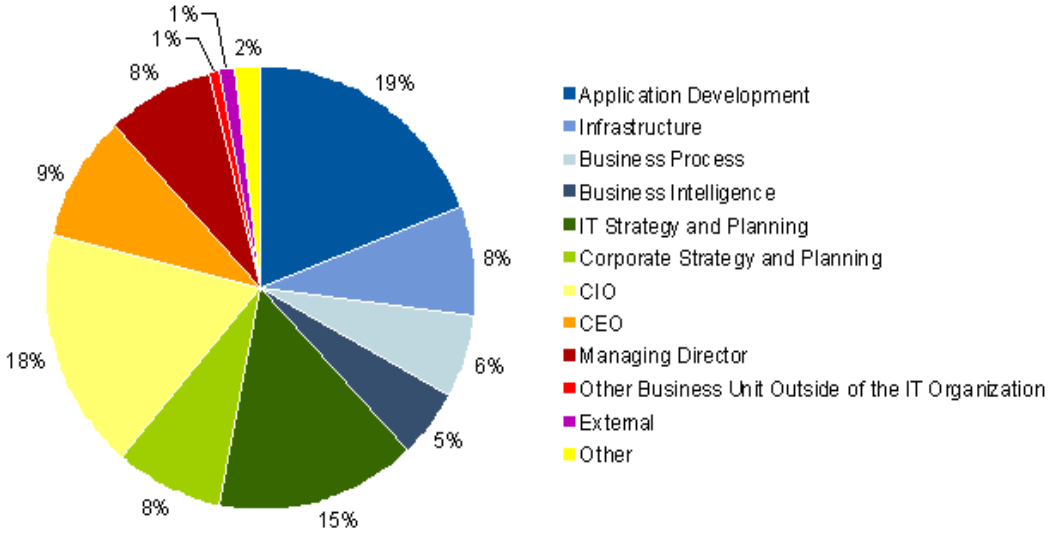

Fig.1. The results of a survey of managers reporting Enterprise Architecture: What percentage of the main architects tion reports directly to these functions, source [3].

Examples of organizational placement of the Czech environment were given at the conference System Integration section 2011 in Enterprise Architecture and its innovation potential[1] :

RWE CZ Group [7] established a new specialized department / team for information management established in direct (Process & Organization / Information Management), responsible for the management of information and communication technologies, including Enterprise Architecture, reporting directly to the CFO.

Česká spořitelna a.s. [1] gives the status of Enterprise Architecture, as follows: Enterprise architecture provides mutual coordination and coherence of business and IT strategic plans, both at the production and updating of IT strategy and in the actual implementation.

Enterprise architecture integrates both layers of architecture within the IT competence center and provides integration at the level of other departments IT and at the interface between IT and business units of the bank. The fulfillment of this role is performed by the selected architectural processes that architecture directly manages or participates in them.

Enterprise architecture is implemented through organizational unit Strategy and Architecture and is subject CIO. Enterprise architecture is Implemented through organizational unit strategy and architecture, and is subject to CIO.

4. Used frameworks

According to [6] is an architectural framework a set of interests, stakeholders, pre-defined criteria and rules that define the binding aspects that have been defined architecture description in a specific area [ISO 4210, 2007], and these frameworks can be divided into classification, process and content. Examples are reported Zachmanův framework E2AF, Gartner EA Framework Model, TOGAF.

Currently, one of most used frames is Enterprise Architecture TOGAF methodology [6]. The Open Group Architecture Framework (TOGAF) is a detailed method and set of supporting tools - for developing architecture of the organization. TOGAF is developed and maintained by members of The Open Group (see: www.opengroup.org / architecture) and can be used freely.

This methodology states that the aim of enterprise architecture is to optimize the often fragmented processes of an organization into such an integrated environment that is able to respond to change and to support the implementation of business strategy.

5. Domains of architecture

Due to the position of enterprise architecture in the organization on the one hand and the expectations of the benefits on the other hand it is important to set the cooperation within the organization - areas of IT, marketing and other support areas as well as setting enterprise architecture itself. There are four basic domain architecture (used English names due to their steady use) :

Enterprise Business Architecture defines the business strategy in the dimensions of people, process, organization finance.

Enterprise Application Architecture sets out plans for the individual application systems and their relations.

Enterprise Information Architecture describes the structure of data - data, content, metadata.

Enterprise Technology Architecture covers infrastructure components - HW, SW.

See Fig. 2.

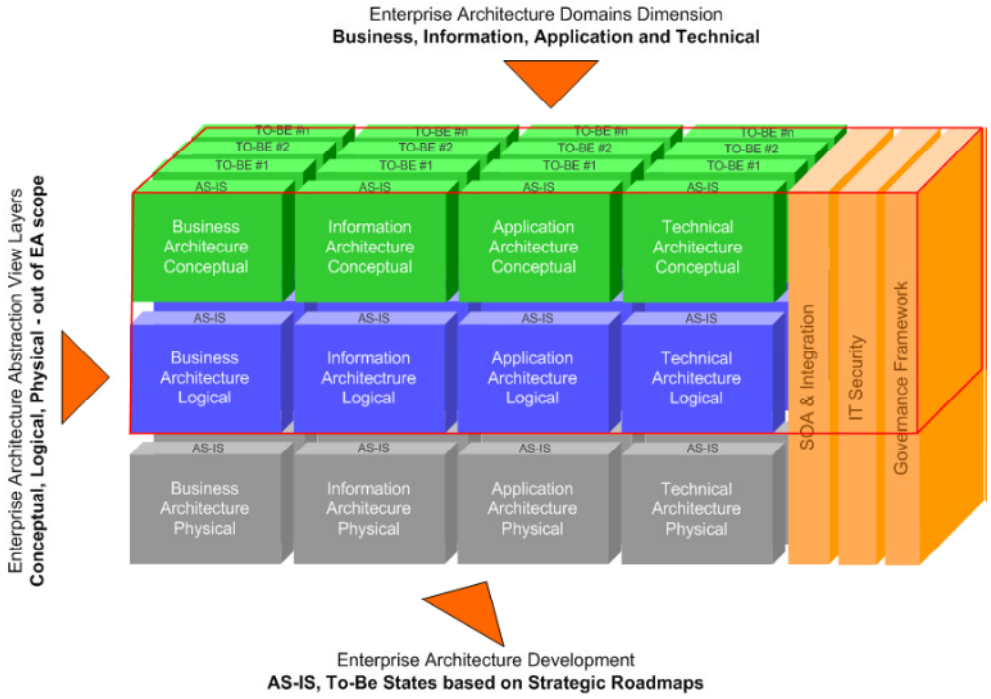

Fig. 2. EA according to The Open Group Architecture Framework, Version 9 / TOGAF , source [5]

6. Roles and type of architects

A different approach requires different skills and abilities and in the organization we need the following types of architects:

Enterprise Architect is architect, whose main task is to strategically align IT and business goals, create a comprehensive solution; requirement is primarily a comprehensive knowledge of both IT and organizational strategy.

Business Architect leads and facilitates the development of business requirements, principles and models that can be used to implement the necessary changes (people, organizations, management and finance).
Solutions Architect is a project-oriented architect who implements specific requirements respecting the defined rules, standards used, designs and services.

Information Architect is responsible for ensuring the overall quality and availability of information in the organization.

Technical Architect has a deep knowledge of specific technologies and how to apply this technology and use it (such as network, storage, security.

7. Conclusion

In the past, information technology architecture often focused primarily on technology and the creation of technological units and the main goal was the definition of the organization's standards and norms for the reuse of products or technologies, their relationships and documentation systems. Today, this technical architecture should not only define standards or recommendations, but also a combination or configuration of these technical components that should be reused in separate implementations and technical patterns and combinations that will serve as a shared infrastructure - technical services, where

the goal not currently have the perfect architecture, but flexible architecture for a reasonable price in the future. The aim of the enterprise architecture is overlap IT architecture and organization to achieve its strategic goals.

In the concept of enterprise architecture described in this items, the main benefits are not only in the actual implementation of enterprise architecture, but in the implementation of new projects and implementation strategy.

8. Použité zkratky

BA – Business architect

CEO - Chief Executive Officer

CIO – Chief Information Officer

CFO - Chief Finance Officer

EA - Enterprise Architecture

IT – informační technologie

ONE IT – oddělení IT v České spořitelně

ITA – infrastructure technology architecture

POIM - Process & Organization / Information Management

TOGAF - The Open Group Architektura Framework

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DETERMINANTS OF ITSM ADOPTIONS: INSIGHTS FROM INNOTRAIN IT PROJECT

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ABSTRACT:
The goal of this study is to investigate and better understand determinants of IT service management (ITSM) adoption. In doing so, this study adopts the understanding of determinants as critical success factors or barriers to successful ITSM adoption. These two perspectives describe in a holistic manner factors that impact ITSM adoption. The results suggest that the most significant determinants of ITSM adoptions are connected with benefit planning and realization, top management support for the project, staff awareness of ITSM concept, project team building, interdepartmental collaboration, and quality of the ITSM solution adopted. Next, the analysis compares the findings revealed by prior studies with the results of research conducted among European small and medium sized enterprises (SMEs) the INNOTRAIN IT project. The study concludes with the discussion of further research that covers investigation of ITSM adoption determinants among small and medium sized enterprises and among countries with non-developed economies.

KEYWORDS:
IT service management, ITSM, adoption, determinants, critical success factors, barriers

1. Introduction

Information technology (IT) has been one of the most important business tools for organizations for many years and, in consequence, has become very complex. Over time, numerous new trends and innovations have emerged, making IT management more and more difficult. Among new IT management methods and approaches, invented with the purpose to help organizations with this complexity, one of the most promising ideas is IT service management (ITSM). In general, ITSM has grown out of the increasing complexity of IT and the growing maturity of IT management (Conger, Winniford and Erickson-Harris, 2008). ITSM can be defined as a strategy by which information systems are offered under contract to customers and performance is managed as a service (Pollard and Cater-Steel, 2009). The most popular existing ITSM frameworks include ITIL, COBIT, MOF, IBM ITSM, and HP ITSM.

ITSM adoption may generate numerous benefits by helping companies to improve their IT organizations and become more flexible and cost effective. ITSM is process-focused and facilitates interactions between technical IT personnel and business customers and users. The most important benefits that a company may expect from ITSM adoption include: (1) client/service orientation and the quality of IT services, (2) greater efficiency due to standardization, optimizing of processes and process automation, and (3) transparency and comparability through process documentation and process monitoring (Hochstein, Tamm and Brenner, 2005).

However, on the other hand, ITSM adoption may also be connected with several disadvantages and challenges. The greatest challenge in implementing ITSM is connected with lack of acceptance and missing understanding of the necessity for introducing new processes (Hochstein et al. 2005). Other disadvantages include greater bureaucracy and lack of individuality as a result of ITSM implementation. There might also appear a temporal drop

in company's performance and client satisfaction after introducing ITSM concept into the organization.

ITSM adoption, as a lengthy and complex process, faces numerous challenges and is connected with various determinants, i.e. factors having influence on the project success. These determinants may be expressed as factors which contribute to the project success and also as issues which have a negative influence and impede the positive run of the project. The first type of determinants are called critical success factors (CSFs) and the latter embody barriers to successful ITSM adoption covering issues preventing ITSM project from the achievement of success (e.g., Soja, 2011).

The goal of this study is to integrate the two abovementioned perspectives, i.e. critical success factors and barriers, and to investigate determinants of ITSM adoption projects. The study starts with the explanation of key concepts of ITSM. Then, it analyzes the most significant barriers to ITSM adoption. Next, it proceeds to the analysis of critical success factors for ITSM implementation. Then, the analysis discusses the most significant determinants of ITSM adoption in an integrated approach. Next, the findings of prior studies are compared with the outcome of the INNOTRAIN IT project researching ITSM-related issues among SMEs. The study ends with concluding remarks and the discussion of further research opportunities.

2. Key Concepts of ITSM

ITSM can be defined as the area that focuses on defining, managing, and delivering IT services to support business goals and customer needs. ITSM is broad, encompassing IT planning, delivery, support, and security. In contrast to the traditional technology-oriented approaches to IT operations, ITSM is a discipline for customer-defined, process-oriented IT services (Winniford, Conger and Erickson-Harris, 2009). The adoption of an ITSM framework is an initiative which deeply interferes in many various areas of the company operations. Therefore, an ITSM adoption should be perceived and evaluated using a multifaceted approach covering several stakeholder perspectives. These perspectives cover management, technology, IT users, and IT employees (McNaughton, Ray and Lewis, 2010).

One of the key concepts of ITSM is the alignment between IT and business, connected with the fact that IT and business have an impact on organizational performance (Khaiata and Zualkernan, 2009). The crucial issue connected with IT-business alignment involves the problem how to measure alignment and its maturity. To address this complex issue, Luftman (2004) proposed a framework called Strategic Alignment Maturity Model (SAMM). The SAMM model posits that IT-business alignment should be captured using the six areas of maturity (Khaiata and Zualkernan, 2009; Luftman, 2004): (1) communication maturity, (2) competency/value measurement maturity, (3) governance maturity, (4) partnership maturity, (5) scope and architecture maturity, and (6) skills maturity.

ITSM is a subset of Service Science that focuses on IT operations such as service delivery and service support. In contrast to the traditional technology-oriented approaches to IT, ITSM is a discipline for managing IT operations as a service that is process oriented and accounts for 60% - 90% of total cost of IT ownership (Fleming, 2005; Galup, Dattero, Quan and Conger, 2007). ITSM is focused on business and client needs and uses good practices as a frame to standardize IT-related activities within the company. The differences between traditional approach to IT and ITSM have been illustrated in table 1.

Table 1. Traditional versus ITSM-related approach to IT

Traditional IT	ITSM
Technology focus	Process focus
"Fire-fighting"	Preventative
Reactive	Proactive
Users	Customers
Centralized, done in-house	Distributed, sourced
Isolated, silos	Integrated, enterprise-wide
"One off", adhoc	Repeatable, accountable
Informal processes	Formal best practices
IT internal perspective	Business perspective
Operational specific	Service orientation

Source: Adapted from http://www.itsm.info/ITSM.htm

3. Barriers to ITSM Adoption

The adoption of an ITSM framework may bring in various benefits for organizations. The most important benefits that companies may expect from an ITSM adoption include: alignment of IT services with current and probable future business needs, improved quality of IT services, and a reduction in the long term costs of service provision (McNaughton et al., 2010). However, in order to achieve the abovementioned benefits, an organization has to go through the process of ITSM implementation which is usually connected with numerous impediments and risks. According to the survey among 201 American companies conducted by Winniford et al. (2009), the most significant barriers preventing companies from using ITSM in their organizations include:

Lack of information – companies need more information about ITSM approach,

Satisfaction with current IT – companies claimed that they were generally satisfied with their current levels of IT service delivery,

Lack of pressure for ITSM – no one was asking companies to initiate service management activities,

Costs too much – companies claimed that it was too expensive to move to service management,

Insufficient monitoring and management capabilities,

Lack of development of ITSM – companies claimed that ITSM was still in the research state,

Lack of support from other business groups – company representatives claimed that they were not able to convince other business groups to move towards service management,

Lack of product maturity – companies claimed that available ITSM products were not mature enough.

Pollard and Cater-Steel (2009), drawing from four case studies conducted among successful ITIL adopters in the USA and Australia, concluded that ITSM implementations are connected with the following challenges:

Dual roles – Employees may experience difficulties in conforming to the new ITSM processes in their everyday work. This might happen despite the fact that the ITSM framework gives clarity to roles and responsibilities of staff members. To overcome this, overlaps in work have to be reduced and better coordination between functional teams should be achieved.

Engaging the right people – Companies may experience problems reaching the right people and involve them in the ITSM adoption project. This is connected with the general challenge in making the needed changes to the corporate culture.

Gaining support from the technical staff – ITSM adopters may experience problems with the technical staff and their resistance to adhering to the new documentation and communication process. This might be resolved by providing constant feedback to the technical staff from the ITSM process champions.

Changing the focus of problem solving – The related challenge to gaining support from the technical staff is connected with changing the focus of problem solving. This should be connected with changing the focus from "crisis management" and "workarounds" to consideration of the real problems as defined by the ITSM framework and resolving the underlying causes of incidents.

Measuring ROI – Companies may experience difficulties in measuring return in investment from their ITSM adoptions. This is due to the fact that, contrary to the costs of ITSM adoption which can be quantified, it may be very difficult to actually measure real benefits from ITSM implementation.

Shang and Lin (2010) conducted case studies among 3 large service organizations that had implemented ITIL with the purpose of researching barriers to successful ITSM implementation. In doing so, the authors employed the approach based on the balanced scorecard (BSC) and investigated the barriers from four BSC-related perspectives: financial, customer, internal process, and learning/growth. The following barriers have been elicited:

Dissatisfied customers – Customers are dissatisfied due to the gap between the degree of improved service quality and customers' perception. This is connected with the fact that customers prefer direct communication with IT service supporting engineers to customer service staff. The customers expect to have a good service quality starting from having a direct contact with the firm rather than after problem occurred, which is the way ITSM frameworks operate.

Inability to satisfy customers' specific needs in time – This barrier is connected with the notion of preferred direct contact with IT service supporting engineers and expectations to obtain an immediate solution to the problem. Meanwhile, the ITSM approach consists in recording the problem and further processing this issue in several steps.

