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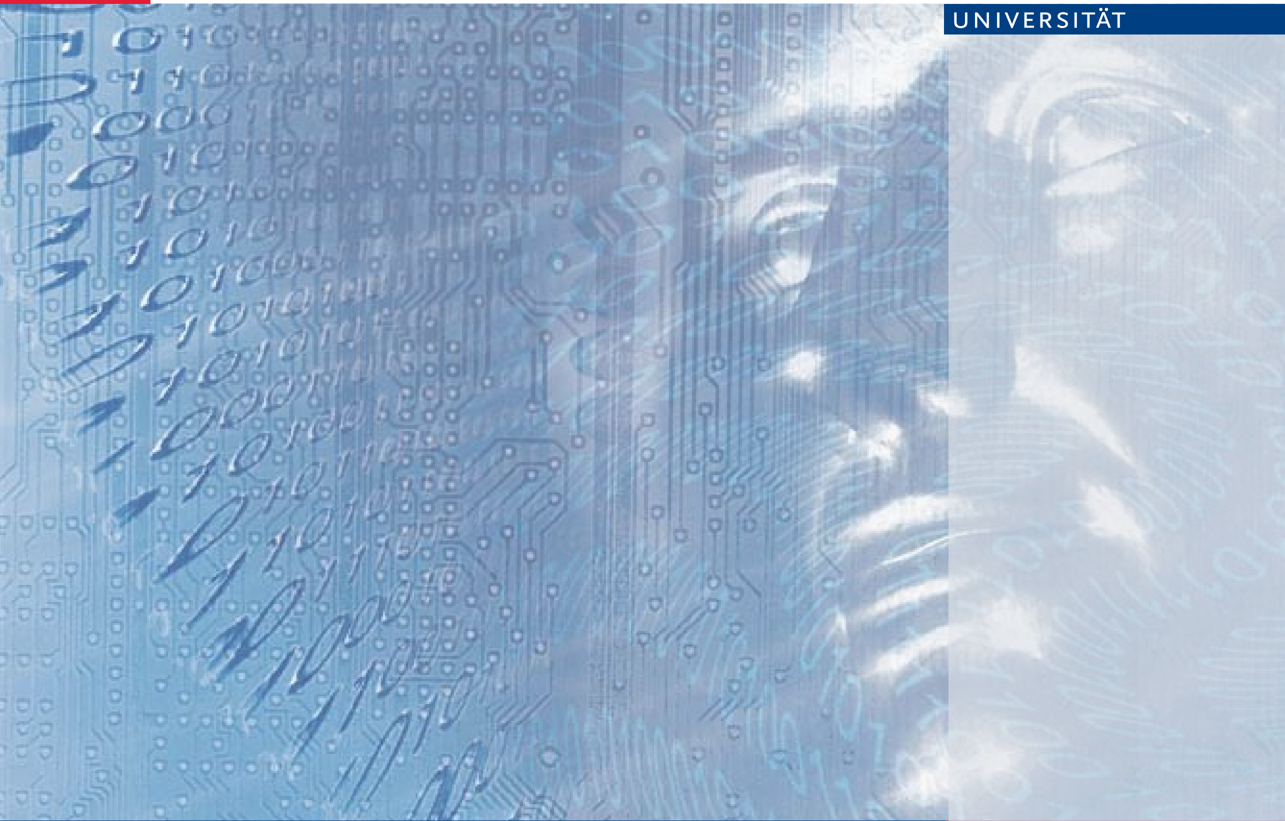

Schriftenreihe
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IDIMT-2010

Information Technology – Human Values, Innovation and Economy

18th Interdisciplinary
Information Management Talks
September 8–10, 2010
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Gedruckt mit Förderung des Bundesministeriums für Wissenschaft und Forschung (BMWF-4.010/0010-III/2/2009)

This publication was partially supported by the Czech Science Foundation (GACR) (Grant BMWF-4.010/0004-III/2/2010)

Die Konferenz IDIMT-2009
fand vom 9.–11. September 2009 in Jindřichův Hradec, Tschechische Republik, statt

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Doucek Petr, CZ
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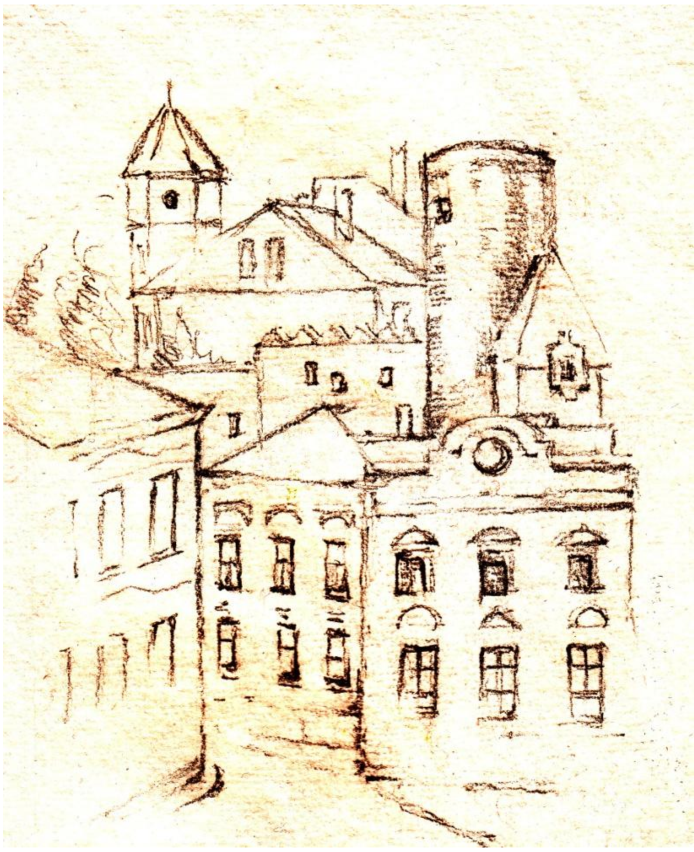
Herstellung: Kern:
Johannes-Kepler-Universität Linz,
4040 Linz, Österreich/Austria

Umschlag:
TRAUNER Druck GmbH & Co KG,
4020 Linz, Köglstraße 14,
Österreich/Austria

ISBN 978-3-85499-760-3
www.trauner.at

This is the 2nd version of IDIMT proceedings, officially published via IDIMT website in September 2010.
See corrections and updates on page 410 for complete checklist of changes.



Janie Chroust 2010 – Jindřichův Hradec

Welcome to IDIMT 2010!

A hearty welcome to the 18th IDIMT Conference!

This year we have to start with very sad news, Prof. Ing. Jan Ehleman passed away in June 2010. He was one of the founding members of the IDIMT conferences and we will always remember him with deep gratitude.

In 2007, at our 15th anniversary, I spoke about "15 Years IDIMT - 15 Years of Change"[1] and this is proving true again this year. We have decided to stay in the same town, lovely Jindřichův Hradec, but to move to another hotel: to Hotel Concertina, just opposite of the Grand Hotel. We hope to have better facilities there.

Jindřichův Hradec, chosen in 2008 as the new location for IDIMT has proven to be a good choice. You will again be able to enjoy this beautiful old town with its historical market square, its old castle with a famous fountain, a lake, and excellent restaurants offering delicious food. Small shops with the handcraft from the area and a wide central plaza will invite you to rest or to wander around the town. Last but not least the famous Czech beer might well inspire our discussions.

---

[1] Gerhard Chroust: „15 Years IDIMT - 15 Years of Change", in Chroust, G. and Doucek, P. and Hoyer, C. (eds.), IDIMT-2007 - 15th Interdisciplinary Information Management Talks, Verlag Trauner Linz, 2007, pp. 119-141.

Hotel Concertino

IDIMT conferences, started in 1993, are now a well-established event in Central Europe. We enjoy interdisciplinary discussions between scientifically and geographically diverse groups of participants. The main focus is current and future challenges in a world dependent on Information and Communication Technology.

In this spirit the key topics of this year's conference are:

- Innovation Potential of ICT in the Crisis
- Human Resources in ICT
- Dependable Systems and Infrastructure Protection
- Factors of Regional Development in the Context of Globalization and International Integration
- Competitiveness of Tertiary Sector
- Values, Culture, Ethics, and Norms as Information Leading to Requisite Holism/Wholeness
- Computer Support of Cooperative Work

This year we have been able to accept 41 papers for the 7 topics, the authors coming from eight different countries. Each session was organized by a Sessions Chairperson. By tradition the session begins with a keynote, the other papers provide additional points of view, followed by intensive discussions.

We believe that intensive discussions are one of the attractions of the IDIMT-Conferences, providing interdisciplinary exchange of thoughts. Staying together in one hotel, having lunch and dinner together also fosters animated discussions.

The preparation and realization of IDIMT 2010 would not have been possible without the support of many organizations and persons. Therefore we would like to thank:

- the Austrian Federal Ministry of Science and Research for supporting the preparation of the proceedings (Grant BMWF-4.010/0004-III/2/2010),
- the Czech Grant Agency and VŠE Internal Grant Agency for partially sponsoring the conference (GACR Grant 402/09/0385 - Human Capital in IS/ICT Operations and Development: Competitiveness of Czech Tertiary Education Graduates, IGA Grant 12/2010 - IG404040),

- the University of Economics Prague and the Johannes Kepler University Linz, which as partner universities provide the organizational infrastructure,
- Václav Oškrdal who took up the work of collecting all papers into the proceedings, keeping contact with all involved parties, especially reminding the authors and performing all the other necessary administrative jobs,
- Petr Doucek for chairing the Organizing Committee and organizing accommodation in Jindřichův Hradec and the lovely excursion on Thursday afternoon
- Ms. Lea Nedomová, secretary at the University of Economics Prague
- all keynote speakers, speakers and contributors of papers,
- all Session Chairpersons for establishing contacts and soliciting contributors,
- all reviewer providing critical remarks and by this improving the papers,
- the Trauner Verlag for acting as the publisher of our conference,
- all other unnamed persons contributing to the success of this conference.

To a successful conference!

Gerhard Chroust

July 2010

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In memoriam Prof. Jan Ehleman

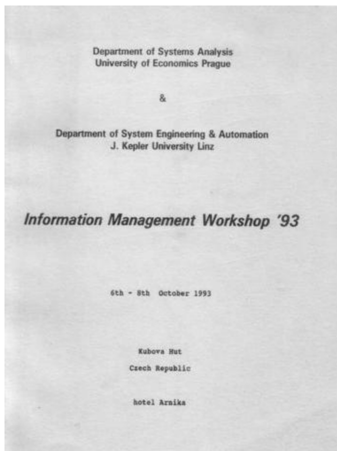
On June 14, 2010, Prof. Ing. Jan Ehleman passed away.

He was one of the founders of our very successful annual IDIMT conferences which initially took place in 1993 and continue annually to the present today[2].

In 1992 the borders in Europe were opening up one after the other. Prof. Ehleman was then Vice Rector for International Cooperation at the University of Economics Prague, responsible for external and international activities. At the same time Prof. Ernest Kulhavý was the Senate's Special Envoy for International Cooperation at Johannes Kepler University Linz. Both agreed to establish closer cooperation between the two universities.

Gerhard Chroust was a newly appointed professor for Systems Engineering at the University Linz and Petr Doucek was a young assistant in the Department of Systems Analysis at the University of Economics Prague.

The first step was to organize a joint conference to be held in 1993 in Southern Bohemia with the support of the Austrian Czech Republic Action Program.



Department of Systems Analysis
University of Economics Prague

&

Department of System Engineering & Automation
J. Kepler University Linz

Information Management Workshop '93

6th - 8th October 1993

Kubova Hut
Czech Republic

hotel Arnika

The purpose of the conferences has been to build bridges in 3 dimensions, namely to exchange views concerning the different economic systems of the two countries, to relate the software expertise of the institute in Linz to the economic expertise as represented by the institute in Prague, and to create personal relationships between the members of the two universities.

The first conference was a great success. The Czech scientists were especially interested in questions of ‚transition' from the old economic/social/political system towards a western style system and at the same time, in the application of modern software technology to create and build the needed software support.

Prof. Jan Ehleman was a strong supporter of this initiative. In the

[2] An extensive history of the IDIMT conferences can be found in Petr Doucek: „The IDIMT History" in Chroust, G. and Doucek, P. and Hoyer, C. (eds.), IDIMT-2007 - 15th Interdisciplinary Information Management Talks, Verlag Trauner Linz, 2007, pp. 111-118 and Gerhard Chroust: „15 Years IDIMT - 15 Years of Change", ibid. pp. 119-141.

first conference in 1993 together with Prof. Leo Vodáček he presented a paper on „Challenges for Information Management in Czech Industrial Firms".

The next year he continued (again with Prof. Vodáček) on the Topic "Restructuring of Czech Industrial Firms".

For many years Prof. Ehleman was a greatly appreciated participant of the IDIMT conferences, to which he gave his full support. He was a delighted observer of how this bilateral 15-person conference of 1993 grew to a conference of about 50 participants from 8 to 10 different countries each year.

IDIMT 2002, Zadov: Erwin Grosspietsch, Hana Křivánková, Gerhard Chroust, Antonín Rosický, Jan Ehleman

IDIMT 2006, České Budějovice: Gerhard Chroust, Petr Doucek, Jan Ehleman

We will always remember him in his friendly, quiet ways and want to thank him for having instituted the IDIMT Conferences.

Petr Doucek, Gerhard Chroust

September 2010

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TECHNOLOGICAL OUTLOOK: THE FUTURE OF INFORMATION TECHNOLOGY

Innovation Potential of ICT in the Crisis

ICT BASED INNOVATION APPROACHES IN THE CZECH COMPANIES HELPING THE COMPETITIVENESS GROWTH

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Keywords

Information and communication technology, innovation, competitiveness, sustainable growth

Abstract

The paper deals with the analysis of innovation approaches in the Czech companies under the current economic conditions. The innovation types of companies, the evolution stages of market and also branch, size and orientation of companies are used for the identification of more successful innovators.

The paper is the outcome of a research that has been accomplished as a part of research program funded by the Grant Agency of the Czech Republic GACR 201/08/0663.

1. Introduction - Even Future Is Not What It Used To Be

It seemed a decade ago that the globalization applying a potential of the information and communication technology (ICT) could be a good opportunity for further nearly unlimited growth of economy and wealth. The term of a new economy were often used at that time. ICT and mainly internet started to play a key role within the social and economic changes at that time. For example P. Friedman in his book *The World is Flat* (2006), which was published with the subtitle *Short history of the 21st century,* summarized interestingly the importance of ICT. The author analyses and presents on concrete examples ten fundamental factors, which according to his point of view, “flat” today’s world.

ICT sector has constantly increased its trend share on the economic activity and is an important factor for the world’s economic performance. But the reality showed that ICT significance was sometimes too ambitious. The “ICT crisis” connected with “dot.com companies bubble” in the beginning of this decade was the first moment to start think over the ICT value and its contributions. But the investments into the ICT sector began to increase again from the beginning of 2002. Pick-up of the ICT sector came up firstly in USA and then spread to Japan and Europe. Increased interest in semiconductors represented real pick-up. Increase concerned mainly computers and its components. The market with communication devices currently boosts due to investments to high-speed broadband internet connection, WiFi technologies, internet voice and video broadcasts.

But the events like beginning of the economic crisis in 2007/2008 or close the „European sky“ in April 2010 confirm interconnectivity of the current world and the real meaning of the world “globalization”. The both events show that the current world is really tide integrated. The consequences can be knowledge that the findings (methods and approaches) gained and successful applied in the past cannot be easily used and extrapolated. These events have proved that the world had never changed in the history so fast and in a way it has started at the end of the 20th century.

The role and position of the ICT is now different comparing with the “dot.com” crisis. Today there are the social networks like Facebook or LinkEd more and more important for communication among people and social CRM is an example of one such reaction today.

2. Innovation as Key Factor of Sustainable Growth

2.1. Importance of ICT Innovation

The owners of the companies, managers and information specialists deal with the topic of effectiveness of ICT in the company. The reason is the fact that ICT can influence the value of the company, its competitive advantage, relations of the company with the customers, suppliers and not least also own sold products and services.

New information, information channels and services can address new customers; actively offer preferred products to existing customers and further help with ordering, distribution and payment for products or services. Information can assist not only with improving a relationship with a customer and increasing sales, but also help with improving cooperation and coordination with suppliers during the process of planning and optimizing feasibility of customer demands together with respect to available resources and capacity potential of the entire chain.

In addition to mutual lowering of costs, shortening the response time to a customer demand and keeping the promised time of delivery can be achieved in cooperation with suppliers and by offering accurate information. Both demands are presently becoming more urgent among customers and so it is possible to increase their number, possibly consider a higher price for the product.

Anonymity disappears, responsibility for entered data is visible, leader gains bigger overview of his/her subordinates (he/she is not so dependent on them) due to implementation of an information system in a company. By the help of ERP (for example) managers can find out by himself how the fulfillment of business case, its planned and continuous calculation, situation in the warehouse, quality and terms of material supplier observance, production capacities utilization, etc. are realized.

Long-term effect of these changes, which enable the company to cooperate with other companies, to take part in cooperation in the form of virtual companies, to offer products on the electronic marketplaces or trade with other companies in a form of B2B or with customers in a form of B2C, shouldn’t be forgotten either. This all is not possible without an innovation. Competitiveness cannot be achieved by producing standard goods and standard services using standard methods. In advanced economies, international competitiveness depends largely on innovation. To discover the importance of ICT innovation management an analysis has been made. Notions about the importance of innovation management can be found e.g. in European Commission working group programs (EuropeanCommission, 2006), at a company level (3M, PricewaterhouseCoopers) and also in a research agencies (Gartner).

A PricewaterhouseCoopers study on innovation identifies key sources of innovation (Rozwell, 2002):

- 46 % originate from customers, suppliers or market intelligence,
- 29 % originate from employees,
- 11 % originate from specialists,
- 9 % originate from R&D,
- 5 % originate from competitors.

This study identifies that 49% of innovation originates from within the company. This represents internal innovation opportunities that need to be managed and integrated with the global enterprise strategy.

That substantiates the motivation to integrate the IT innovation management framework with the IT Governance. External innovation impulses are represented by 46% of market innovation (customer, suppliers) and 5% of competitors' innovation. In order not to lose a market share, company should be flexible in reaction to these external innovation impulses. To do so, a managed process for innovation should exist.

Despite this obvious need for innovation management a Gartner research discloses, that not all companies are ready: "Innovation represents a strong impulse for enterprise growth strategy. However, according to a 3M innovation survey, fewer than 40 percent of companies have formal procedures in place to manage innovation." (Rozwell, 2002).

As another Gartner study predicts innovation management will be crucial to retain competitive: "Organizations that consciously integrate change management best practices into their evolving innovation management strategies will realize a 40 percent improvement in innovation shelf life and cycle times over their traditional competitors (0.7 probabilities)." (Young, 2001).

The analysis has discovered that innovation is the corner stone for the sustainable development and competitive edge. Innovation represents a strong impulse for enterprise growth strategy. It is more effective to develop innovation that lies in focus area given by the company strategy, rather than to develop any innovation impulse at a high costs hoping that maybe once will fit the need.

2.2. Innovation in IT

ICT is enabling rapid productivity growth; the use of ICT combined with skilled personnel can help companies increase their overall efficiency. The services sector is the most intensive user of ICT, thus the economic impact on the performance of the services sectors can be expected, although the specific problems of measuring output from services sectors distort the influence of IT usage in services enterprises.

Employing ICT in the services sector yield productivity gains often realized through new and innovative ways of managing knowledge or organizing processes.

ICT has been identified as a key innovation driver: "The ICT sector continues to drive about half of the EU's productivity gains but this is not sufficient to improve the EU's global competitiveness." (European Commission, 2006) Comparing to United States the indicators of EU are still low: "Uptake of ICT by businesses in general remains much lower than in the United States and the trend does not significantly improve The contribution of investment in IT (by all economy segments) to GDP is about half of the US level. Businesses in Europe, and in particular SMEs, remain slow in embracing IT applications in their organization and processes." The situation can be also illustrated in the investments: "IT investment in Europe is now half the level of that in the US as a share of GDP – with the gap having widened in recent years. Investment in bringing the SMEs up to speed is also lacking.“ The growth of the IT sector itself is essential for the growth of the economy as a whole. Beyond that aspect, a greater use of ITs by society as a whole can significantly improve Europe’s competitiveness on the global scene. This is why ICTs are a cornerstone of the EU strategy for growth and jobs.

2.3. Models of IT Innovation

There are more models dealing with the formulation of all aspects of ICT innovation. One of them, often mentioned, is “The Three-set model of IT innovation” by Lyytinen and Rose which is based on the theory of ICT innovation by E. Burton Swanson (Kärrberg, 2006).