Extra costs in education and management – ITSM implementation usually requires large investments into trainings courses, seminars, taking certifications, internal process maturity assessments, cross-departmental communications, the use of management reports, and educating IT service related quality concepts.

Time lag between investment in ITIL project and performance outcome – The direct link between increased efficiency in IT service and firm performance is usually difficult to be identified in short-run. This is due to the needs of long term learning about new quality service processes. On top of that, the direct outcomes generated from enhanced quality, increased service level and organizational flexibility are hard to measure.

Conflicts between urgent needs for quality improvement and cost consideration – This barrier is connected with the fact that the improvement on the level of

service quality and increased flexibility in organizations is difficult to measure from a financial perspective. In consequence, the immeasurable nature of quality improvement, in terms of financial outcomes, could lead to the misperception of no return on investment.

Difficulties in implementation – This is connected with the fact that, on one hand, ITSM implementation simplifies the existing processes, but, on the other hand, it requires more time in checking and designing new processes. The predefined service processes require some changes and the change of service processes is usually time-consuming.

Employee resistance – This barrier is connected with employees' commitment. Despite the fact that having predefined working procedures may reduce employees' frustration in dealing with complicated IT problems, this may not increase employees' commitment. Overall, a common reason for the IT staff's resistance to the idea of ITSM is its perceived unfairness. This is connected with the fact that for employees recording the details of problem solving into a database may mean losing their advantage.

Lack of interdepartmental collaboration – This barrier is connected with lack of integration ability and refers primarily to lack of close collaboration between IT service support department and customer service department.

4. Critical Success Factors for ITSM Adoption

ITSM adoption is a complex and challenging project involving many stakeholders and affecting numerous areas of the company. Therefore, there are many various issues that have to be taken care of in order to secure the success of the whole project. Conversely, if these issues, called critical success factors (CSFs) are not in good condition, the project success is at risk. The research conducted by Tan, Cater-Steel and Toleman (2009) in a large Australian government agency indicated the following six CSFs for ITSM adoption:

Senior management support – Senior management should understand the magnitude of the implementation and that they should be prepared to allocate sufficient resources. The involvement of senior management in ITSM project can be viewed as an IT governance issue because it includes leadership, organizational structures and processes to ensure that the company's IT sustains and extends the company's strategy.

Project champion – There should be appointed a project champion whose role is to actively and enthusiastically promote the innovation, build support, overcome resistance and ensure that the innovation is implemented. S/he should be a senior manager who is able to negotiate for the resources needed to run the project. The project champion should understand the underlying technology as well as the business and organizational context.

Relationship with multiple vendors – important in the case of ITSM projects as different vendors may be engaged at different stages of the project. It is significant and beneficial for both sides to maintain an open and honest relationship and to foster trust, cooperation and communication. It is emphasized that mutual benefits, commitment and predisposition are important predictors for outsourcing success. Overall, client-vendor relationship should be carefully managed and be part of the risk mitigation process. In consequence, it should be assigned greater importance than simply operationalizing the contract. In

general, a high degree of coordination of activities is necessary if multiple parties are involved in providing a service

Change in corporate culture – there is a need to change the culture from a technology focus to a focus on service. Overall, the desired change must be managed as an integral part of the implementation plan. However, it is suggested that culture change is the hardest type of change to manage. Resistance and counter-implementation, in general, should be overcome by adopting incremental, facilitative approaches. To this end, it is essential to obtain buy-in from project participants.

Realization of benefits – ITSM adoption requires economic justification of benefits. Nonetheless, many organizations reported difficulty in determining tangible benefits from ITSM adoption. Overall, benefits should be carefully managed and several elements from the ITSM process design methodology may be used for this purpose (such as benefit register, benefit deposit slips, benefit saving bank). The benefits realization plan may further enhance communication between senior management and the project team and may contribute to ongoing commitment to the project.

Project governance and execution – there are many elements of project governance and execution that have influence on ITSM project successfulness. They include, among other things, clear objectives and appropriate accountability, risk management, monitoring and reporting, and staying focused on the project. The project should be initiated and further monitored, the project outcomes should be carefully managed with reference to deadlines, costs, and benefits.

Pollard and Cater-Steel (2009), building on four case studies conducted among ITIL adopters in the USA and Australia, found eight critical success factors for ITSM implementations. The discovered CSFs are described in the following.

Top management support – Strong, consistent senior management support is the most important requirement for a successful ITSM implementation. Any company considering ITSM implementation should link the ITSM initiative with the company's corporate strategy to secure executive support before proceeding. Senior management support is essential to endorse policy and enforce compliance to the standard processes across the entire organization.

Training and staff awareness – This factor is related to the need to gain executive management support. It describes the need to create buy-in across all stakeholders in the ITSM initiative. This might be achieved by the appropriate training program and information dissemination about the project. Increased awareness should be beneficial in overcoming resistance from the company's staff.

Interdepartmental communication and collaboration – This factor describes the need to foster open and honest communication among the company's departments during the ITSM initiative. It is connected with training and staff awareness. The participants of the ITSM adoption project should meet on a regular basis to provide support and advice to each other.

ITSM-friendly culture – A company should recognize the need to create a change in organizational culture consistent with the ITSM process framework. This is connected with the shift of an IT organization's culture and focus from the technology to the business strategy. One of the means to foster ITSM-friendly

culture is to engage external consultants and place them in senior IT management positions. This might send a strong message to the company's employees and result in the desired change in the culture of the organization.

Process as a priority – There is a need to focus on processes before selecting and implementing ITSM tools. The processes must be identified and addressed first, only then appropriate tools should be selected and implemented to support and integrate processes. The addressed processes may include incident management, problem management, change and configuration management. The identified process might be then integrated using automated tools which may also facilitate the development of a configuration management database and a known error database.

Customer-focused metrics – The ITSM initiative is connected with a change from technology-focus to customer-centric metrics that need to be recorded and reported. To this end, companies need to change the type of metrics to report in terms that are meaningful to the customers, rather than on IT technology and application performance.

Use of consultants – Companies should engage external consultants in their ITSM initiatives. The consultants may play various roles such as trainers, IT managers, project managers, process owners, and tool implementers. However, it is important to note that organizations have to ensure effective knowledge transfer from the consultants to the permanent staff and should raise the awareness of their employees. Also, it is important to factor in the substantial cost associated with the use of consultants. Nonetheless, sometimes bringing in external expertise is the most efficient solution to the problems faced by the company.

Timing and careful selection of an ITSM toolset – Companies should be aware of the need to select an ITSM toolset which is the most appropriate for their needs. Also, they should bear in mind that the application of an ITSM toolset should be performed in the appropriate time. Inappropriate selection of an ITSM toolset may result in the tool being underutilized and even has the potential to inhibit implementation of new processes.

Hochstein et al. (2005), drawing from six case studies conducted among large German organizations implementing ITSM, found out the following six critical success factors for ITSM adoption:

Quick wins – A company may demonstrate the benefits of service-oriented IT management by showing "quick wins". This might be connected with establishing measurable project goals.

Strive for continuous improvement – A company should strive for continuous improvement in order to guarantee the sustainability of success.

Marketing campaigns – A company should use marketing tools and campaigns in order to create acceptance and understanding. These might include buy-in-phase, management of expectations, use of internal publication media, road shows, workshops, and seminars.

Obtaining support of management – This is primarily needed in order to be able to exert pressure on company's employees.

Training – A company should implement broad-based training and enforce personnel development.

Virtual project teams – Virtual project teams should be formed so that the new processes would not be developed separate from operational activities. In this way the company will simultaneously achieve integration of service orientation into existing areas.

Iden and Langeland (2010), using a Delphi research method, researched critical success factors for ITSM adoption drawing for the experiences of representatives of Norwegian Armed Forces. The authors built on the opinions of 15 experts and elaborated a ranked list of 12 critical success factors. The following CSFs, ranked in order of decreasing importance as reported by the experts, have been discovered by the authors:

Managers at all levels must have an ownership to the ITSM introduction (Management ownership)

Senior management must formally decide the introduction of ITSM (Top management support)

Identify and involve key personnel, and let them participate in the design and improvement of processes (Team)

Senior management must have knowledge about and understanding of what process orientation means (Top management awareness)

Start with and prioritize a few ITSM processes where there are greatest opportunities for success (Process approach)

Information, characterized by openness, must be given up front to personnel and customers about what ITSM means, why ITSM is being introduced and what it will entail (Information)

General competence in process thinking and ITSM must be provided for all concerned (Competence)

A modular ITSM system is needed and must be applied for all processes (Solution)

Plan for and communicate positive project results early and along the way (Benefits)

A specific training program for the ITSM introduction of the various processes must be provided (Training)

Implement a standard system for measuring, analyzing, and reporting on service level (Monitoring)

Be conscious about the fact that introducing ITSM means changing organizational culture (Culture)

Overall, the list elaborated by Iden and Langeland includes factors relating to management and leadership, competence and training, information and communication, focus on stakeholders and their roles, and culture. It is interesting to note that there is a clear focus on the organizational aspects of the adoption of ITSM. We may conclude that technology and issues related to methodology are deemphasized by the experts in favor of the "softer" aspects.

5. Discovering the Most Critical Determinants of ITSM Adoption

The application of a holistic approach to ITSM adoption determinants, covering CSF- and barrier-oriented perspectives in a unified way, allowed us to discern factors that are the most critical issues in ITSM implementation. These elements represent areas or mechanisms that have to be addressed in an ITSM adoption project and, on the other hand, failing to do so

may expose the project to significant risk of failure. The determinants of ITSM adoption success have been summarized in table 2. The elements were ordered on the basis of the number of citations in prior literature.

Table 2. The most important determinants of ITSM adoptions

Determinant	Tan et al. (2009)	Pollard and Cater-Steel (2009)	Hochstein et al. (2005)	Iden and Langeland (2010)	Winniford et al. (2009)	Pollard and Cater-Steel (2009)	Shang and Lin (2010)
CSF (c) / Barrier (b)	c	c	c	c	b	b	b
benefits / ROI	✓		✓	✓		✓	✓
top management support	✓	✓	✓	✓			
staff awareness		✓		✓	✓		
project team building / participants choice			✓	✓		✓	
collaboration		✓			✓		✓
ITSM solution quality		✓		✓	✓		
focus on customers / customer satisfaction		✓					✓
information dissemination			✓	✓			
training			✓	✓			
process identification		✓		✓			
culture change	✓			✓			
provider	✓	✓					
cost					✓		✓
resistance						✓	✓
philosophy / approach change						✓	✓
sponsor / champion	✓						
project management	✓						
shift from technology to strategy		✓					
continuous improvement			✓				
management ownership				✓			
top management awareness				✓			
service level monitoring				✓			
duties						✓	
need					✓		
pressure / motivation for ITSM adoption					✓		
managerial capabilities					✓		
ITSM maturity					✓		
organizational change							✓

Source: Author's elaboration.

The most significant issue influencing ITSM adoption is connected with expected benefits from the project. Companies have to plan carefully the realization of benefits with one rule in mind: the sooner the better. It is highly advisable to achieve positive project results early and this should be communicated to the whole company. Nonetheless, this is not easy as ITSM adopters may experience time lags between investment in ITSM and performance outcomes. In addition, the adopters may experience difficulties in measuring return of investment in ITSM solution.

The second most important determinant of ITSM adoption is connected with top management support for the project. Senior management should support the ITSM adoption throughout the whole project lifecycle, starting from the formal decision about the introduction of ITSM into the organization. The actual support may take the shape of resource

allocation and motivating participants for project duties. Top management should also become familiar with the concept of ITSM and should have the understanding of process orientation.

Top management familiarity with ITSM is essential for the project success; however, stakeholders across the whole company should be competent and aware of ITSM-related ideas. This might be achieved through the training program and information dissemination about the project. Lack of information about the ITSM initiative taking place in the company may become a significant barrier to the project success.

The introduction of ITSM into the organization is performed with the help of the project team. This group of people should be carefully identified in the company and should participate in the design and improvement of processes. The key issue here is to build the project team that consists of motivated and involved people. Also, the ITSM project participants should represent diverse areas of the organization so that the high level of integration might be achieved by the worked out solution.

Team building is connected with the idea of interdepartmental collaboration. During the ITSM adoption, company's IT department plays a very significant role and should closely collaborate with other company's departments with a special emphasis on customer service unit. It is worth noting that the interdepartmental collaboration should be established or evaluated at the very beginning of the project. It turns out that lack of support from other business groups may become a significant barrier to the project success.

It is interesting to note that the all abovementioned most significant determinants of ITSM adoption refer to the project participants or company's organization; they do not refer to the actual ITSM technical solution. This issue is covered by the sixth most significant factor that illustrates the importance of the ITSM solution choice. In particular, it is advised that the actual ITSM product should be mature, have modular structure, and should be applicable for all crucial processes of the company.

The list of the most important determinants of ITSM adoption is concluded by the notion of changing focus of the company operation. In particular, the ITSM implementation should be combined with the focus on the company's customers and performance measures should be adjusted accordingly. However, there is risk of customer dissatisfaction especially during the phase following the actual introduction of the ITSM solution. This might be due to lack of expertise in new processes and approach, combined with different customers' expectations.

6. Lessons from INNOTRAIN IT Project

The findings from prior literature illustrate the situation first and foremost among large companies from developed countries. Meanwhile, it is interesting to compare these findings with experience of smaller companies that not only operate in highly industrialized countries but are also based in transition economies, i.e. economies in transition from communist style central planning to free market systems (Roztocki and Weistroffer, 2008). To this end, we draw from research conducted within the ongoing INNOTRAIN IT project (www.innotrain-it.eu), whose goal is to disseminate ITSM approach among European SMEs by creating a new method tailored for SMEs and train SMEs managers and employees to use this method. The project is taking place in 6 European regions in Austria, Czech Republic, Germany, Hungary, Poland, and Slovakia.

The initial step of the project was to diagnose the actual situation as regards ITSM awareness and usage by European SMEs. With this end in view, the exploratory survey has been conducted among the all involved regions and in consequence 215 survey responses

have been gathered with 185 respondents coming from SMEs. The main findings as regards drivers and barriers for ITSM adoption in SMEs in Central Europe have been presented in table 3.

Table 3. Drivers and Barriers for ITSM implementation in SMEs in Central Europe

Drivers for ITSM	Barriers against ITSM
Cost transparency	Missing ITSM awareness
Cost reduction	Complexity of existing frameworks
Workload reduction	Lack of skills
Business service quality enhancement	Work overload and lack of resources
Business competition	

Source: Research data

Upon comparing the findings presented by prior research with those achieved by the companies investigated within the INNOTRAIN IT project, we may conclude that both groups of respondents agree as regards the importance of cost-related issues and elements connected with company's staff awareness and skills. In particular, the findings suggest that regardless of the company size and economic setting, it is of vital importance to set the cost of ITSM adoption against expected benefits and try to achieve ROI. In the similar vein, companies of both types may suffer from inadequate skills of their employees and lack of awareness as regards ITSM approach.

The analysis suggests that for larger companies it is more important to secure top management support for the ITSM project. Big organizations should also pay special attention to project team building and try to choose project participants that are fit to the challenging project tasks. This might be connected with the more complex considerations of ITSM adoption in large companies and related higher complexity of managerial issues.

Smaller companies, on the other hand, seem to experience more significant problems and barriers connected with complexity of ITSM approach and work overload of company's employees. It turns out that existing ITSM frameworks may be too complicated for SMEs and may not fit their needs and usually restricted resources. The restricted human resources, caused among other things by the organization's smaller size, may also be connected with employees' work overload which poses a serious barrier to ITSM adoption project.

7. Conclusions

This study investigates issues influencing the adoption of ITSM frameworks. Such issues, called determinants, were discussed in a holistic approach taking into consideration critical success factors and barriers to ITSM adoption. The performed analysis using such an approach allowed us to discern the most significant areas of ITSM initiative that should be addressed in order to achieve success. The discovered most crucial determinants of ITSM adoptions are connected with benefit planning and realization, top management support for the project, staff awareness of ITSM concept, project team building, interdepartmental collaboration, and quality of the ITSM solution adopted.

The main limitation of this study is connected with the fact that the analyzed prior research works are based first and foremost on the experience of large companies based in highly developed economies such as Australia or countries from Europe and North America. Meanwhile, transition and emerging economies appear to lag behind developed countries in various ITSM-related areas such as use of sophisticated IT solutions, awareness of new IT-related methods and concepts, strategic approach to IT, level of IT maturity, and attention paid to business strategy and its alignment with IT strategy (Zając and Soja, 2012).

This indicates the need for further research on determinants of ITSM adoption among non-developed, transition and emerging economies as ITSM initiatives conducted in such economic settings might be connected with different factors. Other topics of further research may be connected with the examination of ITSM adoptions in small and medium sized enterprises. The preliminary findings achieved by this study indicate that SMEs may experience different considerations mainly due to restricted resources as compared to large organizations.