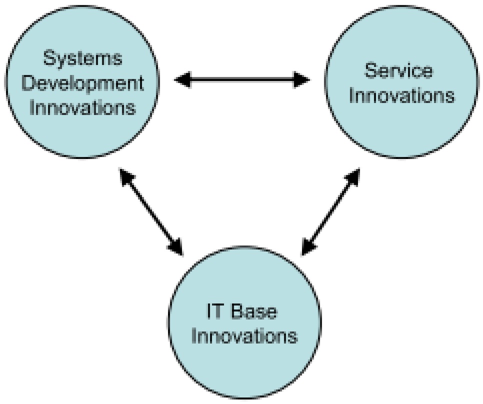

Figure 1: "Three-set of IT innovation" model (Kärrberg, 2006)

This model distinguishes following ICT innovation types:

- Systems Development Innovations – innovation oriented directly into information systems development
- Service Innovations – innovation based on developed ICT products, mainly offered in services via IT
- IT Base Innovations – innovation of business models and processes applying information systems and technologies

The author of this article locates the innovation within the „innovation cycle“, where the ignition of innovation is the first phase before the following innovation project and before the maintenance of innovation.

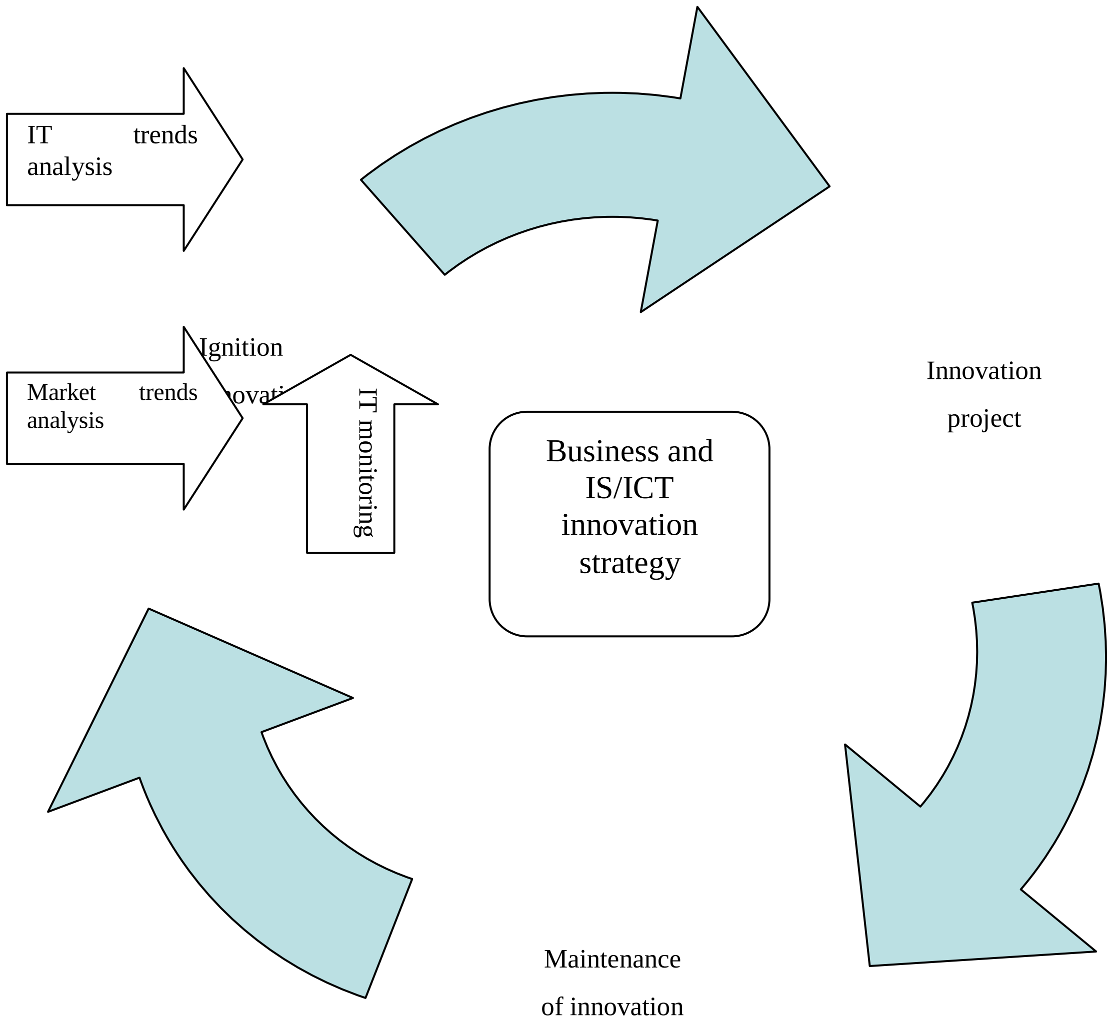

Figure 2: ICT Innovation phase model

The enterprise and its business and innovation strategy is a core of this model. There is necessary to know what type company is, which approach to ICT innovation is applied. All that should be done within the frame of the situation on the market and general social and political conditions.

3. Situation in ICT Innovation Adoption within the Czech Enterprises

The paper presents a part of the outputs of the survey. This survey undertaken among the Czech enterprises offers the good picture of the ICT innovation potential and describes the attitude to ICT innovation and applied strategies.

Questions were formulated as an outcome from the innovation literature study, oriented on the role of ICT in business innovation processes. All questions were incorporated together into the questionnaire designed with 57 statements in three blocks (information about company, usage of ICT and the role of ICT in business innovation). The questions could be answered by following possibilities (5-full agree, 4-nearly agree, 3-I do not know, I cannot express, 2- nearly disagree, 1-completely disagree, 0: no answer)

The questionnaire was first distributed as a pilot research in the first half of 2009, among the participants of the Systems Integration 2009 conference, the most significant IT conference in the Czech Republic. The second main round of the research (Zima, 2009) was carried out among the Czech companies regardless of business branches, size, region etc. Twenty companies were asked directly and 4 500 companies were asked by email. The rate of return was 1,25 % it is 48 filled questionnaires. The data source for the research represented 68 filled questionnaires.

The sample of analyzed companies is good representative of the proportion of the whole economy:

- small companies 47%,
- medium companies 31%,
- large 22%.

Based on the categories of innovation adoption the four categories of companies were set up as a basic dimension for further analysis. Respondents answered what is their attitude to receiving innovation in the following way:

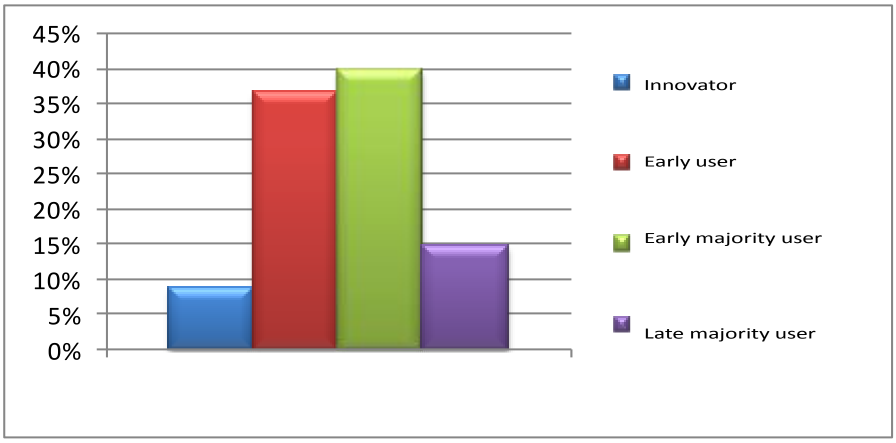

Figure 3: Attitude of enterprises to innovations

- 9 % Innovator,
- 37 % First User – company which receives innovations very early,
- 40 % First Majority User – company which receives innovations early,
- 15 % Late Majority User – company which receive innovations as a last one.

The area where companies get most effects is improving of work effectiveness and business processes. Most successful were companies in the category First Majority User. This is reason why the analysis was focused on the measure of ICT innovation influence within this group on other kind of innovation in individual innovation phases.

This question the ICT innovations most affect the process innovations where positive answers get over 70%, especially positive answer „included of innovation“ is nearly 80%.

One of the reset is that ICT innovation is included of process innovation, and the second biggest influence we found out in product innovation where positive answers get over 60 %. We can see growing trend of positive answers in each phases. In this case the ICT innovations create a support for product innovations.

The survey results show that late users of innovations are mainly from the industry (nearly 80%). The group of innovators is spread among all branches on the other hand. The next factor is visible from received data – the companies offering services applied technical trends and innovations often than companies in other branches.

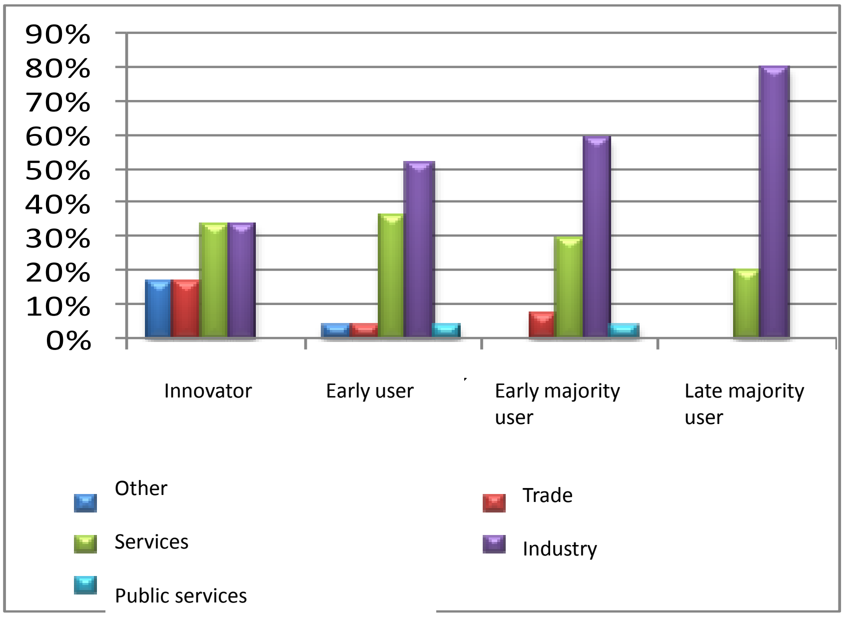

Figure 4: Innovation adoption in different industries

The survey identified that companies receiving technical news more than other are often in the stage of growth and merges (67% of innovators and 32%of early adopters). The reason could be the fact that companies playing the role of innovators and early adopters are more dynamic.

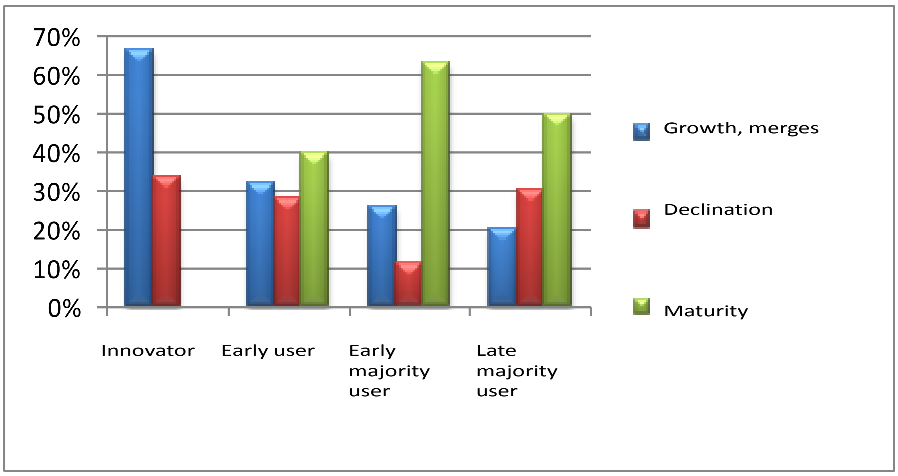

Figure 5: The stage in life cycle of different

The relation between innovation groups of companies and a stage of the market is also interesting. The group of innovators is most powerful in stage of growth (32% - it means more than any other group). This group of innovators is on the other hand strongly in the stage of declination. The stage of stability is more typical stage for the other groups.

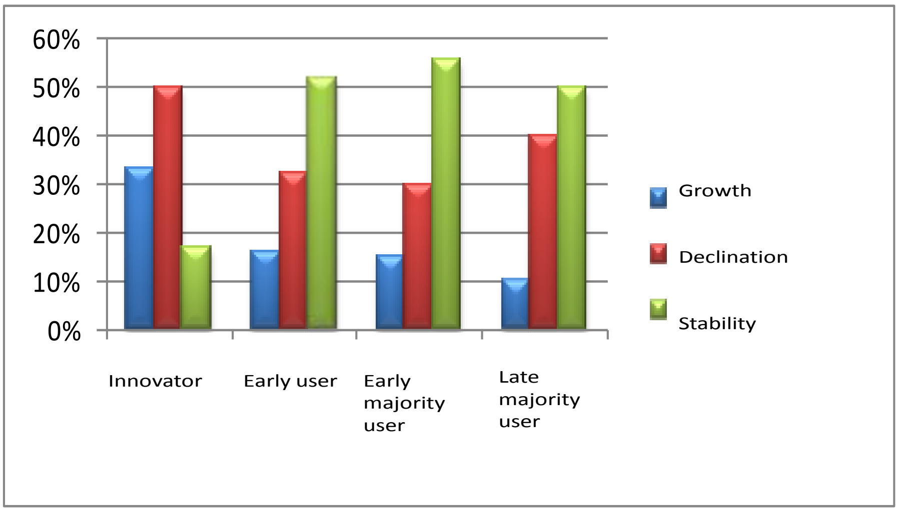

Figure 6: Stages of market

The following output is identification of the relationship between the frequency and time of adoption of innovation. The later user companies adopt the news the smaller market share has. The significant share of innovators (30%) has market abroad and it is more than any other groups.

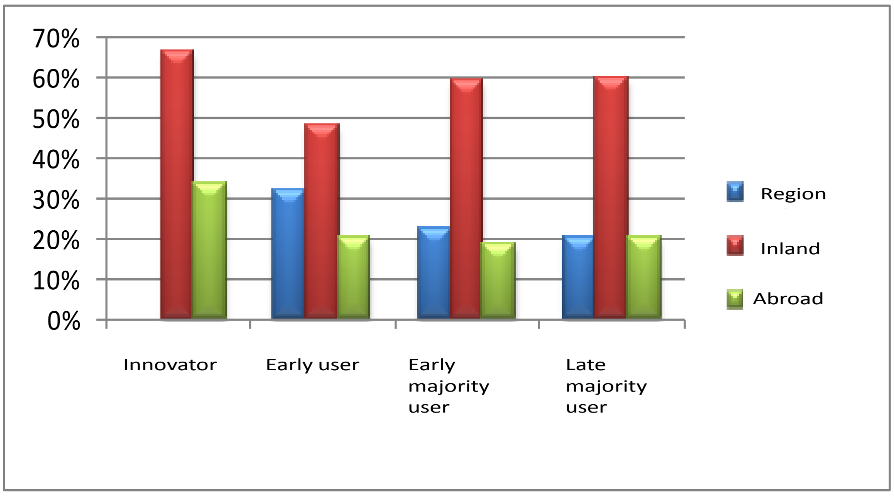

Figure 7: Destination of companies' product and services

The last surveyed aspect was an attitude to innovation according to a size of company. It seems that the larger companies adopt news and innovation later but only small percentage of them is in a group of late majority user. The smaller are more active in the process of innovation adoption.

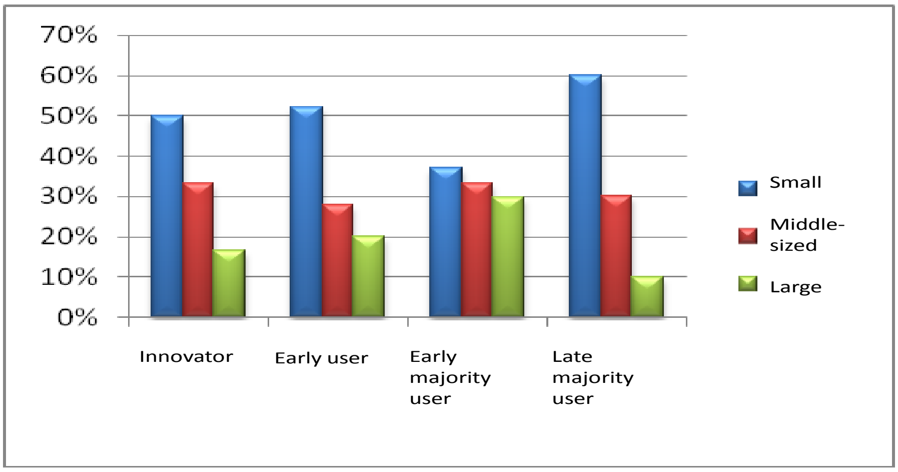

Figure 8: Division of innovators group according the company size

4. Conclusion

The survey helped to identify the main features of companies that are successful in innovation adoption in the Czech Republic. The most successful companies are those in a group of early adopters and partly early majority adopters. The innovators are more successful on market that is growing. The smaller companies are more successful and more flexible in innovation processes. The effect and benefit from innovation are the highest if adapted in proper time - not to early but not too late as well.

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THE IMPACTS OF SPECIFIC ICT SOLUTIONS ON PRODUCTIVITY

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Keywords

ICT, specific ICT solutions, productivity, efficiency, decision trees

Abstract

The purpose of this study is to illustrate the relationship between use of ICT and productivity in organization. Based on comprehensive study conducted by e-business watch initiative the link between adoption of ICT in organization and productivity will be shown. First, we are testing the strength of relationship between number of ICT solutions implemented in the company and performance of the company. Together, we try to identify those ICT solutions, which are perceived by organizations as essential in term of productivity increase. The identification is done through the decision trees.

1. Introduction

For the last two decades Information and Communication Technologies (ICT) penetrate every single area of organization. Find the organization which doesn't use any of these technologies is harder and harder. On the other hand recent financial crisis slows rapid growth of ICT as well as implementation of ICT within organizations. Firms now, in the time of great uncertainty, choose very carefully what ICT solution they should implement and they are not willing to experiment without some kind of assurance that such implementation increases their performance as well as their productivity. Therefore to support innovation through the ICT, the relationship between ICT and productivity should be determined. Although number of studies tries to identify the role of ICT on productivity improvement, most of them are dealing with this issue on macroeconomics level. This study wants to determine this relationship from the enterprise's point of view. It analyses how the organizations perceive impacts of ICT on productivity, based on the number and structure of ICT solutions they have already implemented. Study also tries to determine whether number of implemented ICT solutions or support of particular type of ICT solutions have significant influence on perceived impact of ICT on productivity of organization or not. Lastly study identifies the ICT solutions which are perceived by organization as significant for productivity improvement. These analyses determine whether organizations recognized role of specific ICT solutions as a driver towards higher productivity and use them as an aid kit for surviving the crisis.

2. Impact of Specific ICT Solutions on Productivity

Productivity of the company can be understood as a measure of how efficient can organization allocate their resource in order to create desired outputs. (Petterson, 2009) Impact of ICT on productivity of the organization was subject of study for many researchers. Some of them advocate that ICT has a positive influence on productivity (Oliner & Sichel, 2000; Baily & Lawrence, 2001) and that not only improve efficient use of labour and capital within the organization, but also force organizations to be more innovative.(United Nations Conference on Trade and Development [UNCTAD], 2009) Although nature of the innovation isn't generally identified, some evidence shows that ICT supports innovation in areas like patent development, product and process innovation and also raise value of intangible capital. (Van Reenen, Bloom, Draca, Kretschmer & Sadun, 2010) On the other hand it should be mentioned, that ICT supports productivity indirectly and the level of this support depends apart from ICT investment on complementary investment to labour skills, human capital, and organizational processes. (Brynjolfsson & Hitt, 2000; David, 1990; Greenwood & Jovanovic 1998; Malone & Rockart, 1991) On the other side of the barricade stands supporters of "information paradox" (Brynjolfsson, 1993; Wilson, 1993), which proclaim a very weak or no relationship between the use of ICT and the productivity. (Delina, 2008) However, according to Brynjolfsson & Yang (1996), absence of mentioned relationship could be caused by lag between the time of ICT investment and the time of productivity improvement. (Delina, 2008)

Although the research methods depends on available data and subject of interest, (UNCTAD, 2009) researchers usually use correlation analysis (Rooney, Hearn & Ninan, 2005) and Coob-Douglas production function, to identify impact of specific ICT solution on labour productivity. (UNCTAD, 2009) Specific ICT in Cobb-Douglas production function models are usually represented by binary variables (0,1) based on availability of particular solution in organization. (UNCTAD, 2009) Based upon the type of specific ICT solutions represented in the models research can be divided into three groups. First group is represented by the studies (Atrostic & Nguyen, 2005; Maliranta & Rouvinen, 2006) which under the label of specific ICT solutions examine impact of network solutions as Internet, Intranet, Local Area Networks (LAN), Electronic Data Interchange (EDI), Extranet, Wireless Internet (WLAN) on labour productivity. Second group of studies (Criscuolo & Waldron, 2003; Farooqui, 2005) measures how labour productivity is influenced by e-commerce. And last group represented by the work of Hagén & Zeed (2005) based on composite ICT index measure how number of ICT solutions influence labour productivity of organization. Despite the different understanding of specific ICT solutions and different measures of labour productivity across studies, all three groups in proves that specific ICT solutions (except solutions that enables receiving online orders) have positive impact on labour productivity of organization. (Overview of mentioned studies together with results can be found on UNCTAD, 2009) . Approach presented in this study is slightly different. Instead of use of cross-sectional or panel data, which do not have sufficient information about type of ICTs, that organizations implement, (UNCTAD, 2009) it use detailed questionnaire survey to create ICT profile of the organization. This profile is compared to evaluation questions, which measure organizational perception of ICT on productivity and overall organizational productivity progress. Aim is to find out, whether number of specific ICT solutions influence productivity. Next characteristic of presented approach is differentiation of specific ICT solutions based on the processes they support. Purpose of this act is to determine whether adoption of ICT that supports ordering and procurement influence productivity more, than sales and marketing supporting ICT. Last objective of this study is to determine, which ICT solution influences the productive at most. This type of analysis is conducted through the decision tree.

3. Methodology

The research is based upon the comprehensive survey conducted by organization called e-Business Watch. The aim of this survey was to study the impact of ICT and e-business on enterprises, industries and the economy in general. Although the study was conducted in 2006, it is probably most extensive study orientated on impact of ICT on organizations, till today. The survey covered about 14,000 enterprises of 10 sectors from 25 EU Member States and EEA and Candidate Countries. It contents data from 14,065 telephone interviews with decision-makers in enterprises from 29 countries. (The European e-Business Report, 2007)

Questionnaire is divided to 9 modules based on the area of interest, although only 5 modules are important for purpose of this study. Three of them help identify which ICT solutions are being implemented in a particular organization. From these modules 25 yes or no questions were identified, which cover issues such as internal and external e-collaboration, online sourcing and procurement and also online marketing and sales. Other two modules on the other hand deal mainly with evaluation or economic impact. One of the measures the impact of ICT on some performance indicators and the other illustrates the change of these indicators over the one year period. One of the measured performance indicator is productivity. Therefore were from these modules selected two questions, which help find link between implemented ICT and productivity. First one H4g is focusing on perceived impact of ICT on company's productivity. Based on perception of decision makers, this question is trying to defines whether the impact of ICT on productivity is negative, none or positive. The question clearly illustrates how organizations perceive ICT in term of productivity. On the other hand, second question U16 examines, whether the productivity of organizations decreases, stays roughly still the same or increase, over the year. It helps to identify unique characteristics of organizations that productivity increased respectively decreased.

Because in some cases, the mentioned questions weren't answered or answer was "Don't know'', the original sample was restricted to 9 006 cases. Distribution of the sample according to size and industry is presented below (table 1):

Industry	**Size** (number of employees)				**Total**
	1-9	**10-49**	**50-249**	**250+**	
Food and beverages	436	377	309	86	1208
Footwear	302	230	155	29	716
Pulp and Paper	319	297	182	67	865
ICT Manufacturing	519	363	240	64	1186
Consumer electronics	298	125	48	13	484
Shipbuilding and repair	7	51	35	9	102
Construction	603	565	437	115	1720
Tourism	668	563	376	112	1719
Telecommunications	581	270	106	49	1006
Total	3733	2841	1888	544	9006

Table 1 Distribution of sample

4. Tested Hypothesis

In order to examine the impact of specific ICT solutions on productivity, these hypotheses were formulated:

- **Hypothesis 1:** There is a strong relationship between adoption of ICT in enterprises and productivity.
- **Hypothesis 2:** There is a strong relationship between adoption of procurement supporting ICT in enterprises and productivity.
- **Hypothesis 3:** There is a strong relationship between adoption of sale supporting ICT in enterprises and productivity.
- **Hypothesis 4:** Adoption of particular ICT in enterprises has a positive influence on perceived impact of ICT on productivity.
- **Hypothesis 5:** Adoption of particular ICT in enterprises has a positive influence on change in productivity.

4.1. Testing Hypothesis 1, 2, 3

Measuring the adoption of ICT in organization is a very complex problem. Based upon the idea, that the quantity of various ICT solutions used to do business can be a degree of how well is the ICT adapted across the organization, we decided to measure the adoption of ICT in enterprise by number of ICT solutions that are implemented by enterprise. Based upon that, three aggregate indexes were created (table 2):

1. **The General ICT Index:** Index specified how many ICT solutions are implemented across the enterprise. Index covers all ICT solutions that support internal and external e-collaboration, on line sourcing and procurement, online marketing and sales. Every solution that is accommodate by organization increase index by one point. Therefore General ICT Index gets from 0 to 19. Used to test hypothesis 1.
2. **Procurement ICT Index:** Index specified how many procurement supporting ICT solutions are implemented across the enterprise. It is specialized on ICT solution which support ordering and procurement. Every implemented solution increase index by one point. It gets from 0 to 7. Used to test hypothesis 2.
3. **Sales ICT Index:** Index specified how many sales supporting ICT solutions are implemented across the enterprise. This particular index is specialized on ICT which support sales and marketing. One of these solutions implemented in organization, raise the value of index by one point. Used to test hypothesis 3.

<table>
<tr><th colspan="2">Indexes</th><th>Transcriptions of questions in questionnaire</th><th>Answers</th></tr>
<tr><td rowspan="4">General ICT index</td><td rowspan="4">Procurement ICT index</td><td>D5h: Use of online technologies OTHER THAN e-MAIL - to receive e-invoices from suppliers?</td><td>1YES/2NO</td></tr>
<tr><td>E1: Does your company use the Internet or other computer-mediated networks to place orders for goods or services online?</td><td>1YES/2NO</td></tr>
<tr><td>E8a: Do you use IT solutions for - Finding suppliers in the market?</td><td>1YES/2NO</td></tr>
<tr><td>E8b: Do you use IT solutions for - Inviting suppliers to quote prices or</td><td>1YES/2NO</td></tr>
</table>

		submit proposals?	
		E8c: Do you use IT solutions for - Ordering goods or services?	1YES/2NO
		E8d: Do you use IT solutions for - Running online auctions?	1YES/2NO
		F13a: Is your company's ICT system linked to the ICT system of suppliers?	1YES/2NO
	Sales ICT index	D1f: Do you use for managing information in the company an SCM system that is a Supply Chain Management System?	1YES/2NO
		D5c: Use of online technologies OTHER THAN e-MAIL - to collaborate with business partners to forecast product or service demand	1YES/2NO
		F1: Does your company have its own website on the Internet?	1YES/2NO
		F2: Does your company use a CRM system that is a specific software suite for customer relationship management?	1YES/2NO
		F4: Does your company allow customers to order goods or book services online from the website or through other computer-mediated networks?	1YES/2NO
		F11a: Does your company use IT solutions for publishing offers to customers?	1YES/2NO
		F11b: Does your company use IT solutions for publishing offers to answering calls for proposals or tenders?	1YES/2NO
		F11c: Does your company use IT solutions for launching sales auctions, like on B2B or B2C marketplaces?	1YES/2NO
		F11d: Does your company use IT solutions for receiving orders from customers?	1YES/2NO
		F11e: Does your company use IT solutions for enabling customers to pay online for ordered products or services?	1YES/2NO
		F13b: Is your company's ICT system linked to the ICT system of customers?	1YES/2NO
		D1b: Do you use for managing information in the company - Knowledge Management software?	1YES/2NO
		D1d: Do you use for managing information in the company an ERP system that is Enterprise Resource Planning System?	1YES/2NO
		D5a: Use of online technologies OTHER THAN e-MAIL - to share documents between colleagues or to perform collaborative work in an online environment	1YES/2NO
		D5b: Use of online technologies OTHER THAN e-MAIL - to track working hours and production time?	1YES/2NO
		D5e: Use of online technologies OTHER THAN e-MAIL - to manage capacity or inventories?	1YES/2NO
		F12d: Do you use functionalities offered via the ICT system of a supplier or customer either for sourcing, procurement or sales related	1YES/2NO

		processes?	
		F12e: Do you use functionalities offered on e-marketplaces or trading networks either for sourcing, procurement or sales related processes?	1YES/2NO
Evaluation questions		H4g: What kind of influence did ICT have on - the productivity of your company?	1NEGATIVE 2NONE 3POSITIVE
		U16: Has the productivity of your company increased, decreased or stayed roughly the same when comparing the last financial year with the year before?	1DECREASED 2STAYED THE SAME 3INCREASED

Table 2 Structure of indexes, adapted from: E-business w@tch. (2006)

To accept one of the hypotheses, the strength of relationship between indexes and productivity should be examined. Productivity can be measure by perceived impact of ICT of productivity or by change of productivity over the year. To measure strength of relationship the Kendall tau –c are used. To accept the hypothesis 1, 2, 3 the values of particular indexes should be lower than -0.5 or higher than 0.5. (Muth, 2006) Values of correlation index are presented in table 3.

Questions	**Indexes**		
	Procurement ICT Index	**Sales ICT Index**	**General ICT Index**
H4g: What kind of influence did ICT have on - the productivity of your company?	0,216	0,253	0,307
U16: Has the productivity of your company decreased, stayed roughly the same or increased, when comparing the last financial year with the year before?	0,139	0,171	0,202
Tested hypotheses	Hypothesis1 Not confirmed	Hypothesis2 Not confirmed	Hypothesis3 Not confirmed

Table 3 Results of correlation analyses

Based on the values from Kendall's tau-c correlation indexes, all three hypotheses were not confirmed, therefore the strong relationship between adoption of ICT and productivity wasn't confirmed either.

4.2. Testing Hypothesis 4, 5:

In order to find out which ICT solutions influence perceived impact of ICT on productivity or on the other hand cause change in productivity, the question H4g and U16 were examined. It was done by the decision tree analyses. Trees were constructed from previously mentioned questions, indexes and also from factors such as size and country.

5. Research Conclusions

5.1. Analysis of Perceived Impact of ICT on Productivity

To analyze the organizational perception of ICT in term of productivity, question H4g was examined.(Picture 1) In general, the impact of ICT on productivity is perceived as positive by 56.63% of organization on the over 40% of organizations thinks that ICT doesn't influence productivity. Based upon decision tree, it can be seen that number of sales supporting ICT implemented in organization and represented by Sales ICT Index, play a significant role in the perception of ICT in term of productivity. Over 70% of organizations with two and more sale supporting ICT solutions thinks that ICT has positive impact on productivity (node 127). It can be also seen that the percentage of organizations, which recognized positive influence of ICT, increases based upon the ICT solution that have implemented. For example early 85% of organizations which enable customers to pay on line and have at least one more sales supporting ICT (node 234) perceive positive impact of ICT on productivity. Percentage of organizations decrease to 78%, if organization doesn't allow customers to pay on line, but enables to share documents between colleagues or enables to perform collaborative work in an online environment.(node 233) Base upon this, the tree illustrates the hierarchy of ICT solutions, which from perception of organizations, have a positive impact on productivity.

On the other hand left side of the tree illustrates that more than a half of the organizations with no or at most one sale supporting ICT doesn't recognize any influence of ICT on productivity. (node 1) However it can be seen, that if the one mentioned sale supporting ICT solution enable use of functionalities offered via ICT system of a supplier or customer, then the positive impact of ICT on production is recognize by 80% of organizations. Therefore can be said that 80% of organizations which have access to ICT solutions of suppliers or customers, recognized positive impact of ICT on productivity. (node 126) Left side of the tree also represents, that in organizations with at most only one sale supporting ICT and with no aces to ICT of suppliers and customer increase, the positive impact of ICT on productivity increases through the procurement supporting ICT solutions.

5.2. Analysis of Factors Influencing Change in Productivity

To analyze factors which influence changes in productivity over the year, the question u16 was analyzed. (Picture 2) Top of the decision three outlines the distribution of the organizations. It can be seen that the 51% of surveyed companies recorded increase in productivity over the year. On the other hand, for more than 40% of companies productivity stayed the same (node 0). It can be also seen that 65% of organizations recorded increase of productivity, if they have ICT solutions, whose enable internal sharing of documents between colleagues or collaborative working in online environment (node 58). Similarly, 68% of organizations with accommodated sales auctions record increase of productivity (node 57). Therefore the ICT solutions, which support sales auctions or enable internal collaboration in online environment, should be implemented in order to increase performance of organization.

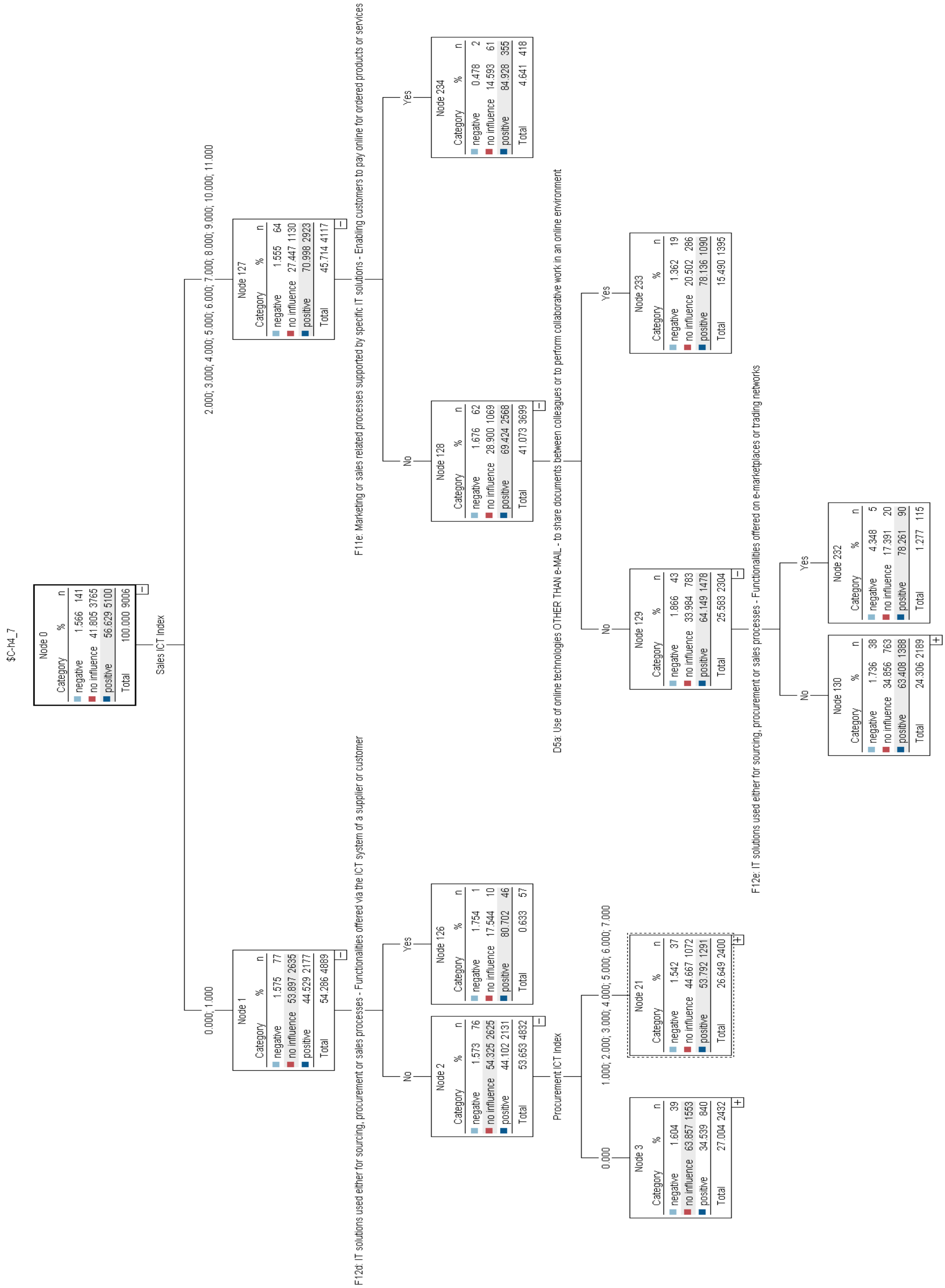

Figure 1 Decision tree illustrating perceived impact of ICT on productivity

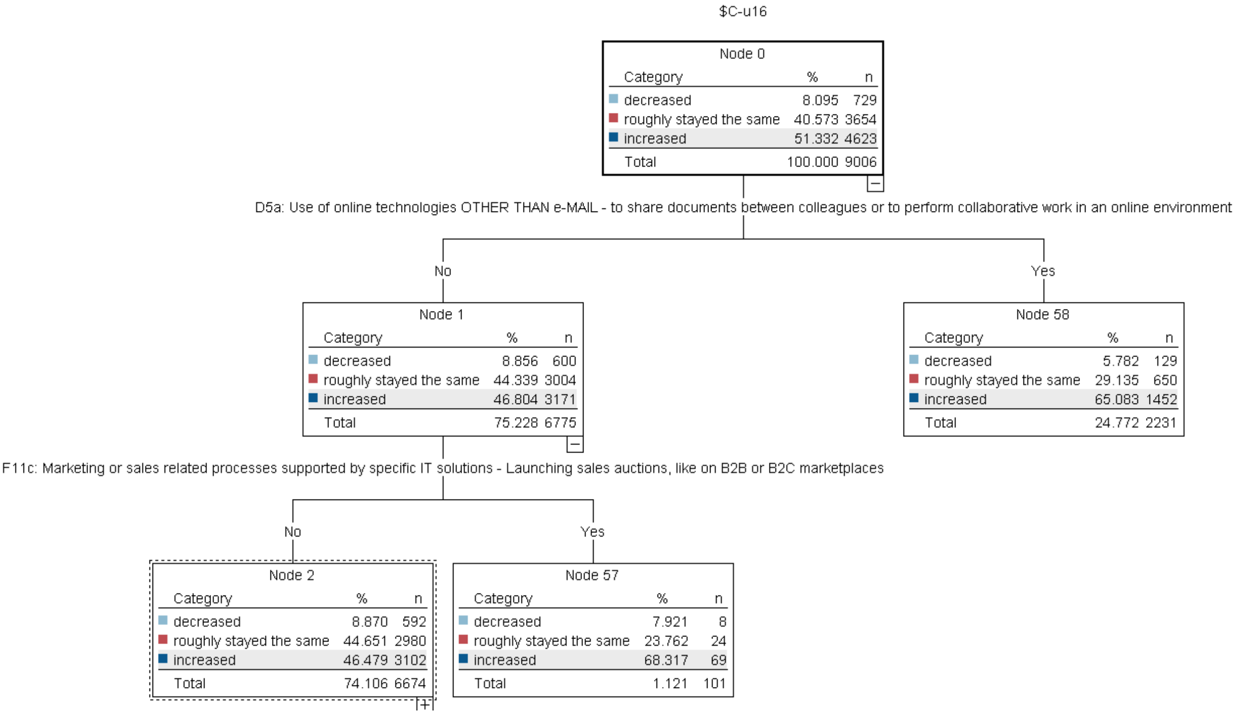

Figure 2 Decision tree illustrating factors influencing change in productivity

6. Conclusion

Presented study tries to examine role, that specific ICT solutions plays in productivity improvement of organization. By examining adoption of ICT in more than 9000 enterprises, it tries to determine potential of ICT in term of productivity. Based on the conducted correlation analysis, it can be seen, that adoption of ICT in general, represented by number of different ICT solutions, doesn’t significantly influence organizational perception of ICT in term of productivity, as well, as in term of productivity changes. Slightly different results came from the Sales ICT index, which represents all sales and marketing supporting specific ICT solutions. Although correlation analysis doesn’t confirm relationship between mentioned solutions and productivity, decision tree does. It shows, that more than two third of organizations with more than two sales supported solutions, recognize impact of ICT on productivity within their organizations. Weakest results in term of performance improvement are presented by order and procurement supporting ICT solutions. The fact, that correlation coefficient of ICT procurement Index is the lowest, as well, as position of ICT procurement Index in decision tree implicate, that organizations do not recognize impact of order and procurement ICT solutions on productivity improvement. On the other hand specific ICT solutions, which enable internal sharing of documents between colleagues or collaborative working in online environment, are according to analyses drivers of productivity improvement.