8. Acknowledgements

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POŽADAVKY NA OPTIMALIZACI EVENT MANAGEMENTU V CLOUDU – WEBOVÁ SLUŽBA TAKEPLACE

EVENT MANAGEMENT OPTIMALIZATION DEMAND IN CLOUD – WEB SERVICE TAKEPLACE

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ABSTRAKT:
Článek poprvé v této ucelené podobě předkládá výsledky průběžného průzkumu mezi zástupci akademické obce i komerční sféry na téma pořádání odborných akcí – event management – a problémů s tím spojených. Využívání, resp. opomíjení moderních technologií usnadňující celý proces plánování a přípravy konferencí, seminářů, workshopů a jiných je diskutováno s respondenty. V závěru je prezentovaná případová studie mobilní a cloudové platformy Takeplace řešící identifikované problémy.

ABSTRACT:
The article introduces results of continuous research about event management and connected issues among representatives of both academic and commercial sphere for the first time in such a complex form. Modern technologies utilizing, respectively neglecting, that help in making the whole organizing process more efficient and easier, is discussed with respondents. The Takeplace – mobile and cloud event management platform – is presented in the end as a Case Study solving identified issues.

KLÍČOVÁ SLOVA:
Cloud, event management, průzkum, problémy, komunikace, organizátor, propojení, Takeplace

KEYWORDS:
Cloud, event management, survey, problems, communication, organizer, interconnection, Takeplace

1. Úvod

Mnoho činností se v běžném světě ve svém způsobu zpracování zastavilo v optimalizaci před deseti i více lety vůbec nereflektující rozvoj technologií i přístupů. Oblast event managementu – plánování a správy odborných akcí – konferencí, seminářů, workshopů, školení a dalších – je jednou z nich. I když si členové organizačních nebo programových výborů pro své osobní účely navykli používat rozličné kooperativní nástroje pracující v Cloudu[1] typu Google Drive [Google, 2012] nebo Office 365 od [Microsoft, 2012], širšímu nasazení v této oblasti brání určitá specifičnost ve workflow celého procesu. I proto se dnes setkáváme s přístupem značně neefektivním. Komunikace se provádí na základě individuálních dotazů, mnohé dokumenty se upravují v offline kancelářských programech, následně sdíleny s ostatními spolupracujícími členy pomocí emailu bez pokročilých

[1] Cloud computing je model umožňující pohodlný síťový přístup k souboru konfigurovatelných zdrojů (např. servery, datová úložiště, aplikace nebo služby) na základě poptávky. Výhodou je obrovská škálovatelnost, rychlost nasazení a použití poptávajícím zákazníkem za minimálních provozních nákladů. [NIST, 09]

verzovacích technik. Důsledkem toho je zvýšená organizační zátěž zapříčiňující až 12 hodin týdně strávených neproduktivní prací na jednotlivce [Acemcee, 2012].

Optimalizací procesů organizování akcí lze pak nejen ušetřit čas a peníze na personálních nákladech, ale také zvýšit účastníkův prožitek z eventu. Proto je klíčové, aby organizátoři – event manažeři optimálně využívali technologií ke strategickému řízení eventů.

2. Průzkum potřeb event manažerů

Ke zjištění uživatelských potřeb a přání organizátorů odborných akcí z akademického i komerčního sektoru bylo provedena série expertních interview a průzkumů mezi cílovou skupinou společností ACEMCEE, s. r. o.

Na podzim roku 2009 proběhlo expertní interview mezi univerzitními pracovníky organizující akademické odborné akce (konference, symposia) na Masarykově univerzitě a Vysokém učení technickým v Brně. Analytický vzorek se skládal ze 14 akademiků – 2 profesoři (prof. Serba, prof. Matyáš), 3 docenti (doc. Pitner, doc. Staudek, doc. Koch), 4 odborní asistenti a 5 post-doců. Identifikovaný výčet problémů, které vnímají akademičtí organizátoři akcí:

- absence vhodných nástrojů pro organizování
- úroveň grafického uživatelského rozhraní
- uchovávání informací o akci v čase – archivace
- webové prezentace
- absence propojených nástrojů
- chybějící koherence a konzistence
- podpora vzájemné komunikace a kooperace mezi členy organizačního týmu i mezi účastníky

Poslední průzkum proběhl v únoru 2012 při panelové diskuzi *Quality Event Management* [QEM, 2012] s účasti českých nejvýznačnějších profesionálů z komerční oblasti event managementu. Celkový vzorek respondentů byl 94.

2.1 Definice problémů

Uživatelé cítí za zásadní problém **absenci vhodných nástrojů pro organizování** odpovídající současnému stavu rozvoje Internetu (Web 2.0). Mnohé existující produkty mají tendenci být velmi uživatelsky nepřívětivé, s mnoha nelogickými průběhy práce (workflow) v jejich ovládání. Jejich **úroveň grafického uživatelského rozhraní** odpovídá stavu grafického designu devadesátých let 20. století.

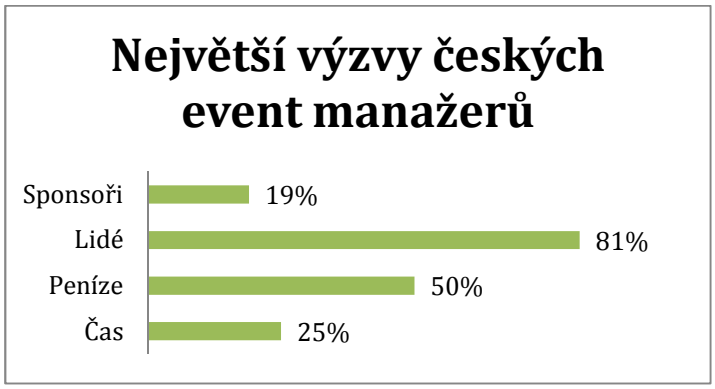
Další problém současných akademických akcí je jejich **uchovávání v čase**. Často se stane, že po skončení akce dojde ke zrušení webových prezentací i jiných materiálů, které pomohou účastníkovi se zorientovat a nalézt potřební informace. Přičemž tato skutečnost je patrná již při konferencích, seminářích, atd. starých pouhé dva roky. **Úroveň grafického designu webových prezentací** je prakticky totožná s uživatelským rozhraním systémů zaštiťující organizaci těchto odborných akcí – nereflektují současné moderní trendy, například nereflektují současné standardy v uživatelské orientaci, použitelnosti, přístupnosti, nebo poslední psychologické závěry z oblasti Person-Centered Approach (přístupu orientovaného na člověka) [Pitner, 2007], [Skrabalek, 2011].

Největším rozpoznaným problémem při interview je pro organizátory **absence propojených nástrojů**, které používají, a jejich vzájemná **chybějící koherence a**

konzistence. V rámci průzkumu trhu bylo vyzkoušeno mnoho nástrojů bez uspokojení základních potřeb dotazovaných v interview. Vytýkáno jim bylo pokrytí jen malé části životního cyklu akce anebo byly velmi těžkopádné na ovládání, což vyústilo k vrácení se k tradičním kancelářským nástrojům.

V neposlední řadě organizátoři chtějí **komunikovat** z webové služby s účastníky a ostatními členy organizačního týmu – různé výbory, vedoucí, recenzenti, šéfové sekcí nebo paralelních konferencí atp. Tedy pokročilý subsystém zpráv a mailování, IM – instant messaging nebo unikátní VoIP řešení pro zasílání krátkých textových zpráv zúčastněným je nezbytností při efektivním organizování eventů. Kromě toho by uživatelé měli mít rozhrání pro okamžité zaplacení plateb za akci, možnost si vybrat vhodné ubytování, nebo zaslat příspěvek.

Hlavní zjištění posledního průzkumu z [QEM, 2012] je z personálního pohledu skutečnost, že více než dvě třetiny českých event manažerů se snaží najít **kvalitní lidi** při pořádání veřejných akcí (graf 1). Přibližně 81 % respondentů – organizátorů akcí – tvrdí, že **lidský talent** je nejdůležitější výzvou, kterou v poslední době čelí. U přibližně 50 % respondentů je dalším velkým problémem **nedostatek finančních prostředků** a u 25 % také čelí problémům s **nedostatkem času**.



Graf 12 Výzvy event manažerů

Na českém trhu jsou akce pořádané **ve stejné míře** specializovanými event agenturami, firmami a dodavateli služeb, jako jsou hotely a restaurace.

- Nejčastěji organizátoři připravují akci **jednou za tři měsíce**.
- Přesto **42 % účastníků** uvedlo, že pořádají různé akce **každý měsíc** a
- 25 % z nich dokonce několikrát týdně.

Většina společností pořádají akce až pro **100 hostů**.

Je zde prostor pro další zlepšení (graf 2). Způsob, jak organizátoři akcí usilují o **zvýšení zisku**, je především v **efektivní organizaci** a **snížení nákladů**. Pouze 12 % respondentů si myslí, že úspora času a více sponzorů může zvýšit jejich příjmy.

Graf 13 Optimalizace eventů pomocí různých způsobů

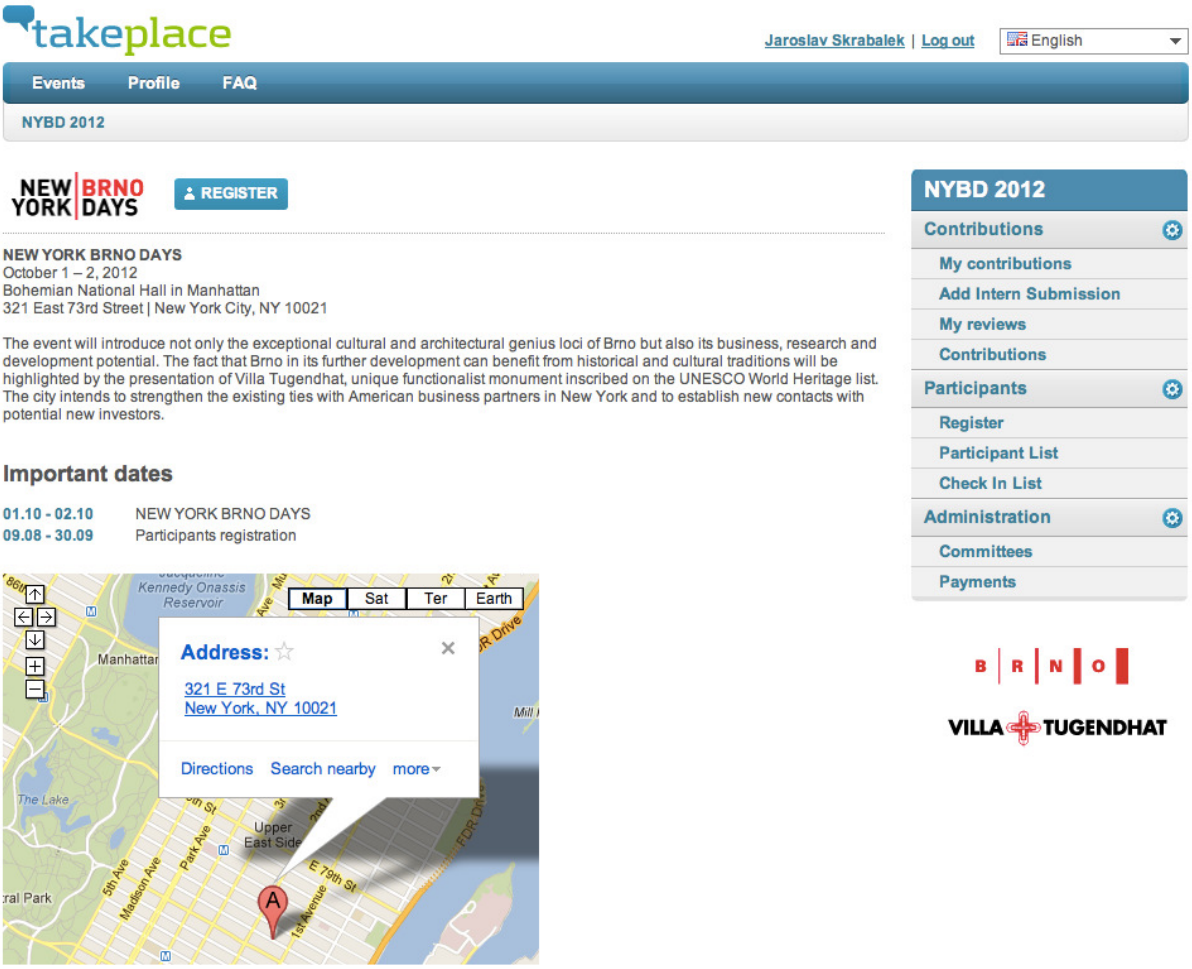
Organizátoři akcí by také uvítali

- získávat zpětnou vazbu (55 %);
- pomoc s on-line platbami,
- řízením účastníků v průběhu akce a
- propojení se sociálními médii.

Čísla, která jsme získali, na českém trhu odrážejí celosvětový trend růstu v event managementu, který byl zdůrazněn navzdory probíhající hospodářské krizi. Event manažeři se často obrací na tradiční nástroje Microsoft Windows, jako je Outlook, Word nebo Excel, kde zpracovávají digitálně své úkoly, ale jen málo z nich má své vlastní digitální řešení nebo specializovaný program, jako je digitální aplikace Takeplace.

3. Případová studie Takeplace

Takeplace [Takeplace, 2012] je moderní webová a mobilní platforma pro organizování odborných akcí, přinášející efektivitu, pokročilé možnosti týmové spolupráce a sociální i vzdělávací propojení uživatelů. Byla navržená a implementovaná na základě požadavků odborných kruhů. Mapuje různé fáze organizace akcí a zahrnuje komplexní funkce, které své uživatele provází celým procesem pořádání odborné akce, nebo účasti na ní – mimo jiné také registraci účastníků a sběru přihlášek vystavovatelů nebo automatickou distribuci upomínek. Pořadatel má k dispozici sadu vzájemně provázaných nástrojů pro komunikaci, organizaci a prezentaci, vše v jednotném grafickém stylu s návazností na minulé ročníky. Služba je velmi snadno přizpůsobitelná rozsahu akce i požadavkům pořadatele. Působnost služby s akcí nekončí: Takeplace dále udržuje databázi dokumentů a profesní komunitu uživatelů.



Obrázek 1 Ukázka obrazovky platformy Takeplace

Takeplace pokrývá celou řadu sofistikovaných organizačních procesů s jednotným uživatelským rozhraním ať už na webu, nebo na mobilních platformách. Uživatel si vybírá z typizovaných postupů organizování odborné akce dle jejího typu – základními typy akcí jsou konference, kongresy, symposia, semináře, školení, konzultační setkání, workshopy, teambuildingy, atd. PlatformaTakeplace se odlišuje od svých konkurentů **jedinečným souborem funkcí**. Kromě pokročilého organizačního systému nabídne uživatelům *webovou prezentaci*, *historickou kontinualitu* pořádaných akcí, *jednotné názvosloví* v rámci série odborných akcí, platební portál, sofistikované plánování a rozvrhování, nebo tvorbu propagačních materiálů a prvků vizuálního informačního systému akce. Značnou výhodou je celkové **snížení nákladů** na řízení organizace odborné akce – ušetří se na lidských zdrojích, grafických pracích i softwarovém vybavení.

Systém Takeplace se vyznačuje také pokročilým upozorňováním na jednotlivé aspekty akce – blížící se konec termínu, nedodání výstupu od zainteresovaných lidí, překročení kvót atp., čímž celou správu a organizaci akce činí jednodušší. Všechny akce pořádané v rámci systému jsou archivované a dostupné návštěvníkům navždy. Kromě samotného organizačního systému nabízí Takeplace uživatelsky přívětivou tvorbu webové prezentace i tiskových materiálů s profesionální grafikou. Systém se vyznačuje jednoduchým a intuitivním grafickým uživatelským rozhraním; ačkoli je nabízený soubor funkcí pestrý, prioritou je zachování přehledného ovládání, jež maximálně usnadňuje náročnou organizaci odborných akcí.

4. Závěr

Podobný výčet jednotlivých aktivit a možných problémů je samozřejmě jen nevelkým zlomkem celého životního cyklu eventu. Je náročný, ale v případě využití současných technologických možností je možné většinu problémů eliminovat nebo výrazně snížit. Je proto organizátorovým nejlepším úmyslem si tuto činnost co nejvíce usnadnit a optimalizovat. Navíc použitím moderních technologiích nejenže poskytne i účastníkům novinku, která je o hodně pohodlnější a efektnější než staré způsoby, a proto je zaujme, ale především sami budou krok před konkurencí. Podobný přístup nabízí například český startup [E15, 2012] s řešením Takeplace, který se rychle stává vedoucí digitální platformou pro pořádání eventů. Takeplace dále monitoruje vývoj a flexibilně reaguje nejen na nové potřeby ze stran organizátorů a event manažerů, ale i na nové možnosti technologického pokroku – mezi posledními například bezdrátová komunikace na blízkou vzdálenost.

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CLOUDOVÉ ŘEŠENÍ PODNIKOVÝCH APLIKACÍ

CLOUD COMPUTING AND ENTERPRISE APPLICATIONS

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ABSTRAKT:
Ve svém příspěvku bych chtěl zdůraznit, že podstatou cloudového řešení podnikových aplikací je především řešení aplikační. Podnikové aplikace pro cloudové řešení musí být vytvořeny tak, aby jediná instalace aplikací obsloužila velkou skupinu zákazníků (aplikační architektura 1:N).
Hlavním přínosem podnikových aplikací vytvořených pro architekturu 1:N jsou úspory z rozsahu při provozování.
Mezi hlavní charakteristiky těchto aplikací patří: možnosti pro rozsáhlé parametrizace zpracování, vysoký stupeň zabezpečení přístupu do aplikací s využitím bezpečnostního modelu, komplexní datový model s časovou dimenzí, možnosti pro zpětné zpracování a pro zpracování do budoucnosti a vložená inteligence.
Jako příklad aplikací, které plně podporují architekturu 1:N, uvádím naše řešení Vema V4 Cloud.