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ENTERPRISE ARCHITECTURE BASED INNOVATIONS: COMPETENCIES PERSPECTIVE

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Keywords

Enterprise architecture (EA), eEnterprise architect competencies, university EA education

Abstract

Enterprise Architecture concept per se may be seen as innovation in enterprise which may be labeled as process and organizational innovation. In order for enterprise architecture activities are successful, the enterprise architect should exhibit certain competencies. They may be partially built either at universities or at professional trainings. The main aim of this paper is to present an original analytical methodology for investigation of university's contribution towards enterprise architect's competencies building. Application of this methodology for analysis of curricula of the Faculty of Informatics and Statistics, University of Economics Prague is presented as case study. Target of future research is presented in paper conclusion.

This paper describes the outcome of a research that has been accomplished as a part of research program funded by Grant Agency of Czech Republic grant No. P403-10-0303.

1. Introduction

IT use and innovation in organization should be in accord with organizations business strategy. From our point of view the suitable means could be enterprise architecture, which may be seen as an extension of Henderson's and Venkatraman's models of strategic alignment and which may provide consistency between business and IT both on strategic as well as on tactical management level. This our assumption is supported also by analysis of Langenberg and Wegman (2004) and Schöenherr (2008), which document increasing interest in EA not only in government organizations abut also in business and academia. In (Kamogawa & Okada, 2009) it is stressed that in the same time the EA implementation may increase the enterprise efficiency. Infosys surveys (Aziz & Obitz, 2007) have also shown that the EA concept is not only mature enough for adoption in enterprises but also significantly support the enterprise strategy reactions to business environment changes (Obitz & Babu, 2009).

Although there is no universally accepted definition of EA, we present Gartner's definition (Rollings, 2010) *"Enterprise architecture is the process of translating business vision and strategy into effective enterprise change by creating, communicating and improving the key principles and models that describe the enterprise's future state and enable its evolution."*

EA concept per se may be seen as innovation in enterprise which, according to OECD classification (OECD/Eurostat, 2005) may be labeled as process and organizational innovation. Both innovations are directed towards enterprise strategic management, especially towards enterprise and IT governance, as well as towards management – both tactical business management and IT management.

In case of orientation towards EA it is, according to our point of view, necessary that enterprise and IT organizational structure fulfill the architecture requirements. It should than include the positions of architects and their teams, while their role is strengthened. This situation may be illustrated by following possible future enterprise scenario. In case the concept of IT services, represented by Cloud computing, SaaS, IaaS etc., will prove to be viable, the situation may arise when the enterprise IT will be represented by IS architect and his team, which will provide services purchase and continuity of their use. Enterprise architect and his team would then guarantee that the "fully" outsourced IT would be aligned with business on strategic as well as on tactical management levels.

Architectural team structure and its break-up are dependent on enterprise organization and management method. At federal US ministry Strano and Rehmani (2007) located up to 5 levels of architectural teams, all with enterprise architect.

Organization structure innovation is not enough. For architectural position it is necessary that they are taken by employees with proper competencies. Enterprise architect is described by Bredemeyer and Malan (2004) as strategist, expert, leader and politician. Employees' education with this extent of competencies is long- term process, which should be started already at universities.

Analysis of how university fulfils this requirement is an aim of this paper. Conclusions presented are based on university curricula analysis and are oriented towards above mentioned enterprise architect competencies.

2. Enterprise Architect's Competencies

Enterprise architect's position may be taken only by people with proper competencies. These competencies include both knowledge and skills. They may be divided into two basic subsets i.e. personal competencies and professional competencies.

Knowledge is specified in Merriam Webster Online Dictionary (knowledge, 2010) as "*2 a (1) : the fact or condition of knowing something with familiarity gained through experience or association (2) : acquaintance with or understanding of a science, art, or technique b (1) : the fact or condition of being aware of something (2) : the range of one's information or understanding <answered to the best of my knowledge> c : the circumstance or condition of apprehending truth or fact through reasoning : cognition d : the fact or condition of having information or of being learned <a person of unusual knowledge>*"

While skill is specified in Merriam Webster Online Dictionary (skill, 2010) as "*2 a: the ability to use one's knowledge effectively and readily in execution or performance b: dexterity or coordination especially in the execution of learned physical tasks 3: a learned power of doing something competently: a developed aptitude or ability <language skills>*"

Enterprise Architect's competencies are specified in number of sources.

Strano (Strano & Rehmani, 2007) presents competencies based on interviews with number of experienced enterprise architects, mostly from governmental organizations. The most needed competencies are the following *"analytical, change management, communication, interpersonal, leadership, management, modeling and problem solving skills as well as business acumen* *(including managerial experience with preparing business cases or understanding what the enterprise was trying to accomplish within particular context) and technical acumen (acquired through a broad knowledge of technical disciplines such as telecommunications, security, database design, computers, management information systems and IT program management)"*.

Bredemeyer in (Bredemeyer & Malan, 2004) presents enterprise architect's competencies in four domains i.e. expert, strategist, politician, and leader. We choose Bredemeyer classification, augmented by quantification of level, as the basis of our analysis in section 4.

TOGAF presents enterprise architect's (denoted as "IT Architecture Manager") competencies in Architecture Skills Framework" which is not only the most detailed but also includes quantification of knowledge or proficiency into 4 levels in any of the following areas of competency: *"Generic skills, Business skills and Methods, Enterprise architecture skills, Program or Project Management skills, IT General knowledge skills, Technical IT skills and Legal Environment"* (The Open Group Architecture Forum, 2009).

Enterprise Architects–to be may acquire some of required competencies in universities, as well as other IT professions (Doucek, 2009), or in professional trainings.

The main differences between this education at various Universities are the following:

- number of courses with content oriented towards enterprise architect competencies,
- level of competency coverage (see below) by individual courses,
- level of courses connection/integration i.e. whether the courses are isolated, generally oriented or specifically oriented towards enterprise architecture, or integrated, perhaps into integrated study (or degree) program

Professional organizations are the second source of enterprise architects education/training, which is typically more practically oriented, i.e. towards skills, than university education. These courses are typically more specific, often narrow and in some cases are concluded by (professional) certification exam.

3. Methodology

3.1. Methodology

In this section our original methodology for research of how universities react on the (industry) requirements for enterprise architects competencies is presented. Quantitative analysis is used.

Competencies formulated by Bredemeyer, and summarized in table 1, are selected as criteria of analysis of courses offered by given University. Capabilities which may be acquired by enterprise architect only by experiences in concrete enterprise are excluded. These are the following:

- Past experience in the domain to quickly integrate key principles and identify issues
- Political process in the organization
- Hidden agendas exist that could derail the architecture; seek to discover them

Enterprise Architect as	Skill ID	Description
Expert	E1	Deep knowledge in some area of the business and/or technology of the business; broad knowledge in other areas of the business
	E2	Experience creating more than one architecture in a complex organizational and technical petting
	E3	Broad experience; can see from multiple perspectives, having worked in various roles on multiple projects
	E4	Good understanding of the products or services of the enterprise as well as the capabilities on which the business depends
Strategist	S1	The competitive landscape of the whole business, including: Industry structure; Market segments and respective users' needs and values; The competition, and their products, strategies, and processes; insight into where competitors are headed; The supply chain and value proposition of different players
	S2	Company's capabilities and weaknesses
	S3	Business strategy and its rationale
Politician	P1	Model of the organizational networks of influence across the business
	P2	Who the key players are and what they care about, personally and with respect to the business
	P3	Organization's culture and core values; sense what it takes to align projects and groups despite their differences
	P4	Where power is focused and how it flows in the organization (e.g., who really makes what decisions)
Leader	L1	Know yourself and what you care to achieve
	L2	Understand the need to align people with the vision, by making it personally compelling to them

Table 1: Criteria List

Methodology comprises the following 4 steps:

Step 1: Syllabi of courses presented by university in public catalogue are analyzed. For every course the following basic information is founded - out:

- Title
- Daily attendance (hours of lectures per week [L] / hours of seminars per week [S])
- Number of credits (One ECTS credit corresponds to 26 hours of workload for an average student)
- Level of course (Bachelor, Master/Master Continuing, Doctoral)

Step 2: For every course the course description presented in "Course Contents and Learning outcomes and competences" is evaluated by above specified criteria. Individual criteria content is extended by keywords and synonyms presented by (de Jonge, 2010) in the list of methods, models and management theories. Actual evaluation is executed as comparison of course description with these keywords and synonyms.

Extent of given criteria topic coverage by given course is evaluated by one of six possible levels (level 0 up to level 5), denoted further as "score", specified below

- 0: given criteria topic is not covered by the course at all
- 1: less than 20% of course extent is devoted towards coverage of given criteria topic
- 2: less than 40% of course extent (but more than 20%) is devoted towards coverage of given criteria topic
- 3: less than 60% of course extent (but more than 40%) is devoted towards coverage of given criteria topic
- 4: less than 80% of course extent (but more than 60%) is devoted towards coverage of given criteria topic
- 5: less than 100% of course extent (but more than 80%) is devoted towards coverage of given criteria topic

Lectures (L) and seminars (S) are evaluated separately.

The sample data for two courses are presented in table 2

Course	Level of Course	Number of credits	Daily attendance	Expert								Strategist						Politician								Leader			
				E1		E2		E3		E4		S1		S2		S3		P1		P2		P3		P4		L1		L2	
				L	S	L	S	L	S	L	S	L	S	L	S	L	S	L	S	L	S	L	S	L	S	L	S	L	S
Theory of Games and Economic Decisions	M	6	2/2	2	1	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Innovation of Information Systems	M	6	2/2	1	1	1	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2: Course sample data

Where L and S are the respective scores of lectures and seminars.

Step 3: For the purpose of quantitative comparison the values from table 2 are transformed into number of teaching hours (HL, resp. HS) devoted theoretically (L) and practically (S) to given criteria (in given course):

- $H_L=N_h$ * Daily attendance$_L$*Score$_L$/5, where N_h = 13 weeks)
- $H_s=N_h$ * Daily attendance$_S$*Score$_S$/5, where N_h = 13 weeks)

Step 4: Further, for the purpose of quantitative comparison, the values from table 2 are transformed into study load E (in ECTS credits) devoted to given criteria (in given course):

- E = (1/5)*Number of Credits*(Score$_L$+Score$_S$)/2)

Steps 3 and 4 are illustrated in table 3, where

- HL = number of hours devoted to lectures on given criteria
- HS = number of hours devoted to seminars on given criteria
- E = number of ECTS credits devoted to course (lectures and seminars) for given criteria content

Course	Expert												Strategist								
	E1			E2			E3			E4			S1			S2			S3		
	HL	HS	E	HL	HS	E	HL	HS	E	HL	HS	E	HL	HS	E	HL	HS	E	HL	HS	E
Theory of Games and Economic Decisions	10.4	5.2	1.8	0	0	0	0	0	0	0	0	0	0	5.2	1.8	0	0	0	0	0	0
Innovation of Information Systems	5.2	5.2	1.2	5.2	0	0.6	0	0	0	5.2	5.2	1.2	0	0	0	5.2	0	0.6	0	0	0

Table 3: Sample data – steps 3 and 4

3.2. Results and Discussion

The methodology was verified on courses offered by University of Economics Prague, Faculty of Informatics and Statistics, to undergraduate (B), graduate (M) and Ph.D. (D) students. Public courses catalogue (http://isis.vse.cz/katalog/) is the source of list of courses and their syllabuses. 62 courses, i.e. 27.6% of total of 224 courses offered by faculty, satisfied the criteria. Number of courses devoted to education in individual criteria is presented in table 4. These are autonomous (i.e. not integrated) courses without specific orientation towards enterprise architecture. The reason being there is no enterprise architecture program or degree accredited at the university.

Faculty	**Level of Course**	**Expert**				**Strategist**			**Politician**				**Leader**	
		E1	**E2**	**E3**	**E4**	**S1**	**S2**	**S3**	**P1**	**P2**	**P3**	**P4**	**L1**	**L2**
Informatics and Statistics	B	5	5	0	0	8	0	1	1	0	0	0	2	2
	M	10	14	1	1	7	5	4	6	2	1	4	2	4
	D	2	7	2	0	1	2	1	1	0	0	0	0	0
	Total	**17**	**26**	**3**	**1**	**16**	**7**	**6**	**8**	**2**	**1**	**4**	**4**	**6**

Table 4: Number of courses oriented towards individual criteria

Score	Expert								Strategist						Politician								Leader			
	E1		E2		E3		E4		S1		S2		S3		P1		P2		P3		P4		L1		L2	
	L	S	L	S	L	S	L	S	L	S	L	S	L	S	L	S	L	S	L	S	L	S	L	S	L	S
0	45	52	37	48	59	61	61	61	47	54	55	61	56	61	53	60	60	62	61	62	58	60	58	58	58	58
1	12	10	14	9	2	1	1	1	7	7	6	1	5	1	8	2	2		1		4	2	2	2	3	3
2	5		5	3	1				8	1	1		1										2	2	1	1
3			6	2											1											
4																										
5																										

Table 5: Courses score for individual criteria (Faculty: Informatics and Statistic, 62 Courses)

ECTS	E1	E2	E3	E4	S1	S2	S3	P1	P2	P3	P4	L1	L2
0	45	36	59	61	46	55	56	53	60	61	58	58	56
(0,1>	6	10	3	0	8	5	4	8	2	1	3	0	5
(1,2>	11	13	0	1	7	2	2	0	0	0	1	3	0
(2,4.5)	0	4	0	0	1	0	0	1	0	0	0	1	1

Table 6: E-score (number of courses; Faculty: Informatics and Statistic)

As seen from table 4 the following criteria are covered by most courses: E1, E2, S1, and P1. As seen from table 5 criteria E2, S1, P1 are covered by courses with big score, i.e. “most deeply“. This is in accord with table 6 where faculty offers 4 courses for E2 with E >2, 1 course for S1 with E>2, 1 course for P1 with E >2. But also 1 course for L1 and 1 course for L2 are offered with E >2. Faculty courses provide therefore only partial knowledge base for enterprise architect’s profession.

4. Conclusion

Enterprise architect’s competencies, as was shown above, include both knowledge and skills. While knowledge may be acquired by education, e.g. at University, skills may be only acquired by praxis. University education may be, as was shown in section 3, an instrument for acquiring a subset of enterprise architect’s knowledge. Skills may be, in limited scope, acquired by professional training, in full scope by praxis on enterprise architect job. The second case is an example of “learning on the job” (Bredemeyer & Malan, 2004, p 17).

Also for enterprise architect, as well as for number of other professions, continuous lifetime learning is required, especially for two following reasons:

- Scope of enterprise architecture, as a discipline, has been continuously expanding. From initial orientation towards IT technology only towards orientation towards business and its support by IT (Bredemeyer & Malan, 2004, p 9).
- Content and orientation of various disciplines, which are part of enterprise architecting (e.g. frameworks), are also developing in time.

Our presented methodology may be a useful instrument for evaluation and comparison of curricula of various universities from the point of view of fulfilling enterprise architect's expected competencies. The broader analysis including statistical processing, more faculties and more universities is seen as target for future research.

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USEFUL DIMENSIONS OF DATABASE SYSTEMS IN TIMES OF CRISIS WITH SUPPORT SIMULATIONS

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Keywords

Database systems, information, innovations, competitive advantage, simulation, Petri Nets

Abstract

This article focuses on useful dimensions of database systems with suitable links to operating systems and tools from CRM and Business Intelligence areas with support simulations. These systems and tools have an intelligent potential for many companies and individuals. Given potential is interesting in a time of crisis. A time of crisis is complicated and information technology helps with answers to urgent questions from managers, professionals, and analysts from various disciplines. They run a wide range of information systems. A majority of information systems use database systems as a base for organizing stored data and for further searching through defined queries. Database systems have an important role in area access to information and bring new quality applications. Stored data can lead to subsequent analyses and reporting, or optimal contacts with customers. Accessible methods are useful for optimal decision-making and searching for competitive advantages. Knowledge of the available benefits and clarification of the alternatives requires an acceptable analysis of offered database system possibilities and next their dimensions. A good example is periodic and regular analysis with the support simulation of Petri Nets and a multidimensional view.

1. Introduction

Modern information societies are very dynamic and competitive. These aspects build a hard and uncompromising influence on all firms and individuals. Any important place in this environment has innovations. *Innovation is the implementation of new ideas into practical applications, which bring new quality*. (Kebo, 2006). Their optimal implementation requires correct knowledge, ability, skills, and needed sources. Knowledge or information alone is not enough. Knowledge and information must be implemented into practice. Only this brings new values and leads to greater competitiveness. The contributions of new ideas in the form of practical resolutions of innovations are more important in times of crisis; firms and individuals seek new opportunities, new sales, markets, and new clients. Information technology has an optimal place in this situation. Everybody has some sort of experience in using computers, laptops, or notebooks. Everyday, processes are initiated in finding new information. These processes traditionally use a given database system. Of course, these database systems must be executed in an optimal environment of an operating system.

The next link leads to useful tools from the Customer Relationship Management (CRM) or Business Intelligence (BI).

Optimal application of database systems needs effective knowledge about the software, relevant components, and functions. The correct implementation of all software products requires access to new versions of products, documentation, and to global communication. Interactive communication is important for correct understanding of new information and the transfer of this information into skills and knowledge. Hidden knowledge is valueless. *Technology can help unlock knowledge.* (Know how, Managing knowledge for competitive advantage 2005) Database systems avails needed dimensions, tools, and sources for unblocking the true value of knowledge to all users. The key is the search for new possibilities on the basis of interactive communication with the inclusion of simulation by Petri Nets. The clear description by simulations contributes to the wider use of traditional database systems in small and midsize organizations with all the advantages. These advantages help to break down barriers in the area of data processing with data analysis.

2. Dimensions of Database Systems and Innovations

Database systems offer a wide variety of products with useful level adaptability and optimization. Users can select easy resolution that does not provide such ability as analysis tools in the area of BI. *Modern tools of BI serve for the businessperson is to analyze data without the help of experts on information technology and reports from the IT department.* (Business Intelligence, 2008) BI products offer a next dimension of database systems. This dimension is one form of active use of a database system in the majority of situations. Many users have doubts about implementation and database system operation. These doubts include the level of expert knowledge required, needed time, and financial sources. Such aspects and others are the aim of various studies and research as for example research on the theme "*Small and midsized firms are not doing everything they can to secure information*". (Exploration, Computerworld-Aktuality 2009)

For resolving given problems we can identify next inspirational approach in the area of managing customer relationship. Managing customer relationships has an important place in any company or organization. Every company needs loyal consumers and they are a valuable benefit. This is solved through positive care for clients. *Analysis of consumer experience is key for contact with a firm.* (Customer loyalty, intellect and emotion, THINK! 2008) Contact with the company is clearly defined with scalable and emotion metrics. A reason for integration of emotion metrics is experience and feeling services from the contact with vendors – contact is serious to offer maximum service and interest. The given theme is described in the IBM study "*Advocacy in the customer focused enterprise*", which is accessed on www.ibm.com.

Both mentioned approaches from BI and CRM area bring needed innovation to firms and organizations. For better use of selected database systems, it is optimal to understand innovations. There are a numbers views. What is useful is to know important types of innovation as a *new product*, *a new method, new sources of supply, usage of new markets, and new ways of organization* (Fagerberg, J., Mowery, D.C., Nelson, R.R., 2005). There are known relevant elements for correct implementation of innovation. These elements are strategy, skill, shared values, management style, staff, structure, and systems. They are defined as the *7-S framework to improve Competitive Intelligence* (Barnea, 2008). Each one of these elements is important and should not be neglected. Skill is oriented toward optimal usage; systems are oriented to run on information systems based on database system assistance. This database system must be in excellent condition. Correct use of database system needs the multidimensional view.

A good starting point is the optimal philosophy with access as *Multidimensional Development of Information System (MDIS)*. (Voříšek, 2002) It is centred on data decomposition and functioning with this data within global architecture. Finding the well-balanced dimensions of application for database system requires a wide view with all useful aspects. There are a number of models *that links IT resources and IT routines through IT capabilities to the creation of opportunities for new advantages*. (Cragg, P., Caldeira, M., Ward, J., 2006) Offered products and tools must be adapted for various users with different goals, preferences, and possibilities. Optimal clarification offered capabilities need a simulation reality on base useful dimensions of database systems as file systems, support control process, user environment, security operating and implementation hazards with necessary links to operating systems, CRM applications, and tools in the area of BI.

3. Challenges for Database Systems with Support Simulation

The challenges for database systems are how they can help: how to increase influence and adaptability for new resolutions. These questions are important for implementation, and further using of users. Data processing applies an easy and user-friendly interface for better control of saved data. The products consist of flexible and effective methods for managing information and designed applications with support of intuitive usage. Competitive advantage needs flexibility, agility, scalability, and visibility. These aspects are effectively solved by various levels of adaptability.

An optimal view describing the given reality is created through the model with elements of Petri Nets. The default structure of Petri Nets is defined as <P, T, I, O, H>, where P is final set of places, T is final set of transitions, I are input functions, O are output functions and H are inhibitory function. Marking the Petri Nets is the multi-set over set of places:

$$\sum_{p \in P} M(p)'p = M(p1)'p1 + M(p2)'p2 + \ldots + M(p|P|)'p|P|$$ (Kochaníčková, 2008)

Petri Nets are relevant tools for simulating realized activities with model systems such as network, operating, or database systems. Self-made models use basic elements of Petri Nets. These elements create places and transitions. Places are displayed in the form of circles, and transitions are depicted as rectangle. Places and transitions are linked with oriented arcs. Benefit is easily demonstrated by offered activities and their confrontation.

Design of operating and database systems profitably applies to the partition given systems in layers, such as user environment, security and protection, control processes, or file system. Each of the defined layers responsible for the well-defined area, and provide the necessary services. For example, there is a file system for manage needed data in files and with necessary elements as type file, structure file, and internal representation. Operating system offers several type files as standard file, directory, and special file. These file systems allow access to data with form access privileges like read, write, and execute. Standard privileges are allocated for the owner, group, and all. Advanced privileges are created with a sticky bit, and setUID (User IDentification) or setGID (Group IDentification). (Garfingel, S., Spafford, G., 1998) Structure standard file is created by table of contents with direct and indirect data blocks. I-node contains a table of contents, which are used for searching the data file on disk. I-node is an internal representation of the file with nine fields.

The database system has logical and physical structures. The physical database structures Oracle database compose datafiles, redo log files and control files. The data logical database structures (tables and indexes) are physically stored in datafiles of database. The logical storage structures include data blocks, extents and segments. Every object in the database system belongs to schema and has a unique name. A schema is a collection of database objects such as tables, indexes, views, and synonyms. These objects are structures which users create. Objects in the schema use storage in various tablespaces. A tablespace is a logical structure, consisting of one or more datafiles or tempfiles. (Oracle Database 2 Day DBA, 2008) Tablespaces usually group together the application objects for administrative activities. The model for simulating selected elements in an operating system is displayed in Fig. 1. The model for simulating in a database system is displayed in Fig. 2. OpenSolaris (as representative operating systems) and Oracle (as representative database system) products were selected for the simulation.

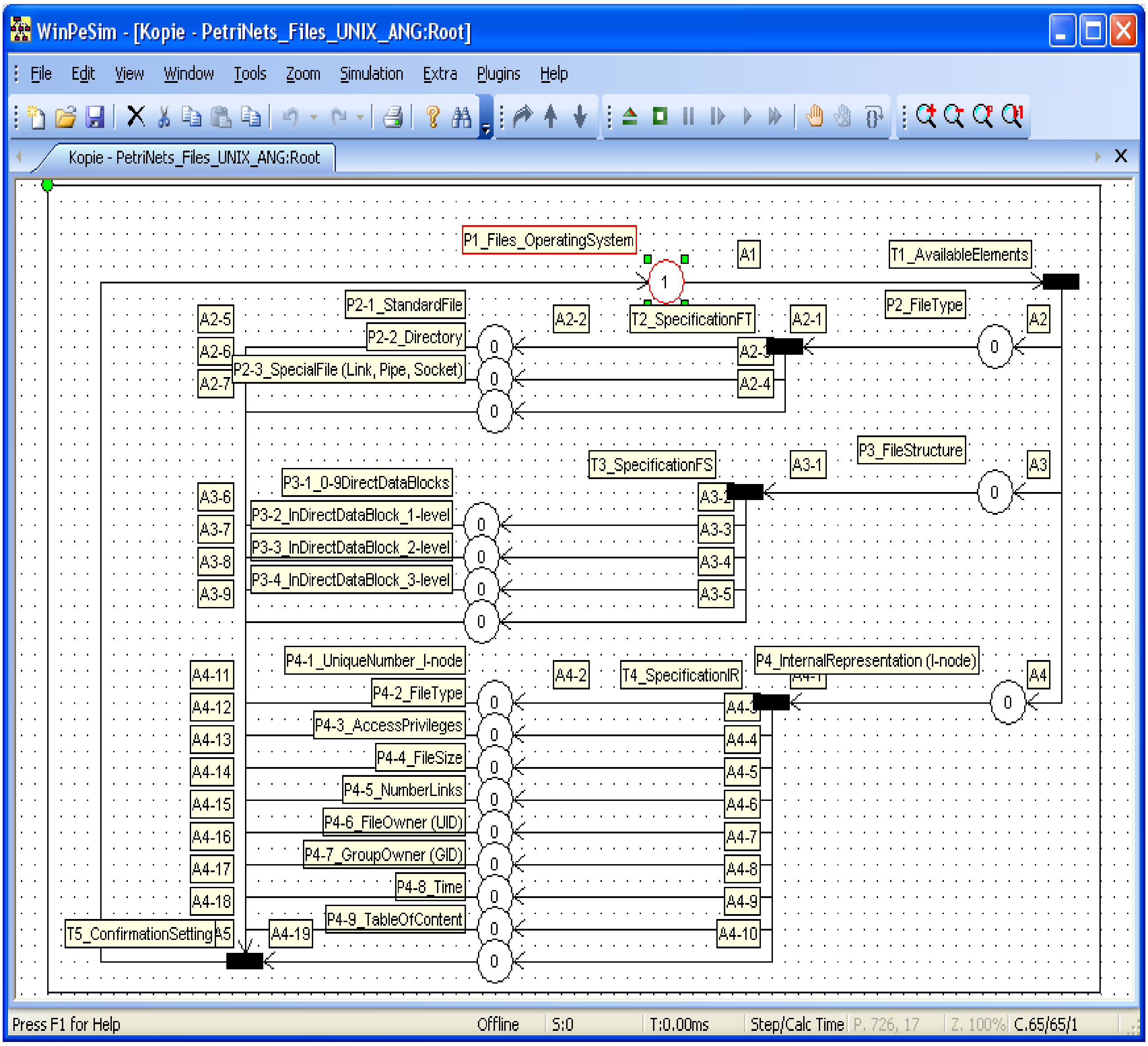

Figure 1: A model describing selected elements of file for an operating system

The starting point is place P1_Files_OperatingSystem for operating system, or P1_Files_ DatabaseSystem for database system. These places represent area files with selected elements for operating and database systems. The next route leads through the transition T1_AvailableElements. Places P2_FileType, P3_FileStructure, and P4_InternalRepresentation (I-node) are declared for operating systems. Places P2_PhysicalStructure, P3_NextUsefulFiles, P4_LogicalStructure, and P5_InternalRepresentation (Tablespace, Schemas) are declared for database systems. The given systems use these elements for storing data to files and further identification.

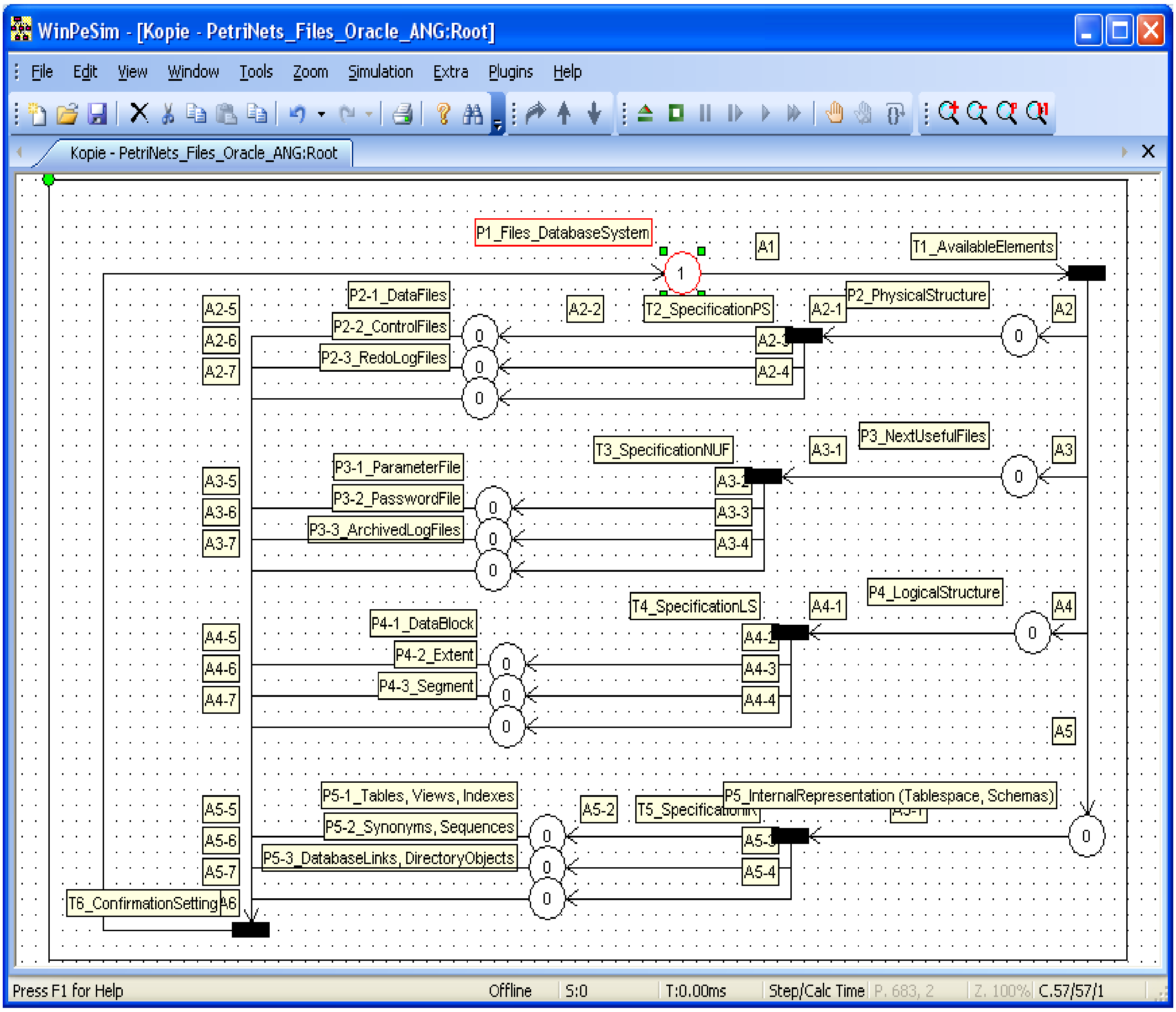

Figure 2: A model describing selected elements of file for a database system

The validity of the defined model is verified by starting the given simulation. A route cycle is built from place P1 via specified transitions and places. Places P2 – P4 (P2 – P5) create needed elements for operating system (database system). The end of the analysis in this area creates transition T5 for operating system (T6 for database system). The next route returns to place P1. The transition rests in the selection and uses of elements with the help of the mouse and the scroll-bar on the basis of given menus or links, such as Oracle Enterprise Manager interface for management database systems. This environment is in the form of web pages and applies link labels for optimal selection of a given menu. The standard buttons for confirming a setting or editing are *Apply* or *OK*. The UNIX operating system offers a default environment with a menu and submenu. Users can also use terminals and commands. Classic analysis of Petri Nets for our two models is realized by matrix representation with *incidence matrix* $C = O^T - I^T$: (Kochaníčková, 2008)

Operating system

	t1	t2	t3	t4	t5
p1	-1	0	0	0	1
p2	1	-1	0	0	0
p2-1	0	1	0	0	-1
p2-2	0	1	0	0	-1
p2-3	0	1	0	0	-1
p3	1	0	-1	0	0
p3-1	0	0	1	0	-1
p3-2	0	0	1	0	-1
p3-3	0	0	1	0	-1
p3-4	0	0	1	0	-1
p4	1	0	0	-1	0
p4-1	0	0	0	1	-1
p4-2	0	0	0	1	-1
p4-3	0	0	0	1	-1
p4-4	0	0	0	1	-1
p4-5	0	0	0	1	-1
p4-6	0	0	0	1	-1
p4-7	0	0	0	1	-1
p4-8	0	0	0	1	-1
p4-9	0	0	0	1	-1

Database system

	t1	t2	t3	t4	t5	t6
p1	-1	0	0	0	0	1
p2	1	-1	0	0	0	0
p2-1	0	1	0	0	0	-1
p2-2	0	1	0	0	0	-1
p2-3	0	1	0	0	0	-1
p3	1	0	-1	0	0	0
p3-1	0	0	1	0	0	-1
p3-2	0	0	1	0	0	-1
p3-3	0	0	1	0	0	-1
p4	1	0	0	-1	0	0
p4-1	0	0	0	1	0	-1
p4-2	0	0	0	1	0	-1
p4-3	0	0	0	1	0	-1
p5	1	0	0	0	-1	0
p5-1	0	0	0	0	1	-1
p5-2	0	0	0	0	1	-1
p5-3	0	0	0	0	1	-1

4. Conclusion

Database systems are an important part of a majority of information systems. For correct functionality, optimal implementation, administration, and application are needed. Database systems help with starting new methods and access to data and information. They help with innovations. Database systems have important links to operating systems and other tools from the area of CRM and BI. Needed data is stored in files of the given system; therefore, area file structure is an important segment of realized systems and tools. The optimal search availabilities of the mentioned systems need to realize many attempts and tests. The analysis is a good help with the models. A method for selecting optimal elements is illustrated by models with the support of Petri Nets.

For analyzing file structure and internal representation for operating and database systems created models are given. By comparing the options, this shows existing inspirational elements from both systems. The common perception of an actual situation in all systems and tools offers more synergy. The optimal resolution for data storage is the "i-node" concept from the operating system. It is a small element but with much information (nine pieces). Some elements are similar for both systems, such as the public principle of writing data to a file. Other elements are different, such as file type, and file structure. The database system offers useful idea tablespaces and schemas. It is more sensitive to area data storage than a standard directory and other file types with access privileges like read, write, and execute from operating systems.

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ENTERPRISE CONTENT MANAGEMENT AND INNOVATION

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Keywords

Innovation, innovation management, enterprise content management, knowledge management

Abstract

This paper is aimed on Enterprise Content Management (ECM) systems as opportunities for innovations in current economic crisis. In the introduction of the paper basic principles of innovations are recapitulated and importance of innovation management is emphasized.

Processes of innovation management could be supported by information systems and information and communication technologies (IS/ICT). The article focuses on Enterprise Content Management systems as a part of IS/ICT. Further ECM is defined and shown in the link to innovation management. ECM is a primary source of unstructured information and a main place for sharing and exchanging of knowledge. New web-based communication environment provides wider opportunity for group thinking and brainstorming which leads to innovation. ECM provides faster information access and effective information sharing and searching. Thus ECM creates crucial ground for effective innovation process. Implementation of ECM can be also viewed as innovation itself in terms of changing of organization processes and business practices in general.

The paper contains findings of a survey conducted during spring 2010 in various organisations in Czech Republic. The goal of the survey was to find respondents view on innovations in the field of ECM.

This paper was supported by the grant „Advanced Principles and Models for Enterprise ICT Management" at Czech Science Foundation under the number P403/10/0092. This grant is being worked at the Department of Information Technologies, University of Economics, Prague.

1. Introduction

Innovation is the starting point of competitive advantage in a global economy of the 21st century. Organizations must innovate not only to compete and grow but to survive.

Basic principles of innovations were described by economist Josef Alois Schumpeter in 1940's. He expanded the theory of entrepreneurship (Schumpeter, 1983). He saw the entrepreneur as a person who is able to convert new ideas into a successful innovation. J. A. Schumpeter thoroughly distinguished innovation from invention. (Inventions are new hypothesis, suggestions, ideas, etc., which appear in the first phase of innovation.) Many innovations are created from inventions, but not all inventions lead into innovation. It is possible to innovate without inventing and to invent without innovating.

The goal of innovations is to improve efficiency, effectiveness or competitive advantage through:

- offering of new products or services,
- applying of new business or manufacturing processes,
- changing of an organizational structure, business practices, external relations,
- implementing of a new marketing method, product or services promotion and pricing.

Peter Drucker in (Drucker, 1999, p. 114) explains that “most innovations, however, especially the successful ones, result from a conscious, purposeful search for innovation opportunities”. He states seven sources of innovation which are divided into internal and external.

Internal sources of innovations:

- unexpected event,
- contradiction,
- change of work process,
- change in the structure of industry or market.

External sources of innovations:

- demographic changes,
- changes in perception,
- new knowledge.

Innovation is not an occasional opportunity, it must be supported by systematic research and through many technological and organizational activities and it also must be financially secured. It means that innovation is a process and as well as any other it must be managed.

This article is linked to the article “The Role of ICT in Business Innovation” (Basl, 2009) that describes the general role of information and communication technology in business innovation. The goal of this article is to point out to specific role of Enterprise Content Management system in innovation management process.

2. Innovation Management and Enterprise Content Management

New discipline which deals with managing processes in innovation is called *innovation management*. To manage innovations means to generate new ideas and convert them into valuable assets.

The definition of innovation management was published for example in (Kelly, 1978) in this way: “The focus of innovation management is to allow the organization to response to external or internal opportunity, and use its creative efforts to introduce new ideas, processes or products.”

Second term in the title of this paragraph is Enterprise Content Management. *Enterprise Content Management* (ECM) was defined by the Association for Information and Image Management (AIIM) as “the strategies, methods and tools used to capture, manage, store, preserve, and deliver content and documents related to organizational processes. ECM tools and strategies allow the management of an organization's unstructured information, wherever that information exists“.

The basic principle of ECM is unified content strategy which integrates processes concerning all types of unstructured information as are for example electronic documents, e-mails, faxes, web presentations, rich media, forms. Mrs. A. Rockley (Rockley, 2003, p. 71) wrote: “A unified content strategy is an innovation in the way an organization creates, manages and delivers content. Getting content out to the right people at the right time and in the right format is critical to an organization’s success.” Companies have amazing opportunity to take a competitive advantage if they will start to manage till this time unmanaged unstructured content. Improving effectiveness of unstructured information exchange, document sharing and whole cross-company collaboration are critical to business success today.

ECM system covers number of applications that manage the complete lifecycle of content. From innovation management point of view the most important applications are knowledge management and communication and collaboration tools. Knowledge management plays more and more significant role in today’s globalized economy and a pervasive Internet. It is possible to document by known and often-repeated statement (Drucker, 1997) that “Knowledge has become the key economic resource and the dominating – and perhaps the only – source of competitive advantage.” ECM system with knowledge management component offers managing of this critical intellectual capital and sharing this information within company. Collaboration tools make possible to share and exchange information across geographical and cultural boundaries. It is possible to state that the information technology and ECM especially are significant source for innovation. Although it sounds logically and simply, the reality may be different.

It is demonstrated by the result of a survey which was published by the consulting company “Information Architected” in the end of the past year. The survey dealt with the innovation management. Over 180 companies participated in the survey. All findings of this survey are available in whitepaper (IAI, 2009). Below only the findings which relate to this paper are listed:

- 68% of the surveyed organizations’ management believes that innovation should be managed as a corporate asset and process,
- only 49% of respondents have any form of executive management presiding over innovation,
- *35% stated that there was a lack of effective collaboration and communication technologies within their organization.*

Although information technologies are driving force of innovation, a lot of organizations have problems with it and they do not use information technologies for sharing of knowledge and for creation of new ideas.

If innovation is a core business process and discipline vital to the success and growth of businesses and organizations in the 21st century, companies should adopt an integrated approach to manage innovation. A good background for managing innovation is ECM because ECM can support innovation processes by capturing and sharing of knowledge and offers communication and collaboration tools for typical innovation methods: brainstorming, product lifecycle analysis, cause and effect solving etc.

3. Survey of Innovations Perspective in ECM

Suppliers of ECM systems do not doubt about their influence on innovation. According to Atos Origin "Correctly delivered ECM & Collaboration services create an environment that enables employees to communicate and collaborate in the same way that they have become accustomed to in their day-to-day lives. This new way of collaboration fosters innovation in all areas of the business and improves much/needed collaboration within the enterprise and with external parties". (Atos Origin, 2010) But managers of organizations can have different look at innovation especially in current economic crisis. For that reason the author realized survey in Czech organizations.

The goal of the survey was to find the level of ECM utilization at organizations, as well as identify expected benefits from innovation in this area.