ABSTRACT:
In my article I would like to point out that the essence of cloud solutions of enterprise applications are mainly application solutions. Software architecture of such applications is multi-tenant with a single code base and data structures, including metadata structures, shared by all customers.
The main benefit of such an architecture are economies of scale.
The main characteristics of these applications include: options for extensive parameterization process, a high level of security using the security model, complex data model with a time dimension, the possibilities for backward and forward processing and embedded intelligence.
As an example of such applications I present our Vema V4 Cloud solution.

KLÍČOVÁ SLOVA:
Cloudové řešení, podniková aplikace, architektura aplikací 1:N, všezahrnující parametrizace, bezpečnostní model, časová dimenze datového modelu, vložená inteligence

KEYWORDS:
Cloud computing, enterprise application, application architecture 1:N, security model, systemic effective-dating, embedded intelligence

1. Úvod

Pod pojmem integrovaný podnikový systém (Integrated Business System v angličtině) budu v článku chápat komplex aplikací pro podporu specifických funkcí a procesů v podniku nebo v libovolné jiné organizaci. Tento pojem používám namísto zastaralého a nepřesného pojmu ERP (Enterprise Resource Planning) systém. Podnikové aplikace jsou základní komponenty takového integrovaného podnikového systému. Příkladem podnikových aplikací mohou být aplikace pro: zpracování mezd, personalistiku, správu vzdělávání zaměstnanců, evidenci a zpracování docházky a další aplikace systému Vema.

Lze očekávat, že v budoucnu z podniků a organizací úplně zmizí servery s instalacemi podnikových aplikací a databází a provozování se zcela přesune k dodavatelům cloudových služeb. To povede k mnohem efektivnějšímu, spolehlivějšímu a kvalitnějšímu způsobu používání integrovaných podnikových systémů než je tomu dnes, kdy jsou podnikové aplikace instalovány na serverech uvnitř organizací.

Ne vždy je ale správně chápáno, co vlastně je cloudové řešení. Ve svém článku se proto zaměřím na charakteristické vlastnosti cloudového řešení podnikových aplikací na příkladu řešení Vema V4 Cloud. Pojem cloudové řešení je poměrně vágní, v zahraničních odborných textech se cloudové řešení podnikových aplikací velmi často označuje jako řešení SaaS (Software as a Service) a právě takovým řešením se budu dále zabývat.

Hlavním cílem mého příspěvku je zdůraznit, že podstatou cloudového řešení je především řešení aplikační. Podnikové aplikace musí být totiž vytvořeny tak, aby obsloužily najednou mnoho zákazníků. To je zatím brzdou většího rozšíření cloudových řešení podnikových aplikací, protože většina dodavatelů takové aplikace dosud nemá.

2. Architektura podnikových aplikací typu 1:N

Mezi základní znaky cloudového řešení podnikových aplikací podle [3] patří:

- Aplikační výkon je poskytován zákazníkovi na základě smlouvy s dodavatelem jako služba přes internet.
- Software i zákaznická data jsou uložena u dodavatele a zpracovávána a spravována dodavatelem.
- Softwarová architektura podnikových aplikací je typu 1:N (v angličtině se označuje jako multi-tenant, což znamená mnoho nájemníků jedné instalace softwaru).
- Dodavatel podnikových aplikací poskytuje zákazníkům pravidelně nové verze podnikových aplikací, které jsou okamžitě dostupné všem zákazníkům.

Podstatným znakem, kterým se cloudové řešení odlišuje od dřívějšího řešení označovaného jako outsourcing IT, je právě architektura aplikací typu 1:N, tedy jediná instalace podnikových aplikací pro celý zákaznický cloud (mnoho zákazníků).

3. Úspory z rozsahu

Jen v případě jediné instalace softwaru lze totiž dosáhnout základní výhody cloudového řešení, kterou jsou úspory z rozsahu při provozování integrovaných podnikových systémů [7]. Pokud by měl dodavatel pro každého zákazníka v cloudu instalovat a udržovat software (obvykle trochu jiný, protože každý zákazník má trochu jiné požadavky), pak na tomto způsobu provozování nelze ušetřit téměř nic. Google také nemá pro každého uživatele Gmailu samostatnou instalaci softwaru elektronické pošty. Samostatná instalace softwaru a databáze pro každého zákazníka byla základní příčina poměrně neúspěšného konceptu outsourcingu IT, který sliboval mimo jiné nižší náklady, ale těch obvykle nebylo dosaženo.

V případě Vema V4 Cloud skutečně jediná instalace podnikových aplikací obsluhuje v tomto okamžiku zpracování pro 378 organizací a celou provozní správu zajišťují dva pracovníci IT oddělení.

4. Všezahrnující parametrizace podnikových aplikací

Z předchozího vyplývá, že podnikové aplikace pro cloudové řešení musí být vytvořeny tak, aby byly schopny obsluhovat celý cloud zákazníků. To znamená, že stejný programový kód, datové i metadatové struktury jsou sdíleny všemi zákazníky [3].

Zákazníci se ale samozřejmě ve zpracování vzájemně odlišují. Proto takové aplikace obvykle potřebují rozsáhlé parametrizace ukládané v datech. Naopak parametrizace, které jsou součástí softwaru včetně databázového systému, vhodné nejsou.

Klíčové aplikace V4 Cloud jsou aplikace pro podporu řízení lidských zdrojů. Vzhledem ke stále se měnící a komplikující se legislativě v této oblasti je nezbytné, aby veškeré funkce těchto aplikací bylo možno parametrizovat. Například výpočet mezd je parametrizován řadou datových konfiguračních prvků (tabulek) tak, aby jediný programový kód zvládl výpočet mezd pro všechny typy organizací nejen v ČR, ale také v SR.

Kromě široké škály takových konfiguračních prvků umožňuje V4 Cloud také použití moderního skriptovacího jazyka Python pro další parametrizace algoritmů zpracování.

5. Zabezpečení

Architektura zpracování 1:N v jednom datovém centru společně s internetovým přístupem ke všem potřebným údajům a funkcím podnikových aplikací klade velké nároky na zabezpečení zpracování.

Správným řešením je univerzální bezpečnostní model pro jednotlivé zpracovatelské role, do kterého jsou zahrnuty veškeré údaje, objekty a funkce podnikových aplikací.

V případě V4 Cloud je univerzální bezpečnostní model automatickou součástí každé aplikace [1]. Vysoký stupeň zabezpečení zpracování je zajištěn mimo jiné autentizací (ověřením identit) uživatelů s využitím certifikátů uložených na hardwarových klíčích s USB rozhraním [2].

6. Časová dimenze dat a algoritmů

Softwarová architektura 1:N klade vysoké nároky na univerzální řešení podnikových aplikací. Podstatnou složkou takového řešení je v aplikacích použitý datový model [5].

Pro zpracování podnikových aplikací ve všech oblastech spojených s řízením organizace je typické, že probíhá v měsíčních časových periodách a údaje z vnitrofiremních procesů je nutné uchovávat a zpracovávat v časových řadách.

Z toho důvodu je třeba, aby záznamy, objekty, ale také funkce a konfigurační prvky obsahovaly časovou dimenzi ve formě časového intervalu od kdy a do kdy je záznam, objekt, funkce nebo konfigurační prvek platný. Vždy se jedná o časové období vztahující se ke skutečným vnitrofiremním procesům v organizaci, nikoliv k zadávání údajů do databáze.

Ve V4 Cloud je časová dimenze řešena systémově. Stejné řešení je implementováno ve všech komponentách integrovaného podnikového systému.

7. Zpětné zpracování a zpracování do budoucnosti

Se zavedením časové dimenze v datovém modelu podnikových aplikací souvisí možnost doplnění nebo opravy údajů do minulých časových období a následné zpětné zpracování těchto údajů [5]. Dalším požadavkem na podnikové aplikace je možnost využití systému pro plánování budoucího vývoje organizace například v oblasti mzdových nákladů nebo v oblasti vzdělávání a dalšího rozvoje zaměstnanců.

Ve V4 Cloud jsou kdykoliv možné přepočty údajů do minulosti a také některé posuny v časové ose směrem do budoucnosti.

8. Vložená inteligence

Mezi další nové vlastnosti, které přináší univerzální řešení aplikací v architektuře 1:N patří vložená inteligence [6]. Tak jako Google nám může pomoci s přesnějším zadání hledaného výrazu, tak může aplikace pomoci uživateli se správným zadáním údaje nebo toto zadání překontrolovat. Systém může pro tyto případy využívat jak své interní informace, tak také informace získávané z okolí (internetu) a ze zpracování v jiných organizacích.

S podnikovými aplikacemi dnes často pracuje v organizaci mnoho zaměstnanců. V případě personálních aplikací mohou například pořizovat nebo opravovat své vlastní personální údaje. V případě, že pořizují adresu bydliště, může systém pomoci se správným zadáním, protože může znát všechny ulice a čísla domů ve městě. Manažerům může systém pomoci třeba s hledáním vhodných kandidátů na novou pozici. Z obdobných pozic v jiných organizacích může odvodit profil kandidáta.

9. Závěr

Cloudové řešení podnikových aplikací vyžaduje zásadní změnu podnikových aplikací tak, aby aplikace podporovaly architekturu 1:N. To znamená, že jediná instalace aplikací musí být schopna obsluhovat velkou skupinu (cloud) zákazníků.

Hlavním přínosem podnikových aplikací vytvořených pro architekturu 1:N jsou úspory z rozsahu při provozování.

Mezi hlavní charakteristiky těchto aplikací patří:

- možnosti pro rozsáhlé parametrizace zpracování
- vysoký stupeň zabezpečení přístupu s využitím bezpečnostního modelu
- komplexní datový model s časovou dimenzí
- možnosti zpětného zpracování a zpracování do budoucnosti
- vložená inteligence

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REALIZÁCIA SIMULÁCIE PODNIKOVÝCH PROCESOV

THE REALISATION OF BUSINESS PROCESSES SIMULATION

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ABSTRAKT:
Tento článok je venovaný problematike simulácií podnikových procesov ako nástroja zvyšovania ich efektivity. Predstavuje metódu diskrétnej simulácie, ktorá je založená na agentovo orientovanom modelovaní a simuláciách. Subjektom simulácií je obchodná firma resp. jej podnikové procesy, zamerané na predaj tovaru konečnému zákazníkovi. Cieľom príspevku je objasnenie nami navrhovanej metódy, popis formálneho modelu, implementácia simulačného prostredia, parametrizácia simulačného modelu a prezentácia výsledkov simulácií. Simulačné prostredie je implementované pomocou nástrojov JADE a slúži ako platforma pre ďalšie simulačné experimenty. Modulárny charakter architektúry umožňuje jeho rozšírenie o ďalšie podnikové procesy. Prínosom metódy je jej využitie pri vývoji nástrojov na podporu rozhodovania managementu firiem s možnosťou predikcie výsledkov obchodovania.

ABSTRACT:
This paper deals with business processes simulations used as a tool for improvement of their effectiveness. It presents a discrete simulation method, which is based on agent-based modeling and simulations. The subject of simulations is a business company resp. its business processes oriented on the selling of goods to customers. The aim of the contribution is the explanation of proposed method, formal model description, implementation of simulation framework, parameterization of simulation model, and simulation results presentation. Simulation framework was implemented in JADE environment and serves as platform for other simulation experiments. The modular character of this framework allows for the extension of different business processes. The contribution of method proposed is it's usability in decision support systems development with prediction possibilities.

KLÍČOVÁ SLOVA:
Simulácia, podnikové procesy, agent, JADE, predikcia

KEYWORDS:
Simulation, business processes, agent, JADE, prediction

1. Úvod

Simulácie podnikových procesov je možné realizovať pomocou celej rady prístupov. Bežné simulácie podnikových procesov sú založené na štatistických kalkuláciách (napr.

Scheer a Nuttgens 2000). Ale použitím štatistických metód je možné odhaliť iba niektoré problémy, súvisiace so simulovaním podnikových procesov. Existujú aj ďalšie metódy napr. process mapping a Activity-Based Costing. Zvláštnu kapitolu tvoria simulácie založené na hodnotových tokoch, napr. e^3-value ontológie (Gordijn a Akkermans 2003) a REA ontológie (Resources, Events, Agents) (Geerts a McCarthy 2000), (Vymětal a Scheller 2012).

Pri týchto simuláciách však existuje niekoľko ďalších vplyvov, ktoré nie je možné podchytiť bežnými modelovacími technikami (napr. dôsledky spolupráce účastníkov podnikových procesov, úroveň skúseností pracovníkov, kultúrne a sociálne faktory apod.). Bežné metódy majú iba limitované možnosti vizuálneho zobrazenia bežiacich simulácií a čo je takisto dôležité, pozorovateľ nevidí účastníkov vyjednávania v podnikových procesoch.

Simulácie, použité v experimentoch, ktoré tvoria jadro tohto článku je možné označiť ako agentovo orientované (Macal a North 2005). Agentovo orientované modelovanie a simulácie môže priniesť niekoľko podstatných výhod (De Snoo 2005), (Jennings 2000). Môže vyriešiť problémy identifikované vyššie. Dokonca je možné zahrnúť vplyvy prostredia do spolupráce agentov. Všetky zo spomenutých vlastností sú typickými rysmi multiagentného systému (Wooldridge 2009). Nová metodológia a workflow, ktoré sú popísané v tomto článku sú implementované vo forme multiagentného systému. Základy nášho prístupu sme popísali vo (Vymětal 2009). Ako implementačná platforma bolo zvolené prostredie JADE (Bellifemine 2010). JADE poskytuje robustnú behovú a simulačnú platformu, ktorá umožňuje realizáciu tisícov bežiacich agentov. Realizovaný multiagentný systém slúži ako simulačný framework. Je založený na princípe regulačného obvodu (Wolf 2006). Keď bude dokončený bude pokrývať simuláciu celej výrobnej spoločnosti od nákupu materiálu, cez výrobu, až po predaj a distribúciu. V súčasnosti pokrýva časť regulačného obvodu, ktorý predstavuje predaj výrobkov konečnému zákazníkovi. Celková myšlienka novej metodológie je simulovať reálne podnikové procesy a poskytovať prediktívne výsledky. Ich použitie by malo viesť k efektívnejšej realizácii podnikových procesov.

Článok ma nasledujúcu štruktúru. V kapitole 2 je uvedená charakteristika agentovo orientovaného modelovania a simulácií. Kapitola 3 predstavuje model podniku a jeho časť, ktorá je v tomto článku implementovaná. V kapitole 4 je objasnený princíp realizácie a v kapitole 5 sa oboznámime s výsledkami simulácií.

2. Agentovo orientované modelovanie a simulácie

Agentovo orientované modelovanie a simulácie (Agent-Based Modeling and Simulation, ABMS) je novým prístupom v rodine komplexných systémov. Je založený na modelovaní štruktúr, skladajúcich sa z autonómnych a vzájomne interagujúcich elementov. Medzi klasické analytické metódy použitia veľkého počtu elementov komplexných systémoch[2] patria napr. Markovove reťazce a Monte Carlo simulácie. Niektorí vedci dokonca pokladajú počítačové simulácie, založené na agentovom (multiagentnom) prístupe, za "Nový druh vedy" (Wolfram 2002). Argumentujú tým, že popri dedukcii a indukcii je ABMS tretím prúdom vedeckej práce.

Hlavnou myšlienkou ABMS je modelovať iba prvky špecifického systému, nazývané agentmi. Simulácia má za úlohu spustiť súhru agentov s cieľom odvodiť a analyzovať správanie celého systému. Neexistuje žiadna štandardizovaná definícia pojmu agent. Koncepcia agentov je blízka objektovo orientovaným moderným programovacím jazykom

[2] Komplexný systém je systém zložený zo vzájomne prepojených častí, ktoré ako celok vykazujú jednu nebo viac vlastností, ktoré nie sú jasne viditeľné z vlastností jednotlivých častí.

(napr. JAVA, C++ apod.). Objekt je definovaný svojím stavom a správaním. Agent môže byť charakterizovaný ako objekt s rozšírenými schopnosťami (napr. pravidlá správania, autonómia, kooperácia, vnímanie, akcia, komunikácia, mobilita, pamäť, učenie, schopnosti, apod.). Pre odlíšenie agentov a objektov je v literatúre (Bonabeau 2002), (Elamy 2005) navrhovaná charakteristika agenta, ktorý disponuje autonómiou, možnosťami kooperácie s inými agentmi, alebo adaptívnym správaním (Mellouli 2003). Ďalšími významnými vlastnosťami agentov sú schopnosti učiť sa a prispôsobiť svoje správanie. Na to agent potrebuje základné rozhodovacie pravidlá a sadu vyšších pravidiel pre zmenu nižších (Casti 1997). Základné rozhodovacie pravidlá potom reprezentujú interakciu s okolím systému a pravidlá vyššej úrovne sú určené pre adaptáciu. Mnoho ABMS modelov je založených na technológii sietí. Niektorí autori zaradzujú celulárne automaty medzi ABMS modely. Ale vo všeobecnosti sú ABMS modely schopné zachytiť rôznorodé situácie prostredníctvom viacerých typov agentov v podobe multiagentného systému (Multi-Agent System, MAS).