3.1. Implementation of the Survey

The survey passed in spring 2010 within the author's course "Collaboration Support Systems" which is annually offered to students at the University of Economics in Prague. In this course students are familiarized with theoretical principles of Enterprise Content Management systems and gain practical experience with selected components of ECM systems. One of their tasks was to realize three interviews on the basis of questionnaire, to complete the questionnaire form and to write short report about their own findings from practice.

Advantage of this way realized survey was that:

- students well understood the problematic of ECM and they were able to explain single part of the questionnaire,
- respondents were people from student's neighborhood (parents, friends, colleagues from part-time job etc.), they were acquainted with the relevance of the questionnaire,
- there was achieved large number of well filled-out forms.

Short reports were a source for team discussions and team presentations in the end of the course. Students could very well compare theory and practice related to ECM and to people's opinion on innovation in the current crisis. Completed questionnaires were a source for the following analysis.

3.2. Structure of the Questionnaire and Data Analysis Methods

The questionnaire had an identification part and ten questions were divided into three sections:

- A – Characteristics of the organization,
- B – Current availability of ECM components at the organization,
- C – Perspective of innovations in the field of ECM.

The identification part was important for an evidence of student's work and for elimination of organization duplicity. Data from this part will never be published.

The section A included organization characteristics (establishment of the organization, number of locations in Czech Republic, number of employees, organization's industry) and respondent's job position (company manager, IT manager or IT specialist and user). It was possible to mark only one item from the list.

The section B had two parts. The first part included a question relating to the level of ECM utilization. Respondents chose one answer from the list. The second part investigated an availability of ECM components at the organization and plans of the organization in purchasing of others ECM components. This part was in table form and students recorded as detailed answers as possible.

The section C asked about expected benefits from innovations in the field of ECM. Respondents could choose more items from the list.

The survey was realized during March and April in 2010. In the end of this period 219 questionnaires were collected. Seven questionnaires were excluded for duplicity reasons. Total number of analyzed questionnaires was 212. Data from questionnaires were manually transcribed to Microsoft Excel spreadsheet. The data analysis was performed using statistic functions.

3.3. Survey Results Overview

3.3.1. Profile of Respondents and Organizations

The survey involved 212 respondents representing a variety of industries (see Figure 1). Ninety respondents (42%) were business managers, fifty five respondents (26%) were IT managers or IT specialists and remaining sixty seven respondents (36%) were end users.

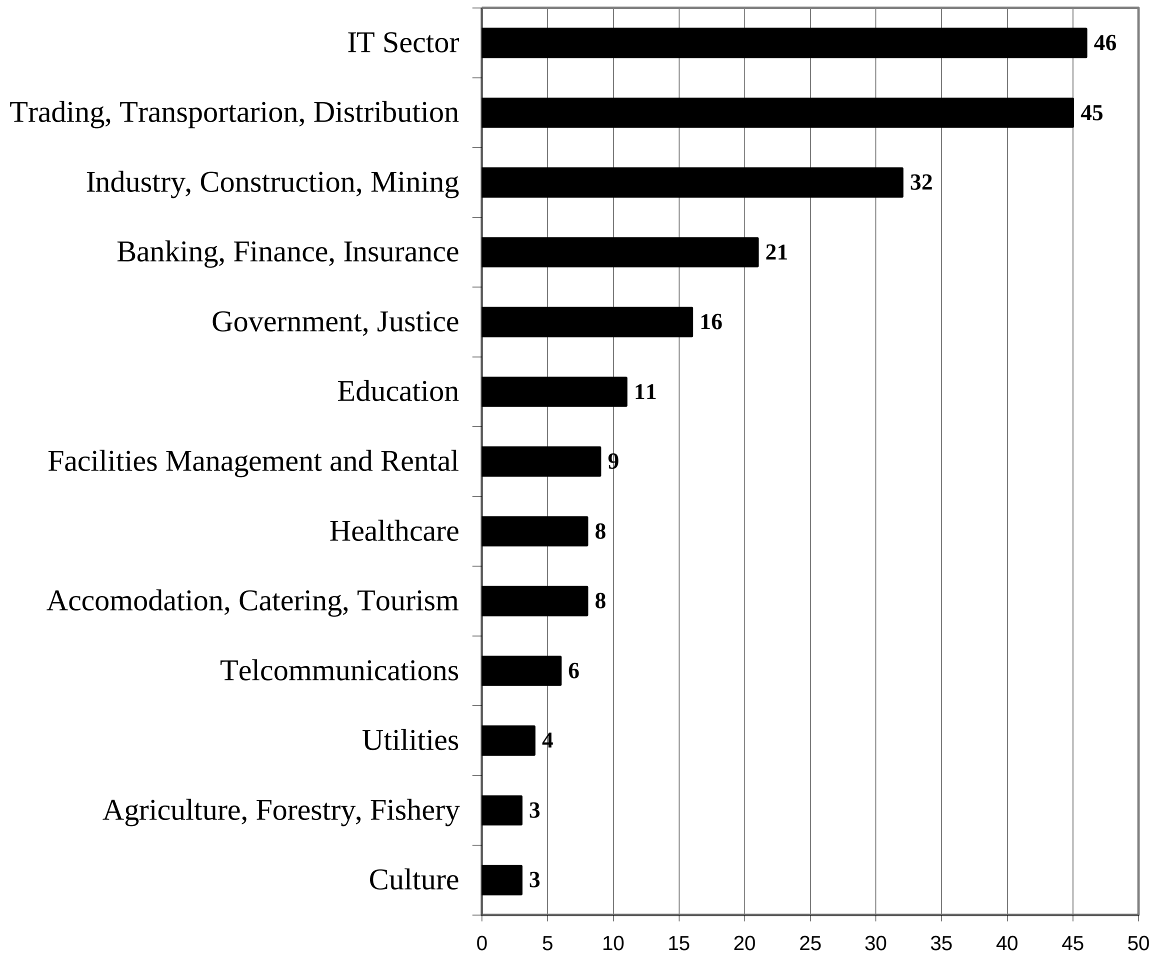

Figure 1: Respondents by Industry

The largest group (129 respondents, 61%) made up Czech organizations without foreign branches, Czech branch offices of multinational corporations were represented by 68 respondents (32%) and remaining 15 respondents (7%) were from Czech organization with branch office in foreign countries. Other organizations characteristics are stated in tables 1 – 3.

3.3.2. Availability of ECM Components

The survey identified that 30 organizations (14%) do not have any ECM components. Respondents answered that their organization does not care about ECM at all. These respondents represented small Czech organization with small or none IT department. Only six of them was convinced that none benefits from innovation is not possible to expect.

Remaining 182 organizations have implemented ECM system in different range of components. When respondents characterized level of utilization ECM components they answered (from 43%) that ECM components are implemented according to the need in single organization‘s departments.

Respondents by number of branch offices in Czech Republic		
1	79	37%
2 - 10	92	43%
11 - 20	12	6%
21 and more	29	14%
	212	100%

Respondents by number of employees working in Czech Republic		
1 - 20	66	31%
21 - 50	33	16%
51 - 250	51	24%
251 and more	62	29%
	212	100%

Respondents by number of IT staff working in Czech Republic		
0	43	21%
1 - 10	115	54%
11 - 25	17	8%
26 - 50	13	6%
51 and more	24	11%
	212	100%

Table 1 – 3: Respondents characteristics

3.3.3. Expected Benefits from Innovation

Only 18 of all respondents (14%) do not expect any benefits. The three most expected benefits from innovation in the field ECM were non-efficient activities removal (129 respondents, 65%), productivity increase (113 respondents, 58%) and cost reduction (105 respondents, 54%). The combination of these three benefits marked 58 respondents (30%). They mostly came from organizations with a few locations, with small IT department and from IT sector, manufacturing industry, market, transportation or distribution. Number of employees was heterogeneous.

Interesting result showed analysis of two benefits combinations. Value over 30% achieved six combinations. Detailed information is in the table 4.

Combination of innovation benefits in the field ECM	Number of respondents	Percent of respondents which expected any benefit
Non-efficient activities removal & Productivity increase	82	42%
Non-efficient activities removal & Cost reduction	77	40%
Productivity increase & Cost reduction	71	37%
Non-efficient activities removal & Operational flexibility improvement	67	35%
Non-efficient activities removal & Organizational flexibility improvement	65	34%
Productivity increase & Operational flexibility improvement	60	31%

Table 4: Combination of two innovation benefits

The most expected benefits correspond with it what is possible to achieve through ECM implementation – to innovate the organization by more effective way of doing business. Transforming paper workflows into digital can deliver cost reduction; general workflow automation can deliver productivity increase and non-efficient activities removal. Collaboration tools, documents and knowledge sharing can deliver operational and organizational flexibility improvement.

4. Conclusion

The survey enables to evaluate organization understanding of ECM advantages, their plans for ECM implementations and what are the key expectations from such innovation.

The survey covered broad-spectrum of organization's industry. All categories of organizations were reasonably represented. Fourteen percent of organization which have not implemented any ECM component yet points out that ECM is not only about technology, but it is about strategy and accordingly about innovations.

Most of organizations (92%) expect benefits from innovations in ECM systems.

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HUMAN RESOURCES REQUIREMENTS FOR PROFESSIONAL MANAGEMENT OF ITSCM PROCESS

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Keywords

Human resources, human potential, IT service, ITIL, IT service continuity management

Abstract

The IT Services generally represent the important source and asset for effective working companies. The IT Services support key businesses processes and from this reason it is necessary to ensure their availability with correspondence of business processes requirements. The good quality of IT management does not only assume IT infrastructure technical knowledge but also process management and IT services management knowledge.

The contribution deals with formulation of requirements on abilities of employees who manage the ITSCM process in companies. The authors will describe their own experience with human support of ITSCM implementation in logistic company.

1. IT Service Continuity Management

1.1. IT Service Management and ITIL

Nowadays IT Services are the important company asset which is necessary to manage effectively in companies. IT Service Management is the discipline which is focused to optimal and effective IT Services delivering and supporting in correspondence with business process goals and requirements according Ráček (2008). IT Services should support key business process and they have to be delivered to the customers with required values of quality parameters. IT Infrastructure Library represents the framework which contains the general recommendations and the Best Case practices for IT Service Management according OGC (2006a) The ITIL is based on the practical real experience of IT professionals. In our days ITIL can be considered as standard enterprise informatics management tool respectively it represents the form of knowledge base.

1.2. IT Service Continuity Management and its Relation with ITSM

IT Service Continuity Management (ITSCM) is process which is part of whole IT Service Management. It is focused on the technical, program, procedure and management tools which are needed for ICT services recovery in critical and disaster cases. Great importance of ICT services for today's companies is the cause of pressure on their availability and reliability. In point of view of effective business processes running ITSCM is one of elements whose ensure the ICT Services availability in accordance with customer and user requirements according OGC (2006c).

1.3. ITSCM Process Description

ITSCM in cooperation especially with Availability management create and implement the strategies which ensure the IT Services availability. ITSCM is focused on critical and disaster situations and it should be realized in accordance with whole Business Continuity Planning/Management because IT Service Continuity Plan supports (is part of) Business Continuity Plan. Compliance with this rule ensures that IT services are restored according to business needs and accepted costs.

ITSCM process steps are shown in figure 1 and achievement of ITSCM implementation needs to reach these milestones and tasks:

- risk assessment and the impact of the unavailability of ICT services company;
- identification of critical ICT services and prevention to ensure continuity of their operation;
- definition of time in which ICT is needed to restore service;
- creating mechanisms to ensure detection, removal or mitigation of the effects disasters;
- definition of procedures and plans for the supply of ICT services;
- creating, testing and maintenance of recovery plans to ensure restoration availability of ICT services within a specified time according Lloyd, V., Rudd, C. (2007).

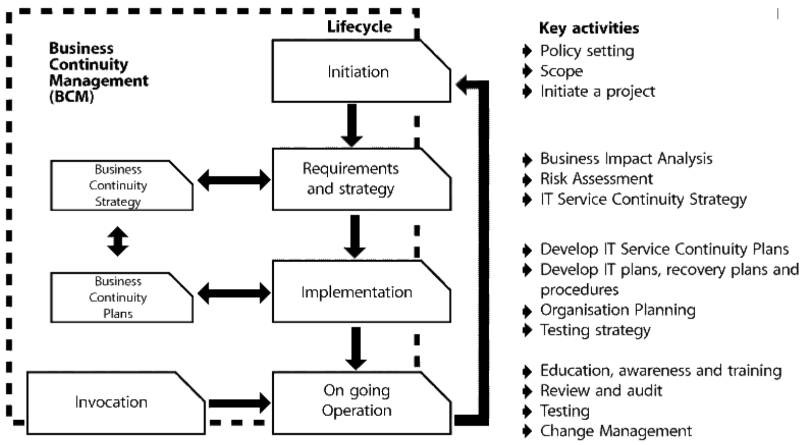

Figure 1 - ITSCM process according Lloyd, V., Rudd, C. (2007)

Implementation of the above described steps depends on the attributes of the major sources especially on human resources quality.

2. General Elements for ITIL/ITSCM Implementation

Implementation of IT Service Management requires the coordination of resources (factors) that contribute to meet its goals.

ITSCM defines four basic areas involved in “4P” model - personal, processes, products, partners (see figure 2). These elements come into mutual interactions. Company management must develop strategies and manage all four areas according OGC (2006c). Achieving the key objectives of

ITSM is dependent on effective use of all elements of the 4P model. Effective use involves three components - efficiency, effectiveness and economy OGC (2006c).

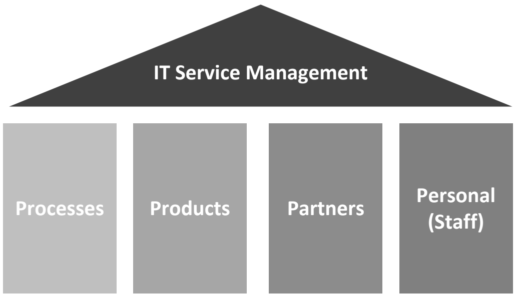

Figure 2 - Model "4P"

2.1. Personal (Staff)

Human resources are an essential component of the participants in the implementation of ICT services as describe Doucek (2009). Each group of participants in the ICT service has a different role and position.

The user is a person who uses or uses of ICT services for its everyday work. His position reflects the statement: "the user is the hands on the keyboard”.

The customer is the entity that authorizes a person to define the requirements of the organization on ICT services, negotiation of service level of a termination hearing, including the signing of the contract. The customer provides money for services transactions (services).

IT staff realizes the implementation of ICT services for the customer, respectively users. IT staff is the most valuable asset and resource. On the base of opinion Basl (2009) and Doucek (2009) it is useful to exploit full human potential for the successful implementation of ITSM. Roles and responsibilities of participants in ICT services must be clearly defined according Doucek (2009).

2.2. Processes

Processes are the way to realizing the objectives. IT processes outputs ensure the achievement of IT department objectives that are in correspondence with business objectives. The company aims have to reflect the vision and mission of the firm.

2.3. Products

Products and technologies are tools that are used in the implementation and execution of IT processes and services. There are many resources that are in conformity with the recommendations of ITSM and ITIL. Some of them were developed specifically for ITIL environment, others were adapted.

Ability to be a quality product or help provide high quality service depends on the manner of its usage. Also it depends largely on people who are treated with the product. Motto: "A fool with a tool is still a fool", very clearly describes the relationship between tools and a person who uses it.

2.4. Partners

Organizations are not self-sufficient in all areas of fulfilment the business needs. So it is necessary to work with partners to ensure delivery of required equipment, materials and services. Partners do not operate within the organization, but they are outside of company environment - they are external vendors and suppliers.

It is necessary to motivate partners to deliver timely and quality services. They have to respect customers' requirements and find new solutions and their implementations according OGC (2006c).

3. Requirements on Human Resources

Employees of company should be divided into specific groups according to their particular roles and knowledge as described Basl (2009). Authors proposed the employees division into the following groups on the base of their experience with ITSCM implementation in logistic company:

- IT Infrastructure expert;
- IT Service Manager;
- Business Process Owner;
- Users.

The particular groups and their relation to ICT service knowledge and requirement definition is shown on figure 3.

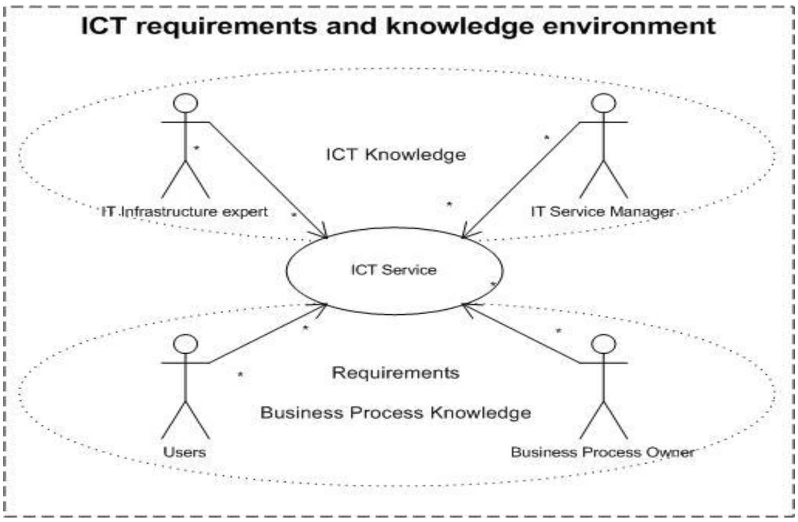

Figure 3 - Internal participants of ITSCM implementation

All categories of implementation participants share the following attributes with different volume of importance for individual category:

- IT hardware technologies knowledge;
- IT information systems technologies knowledge;
- Business processes technology (real environment state) knowledge;
- IT Service Management knowledge;

- Management on the of KPIs;
- Metrics definition and usage.

Each characteristic was evaluated in the scope 1 – 5 with following meaning:

- 1 – Fail;
- 2 – Satisfactory;
- 3 – Good;
- 4 – Very good;
- 5 – Excellent.

The example of results the internal knowledge evaluation of employees is shown in table 1.

	IT hardware technologies knowledge	IT information systems technologies knowledge	Business processes technology knowledge	IT Service Management knowledge	Management of KPIs	Metrics definition and usage
IT Infrastructure expert	**4**	**4**	**1**	**2**	**1**	**2**
IT Service Manager	**3**	**4**	**3**	**5**	**3**	**3**
Business Process Owner	**1**	**1**	**5**	**2**	**3**	**2**
User	**1**	**2**	**4**	**1**	**2**	**2**

Table 1 - Internal knowledge evaluation of employees

The table 1 shows only evaluation of individual knowledge each category but not the importance for individual category requires by ITSCM.

4. Human Resources Potential and its Evaluation

4.1. Knowledge Priority

Each category has own role in the ITSCM implementation process. On the base of author's experience they assign the importance to each property within the individual categories as shown the table 2.

It is necessary to define the metric for evaluation the scope of importance of each category and its value in numerical potential calculation (see below):

- High – value 10;
- Middle – value 5;
- Low – value 1.

Role/ Knowledge	IT hardware technologies knowledge	IT information systems technologies knowledge	Business processes technology knowledge	IT Service Manage-ment knowledge	Management of KPIs	Metrics definition and usage
IT Infra-structure expert	**High**	**High**	**Low**	**Low**	**Low**	**Low**
IT Service Manager	**Middle**	**Middle**	**Middle**	**High**	**Middle**	**Middle**
Business Process Owner	**Low**	**Low**	**High**	**Low**	**Middle**	**High**
User	**Low**	**Low**	**High**	**Low**	**Low**	**Low**

Table 2 - Knowledge priority

4.2. HR Potential Calculation

Through the described method, finally we are able to evaluate the scope of company knowledge in ICT domain – the indicator is named "HR potential" by authors. HR potential is value which could be calculated on the base of knowledge priority for each category of participants and real knowledge of employees in particular categories. This indicator shows the overall level of knowledge in particular categories.

Own calculation is based on the weighted average of the values described above (See Formula 1).

$$P_{category} = \frac{\sum_{I=1}^{number\ of\ categories} KP_I * RKV_I}{\sum_{I=1}^{number\ of\ categories} KP_I}$$

Formula 1 - HR potential calculation

The formula 1 contains these variables:

- $P_{category}$ – the resulting potential for each role;
- KP_I – Knowledge priority of each category for particular role;
- RKV_I – Real knowledge value of each category for particular role.

The results of HR potential could be normalize for each role and this process allows comparison of the different categories and rates meet the demands imposed on them in terms of priorities (see Formula 2).

$$P_{category\ normalise} = \frac{\dfrac{\sum_{I=1}^{number\ of\ categories} KP_I * RKV_I}{\sum_{I=1}^{number\ of\ categories} KP_I}}{\dfrac{\sum_{I=1}^{number\ of\ categories} KP_I * RKV_I^{MAX}}{\sum_{I=1}^{number\ of\ categories} KP_I}}$$

Formula 2 - HR normalize potential calculation

The formula 2 contains these variables:

- $P_{category}$ – the resulting potential for each role;
- KP_I – Knowledge priority of each category for particular role;
- RKV_I – Real knowledge value of each category for particular role;
- RKV_I^{MAX} – Knowledge value of each category for ideal employee who reaches in all categories maximal knowledge points (5 – excellent).

5. Conclusion

The level of human resources potential of internal employees is very important factor because people respectively employees are the most important factor for successful ITSCM implementation.

In the initiation phase of ITSCM implementation is suitable to realise the evaluation of human resources potential. It is necessary to establish (set) the reference or minimal acceptable values. If the real HR potential was less than reference or minimal acceptable values the provisions would be taken to employee knowledge improvement or outsource the implementation or hire new employees with experience and knowledge in problematical area. These actions usually need:

- Increase project cost;
- Provide extra time to project realisation;
- Senior management acceptance and support.

Due to importance of ICT Service for modern and contemporary companies the authors recommend not to underestimate the importance of project preparation and realistic assessment of own skills and experience. Correctly performed ITSCM implementation enables to manage even the most difficult situations without losing the security and control of ICT services but mistakes in implementation may result to failure of whole IT management in critical and disaster cases. The impact of potential losses may be worse for the companies in times of economical crisis than at the time of “plenty” because IT service outage may cause the company's huge losses and the management of company should reasonably ensure the risks associated with IT operations.

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IMPACT OF ERP SYSTEMS IMPLEMENTATION: A CASE OF SLOVAK COMPANIES

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Keywords

Enterprise resource planning (ERP) systems, post-implementation efficiency

Abstract

According to the literature review conducted by Botta-Genoulaz et al. (2005), there had been very little research focused on of enterprise resource planning (ERP) systems post-implementation period. The paper tries to contribute to filling in this gap in theory. The aim of the paper is to analyze impact ERP systems implementation on overall IS/IT costs, on proportion of the IT/IS costs attributed to the IT and other departments, on efficiency as profitability, on effectiveness as productivity, and on availability of IS/IT services. The research is based on data from Slovak companies. The most surprising finding is that the fact, whether the company stayed on budget or spent more in ERP systems implementation, does not have significant bearing on any of the investigated variables. Information strategy seems to influence change in overall IS/IT costs and in their distribution between the IT and other departments. Companies with information strategy report lower overall IS/IT costs after ERP implementation and higher percentage of these lower costs is attributed to the IT department. The percentage of overall IS/IT costs attributed to the IT department is significantly higher in large than in small companies.

1. Introduction

The first journal article on enterprise resource planning (ERP) systems covered by Web of Science was published in 1994 (Morris and Morris, 1994) and there are already about 500 journal articles and about 700 conference papers covered by Web of Science. In other words, the topic of ERP systems is already a well established topic. Despite this, according to the literature review conducted by Botta-Genoulaz, Millet and Grabot (2005), there had been very little research focused on ERP systems post-implementation period. The paper tries to contribute to filling in this gap in theory. The aim of the paper is to analyze impact of enterprise resource planning (ERP) systems implementation on overall IS/IT costs, on proportion of the IT/IS costs attributed to the IT and other departments, on efficiency as profitability, on effectiveness as productivity, and on availability of IS/IT services. It may be perceived as an extension of (Sudzina and Kmec, 2006). The research is based on data from Slovak companies. Because of a similarity of business environment, it is likely that the same relationships may hold also for Czech companies. The paper is organized as follows: the second section describes data and methodology, the third section presents the results, and fourth section provides conclusions.

2. Data and Methodology

The research is based on a questionnaire survey conducted in Slovakia in May and June 2007. Questionnaire forms, accompanied by a cover letter, were mailed to randomly selected companies. Lists of addresses and information about the number of employees were retrieved from the Statistical Bureaus of the Slovak Republic. Unlike in (Antlova, 2009), large companies were not excluded. Regarding the random sample, 600 questionnaires were sent to small, 300 to medium-sized enterprises, and 300 to large companies in each of the three countries. The number of questionnaires mailed to small companies was double the number of medium and large companies because small companies constitute the highest proportion of companies and based on our personal experience, they are less likely to respond.

The definition of company size used in this paper is consistent with the European Commission (2003) definition of SMEs, i.e. companies with 10 to 49 employees are considered to be small, companies with 50 to 249 employees are considered to be medium-sized enterprises, and companies having 250+ employees are considered to be large companies. In total, there were 112 responses out of 1200 mailings, i.e. the return rate was 9,3%. However, since we did not have prior information, which organizations actually had implemented ERP systems, we also have to consider adoption of ERPs when calculating response rate; and considering adoption of ERP systems by small, medium-sized, and large companies in these countries according to 2007 Eurostat estimates, the overall response rate was 19,2% in Slovakia. Table 1 provides information on number of respondents that had ERP systems, 2007 Eurostat estimates of ERP adoption by company size, theoretical number of companies from the research sample that were supposed to have ERP systems (since the sampling was random, the theoretical number is calculated as a product of number of questionnaires sent out and the 2007 Eurostat estimate), and the response rate calculated as the number of respondents that had ERP systems divided by the theoretical number of companies with ERP systems in the sample.

Company size	**No. of respondents with ERP**	**No. of questionnaires sent out**	**Percentage of ERP adoption (Eurostat)**	**Theoretical no. of companies with ERP in sample**	**Response rate**
Small	11	600	10,80%	64,83	16,97%
Medium-sized	10	300	23,08%	69,23	14,44%
Large	32	300	47,27%	141,81	22,57%
Total	53			275,86	19,21%

Table 1 Descriptive statistics of responding companies

When focusing on the post-implementation period, it may be expected that staying on budget during the ERP systems implementation may have some impact. The question related to staying on budget was „What was the actual total cost of implementation?“ with possibilities „lower than estimated“, „equal“, and „higher than estimated“, while for the first and third possibility we asked by how many percents. There were no companies in the sample, which would claim to spend less than estimated. Therefore the paper will mention only possibilities of staying on budget or going over budget. Because some respondents did not answer the question and some of those, who answered the question by stating going over budget, did not provide percentages, there will be three models used for each dependent variable. In the first model, staying on budget will not be considered; in the second model, there will be a binary variable coding staying on budget and going over budget; in the third model, there will be a percentage of actual ERP systems implementation costs compared to planned costs.

Besides already mentioned company size and staying on budget, also information strategy and representation of IT department at the board level (i.e. CIO or alike) are used as independent variables.

The adoption of ERP systems was estimated on the respondent's company ERP system stage, the stages included (1) ERP system is being considered, (2), ERP system is being evaluated for the selection of a specific solution, (3) ERP system is being configured and implemented, (4) an ERP system was recently implemented and is now being stabilized, (5) an ERP system is being used and maintained, and (6) the first ERP system was already substituted with a new one. Stages 4-6 describe the post-implementation period, therefore only companies in these stages are analyzed in the paper.

Regarding dependent variables, respondents were asked to estimate the impact of ERP compared to the situation prior to ERP implementation. There were six areas:

Overall IS/IT costs – measured on 1-5 Likert scales, where 1 means poor rating/higher costs, 3 stands for unchanged, and 5 translates to good rating/lower costs.

a) Proportion of costs attributed to the IT department out of overall IS/IT costs – measured in percents.
b) Proportion of costs attributed to functional departments out of overall IS/IT costs – measured in percents.
c) Efficiency/profitability – measured on 1-5 Likert scales, where 1 means poor rating/decreased, 3 stands for unchanged and 5 translates to good rating/increased.
d) Effectiveness/productivity – measured on 1-5 Likert scales, where 1 means poor rating/decreased, 3 stands for unchanged and 5 translates to good rating/increased.
e) Availability of IS/IT services – measured on 1-5 Likert scales, where 1 means poor rating/decreased, 3 stands for unchanged, and 5 translates to good rating/increased.

The coding was used this way because these issues are usually not publicly shared, i.e. asking about them in a higher detail might prevent respondents from answering completely. In this paper, there will be only five of them analyzed because b equals 100% - c. This relationship actually decreased the sample the most. Unless one of the values was 100% (thus the remaining was supposed to 0%), one of the values missing implied deleting the remaining value. Kept were only rows with the sum of b and c being equal to 100%.

3. Results and Discussion

The research results are provided in subsections in order to group three models for each dependent variable.

3.1. Overall IS/IT Costs

The average value for overall IS/IT costs was 3,73, i.e. slightly lower IS/IT costs after ERP systems implementation. In two out of three models, p-value for information strategy is smaller than 0,1; so there is a chance that in a large sample, information strategy would have a significant impact on overall IS/IT costs change after ERP systems implementation. Companies with information strategy have lower overall IS/IT costs (3,89) after ERP systems implementation compared to companies without information strategy (3,38).

Factor	DF	Sum of Squares	Mean Square	F-Ratio	P-value
Company size	2	1,091245	0,5456226	0,80	0,458505
CIO	1	0,005299344	0,005299344	0,01	0,930382
Information strategy	1	2,677286	2,677286	3,91	0,055684
S	36	24,64786	0,6846628		
Total (Adjusted)	40	28,04878			
Total	41				

Table 2 Analysis of overall IS/IT costs without considering staying on implementation budget

Factor	DF	Sum of Squares	Mean Square	F-Ratio	P-value
Staying on budget	1	0,4186297	0,4186297	0,57	0,455214
Company size	2	0,9319658	0,4659829	0,64	0,535971
CIO	1	0,002291546	0,002291546	0,00	0,955752
Information strategy	1	2,153853	2,153853	2,94	0,095902
S	33	24,19309	0,7331241		
Total (Adjusted)	38	27,4359			
Total	39				

Table 3 Analysis of overall IS/IT costs considering staying on implementation budget or not

Factor	DF	Sum of Squares	Mean Square	F-Ratio	P-value
Percentage spent	1	0,3400695	0,3400695	0,44	0,510302
Company size	2	1,143802	0,5719008	0,75	0,482554
CIO	1	0,007170182	0,007170182	0,01	0,923576
Information strategy	1	1,58646	1,58646	2,07	0,160283
S	31	23,76339	0,766561		
Total (Adjusted)	36	26,81081			
Total	37				

Table 4 Analysis of overall IS/IT costs considering percentage of implementation budget spent

3.2. Proportion of Costs Attributed to the IT Department out of Overall IS/IT Costs

In all three models, company size has a significant impact on the proportion of costs attributed to the IT department out of overall IS/IT costs. It is higher in large companies compared to small and medium-sized companies. P-value related to information strategy is about 0,05 in all of the models, so there is a good chance that its impact is significant. In companies with information strategy, proportion of costs attributed to the IT department out of overall IS/IT costs is higher than in companies without information strategy. (Note: * Term significant at alpha = 0,05)

Factor	DF	Sum of Squares	Mean Square	F-Ratio	P-value
Company size	2	15186,19	7593,095	16,67	0,000046*
CIO	1	1606,854	1606,854	3,53	0,074309
Information strategy	1	2081,413	2081,413	4,57	0,044465*
S	21	9565,534	455,5016		
Total (Adjusted)	25	25900			
Total	26				

Table 5 Analysis of IT department spending without considering staying on implementation budget

Factor	DF	Sum of Squares	Mean Square	F-Ratio	P-value
Staying on budget	1	373,4407	373,4407	0,77	0,390580
Company size	2	14405,55	7202,776	14,89	0,000129*
CIO	1	1385,412	1385,412	2,86	0,106919
Information strategy	1	2038,738	2038,738	4,21	0,054110
S	19	9191,059	483,7399		
Total (Adjusted)	24	25666			
Total	25				

Table 6 Analysis of IT department spending considering staying on implementation budget or not

Factor	DF	Sum of Squares	Mean Square	F-Ratio	P-value
Percentage spent	1	126,7403	126,7403	0,23	0,636393
Company size	2	13185,9	6592,95	12,05	0,000550*
CIO	1	1246,637	1246,637	2,28	0,149483
Information strategy	1	2018,008	2018,008	3,69	0,071691
S	17	9298,432	546,9666		
Total (Adjusted)	22	24415,22			
Total	23				

Table 7 Analysis of IT department spending considering percentage of implementation budget spent

3.3. Efficiency/Profitability

The average value for efficiency/profitability was 3,32, i.e. slightly increased after ERP systems implementation. There was no factor found to have a significant impact on efficiency/profitability change after ERP systems implementation. (Note: * Term significant at alpha = 0,05)

Factor	DF	Sum of Squares	Mean Square	F-Ratio	P-value
Company size	2	0,8615152	0,4307576	0,87	0,425744
CIO	1	0,2623621	0,2623621	0,53	0,470226
Information strategy	1	0,01717557	0,01717557	0,03	0,852919
S	36	17,73282	0,4925784		
Total (Adjusted)	40	18,87805			
Total	41				

Table 8 Analysis of efficiency/profitability without considering staying on implementation budget

Factor	DF	Sum of Squares	Mean Square	F-Ratio	P-value
Staying on budget	1	0,522507	0,522507	1,02	0,320329
Company size	2	0,5377883	0,2688941	0,52	0,597050
CIO	1	0,1346434	0,1346434	0,26	0,611933
Information strategy	1	0,04005096	0,04005096	0,08	0,781724
S	33	16,93743	0,5132553		
Total (Adjusted)	38	18,30769			
Total	39				

Table 9 Analysis of efficiency/profitability considering staying on implementation budget or not

Factor	DF	Sum of Squares	Mean Square	F-Ratio	P-value
Percentage spent	1	0,1032343	0,1032343	0,19	0,668568
Company size	2	0,63728	0,31864	0,58	0,567697
CIO	1	0,09021865	0,09021865	0,16	0,688941
Information strategy	1	0,02008201	0,02008201	0,04	0,850054
S	31	17,13017	0,5525862		
Total (Adjusted)	36	18,10811			
Total	37				

Table 10 Analysis of efficiency/profitability considering percentage of implementation budget spent

3.4. Effectiveness/Productivity

The average value for effectiveness/productivity was 3,61, i.e. slightly increased after ERP systems implementation. There was no factor found to have a significant impact on effectiveness/productivity change after ERP systems implementation.

Factor	DF	Sum of Squares	Mean Square	F-Ratio	P-value
Company size	2	1,133831	0,5669154	0,85	0,435215
CIO	1	0,4295759	0,4295759	0,65	0,427116
Information strategy	1	0,01443225	0,01443225	0,02	0,883775
S	36	23,96994	0,6658317		
Total (Adjusted)	40	25,7561			
Total	41				

Table 11 Analysis of effectiveness/productivity without considering staying on implementation budget

Factor	DF	Sum of Squares	Mean Square	F-Ratio	P-value
Staying on budget	1	0,02010362	0,02010362	0,03	0,868236
Company size	2	0,9072666	0,4536333	0,63	0,538466
CIO	1	0,4392238	0,4392238	0,61	0,440076
Information strategy	1	0,04053537	0,04053537	0,06	0,813803
S	33	23,73199	0,7191512		
Total (Adjusted)	38	25,4359			
Total	39				

Table 12 Analysis of effectiveness/productivity considering staying on implementation budget or not

Factor	DF	Sum of Squares	Mean Square	F-Ratio	P-value
Percentage spent	1	0,7225905	0,7225905	1,07	0,307971
Company size	2	0,2201843	0,1100922	0,16	0,849731
CIO	1	0,8566936	0,8566936	1,27	0,267714
Information strategy	1	0,003370709	0,003370709	0,01	0,944016
S	31	20,84905	0,6725501		
Total (Adjusted)	36	22,7027			
Total	37				

Table 13 Analysis of effectiveness/productivity considering percentage of implementation budget spent

3.5. Availability of IS/IT Services

The average value for effectiveness/productivity was 3,95, i.e. somewhat increased after ERP systems implementation. There was no factor found to have a significant impact on availability of IS/IT services after ERP systems implementation.

Factor	DF	Sum of Squares	Mean Square	F-Ratio	P-value
Company size	2	0,4287806	0,2143903	0,36	0,700175
CIO	1	0,004320965	0,004320965	0,01	0,932596
Information strategy	1	0,6610777	0,6610777	1,11	0,299234
S	35	20,83892	0,5953978		
Total (Adjusted)	39	21,9			
Total	40				

Table 14 Analysis of availability of IS/IT services without considering staying on implementation budget

Factor	DF	Sum of Squares	Mean Square	F-Ratio	P-value
Staying on budget	1	0,009554771	0,009554771	0,01	0,903799
Company size	2	0,577983	0,2889915	0,45	0,642295
CIO	1	0,0000939509	0,0000939509	0,00	0,990437
Information strategy	1	0,8145499	0,8145499	1,27	0,269029
S	32	20,60138	0,6437932		
Total (Adjusted)	37	21,89474			
Total	38				

Table 15 Analysis of availability of IS/IT services considering staying on implementation budget or not

Factor	DF	Sum of Squares	Mean Square	F-Ratio	P-value
Percentage spent	1	0,3767376	0,3767376	0,56	0,460391
Company size	2	0,4623043	0,2311521	0,34	0,712298
CIO	1	0,0002438995	0,0002438995	0,00	0,984945
Information strategy	1	0,8287506	0,8287506	1,23	0,276179
S	30	20,21001	0,673667		
Total (Adjusted)	35	21,88889			
Total	36				

Table 16 Analysis of availability of IS/IT services considering percentage of implementation budget spent

4. Conclusions

ERP systems seemed to decrease overall IS/IT costs, it was higher decrease in companies with information strategy than without. After ERP system implementation, IT departments were able to spend a higher percentage of the remaining costs in large companies and in companies with information strategy. ERP systems implementation slightly increased efficiency/profitability, effectiveness/productivity, and availability of IS/IT services; none of the investigated factors seems to significant influence on the three indicators. It may be concluded that ERP systems implementation seems to have a positive effect in all investigated areas.

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RECENT CHANGES IN THE IS AUDIT ENVIRONMENT

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Keywords

IS audit, enterprise governance of IT, Cobit 5, IS assurance

Abstract

The main aim of the paper is to summarize the recent changes and evolution in the information systems audit environment. Random global financial and business catastrophes over the last few years have brought the Governance principles and related IS audit/assurance activities to the forefront of business thinking. Now there is a clear and widely accepted need for more rigorous governance over companies´ systems of internal control. There exist many different activities aiming to support effective enterprise governance (legislative acts, best practices, standards, frameworks). But all these activities may have reinforced the already-existing focus on enterprise governance, but they did not necessarily bring clarity to the topic. Therefore we can currently notice some changes aiming to improve the adoption and adaptation of best practices and standards within the area of enterprise governance. The paper discusses the changes in the Enterprise Governance of IT/IS audit/assurance evolution, and intended Cobit improvements.

1. Introduction

The global economic downturn is recovering, but even to this fact we can still expect the IT budget cuts. In this situation of limited investments the business managers and stakeholders need to provide reengineering of business as well as IT processes in order to understand where they can obtain short and long term savings without jeoparding their strategic goals. One of the most powerful managerial tool which can help to do this job is audit of information systems (IS audit). Therefore currently we can notice some new activities and changes in the IS audit environment. They are covering the next topics:

- IT Governance: Effective enterprise governance of IT encompasses the need to drive more value from IT investments, IT risk management, compliance to external requirements and improved IT performance. For many years ISACA3 has researched this key area of enterprise governance to advance international thinking and provide guidance in evaluating, directing and monitoring an enterprise´s use of IT. ISACA has developed different frameworks – Cobit, Val IT, Risk IT, the Business Model for information Security and the

[3] ISACA – Information Systems Audit and Control Association, isaca.org

Assurance Framework (ITAF4) – to help enterprises implement governance mechanisms and address specific areas such as information security and assurance. Now there is the time to rethink the concept of Enterprise Governance of IT.

- COBIT: Different views of enterprise governance arose, leading to confusion on the relationships among them. This is currently the incentive for the new initiative aiming to formulate the more integrated and advanced framework of enterprise governance of IT and thus open the wide discussion of all interested parties which should result in the new version of Cobit.
- IS Audit/Assurance: Corporate reporting and the auditing profession are heavily involved in the process of business recovering from the last financial scandals. There have been calls for enhanced audit practices as well as regulations helping to prevent or predict similar financial problems. But the question is, weather the audit can meet such expectations.

2. Enterprise Governance of IT

Many entities have proposed various definitions of governance, in which they tend to be focused on a particular view or type of governance, activities or roles. The following high-level definition of governance is proposed, to cover all types and views:

Governance is the framework, principles, structure, processes and practices to set direction and monitor compliance and performance aligned with the overall purpose and objectives of an enterprise (ISACA, 2009).