Hlavným účelom modelov na agentovej báze je pomôcť pri vývoji nových a formalizácií existujúcich teórií. Podstatný je proces formalizácie, ktorá obsahuje presnú formuláciu teórie a zabezpečenie jej súdržnosti a úplnosti. Počítačové simulácie ekonomických problémov majú podobnú úlohu ako matematika v prírodných vedách. Ako aspekty, ktoré robia počítačové simulácie vhodnejšími pre formalizovanie teórií sociálnych systémov než väčšina matematických modelov je možné identifikovať tieto skutočnosti:

- Programovacie jazyky sú expresívnejšie a menej abstraktné ako väčšina matematických techník.
- Počítačové programy riešia úlohy s paralelnými procesmi ľahšie a bez toho, aby mali správne definované poradie akcií v porovnaní so systémami matematických rovníc.
- Programy vytvorené v súlade so zásadami softvérového inžinierstva sú modulárne, čo uľahčuje ich úpravu, matematické systémy často nemajú tento druh modularity.
- Je ľahšie vybudovať simulačné systémy, ktoré zahŕňajú rôznorodých agentov - napríklad simulovať ľudí s rôznymi pohľadmi na ich sociálne svety, rôzne zásoby vedomostí, rôzne schopnosti atď. - a zároveň je obvykle pomerne ťažké používať matematiku.

Niektoré ďalšie špecifické výhody ABMS modelov (Cederman 1997):

- Možnosť modelovať "turbulentné" sociálne podmienky, kedy agenti a ich identita nie je stanovená, ale je citlivá na zmeny, napr. "narodenie" alebo "smrť" jednotlivých elementov, rovnako ako prispôsobenie ich správania.
- Možnosť modelovania racionálnymi agentmi, ktorí rozhodujú a komunikujú v podmienkach neúplných znalostí a informácií.
- Možnosť modelovať procesy v nerovnováhe.

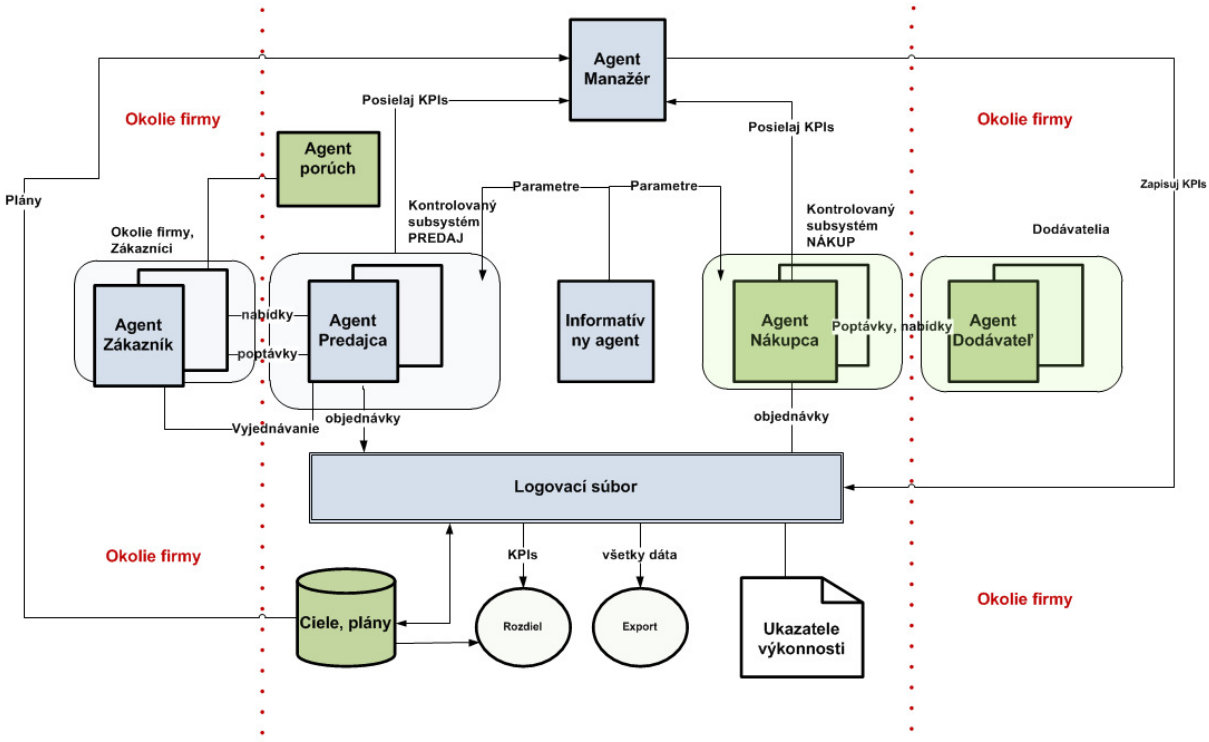
ABMS modely a simulácie slúžia viacerým, ako len prediktívnym účelom. Prostredníctvom počítačovej simulácie nám poskytujú presnejší pohľad na modelovaný jav. Táto funkcia je obzvlášť dôležitá v oblasti sociálnych systémov, kde sú možnosti experimentovania v reálnych situáciách skôr obmedzené. Výsledky experimentov majú byť porovnané s teóriou, ktorá bola použitá pri ich navrhovaní.

3. Model podniku a predstavenie rozsahu implementácie

Metodológia nášho výskumu vychádza z obecného modelu podniku ako regulačného obvodu. Popis regulačného obvodu predstavuje abstrakciu, zobecňujúcu hlavné podnikové

činnosti (Wolf 2006). Obsahuje riadenú sústavu (podnikové podsystémy), ktorá produkuje výrobky. Po predaji výrobkov sa generuje obrat a zisk (Key Performance Indicators, KPIs). Regulačný obvod ďalej obsahuje primárne a podporné procesy, ktoré vykonávajú ďalšie meracie a regulačné funkcie. Výstupné veličiny (obrat, zisk, počet a stav zákazníkov, ROI, mäkké výstupy atď.) sú zachytávané a merané podnikovými podpornými procesmi (napr. výstupy informačného systému). Tieto procesy sú považované za merací člen sústavy. V diferenčnom člene sústavy sú výstupné veličiny porovnávané so stanovenými cieľmi podniku. Rozdiely sú k dispozícii riadiacemu členu sústavy (managementu) za účelom prijatia opatrení. Na celú sústavu môžu pôsobiť poruchy napr. zmena pravidiel poskytovania bankových úverov, daňové zaťaženie, konkurencia, úroková miera, zmeny v legislatíve apod.

Do takto nastaveného obecného modelu vstupuje multiagentná technológia, ktorá vhodným spôsobom zastupuje ľudský faktor v počítačovej simulácii. V tomto článku je vyššie uvedený princíp regulačného obvodu aplikovaný na obchodnú firmu, ktorej „riadená sústava" bude reprezentovaná nákupom a predajom tovaru na trhu (Obrázok 1). V súčasnej fáze výskumu je spracovaná strana predaja, kde zákazníci obchodujú s predajcami firmy. Táto časť celého systému slúži ako pilotná platforma pre testovanie a experimenty.



Obrázok 1 Simulačný model (zdroj: upravené podľa Vymětal 2009)

Obchodná firma je v tomto prípade reprezentovaná ako sociálny systém, kde ľudia okrem KPIs sledujú aj svoje osobné ciele a preferencie. Takisto sa uvažuje o vplyvoch prostredia, napr. výkyvoch trhu na výsledky hospodárenia. Regulačný obvod takejto firmy v tejto fáze pozostáva z agentov predajcov, zákazníkov, informačného agenta a agenta manažéra. Agent predajca vstupuje do interakcie s agentom zákazníkom podľa multiagentného prístupu. Interakcia je založená na FIPA contract-net protokolu (FIPA 2002). Takto zjednodušený systém bol rozšírený náhodnými poruchami (agent simulácie porúch), ktoré ovplyvňujú správanie agentov. Počet agentov zákazníkov je výrazne vyšší ako počet agentov predajcov.

Workflow navrhnutého systému je popísaný v nasledujúcom texte. Agent zákazník náhodne generuje požiadavku na nákup náhodného množstva tovaru. Agent predajca reaguje

na túto požiadavku podľa svojich vnútorných rozhodovacích funkcií a pokračuje vo vyjednávaní so zákazníkom. Účelom agenta manažéra je riadiť výmenu požiadaviek a ponúk. Obchodovanie vedie k predajným udalostiam. Simulačný experiment prebieha v tomto článku po dobu jedného roka a za tento čas je výsledkom simulácií časová rada indikátorov predaja. Medzi tieto indikátory patrí zisk, počet predaných kusov, náklady a tržby. V ďalšej kapitole bude objasnená implementácia multiagentného systému, ktorý slúži ako simulačný framework.

4. Realizácia simulácie podnikových procesov

V tejto kapitole bude predstavená implementácia simulačného frameworku a matematická definícia produkčnej funkcie (1). Produkčná funkcia sa používa počas vyjednávacej fáze interakcie agentov. Slúži k určeniu limitnej ceny agenta zákazníka ako interný parameter.

Ako bolo spomenuté v predchádzajúcej kapitole, rozsah implementácie pokrýva časť celého regulačného obvodu. Táto časť pokrýva predaj tovaru a pozostáva z interakcie agentov predajcov a agentov zákazníkov. Pre zjednodušenie sa bude obchodovať s jedným typom tovaru. Každé časové obdobie (my sme stanovili týždeň) sa agent zákazník rozhoduje, či niečo nakúpi. Toto rozhodnutie je náhodné. Ak sa rozhodne nekupovať, jeho časové obdobie uplynie a nestane sa nič. Ak sa rozhodne nakúpiť, vytvorí dopyt a odošle ju svojmu agentovi predajcovi. Predajca odpovie ponukou (konkrétna ponuka štartuje na cene, ktorá je vypočítaná ako maximálna cena – limitná cena * 1,25). Ponuka môže, ale nemusí byť zákazníkom akceptovaná. Zákazník vyhodnocuje ponuky podľa produkčnej funkcie. Produkčná funkcia bola navrhnutá, aby sa pri vyjednávaní brali do úvahy faktory ako podiel firmy na trhu, sila predajcu pri vyjednávaní, celkový podiel na trhu konkrétneho tovaru (podrobnejšie napr. Vymětal a Šperka 2011). Ak je ponúkaná cena nižšia, než zákazníkom vypočítaná cena na základe produkčnej funkcie, ponuka je akceptovaná. V opačnom prípade zákazník ponuku odmietne a vyjednávanie začne znovu. Predajca zníži ponúkanú cenu na priemer minimálnej limitnej ceny a aktuálnej ceny (v každej iterácii sa aktuálna cena približuje minimálnej limitnej cene) a znovu pošle ponuku zákazníkovi. Výmena správ prebieha až do uzavretia obchodu alebo do okamžiku, keď ubehne stanovený maximálny počet interakcií.

Predajná produkčná funkcia pre *m*-tého predajcu prideleného k *i*-tému zákazníkovi určuje cenu, ktorý *i*-tý zákazník akceptuje (Vymětal et al. 2012):

$$c_n^m = \frac{\tau_n T_n \gamma \rho_m}{ZM\gamma_n^{mi}} \qquad (1)$$

c_n^m - cena *n*-tého produktu ponúkaného *m*-tým predajcom,

τ_n - podiel firmy na trhu pre *n*-tý produkt $0 < \tau_n < 1$,

T_n - podiel na trhu pre *n*-tý produkt v lokálnej mene,

γ - koeficient súťaživosť, znižujúci úspech predaja $0 < \gamma \leq 1$,

ρ_m - parameter schopnosti *m*-tého predajcu, $0.5 \leq \rho_m \leq 2$,

Z – počet zákazníkov,

M – počet predajcov spoločnosti,

y_n^{mi} - požadované množstvo *n*-tého produktu *i*-tým zákazníkom od *m*-tého predajcu.

Agenti zákazníci sú organizovaní v skupinách a každá skupina je pridelená konkrétnemu agentovi predajcovi. Tento vzťah je daný. Bolo by možné nepridelovať skupiny

zákazníkov agentom predajcom, toto by však neodpovedalo bežnej realite obchodných firiem. Agent predajca je podriadený agentovi manažérovi. V každej iterácii agent manažér zbiera údaje od všetkých predajcov a sumarizuje obchodnú situáciu firmy, ktorá je vykazovaná vo výsledkoch simulácií. Tieto dáta sú potrebné na pochopenie situácie firmy v čase vzhľadom k rozhodnutiam a správaniu agentov. Agent zákazník potrebuje informácie o trhu. Tieto informácie dodáva informatívny agent, ktorý je takisto zodpovedný za riadenie iterácií. Možnosť ovplyvňovať priebeh simulácie poruchami, ku ktorým dochádza na reálnom trhu bude mať agent porúch. Ako sme uviedli vyššie, využili sme pre simulácie platformu JADE. JADE riadi celú radu funkcií multiagentného systému, ako je životný cyklus agentov, komunikácia medzi agentmi, žlté stránky s ponukou funkcií atď. Tieto vlastnosti JADE umožnili sústrediť sa na simuláciu základných funkcií agentov, ktorých správanie je popísané vyššie. V ďalšej kapitole sú uvedené výsledky simulácií.

5. Výsledky simulácií

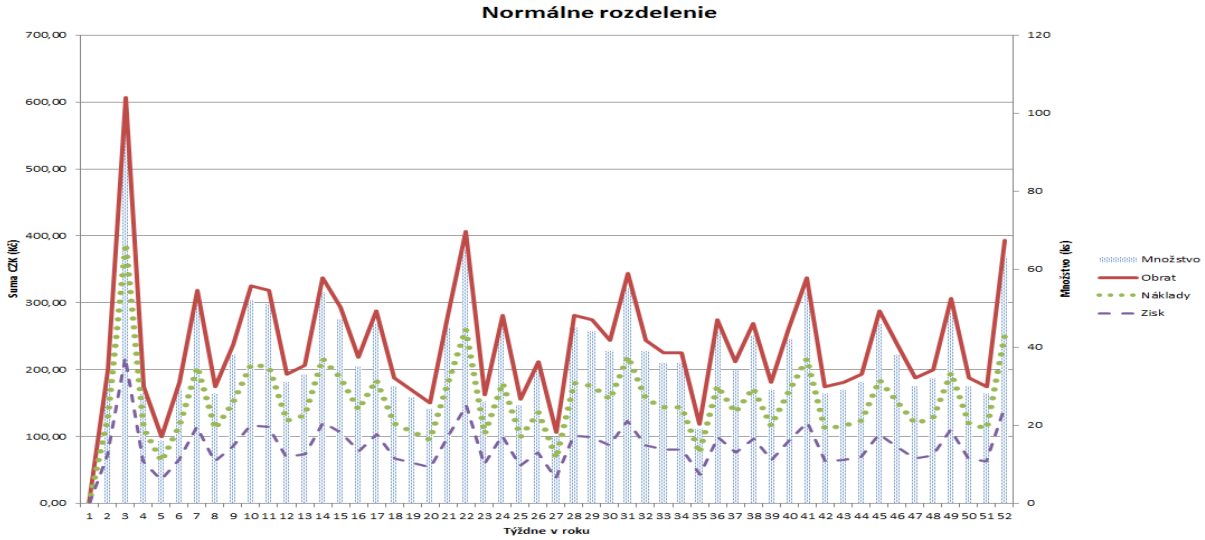
Simulačné experimenty, ktorých výsledky sú predstavené v tejto kapitole, neprebiehajú na základe reálnych dát. V situácii, kedy reálne dáta nemáme k dispozícii sme túto potrebu nahradili náhodne generovanými hodnotami niektorých parametrov. Použili sme pseudonáhodné generovanie. Ide o tieto parametre: schopnosť agentov predajcov a rozhodnutie zákazníka o počte dopytovaného tovaru. Konkrétna parametrizácia agentov je uvedená v tabuľke 1.

Tabuľka 1 Parametre agentov

TYP AgentA	POČET AGENTOV	NÁZOV PARAMETRA	HODNOTA PARAMETRA
Agent zákazník	500	Maximálny počet vyjednávaní	10
		Priemerné množstvo	50
		Smerodatná odchýlka množstva	29
Agent predajca	50	Priemerná schopnosť	0.5
		Smerodatná odchýlka schopnosti	0.3
		Minimálna cena	5
Agent manažér	1	Nákupná cena	4
Informácie o trhu	1	Podiel produktu na trhu	0.5
		Veľkosť trhu produktu	5 000 000

Simulácie boli nastavené na jeden rok predajných činností (52 iterácií/týždňov). Na obrázku 3 je možné vidieť časový priebeh jednotlivých indikátorov obchodnej situácie firmy a to zisku, obratu, nákladov a počtu predaných kusov.

Priebeh jednotlivých kriviek a ich fluktuačný charakter zodpovedá reálne dosahovaným hodnotám obchodnej bilancie firiem na súčasnom trhu. Interpretácia výsledkov simulácií smeruje predovšetkým k prediktívnym možnostiam navrhovanej metódy. Simulačný framework umožňuje nastaviť parametre agentov takým spôsobom, aby zodpovedal reálnej situácii konkrétnej firmy. V prípade, že firma nemá všetky hodnoty k dispozícii je možné ich nahradiť náhodným generovaním. Zmena parametrov umožňuje vo výsledkoch skúmať odchýlky od sledovaných hodnôt a tým preveriť možnosti zásahu managementu firmy do podnikových procesov. Manažér si tak môže overiť svoje rozhodnutie ešte predtým, než ho uvedie do praxe.



Obrázok 3 Simulačné výsledky za obdobie jedného roka (zdroj: vlastný)

6. Záver

V článku bola predstavená metóda simulácie podnikových procesov, ktorá je založená na myšlienke modelu podniku ako regulačného obvodu, pričom vlastná realizácia simulácie využíva výhod multiagentných systémov. V súčasnosti implementovaná časť predajných podnikových procesov je spracovaná vo forme simulačného prostredia, ktoré umožňuje modulárne rozšírenie o nákup, výrobu, distribúciu apod. Simulácie boli pripravené v prostredí JADE (platforma JAVA), v ktorom sa správanie jednotlivých agentov modeluje v súlade s navrhovanými postupmi simulácií.

Výsledky simulácií potvrdzujú reálnosť výstupov (obrat, zisk, náklady počet predaných kusov tovaru). Zmyslom takýchto simulácií je poskytnúť možnosť simulovať podnikové procesy. Prediktívny charakter výstupov umožňuje efektívnejšie riadenie procesov, ktoré sú pre firmy kľúčové z hľadiska postavenia na trhu. Ďalšie kroky výskumu v tejto oblasti budú smerovať k overeniu a validácii metódy predovšetkým k overovaniu vlastností spätnej väzby rozhodovania managementu a k previerke vplyvu rôznych typov náhodného rozdelenia pri generovaní pseudonáhodných parametrov modelu.

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EKONOMICKÉ A EKOLOGICKÉ EFEKTY PŘECHODU NA CLOUD COMPUTING

ECONOMIC AND ENVIRONMENTAL EFFECTS OF TRANSITION TO CLOUD COMPUTING

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ABSTRAKT:
Vývoj informačních a komunikačních technologií radikálně mění podmínky pro budování a řízení úspěšného podnikání. Příspěvek je věnován zajištění dostupnosti potřebných informačních technologií a kvalitních informačních systémů formou Cloud Computingových služeb. Zabývá se také současnými trendy v ICT službách souvisejících s řízením firem a organizací a technologickými trendy ve vývoji IT. Upozorňuje na výhody a rizika, které přináší cloud computing, jako množina snadno využitelných a snadno dostupných virtualizovaných IT zdrojů jejich uživatelům. Diskutovány jsou rovněž ekologické přínosy a rizika tohoto řešení. Na základě průzkumu zaměřeného na využívání IT pro podporu činnosti malých a středních firem a institucí v Moravskoslezském kraji upozorňuje na malou informovanost majitelů firem, manažerů i koncových uživatelů o možnostech služeb Cloud Computingu.

ABSTRACT:
The development of information and communication technologies radically changes the conditions for building and managing a successful business. The paper focuses on ensuring the availability of the necessary software solutions and the quality of information systems by means of cloud computing services. It also discusses the current trends in ICT services related to the management of firms and organizations and technological trends in IT. Furthermore, also deals with the benefits and risks of cloud computing, as a set of easy to use and easily accessible virtualized IT resources to their users. Also discussed are the environmental benefits and risks of this solution. Based on a survey focused on the use of IT to support the activities of small and medium-sized companies and institutions in the Region, highlights the low awareness of business owners, managers and end-users about the possibilities of cloud computing services.

KLÍČOVÁ SLOVA:
Investice do ICT, kvalita IS, Cloud Computing, ekonomické efekty, ekologické efekty, limitující faktory

KEYWORDS:
ICT investment, quality of IS, Cloud Computing, economic effects, environmental effects, limiting factors

1. Introduction

Trendy v informačních a komunikačních technologiích (dále ICT) jsou ovlivňovány primárně technologickými inovacemi, které vedou ke zvyšování rychlosti mikroprocesorů, paměťové kapacity počítačů a přenosové rychlosti počítačových sítí. Integrační trendy přispívají ke zmenšování velikosti zařízení, snižování jejich spotřeby elektrické energie a

růstu jejich funkcionalit. To vede v případě počítačových sítí k přesunu inteligence od koncových zařízení do sítí. Sekundárně jsou technologické inovace následovány vývojem nových aplikací.

Velké změny přinesly otevřené standardy a technologie, jako jsou Java, servisně orientovaná architektura (SOA) a webové služby (WAS). Zvyšují možnosti elektronické spolupráce mezi dodavateli, zákazníky a klienty, podporují značně rozvoj e-trhů a vytváření komunit kolem výrobků nebo služeb.

Dlouhodobým problémem mnohých podniků byla nedostupnost těchto informačních a komunikačních technologií z důvodů cen potřebných aplikací a infrastruktury. Situace se nyní mění, průzkum však ukazuje, že povědomí o možnostech současných řešení a ICT služeb mezi manažery těchto firem je minimální. V současné ekonomické situaci, zejména malým a středním firmám a institucím, nabízí schůdné řešení pro zajištění kvality jejich informačních systémů (dále IS) technologie Cloud computingu (dále CC).

Cílem užívání služeb CC je zvyšování kvality užívaných informačních systémů a tím i konkurenceschopnosti firem a institucí při zohlednění jejich finančních a investičních možností.

2. Vliv ICT na řízení firem a technologické trendy

Dynamický vývoj v ICT se výrazně odráží ve vývoji celé společnosti. Vývoj trhu podnikových IS/ICT lze charakterizovat cykly, jež jsou dány zejména technologickými inovacemi mikroelektronické a komunikační platformy. Na této platformě jsou pak vyvíjeny nové aplikace [1].

Současné trendy v ICT službách související s řízením firem a organizací: [2]

- procesní řízení firmy a jejího ICT,
- snaha o unikátní a efektivní propojení ICT s podnikatelským modelem, podnikovou kulturou a podnikovými procesy,
- posilování vztahu mezi byznysem a informatikou,
- využívání škálovatelných ICT služeb,
- narůstající podíl externích dodávek ICT služeb formou klasického outsourcingu, ASP nebo XaaS (termín zahrnující všechny typy distribučních modelů CC).

Cílem je umožnit podniku zvyšovat rychlost reakce na významné události, snižovat náklady, zvyšovat kvalitu a poskytovat nové produkty či služby zákazníkům.

Technologické trendy lze shrnout do:

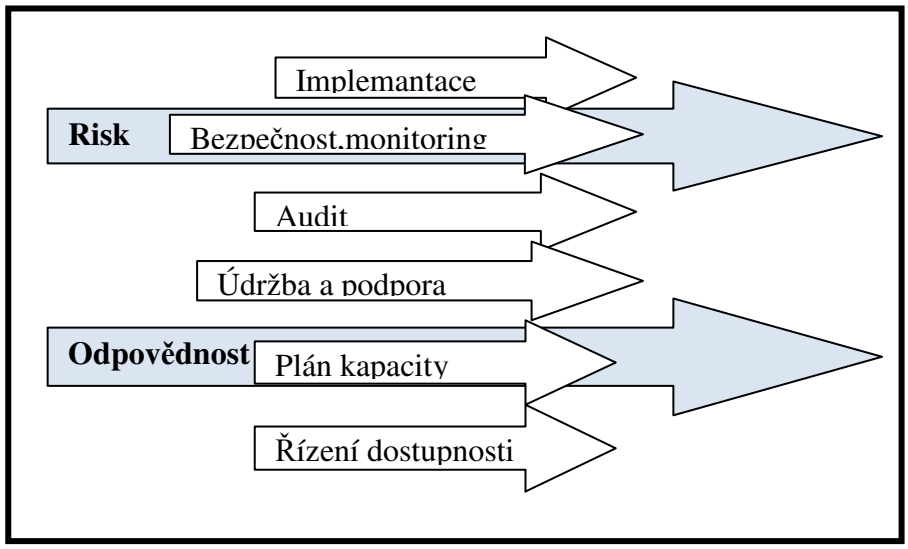
- Konsolidace a virtualizace datových úložišť napomůže dosáhnout snížení počtu fyzických datových serverů při současném zvýšení jejich odolnosti proti výpadkům a snadné rozšiřitelnosti takové architektury. Konsolidaci lze usnadnit pomocí datových úložišť různých produktových řad s možností až řádového snížení nároků na potřebné kapacity pomocí speciálního deduplikačního nástroje pro kompresi dat.
- Virtualizace výpočetní kapacity zajistí větší flexibilitu při získávání vyššího výpočetního výkonu (potřebného například pro zatížení finančních aplikací v čase účetních uzávěrek, nebo zpracování odezvy nárazových marketingových kampaní). Naopak lze odpojit nebo vypnout výpočetní kapacity v době, kdy nejsou potřeba.

- Standardizace a zprůhlednění business procesů – zde lze dosáhnout vyšší flexibility a optimalizace základních činností jednotlivých organizací - to vše při snížení nákladů a nároků na správu, údržbu a vývoj tohoto prostředí. To ostatně platí pro všechny úrovně virtualizovaného prostředí. Konkrétně se v tomto bodě jedná o nástroje pro řízení zdrojů a optimalizaci spotřeby energie.
- Zvýšení výkonu a mobility jednotlivých aplikací a služeb – u globálně působících organizací, jež své řídící nebo kontrolní činnosti migrují mezi několika středisky po celém světě, lze zajistit přesun celých aplikací na místo lokálního vykonávání. Tím se dá ušetřit za licence takto sdílených aplikací. Virtualizační nástroje v současnosti umožňují přesunout virtuální počítače ve spuštěném stavu bez přerušení poskytovaných služeb. Za provozu je tímto způsobem možné měnit konfiguraci a usnadnit upgrade hardwaru i softwaru.
- Virtualizace desktopů – zlepší zabezpečení, zjednoduší správu a dokáže si vynutit dodržování standardů.

3. Cloud Computing - ekonomické efekty

CC (sdílení hardwarových a softwarových prostředků pomocí sítí) mění ve světě informačních technologií (dále IT) zažité postupy a obchodní modely. Na jedné straně umožňuje efektivnější využití výpočetních a jiných zdrojů datových center a poskytovatelů služeb, na straně druhé uživatelům umožní splnit jejich požadavky na rychlost zavádění služeb, jejich kvalitu a dostupnost za transparentní cenu.

Jak již bylo řečeno, princip CC spočívá ve virtualizaci. Úložiště, servery, aplikace i desktopy jsou odděleny od vlastní fyzické podnikové informační infrastruktury. Virtualizace umožní vyšší efektivitu a flexibilitu IT při snížení nákladů na IT. Velmi významným přínosem CC je pro zákazníka přesun rizika a odpovědnosti na dodavatele služby (viz. obr.1.)



Obr. 1: Přesun rizika a zodpovědnosti [3] - zdroj autor

Tab. 1. Výhody a limitující faktory Cloud computingu. (zdroj autor)

Výhody Cloud computingu	Limitující faktory Cloud computingu
Aplikace nebo služby, jsou poskytovány z centralizovaných datových center po síti, odpadá správa software na každém PC.	Možné riziko neudržení stálého provozu informačních technologií po internetu (spolehlivost).
Uživatelé nemusí znát technologie, ani nemusí sami řídit jejich chod. Pro přístup k aplikacím a datům umístěným na serveru se používá webový prohlížeč (SaaS - software jako služba). Také HW může být poskytován jako služba (IaaS - infrastruktura jako služba) poskytování fyzického výpočetního prostředí. Jako služba bývá také poskytována výpočetní platforma (PaaS – platforma jako služba), která obsahuje komponenty pro stavbu aplikace, jako jsou operační systém, databázový systém, webový server nebo jiné aplikace.	Zvýšené náklady na přenosy velkých objemů dat.
Vysoká škálovatelnost (dynamicky škálovatelné zdroje) a elasticita.	Obavy o bezpečnost citlivých údajů a dat vůbec.
Snížení licenčních nákladů, poskytovatel pronajímá více uživatelům (multitenancy).	Nedostatek kontroly nad vlastními daty, cenná data mimo firmu.
CC mění software na službu, kde spotřebitel neplatí za licenci ale za to, jak hodně ji používá. Z výpočetního výkonu se stává komodita, kterou kupujeme a škálujeme podle potřeby.	Problémy s řízením oprávnění a rolí pokud roste vaše portfolio CC aplikací.

SaaS

Poskytovatel služeb má administrativní kontrolu nad aplikací a je odpovědný za její aktualizaci, instalaci, údržbu a bezpečnost. Uživatelé nejsou nuceni investovat předem, platí v dohodnutých termínech a jen za skutečnou dobu využití. SaaS snižuje potřebu předvídat rozsah poptávky a investic do infrastruktury. Náklady jsou předem známy, bez překvapivých navýšení. SaaS umožňuje užívat profesionální systém také malým a středním firmám. Mohou zaměřit své rozpočty na konkurenční výhodu, nikoliv na infrastrukturu. Značnou výhodou je rovněž snadnost užívání [4].

IaaS

Nabízena je výpočetní infrastruktura v dojednané konfiguraci ve virtualizované podobě. Poskytovatel řešení je odpovědný za dodávku objednaného výpočetního výkonu a propojení pomocí sítí, zákazník si následně instaluje operační systémy a zprovozní vše sám dle svých požadavků. Zjednodušeně řečeno jde o pronájem serverového HW v dojednané konfiguraci. Využívání této služby je vhodné pokud vlastníme SW a HW se nechceme zabývat. Cena IaaS je obvykle tvořena na základě poskytnuté RAM, procesoru, velikosti úložiště a konektivity.

Výhodou užívání IaaS jsou nulové pořizovací náklady na HW a velmi nízké náklady při jeho upgrade. Možnost využití hotových řešení, nakonfigurovaných virtuálních PC, sítí apod. a nulové náklady na provoz (elektřina, internetové připojení, prostory).

PaaS

Platforma jako služba je služba poskytující kompletní prostředky pro vývoj a údržbu vlastních aplikací, dostupná prostřednictvím Internetu. Oproti předchozímu modelu, v tomto případě, poskytovatel zajišťuje podporu celého životního cyklu tvorby a užívání aplikace, poskytuje také operační systém pro celé řešení, včetně potřebných nadstaveb. Zákazníkovi je tak poskytnuta vývojová platforma, do které zákazník umístí své vlastní aplikace. Oproti IaaS modelu zákazníkovi odpadá starost o infrastrukturu, nasazení, správu a aktualizaci operačních systémů. Jedná se o pronájem platformy nad, kterou aplikace běží (podobné hostingu). Na rozdíl od SaaS zde nejsou pronajímány již vytvořené aplikace, ty si zákazník vyvíjí sám. Nevýhodou PaaS je, že uživatel nemá pod kontrolou hardware, na kterém platforma pracuje a také velká závislost na poskytovateli.

Využitím CC lze dnes řešit dlouhodobý problém podniků a institucí, nedostupnost mnoha iICT z důvodů jejich cen a požadované infrastruktury. Uživatelům odpadá starost se správou aplikací, serverů i počítačových sítí a mohou se zaměřit na výběr rozsahu a kvality služeb nakupovaných od poskytovatele, měření jejich odběru a výši jejich cen.

Změny ve strategii firem a firemních procesech vyžadují změny v ICT vybavení. Kvalita firemních procesů je často závislá na možnostech a funkcích, které IS nabízí. Katedra aplikované informatiky EkF, VŠB-TU Ostrava prováděla v loňském roce průzkum zaměřený na využívání IT pro podporu činnosti malých a středních firem a institucí (SME) v Moravskoslezském kraji. Hlavním cílem projektu bylo na základě dotazníkového šetření zjistit, jakým způsobem SME v Moravskoslezském kraji zajišťují nákup, provozování a údržbu svých ICT.

Účelem projektu byla segmentace subjektů podle typu užívaných aplikací a jejich vztahu k typu zajišťování ICT služby. Dílčím cílem bylo seznámení respondentů se škálou v současnosti nabízených možností nákupu, provozování a údržby ICT a zjištění, jak jsou firmy informovány o možnostech využití CC.

Z výsledků průzkumu vyplývá, malá informovanost o mnohých ICT aplikacích. Při pořizování nových ICT firmy z našeho vzorku preferují nákup licencovaného software, pak následuje opensource a vlastní vývoj a pronájem. Z průzkumu také jasně vyplývá, že významná část majitelů firem, manažerů i koncových uživatelů je s existencí CC seznámená, větší část z těchto respondentů k ní ale nemá důvěru nebo nemá představu, co pojem znamená [5]. Značnou roli hrají zejména obavy z bezpečnosti těchto technologií. [6]

4. Cloud Computing – ekologické efekty

Hovoří se také o pozitivních ekologických efektech těchto technologií.

Významným ekologickým efektem CC je snížená spotřeba energie a emisí. Za sníženou spotřebou i emisemi jsou dle zkoumajících firem 3 základní faktory: [7]

- Vytíženost serverů - už zmiňovaná multi-uživatelskost (multitenancy), jediný server je schopen zajistit provoz i několika firem, to vše díky sdílení infrastruktury (je absurdní nechávat si rezervu 10 % výkonu, když je poptávka po 100 %).
- Dynamické poskytování snižuje plýtvání počítačovými prostředky tím, že přiděluje serverovou kapacitu podle aktuální poptávky. Z technologického hlediska bývá běžně skutečné využití serverového výkonu třetinové, v CC řešení by mělo jít o více než

dvoutřetinové využití, snižuje se také potřeba počtu fyzických serverů ve virtuálním prostředí. Podstatné je i flexibilní využívání dalších počítačových zdrojů např. CPU, paměti a datových úložišť dle aktuálních potřeb.

- Zvýšení efektivnosti datových center – velký prostor ke snižování emisí a energetické náročnosti je i ve zvyšování efektivity datových center (různé energetické ztráty, neefektivní chlazení, zbytečně jedoucí disková pole atd.). Převládá názor, že jedině velké firmy nabízející CC služby mají dostatek peněz, znalostí, pozemků, speciálních sekcí věnovaných zkoumání této oblasti, takže jsou mnohem efektivnější v redukci vydaných energií a emisí. Je pravda, že spíše velké firmy si mohou dovolit postavit solární pole nebo začnou využívat vodního chlazení i energie. Pro lokální malou firmu by podobný krok byl téměř likvidační). Byla zpracována studie, ve které byly uvažovány podniky tří velikostí: malé (100 uživatel), střední (1 000 uživatel) a velké (10 000 uživatel). Vždy se srovnával provoz aplikací klasickým způsobem na vlastním HW a distribučně/uživatelský přístup CC. Že u skutečně velkých skupin uživatelů lze zredukovat energetickou spotřebu a ve finále emise CO2 až o 30 % oproti případům, kdy se aplikace instalují na počítače v provozovnách podniků. U podniků malých je výsledek impozantní, blíží se 90 %.

Podíváme-li se na tento problém z jiného úhlu, je nutné uvést, že počet datových center výrazně roste a stejně tak i jejich energetické nároky: výsledky jiné studie od Environmental Protection Agency ukazují, že datová centra jen v USA spotřebují 1,5 % z veškeré energie produkované v USA. Jestli to prý půjde podobně dál, tak v roce 2020 emise CO2 dosáhnout 680 milionů tun ročně, což bude více, než kolik chrlí celý letecký průmysl. Jelikož nelze očekávat, že lidé najednou začnou produkovat a konzumovat méně informací, nabízí se řešení toho problému hned v celé řadě možností, z nichž se zdaleka nejpravděpodobnější jeví být větší efektivita hardware obecně a priorita při používání ekologických zdrojů: voda, slunce, vítr. [8]

5. Závěr

Ekonomické modely fungování světa procházejí razantními změnami, jako jsou globální konkurence, globální transfery, změny způsobu práce v mnoha oborech nebo tlak na kvalifikaci pracovní síly. Ty způsobují ve vyspělých zemích postupný přesun k ekonomice nehmotných statků a vztahů. [9] V těchto změnách hrají jednu z klíčových rolí ICT poskytující moderní infrastrukturu, která umožňuje většinu změn realizovat. Souběžně ICT poskytují nástroje pro zvýšení výkonnosti, konkurenceschopnosti a provádění inovací v prakticky všech oblastech hospodářství.

Z informačních technologií, se stal nástroj, nezbytný pro podniky i instituce. To je důvodem pro sledování připravenosti a vybavenosti podniků na nové podmínky a zavádění nových řešení do podnikových informačních systémů.

Rozvoj CC v Evropě zaostává za celosvětovým průměrem. Ze zprávy Carbon Diclosure Project v Londýně však vyplývá, že firmy ve Velké Británii a ve Francii ztrojnásobí používání CC během dvou příštích let. [10]

Bariéry přijetí informačních a komunikačních technologií je třeba překonat. Výsledky výše zmiňovaného průzkumu v Moravskoslezském kraji naznačují, že míra využívání ICT zde není nízká, je většinou průměrná. Investování do nových ICT by však mělo být rozumné, s využitím nových služeb, které umožňují i SME zvýšení jejich konkurenceschopnosti s nižšími náklady. Cílem je provázanost mezi vývojem IS a globální strategií firmy či instituce.

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Poděkování

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OPERATIONAL-ECONOMIC ASPECTS OF CLOUD COMPUTING

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ABSTRACT
Recent years development of cloud computing offers increased number of not only individuals but also organizations who are using services covered under title cloud computing. However, these are relatively new offers on the global market and this entails certain risks and even prejudice. This article is focused on an examination of significant nevertheless often overlooked operational-economic aspects of each class cloud computing services.
There are introduced interesting cloud computing provider practices and service aspects. The steps for customers how to deal with mentioned aspects are also introduced in the article. Aspects mentioned include service operation, service parameters and service costs.

KEYWORDS
Cloud computing; SaaS; PaaS; IaaS; private cloud; decision; choice; clasification; hybrid cloud; public cloud

1. Introduction

The severe economic situation in Europe and shifts in Information and Communication Technologies (ICT) caused certain shift in understanding and deploying ICT. From that reason, the ICT no longer uses organizational sources only, but also certain kinds of outsourcing. The cloud computing services defined in (NIST, 2009) may be included among available and often-used outsourcing services.

Interest in cloud computing among enterprises most often stems from the need to reduce costs associated with the use of ICT services. Moreover, this urge is often thanks to cloud computing satisfied, since the cloud supply except reasonable prices, also the opportunity for monitoring service usage and transparent financial flows into ICT for organizational senior management.

The combination of terms „cloud computing" and „risk" means in almost all cases, an interesting analysis of the security risks alternatively (and not very often) legal risks. The awareness concerning these risks can be found in articles (Armburst, 2010) or (Dahbur 2011). The data security risks are of course an important aspect when considering whether to deploy cloud but this is not the only category of risks encountered. When selecting and deploying cloud services, it is necessary also to take into account operational and economic risks, because even if the data are well secured, the expenses associated with cloud services may be unexpectedly high, and the importance of using cloud computing for the economic subject is going to be likely negative.

The operational-economic risks, although not lead to security breaches of data, but can generate significant investments in cloud services (higher than originally anticipated), or may result in significant service problems due to data transfers between providers. The core of these problems is the choice of cloud service offer, which an organization or an entrepreneur will deploy.

2. Defining the problem

While the economic subject is considering deploying of cloud services it will gradually come to a certain number of selected offers on the market that are able to support the selected business process (activities). The author discussed the problem of narrowing the selection in (Veber 2012). From the group of offers the economic subject must choose one - the best fitting its needs and demands. It is of course necessary to consider aspects of security, legal, but we cannot ignore the operational and economic aspects. These aspects may be overshadowed by security or law and therefore are neglected. This article will focus on seemingly less important aspects that should be addressed, by anyone who is making the decision whether to deploy cloud services, and which offer to choose.

3. Classification of cloud computing services

By definition of cloud computing presented in (NIST, 2009), the cloud services are divided into classes depending on the service model. This classification has been previously mentioned in the above example (Armburst, 2010) or in the Czech version in (Pochyla 2010) or by the author himself in (Veber 2010).

According to the service delivery, model cloud services are divided:

1. IaaS (Infrastructure as a Service),
2. PaaS (Platform as a Service),
3. SaaS (Software as a Service).

Briefly, we can mention that in case of model IaaS the infrastructure is delivered to customers. The PaaS model means offering of an infrastructure and development environment for developing specific cloud applications. The SaaS model means provision of certain software functionality.

Detailed description of each model can be found in articles (Armburst, 2010), (NIST, 2009). For the purpose of related problem this classification appropriate, because operational and economic risks are connected with service and deployment model.

NIST (NIST, 2009) also mentions deployment model - this classification is based on the separation possibilities for the usage of virtualized hardware infrastructure – these are:

1. community cloud,
2. hybrid cloud,
3. private cloud,
4. public cloud.

Community Cloud is managed by the community and is therefore very specific and dependent on an environment and we will not deal with it in this article.

Hybrid cloud is a combination of public cloud and private cloud that is not in the ČR used often. Risks of hybrid cloud solutions are specific depending on the deployment and the ratio between public and private component, but risks can be inferred from risk analysis of its individual parts.

When providing services in a way of private cloud customers are getting a certain hardware that is not shared with other customers. This selected hardware is virtualized and one customer uses all virtual machines.

The method of providing cloud services in the form of public cloud is very similar to the way of private cloud, but with the difference that individual customers share hardware. So on one physical server can be running multiple virtual machines owned by different customers. In addition, the disk storage, transmission routes, and other IT resources are shared as well.

Furthermore, the article will discuss classes of private and public cloud.

4. Methodology and data collection

Foundation for this article was the completed research lead by author of the article in the Czech Republic. Therefore, it is relevant for this region and recommendations for other regions may vary in some aspects.

The research was conducted in a form of discussions (with research participants). Research involved two different parties: cloud service providers and cloud service customers.

The dialogue with providers was focused on aspects of provided services. What kind of customers do the providers expect of offered services and why? What is the price of the services and how is it calculated? Additionally the detailed description of provided services and comparison to other similar services provided by other providers was demanded.

The dialogue with (potential) customers was focused on their IT demands. What services are the IT departments managing? Are the organizations interested in cloud services? What do the customers expect of cloud service? What are the main advantages and disadvantages of current cloud service solution?

The participants of this research were employees (high company management or CIO) from approximately twenty organizations (about half were smaller organizations or entrepreneurs):

Cloud providers: Cloud4.com, IBM, SAP, Eltodo, Oracle.

Cloud customers: Deloitte (consulting), Ceska Pojistovna (insurance), Vseobecna fakultni nemocnice v Praze (hospital), Elektrizace Zeleznic (railway projects), Metrostav (construction), and others.

Subsequently additional internet published data cloud offer were collected. A comparison of data obtained for each cloud offering type was performed using collected data. The result of this comparison was an evaluation of individual aspects mentioned below:

- significant economic items that depend on the use of service or are somehow hidden to customer,
- the most frequently utilized model of payment for the service,
- dependence on providers and the resulting risks,
- the parameters that determine the quality and service.

5. Results

5.1 Iaas

Virtual infrastructure offers based on cloud computing are available as private cloud services as much as public cloud. These two approaches differ in the way of sharing hardware. In the case of private cloud infrastructure is dedicated to the only one customer, while the public cloud, customers share available computational resources.

5.1.1 Private cloud at the customer

5.1.1.1 Service description

Private cloud can also be operated in such a way that the hardware is physically stored on customer's site. In this case, it is also possible that the customer buys their own hardware and performs the investment costs often in order to increase the company value. Implementation in this case is usually realized by contract with a fixed monthly fee, the customer gets a certain number of physical machines (which placed inside the customer's own "server room"). Using more physical machines also means higher price. A customer can change the requirements for the number of machines but with low flexibility (change once a month or six months). Requirements for performance improvements often made quicker by providers (within days).

5.1.1.2 Service parameters

The performance of each virtual machine depends on the hardware and the virtualization settings (that is laid down by the customer). The parameters can be changed only through the exchange of hardware.

5.1.1.3 Economic characteristics

In terms of deployment and the resulting price, this method is very similar to the method of managing own IT (partly outsourced). Therefore are only common operating-economic or security risks. The customer's monthly fee covers the rental of hardware, software, and cloud machine maintenance. The costs of energy consumption (including cooling) and supervision remain under the direction of the customer. Although ICT operating costs are not so different from operating own ICT, the investment costs may be spread over a longer period (it's possible to avoid the disposable investment in hardware, etc.). Price depends on the number of machines, machine configuration, and choice of accessories such as disk storage. In this case, the price is very often fixed by agreement between the provider and the customer.

5.1.2 Private cloud at the provider

5.1.2.1 Service description

Hardware is placed at the provider's site and he ensures oversight over hardware operation, cooling and electricity supply. The customer is connected directly to his hardware using usually dedicated optical line. It is also possible that the hardware is either owned by the customer (so the price may be reflected in the investment costs) or by service provider (so the price is reflected in the operating costs). Requirement changes in the number of machines or configuration are possible while the flexibility in this case often depends on the flexibility of the provider, some of them offer change within minutes, some within months (increasing performance is often done with better response than decreasing).

5.1.2.2 Service parameters

The performance of each virtual machine depends on the hardware and the virtualization settings (that is laid down by the customer). Parameters are changed only through change of hardware. Providers should therefore ensure within the SLA that the hardware would not change. Change should either mean better parameters or be part of new SLA.

5.1.2.3 Economic characteristics

Payment in this case is also dealt through a monthly payment and price depends on the number of machines. In comparison to the above-mentioned placement at the customer, the price is often lower because the provider can better optimize the cost of security, cooling and maintenance. In addition to monthly fee for depositing machines, the extra charge for electricity consumed by the machines is paid. At this point, each provider may vary, as some install wattmeter deducting directly consumed energy, while others statically count the energy consumed by the formula, according to the nominal value of consumption written on the label on the hardware resources and time that the machine was running. Therefore, the resulting price for consumed energy with identical hardware placed at different providers may vary greatly and it is important to watch closely this part of concluded contract.

Prices of private cloud shows quite clearly the company OVH (OVH 2012) - the basic configuration of two servers with 16 GB RAM, virtualization software, cloud software, storage and 300 gigabytes to 30 gigabytes of internet communication of data per month is 107 000 CZK per month. Licensees for Windows operating systems are changed separately depending on the number of licenses used (Linux is free of charge).

5.1.3 Public cloud IaaS

5.1.3.1 Service description

Sharing of virtualized machines allows efficient sharing of hardware resources for providers therefore; they may offer lower prices in comparison to private cloud services. In this case, the customer receives a virtual machine with defined parameters. However, in this case, different customers may share physical machine, connection pathways and that is why the performance of each virtual machine can vary not only in time but may also depend on the "current" location (what physical machine it is currently running on) of virtual machine. Flexibility of public cloud is high and performance requirements can be changed very often (in days, hours, or even minutes).

5.1.3.2 Service parameters

Service parameters depend on the current hardware that the provider uses, and on virtualization parameters. When an application of one customer's virtual machine overwhelm physical machine, there are less resources for virtual machines of other customers on same physical machine. It is therefore important that the provider has set the virtualization conditions so customers do "not interfere" each other. From the perspective of the provider it is of course advantageous to share a single physical machine by as many virtual machines as possible, but when the limits are set incorrectly, customers may experience performance degradation of their individual virtual machines.

It is therefore appropriate to ask provider about performance guarantee parameters offered by virtual machines. These parameters can be expressed in different ways. Very precise measurable performance parameter for the virtual machine is the value of "CPU ready time" described in (Kellog, 2008). This value indicates the response times of individual virtual machines. Nevertheless, the computing power is not the only indicator that should be monitored - for example, data storage and transmission networks are also important parameters to study. "Disk Response Time" is for example a value indicates speed of storage system (it is affected by the length of storage request queue and disk array speed).

Sharing hardware resources may evoke in terms of customer unpredictable performance of purchased virtual machines and it is therefore recommended to "test" the

service before signing the contract. The test should take at least one week in full operation in order to determine whether the requirements for an information system with virtualized machines are met. When the provider is unwilling or unable to guarantee the performance parameters, it is advisable to ensure the "back-door" in the form of rapid termination of the contract without additional charge. On the other hand it is not so difficult to change the provider within IaaS (with respect to PaaS and SaaS services).

5.1.3.3 Economic characteristics

The price in case of public cloud is determined much more accurately and depends mostly on the number of machines purchased, the number of data transferred between could and the Internet and the size of the required disk space.

Global cloud providers like Amazon, Rackspace and Microsoft publish the prices on their websites local and smaller providers especially in Czech Republic do not publish prices because of their trade policies, but it can be assumed that prices will range between the prices of private cloud and those that are offered by large public cloud providers.

Comparison of global cloud providers can be found in (Li, 2010) - it also contains prices that are between 0.085 and 0.96 USD per hour for virtual machine (1300 to 14,000 CZK per month), depending on the hardware configuration.

5.2 PaaS

5.2.1.1 Service description

The problem of choice of provider in this case lies in the different databases that providers offer. They also vary in the available programming languages for writing applications and there are differences in provided API. For this reason, it is very difficult to port applications between different providers and there arise a dependency and selected provider. It is therefore important to select such a provider, who can be trusted in terms of stability, or the one who's API is compatible with any other alternative provider, so in case of problems it is possible to switch the selected provider with another (there exist kinds of API bridges for example “libcloud”).

5.2.1.2 Service parameters

PaaS service parameters depend on the needs of the customer-developed applications. Performance in terms of processor and memory can be changed according to predefined virtual machines on offer. Provided is a virtual machine as well as in the case of IaaS but there is the difference in price offered for the machine, and there is preinstalled an environment for running developed applications.

5.2.1.3 Economic characteristics

Payment model is similar to IaaS. Virtual machines are paid separately as much as storage database and network traffic. Fees depend on the usage of PaaS services so the application design itself should take into account the very payment model. For example, there are charged separately database operations. When designing a cloud application it is therefore necessary to focus on the most effective communication with the database (to form query correctly and avoid unnecessary operations) so that the price per unit of time does not grow unnecessarily high because of po2or program design. The situation is similar for transmission of data between cloud and the Internet.

5.3 SaaS

5.3.1.1 Service description

SaaS services are available for many years, their offerings are a few years older than the first mention of cloud computing. Nevertheless, a significant development and wide availability of SaaS offers is possible only in recent years with the development of cloud computing. From the perspective of customer, the trust is the most important in the choice of the SaaS provider. This issue is addressed in (Heart 2010). The customer is going to be tightly bound to his provider, since provider manages customer's data. The problem is not only data security, but also in the ability to transfer data to an-other provider. Specific SaaS applications may store data to the database in unknown format, and it may be very difficult or even impossible to export data from database in certain portable format. This factor favors the provider over the customer, thus is important that the provider acts ethically and offers the service at adequate prices. The risk of provider bankruptcy or service termination must be considered when selecting SaaS services as well.

5.3.1.2 Service parameters

Provider is responsible for service parameters and these are noticed inside the agreement between the provider and the customers - usually enclosed by the SLA. It is therefore quite important to monitor whether the current wording of this agreement will ensure service that is available and fully functional.

5.3.1.3 Economic characteristics

Providers of SaaS very often chose as a payment model "software leasing" as mentioned in (Ojala, 2012) because it is simple and easy to implement, transparent and predictable in terms of price for both provider and customer. The final price per month will vary depending on the functionality offered and mass recovery.

6. Discussion

This article mentioned the most significant operational and economic risks. The risks mentioned above have resulted from conversations between the author and providers of cloud services or customers of cloud services. We cannot say with certainty that this article cover all significant risks of this nature, but the vast majority of those most important is mentioned in the article.

The dialogue was led principally with business entities not with government organizations. In terms of government and non-profit organizations the cloud computing is also quite interesting model for outsourcing, and government can expect a similar situation in terms of operational and economic risks for the usage of publicly available providers.

However, a very convenient solution for the government would be the emergence of an independent state established provider of cloud computing. This one would provide cloud services for state and contributory organizations within the legal regulations of their country while under the supervision of state authorities to provide transparently managed and secure services. Such a procedure would not only ensure affordable and scalable services to individual state organizations, including the government itself, but also would eliminate part of the operational and economic risks associated with dependence of government organizations on commercial providers, which is a major obstacle for the deployment of cloud computing services in government.

7. Conclusion

Evaluation of suitable cloud services offer for the organization is quite challenging and a key decision in organizational future strategy planning. This decision may lead to considerable savings through streamlining of IT service. Organizations can also benefit from very high flexibility of cloud IT services.

Some organizations are existentially dependent on delivering IT services, and disruption of IT services due to wrong choice of provider may cause interruptions of critical business services, whether due to a continuous unavailability of services, or bankruptcy of the selected provider. Therefore, a bad decision in the election of cloud services can lead to considerable problems of managing IT services and it may case to the organization (or its management) existential problems.

The aim of this article was to assist with making the right decisions emphasizing operational and economic aspects, for which the article also contains procedures that allows reduction or even elimination of the risks that are mentioned above.

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COMPARISON ANALYSIS OF CHOSEN APPROACHES TO SENTIMENT ANALYSIS

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ABSTRACT:
In our paper firstly we will shortly describe four text mining approaches to sentiment analysis. In the next part of the work we will present stages of chosen methods of sentiment analysis. In this part we will touch such topics as texts characterization, tokenization, stemming and classification of opinions. Third part of the work is devoted to the research and its results concerning sentiment analysis of textual data collected from the Internet. We will sum up with some conclusions and further research plans.

KEYWORDS:
Sentiment, sentiment analysis, ontology, natural language, computational linguistics

1. Introduction

Sentiment analysis or opinion mining is a field of research that can have significant impact on today's business. A lot of consumers make their decisions after browsing Internet in search for opinions of others. They trust in what they read online. It means that company should know how many opinions about it and its products are in the Internet. Company should also be aware of what type those opinions are (positive, negative, neutral).

2. Sentiment analysis

Sentiment analysis or opinion mining refers to the application of natural language processing, computational linguistics, and text analytics to identify and extract subjective information in source materials.

Generally speaking, sentiment analysis aims to determine the attitude of a speaker or a writer with respect to some topic or the overall contextual polarity of a document. The attitude may be his or her judgment or evaluation, affective state, or the intended emotional communication[1].

In the field of sentiment analysis there are three main tasks (Liu, 2007):

- Sentiment classification: assignment of sentiment to whole opinion. Division of opinions into groups on the basis of its polarity.
- Featured-based opinion mining and summarization: discovering what aspects of product users like or dislike.
- Comparative sentence and relation mining: analysis of sentences comparing directly one object to another

1 http://en.wikipedia.org/wiki/Sentiment_analysis

There are few text mining approaches to sentiment analysis (Lula i Wójcik, 2011):

- Word-based approach
- Pattern-based approach
- Ontology-based approach
- Statistical learning approach

There are some significant differences between those approaches. They can be used in different tasks of sentiment analysis. For each task the best approach can be identified.

2.1 Word-based approach

In the basis of the word-based approach stands division of opinions into words. Text documents containing opinions are gathered in so-called corpus. On the basis of prepared corpus of documents a frequency matrix can be created. Frequency matrix is a matrix where columns represent documents, rows represent words and values at the intersections represent the number of occurrences of particular word in a particular document.

In word-based approach to sentiment analysis it is assumed that the meaning of the opinion (also its sentiment) is carried by separate words. So that the sentiment is assigned to every word in opinion. Then sentiments are transferred into points which are aggregated into one value which is interpreted as the opinion sentiment.

2.2 Pattern-based approach

Second text mining approach to sentiment analysis is pattern-based approach. In this method the major assumption is that sentiments are carried by phrases/expressions instead of separate words. The analysis is also based on frequency matrix but instead of words there are phrases.

The main problem that has to be solved in this approach is how to identify the phrases. To solve it the regular expressions mechanisms can be used. One of the solutions is JAPE – Java Annotation Pattern Engine. JAPE is a component of the open-source General Architecture for Text Engineering (GATE) platform. It allows user to recognize regular expressions in annotations on documents. On this basis it can identify phrases in opinions.

2.3 Ontology-based approach

Another approach to sentiment analysis with roots in text mining is ontology-based approach. Ontology is defined as a formal description of the field of interest. It consists of classes and relation between those classes. Every class can have many different attributes. Ontology also contains instances. An instance is an object representing a class. Classes in ontology can have hierarchical construction.

One ontology concerns only one domain. To construct an ontology the knowledge about particular domain is needed. Ontology designed for one domain cannot be applied to another one. Created ontology can be a starting point for many different analyses of texts representing domain including sentiment analysis.

Single opinion can be presented as an instance of ontology. The comparison analysis of those instances should be conducted. On those basis the sentiment analysis of collected opinions can be made.

2.4 Machine learning approach

Statistical learning approach is the last text mining approach to sentiment analysis. Machine learning is a branch of artificial intelligence that is concerned with the design and development of algorithms that allow computers to discover patterns and rules through analysis of empirical data. Machine learning methods improve automatically through experience. Often it is said that these methods can discover knowledge from data.

In relation to sentiment analysis training set is required. It should contain opinions with sentiments given. On this basis the model learns how to assign polarity to new opinions. The model quality can be improved by expansion of training set.

To classify opinions many methods can be used. The most popular of them are (StatSoft, Inc, 2010):

1. Naive Bayes classifier
2. K-Nearest Neighbors method

3. Empirical analysis

During research the simulation analysis was conducted. Its aim was to compare the results of opinions' classification with usage of different approaches to sentiment analysis. In simulation the word-based and machine learning approaches were used.

3.1 Stages of analysis

Statistical learning approach is the last text mining approach to sentiment analysis. Machine learning is a branch of artificial intelligence that is concerned with the design and development of algorithms that allow computers to discover patterns and rules through analysis of empirical data. Machine learning methods improve automatically through experience. Often it is said that these methods can discover knowledge from data.

In simulation analysis we can identify few stages:

1. Models construction: two main models were constructed. First of the realize word based approach and second of then uses machine learning.
2. Opinions extraction: in research 301 opinions were used. They were extracted from http://reviews.cnet.com/ service. Opinions chosen to research were composed of three parts: pros (product advantages), cons (product disadvantages) and summary.
3. Models' effectiveness testing: The results achieved in particular simulations were compared with known similarity of opinions. The effectiveness of different models were compared with each other to determine the best solutions in sentiment classification among chosen approaches.

In research RapidMiner application was used. It allows to construct models from predefined blocks. To adjust blocks we can set values of parameters. Figure 1 below presents word-based model.

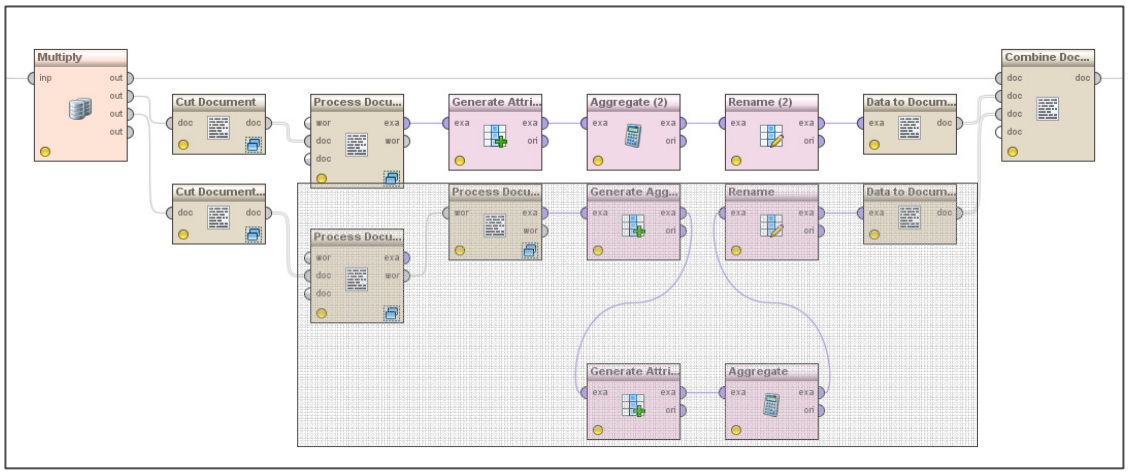

Figure 8. Word-based approach model to opinions classification in RapidMiner.
Source: Screen shot.

In research presented model was used in two variants. First of them (inside frame) treats opinions as plain texts. Whole opinion is analyzed in the same way. Second variant (complete model) divides opinion into two parts: Pros & Cons and Summary. Each of them is analyzed separately with different methods. Summary is examined as plain text. Pros & Cons are analyzed with POS (Part of speech) tagging usage. Nouns and adjectives are counted on both sides and this sum is multiplied by 1 for pros and by -1 for cons. Results are summed and added to result achieved from summary analysis.

Next figure presents machine learning model. It was also used in two variants. The difference between those variants was classification method. Firstly K-Nearest Neighbors method was used (as on the figure) and secondly it was replaced by the Naive Bayes classifier.

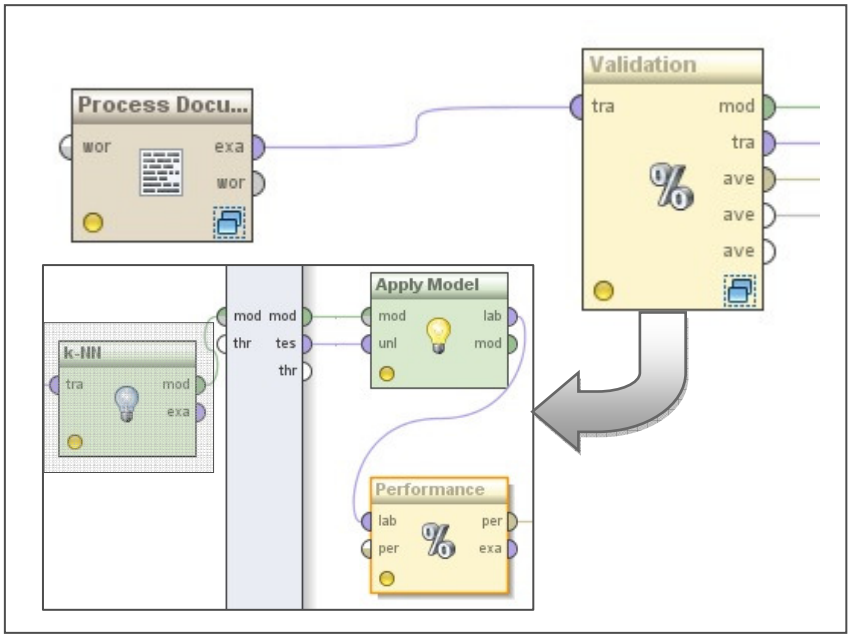

Figure 9. Machine learning approach model to opinions classification in RapidMiner.
Source: RapidMiner screenshot.

In both models Process Document block represents preprocessing of documents including tokenization, stoplist words removal, whitespaces removal and stemming.

3.2 Research results

Figure 3 below presents the efficiency of all constructed models. It can be seen that model which is analyzing whole opinion as plain text achieved the worst result. Other models have similar efficiency.

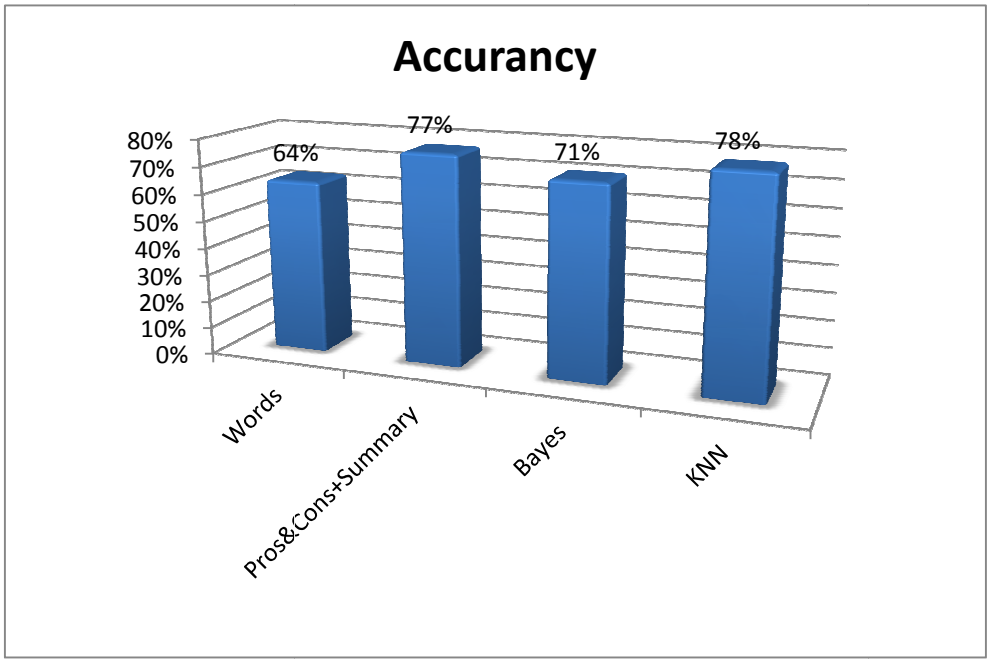

Figure 10. Models accuracy.
Source: Own elaboration based on calculation results.

Next figure shows which method is the best in classification of positive and negative opinions. Model which is analyzing whole opinion as plain text is the best in positive opinions detection. The negative opinions are recognized with the best accuracy by the machine learning model using KNN as classification method.

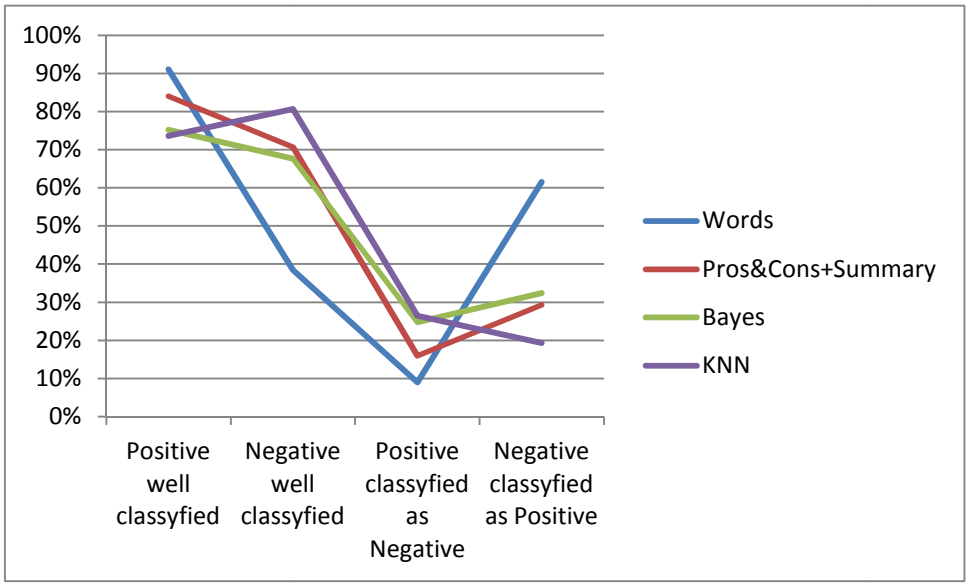

Figure 11. Share of proper and misclassified opinions in whole opinions of particular type.
Source: Own elaboration based on calculation results.

4. Conclusions and further research

There is many different approaches to sentiment analysis. They achieve similar results in opinions classification. The difference is in the share of proper and misclassified opinions of particular type in whole opinions.

In this paper only two approaches were tested. Other two should be modeled and simulations of their performance should be conducted.

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