In this definition, the enablers of governance are "framework, principles, structure, processes and practices"; the activities are "set direction and monitor compliance and performance."

Recently we can notice new features in IT Governance interpretation. The concept of „Governance" was defined at the three different levels: Corporate, Enterprise and IT. The reason for this top-down decomposition of governance principles was derived from the historical sequence of the events and related standards forming the idea of Governance (e.g. OECD Principles of Corporate Governance, SOX, COBIT, COSO, COSO-ERM, ITIL V3, ISO 27000). Even to the fact, that it was stressed, that each governance level depends heavily on the next two levels, there was no unified framework which can help those, involved in governance, to answer the next questions:

- Who is accountable and responsible for governance?
- What do they do, and how and where do they do it?
- Why do they do it?
- What kind international good practices, standards and guidance documents can they apply?

The initiative called The Taking Governance Forward (TGF) should help answer these questions. It is based on the new framework Governance "On Page" which defines three primary views of governance (Figure 1):

1. Enterprise (which contains corporate)

[4] ITAF – Information Technology Assurance Framework - provides a single source through which IT audit and assurance professionals can seek guidance, research policies and procedures, obtain audit and assurance programmes and develop effective reports.

2. Entity
3. Asset

Enterprise governance is the overarching view of governance and applies to all enterprises. It is the highest level view of the governance framework; all governance views within it must be constructed in such a manner as to support the outcomes it defines. The term "corporate governance," which some people use interchangeably with "enterprise governance," is reserved for governance specific to corporations only and very often is based on legal and regulatory compliance. Therefore, enterprise governance is considered to be more generic and to take a wider view.

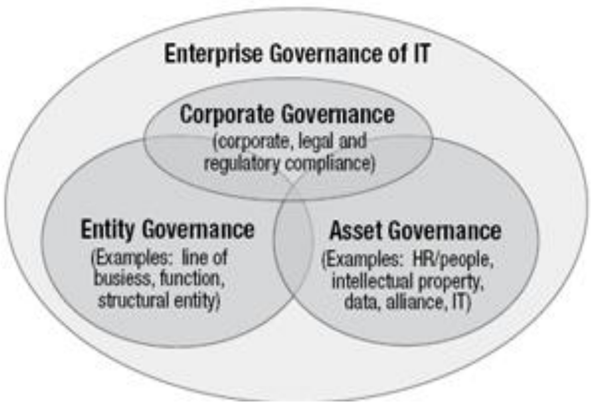

Figure 1: Governance Views (ISACA, 2009)

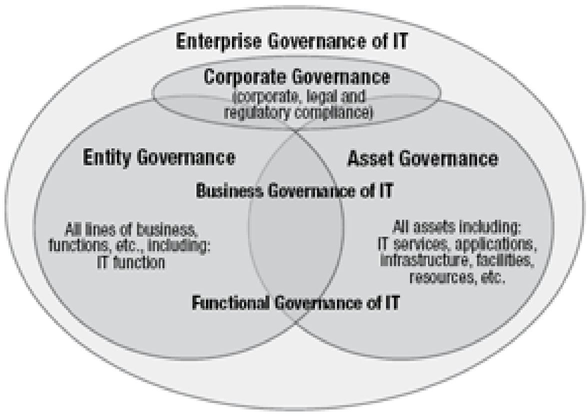

Figure 2: Enterprise Governance of IT (ISACA,2009)

Entity governance deals with a specific line of business within the enterprise (e.g., the MP3 line within a consumer electronics corporation), a specific function within the enterprise (e.g., compliance) or a specific entity within the enterprise (e.g., a branch office in a multinational corporation).

Asset management ensures that those managing the critical asset report back to the owners of the asset. It should be noted that the term "assets," as used in this initiative, is not to be confused with only those assets appearing on a financial statement. These assets can be tangible (e.g., people, technology, capital, facilities, equipment) or intangible (e.g., intellectual property, processes, brand, reputation, knowledge, legal structures). Portfolio, program and project governance reside in this view.

Figure 2 takes the generic governance views model presented in Figure 1 and customizes it for the enterprise governance of IT, which incorporates business governance of IT and functional governance of IT. In the context of IT *corporate governance* focuses on corporate legal and regulatory compliance issues that relate to IT; *entity governance* focuses on IT function issues, and/or *asset governance* focuses on IT asset issues. Combination of entity and asset management called *business governance of IT* is sometimes referred to as "demand" side of governance and it addresses ensuring that IT is aligned with and supports the business strategy (can be supported by Val IT framework); *functional governance of IT* can be referred as the "supply" side and it ensures that IT function operates effectively and efficiently to deliver IT services (can be supported by COBIT, ITIL).

This "governance on page" view should be available to public in a web-based, collaborative environment to support review, discussion and contribution in the second quarter of 2010.

3. COBIT Evolution

The best practice COBIT which is the most recommended standard for IT Governance has already 14 years history:

- In 1996, the first edition of COBIT was released.
- In 1998, the second edition added "Management Guidelines".
- In 2000, the third edition was released.
- In 2003, an on-line version became available.
- In December 2005, the fourth edition was initially released.
- In May 2007, the current 4.1 revision was released
- Currently COBIT 5 is designed in alignment with the mapping initiative TGF.

Based on limited information about the new version of Cobit, the main differences comparing with Cobit 4 are the next ones.

3.1. One Integrated Framework

Till now, Cobit 4, Val IT, Risk IT and ITAF frameworks were separated each other even to the fact they followed the same philosophy. Cobit 5 will be consolidated into a single overarching framework integrating all above frameworks. A new product set will be developed recognizing that the content will need to be presented, readable and usable in practice for diverse range of stakeholder needs (external, internal – owners, governing body, management).

This new concept of Cobit 5 needs to be supported by a new architecture. The core part of this architecture is a database repository – knowledge base, which will ensure, that all the available components are complete, consistent, properly organized and easily maintained in the future. Furthermore the knowledge base will have links to external standards and best-practice sources. This part of architecture will be accompanied by next two parts – layers, so the final Cobit 5 architecture will have next three layers (ISACA, 2010):

- *Cobit 5 stakeholders* – This layer considers stakeholders for IT and their needs and objectives. These needs provide a lens to the knowledge base and through this lens relevant content of Cobit 5 knowledge base is selected and converted either in products or customized deliverables.
- *Cobit 5 knowledge base* – This layer contains complete set of knowledge contained in Cobit 5 including all domain – and process – related information. This information is structured using the models and components defined in the Cobit 5 metadata.
- *Cobit 5 metadata* – This layer contains the description of all components used in Cobit 5 and the relationships between them.

3.2. New Models

Users of Cobit 4 are already familiar with the Process Model and the Maturity Model. New version of Cobit will introduce other models which are either new one (e.g. Information Reference Model) or are taken from another frameworks and aligned to Cobit 5 (e.g. Risk Model, Value Model, Resource Model, Value Model, Control Model, Organizational Structures Model or Behavioral and Skills Model).

3.3. Information Reference Model

Cobit 4 deals with the information criteria (ITGI, COBIT): effectiveness, efficiency, confidentiality, integrity, availability, compliance and reliability.

Cobit 5 defines information as the step between Data and Knowledge on the information life cycle. The dimensions of information are enlarged to next levels:

- *Information criteria* to which information should conform: privacy, regulatory, security (confidentiality, integrity, availability) and quality (consistency, clarity, completeness, timeliness, accuracy, relevance, reliability).
- *Information stakeholders*: Who have an interest in the information, e.g., for conformance reasons? Special impact will be on the stakeholder type and stakeholder role (Owner, Custodian, Sender, Receiver).
- *Information purpose*: Information can serve many purposes, e.g., operational information, or instructions, or monitoring information, etc. It is possible to express the purpose in terms of the TGF communication flows between different roles.
- *Information attributes* that can be used to further describe and manage information, e.g. lifespan, context, access channels, etc.
- *Information type*: Is it current or old information, what is the nature of the information?
- *Information use*: By whom is the information used? By which business processes? Which actions can be performed on it?

3.4. Sustainability

Cobit 5 views the sustainability as a significant issue which includes the ability to trust in and continue to safety and continually use of information and the systems that process it within the enterprises and within the global environment. COBIT 5 will include improved coverage of these sustainability issues and also address the use of IT blond the traditional IT function, within the business and throughout enterprise activities.

3.5. Inclusive Stakeholder Approach

The intended users of Cobit 4 are executives and boards, business and technology management and assurance, governance, control and security professionals. In the context of information, COBIT 5 will extend its scope to ensure that governance and management processes, policies, organizational structures, etc., adequately consider the needs of all potential information and related technology stakeholders both within and outside the enterprise, including employees, contractors, users and business partners and suppliers. It is understood that these needs can be conflicting, so there must be effective governance mechanisms to deal with these potential conflicts: who has a say, who decides, who needs to be involved, and how and what information is needed.

4. IS Audit/Assurance

The word 'audit' is being used in the Czech Republic as well as in the other countries with growing frequency. In addition to financial audit, which are the original and trendsetting type of audit, there are now environmental audits, information systems audits, management audits, forensic audits, data audits, and intellectual property audits, medical audits, teaching audits, technology audits, stress audits, democracy audits and many others besides. More generally, the spread of audits and other quality assurance initiatives means that many individuals and organizations now find themselves subject to audit for the first time and, regardless of protest and complaint, have come to think of themselves as auditees. Indeed there is a real sense in which all advanced countries have become an 'audit society' (Power, 2009).

Audit in general is defined as a systematic process of objectively obtaining and evaluating evidence regarding assertions about business actions and events to ascertain the degree of correspondence between those assertions and established criteria, and communicating the results to interested parties. It is a form of attestation service in which the auditor issues a written report expressing an opinion about whether the financial statements are in material conformity with generally accepted principles or other recognized criteria (Soltani, 2010).

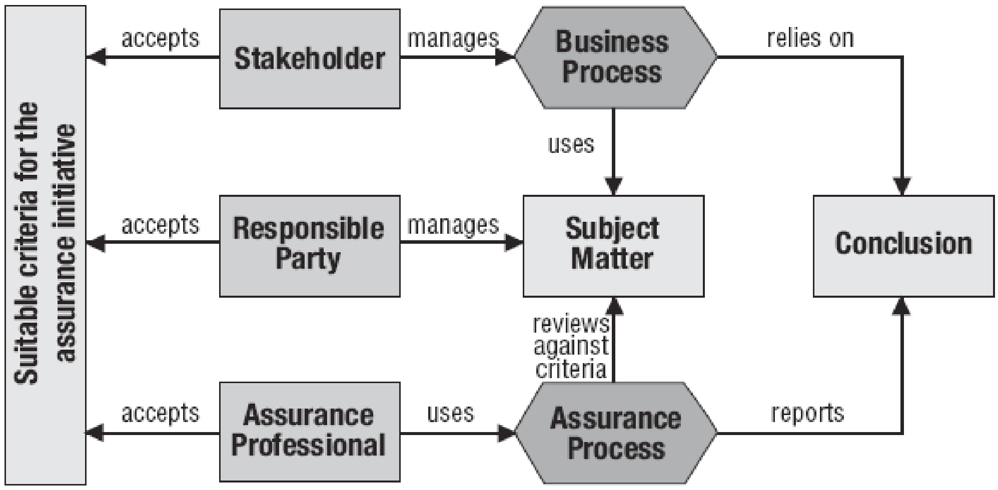

Figure 3: The relationships in the assurance initiative (ITGI, Assurance)

Last few years we can notice the trend to substitute the term audit by the term "assurance". The objective of an assurance initiative is for an assurance professional to measure or evaluate a subject matter that is the responsibility of another party. For IT assurance initiatives, there is generally also a stakeholder involved who uses the subject matter but who has delegated operation and custodianship of the subject matter to the responsible party. Hence, the stakeholder is the end customer of the evaluation and can approve the criteria of the evaluation with the responsible party and the assurance professional. The conclusion of the evaluation provides an opinion as to whether the subject matter meets the needs of the stakeholder 0. Assurance is thus much broader concept than auditing. Assurance also covers evaluation activities not governed by internal and/or external audit standards and thus helps executives to approve, whether the subject matter is able to attain the stated goals.

Trying to apply these types of evaluation in practice, we can face many problems. Going through professional or public communication media, we can register many statements dealing with either the call for some kind of audit as a reaction to some problem or the criticism, that specific audit

(audit firm or auditor) did not fulfilled the expectations of the stakeholders. The frequency of such statements usually increases in the time of financial scandals or crisis.

Owing to the fact, that theory provides a cornerstone for explaining auditing/assurance practices, next part of paper provides short introduction to the theory and problems of auditing in general.

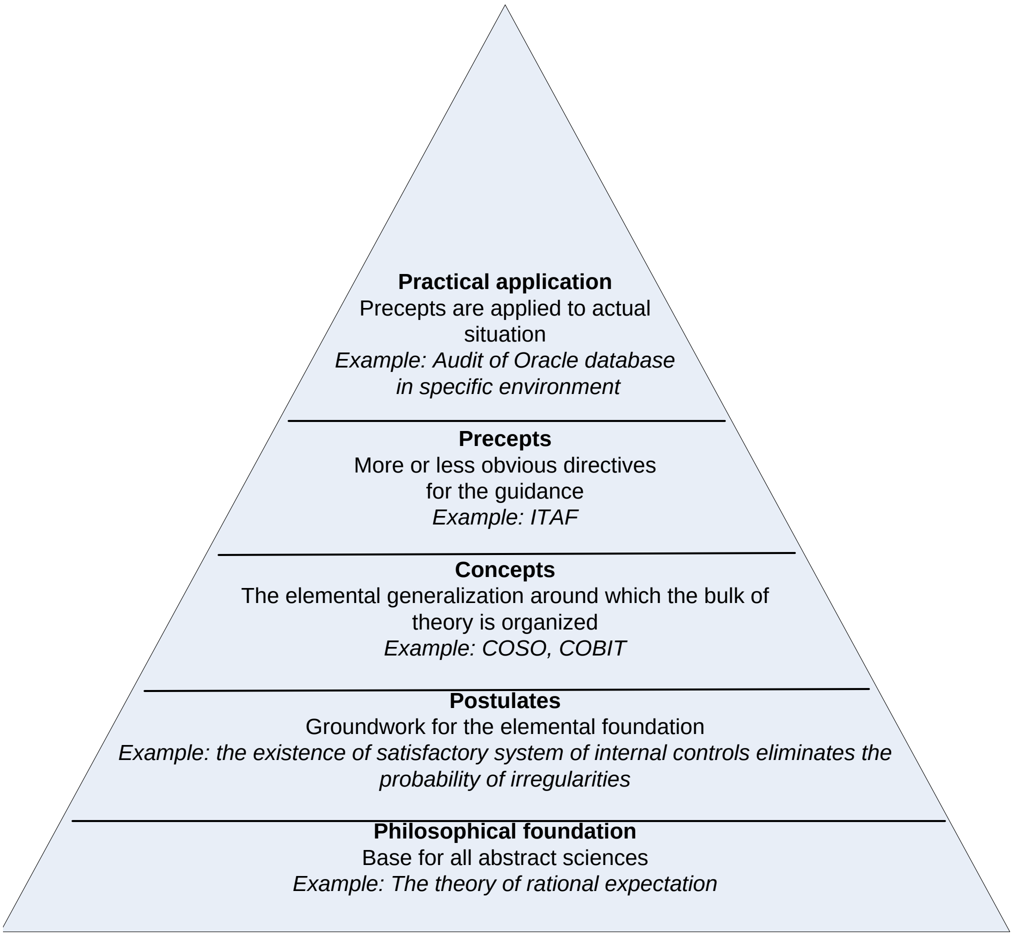

Figure 4: Five-level structure of auditing (Mautz,1961) with examples for IS audit

Auditing has evolved in the capital market economy. The original purpose of audit was to assure that honest and accurate accounting for money and property has been performed in the affairs of government and business as well. In the 1920s and 1930s, Professor Theodor Limperg of the University of Amsterdam presented a set of auditing concepts, which became known as the theory of inspires confidence. Later this theory was called **the theory of rational expectations** (Soltani, 2010). This dynamic theory explains how evolving society´s needs for reliable financial information results in the changes in the auditor´s function and methods. The auditor should be governed by the rational expectations of those who may use his/her report. These expectations should not be disappointed (general auditing norm), but in the same time auditor should not arouse greater expectations in his/her auditors' report than his/her examinations (tools, practices) justifies. Furthermore, Limperg focuses on the social responsibility of the independent auditor and the mechanism for ensuring that audits meet society´s needs. He views auditor as the independent professional acting as a confidential agent for society. Auditor thus must have authority to ask all information about the subject matter but in the same time he/she must be responsible and knowledgeable enough to assess the materiality of the problems (irregularities) and publish only information relevant to the stakeholder´s expectations. In 1960s Mautz and Sharaf (Mautz, 1961) attempted to highlight the scientific nature of auditing. In their view, the status of auditing as a science depends upon the term “science”. If we conceive science as an organized body if knowledge, then auditing can lay some claim to meeting the requirements. If science is interpreted to mean the application of a method requiring the rigorous weighing of evidence and the application of a systematic method to a variety of situations, again auditing may qualify. But if we accept as science only those fields with the power to explain, predict, and control given phenomena, then auditing falls well short (Soltani,2010). Mautz and Sharaf believed that to obtain a comprehensive view of auditing, one should see it as a five-level structure (Figure 4).

5. Conclusion

Current global financial and business catastrophes launched the fundamental changes in the IS auditing. The changes in the understanding the IT Enterprise Government Framework are the base for the new version of best practice Cobit and both of them result in the new more broader concept of IS Assurance. This changes deal mainly with the theoretical concepts, but in case they will be approved and accepted as the new standards, norms, best practices, they will without any doubts influence the everyday management practices in many enterprises. Whether they will bring intended improvements in business process operation and IT value delivery we are not able to say now, and we have to wait several years.

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ICT SERVICE ARCHITECTURE – TOOL FOR BETTER ENTERPRISE COMPUTING MANAGEMENT

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Keywords

ICT service, ICT service architecture, Enterprise computing management.

Abstract

The article discusses approaches to ICT service architecture design and to the role of ICT services in Business – ICT alignment. It identifies the unique role of ICT service architecture in effective ICT support to the business. Better alignment of ICT service architecture with business processes can help the organization to enhance its competitiveness.

This paper describes the outcome of research that has been accomplished as a part of research programs funded by Grant Agency of the Czech Republic. Grant No.: "GACR P403-10-0303" and "GACR P403-10-0092".

1. Introduction

Enterprise computing efficiency and its relationship towards business has been the subject of interest of business and ICT managers for number of years. By *Enterprise computing* we understand the system of an enterprise which consists of ICT services, ICT processes, and ICT resources of an enterprise and their relations. The system development and operations are governed according to the rules set by ICT governance principles.

Numbers of methodologies as well as frameworks oriented toward this area are results of this effort. ITIL, COBIT a TOGAF are between the most important. The latest versions of all these methodologies and frameworks include ICT services as key component. SLA (Service Level Agreement) is used for description of ICT service characteristics. All services are then registered in the services catalogue.

At the time being there is neither generally accepted view on the role of ICT services within Enterprise computing management, nor on architecture of ICT services, nor on classification of ICT services. As the result of this situation ICT services providers as well as ICT services users use their own classification, which creates complications in orientation on ICT services market as well as in design of ICT services catalogue in enterprise. Position of ICT services architecture, being not clear, bring difficulties in enterprise IS solution, especially with use of different forms of outsourcing (e.g. using SaaS-Software as a Service, PaaS-Platform as a Service, and IaaS-Infrastructure as a Service).

Based on ICT Service definition (see section 2), the aims of this paper are the following:

- Proposition of ICT services classification suitable for development of service catalogue (see section 3).
- Present arguments for suitability of ICT services architecture (see section 4).
- Present role of ICT services for solution of relationship between business and Enterprise computing (see section 5).

All procedures presented further in this paper are part of SPSPR model (see below), which is oriented towards solution of relationships between business and Enterprise computing, and which was developed at University of Economics, Prague. These procedures have been practically verified by several practical implementations.

2. ICT services

2.1. ICT Service Definition

Exact definition of ICT service is necessary prerequisite for further discussion of Enterprise computing management based on ICT services. We may start with definition of service in general. Many definitions have been presented in literature. For example, Kotler (1988) defines service as "a dealing, which one party may offer to other party and which is basically immaterial". Booth's (2004) definition is the following „Service is an abstraction of some source, which is represented by source capability of task processing with coherent functionality from the point of view of service provider as well as of service consumer. In order to use the service, it must be realized by a particular provider's agent".

For modeling and management of ICT business support, distinction between business services and ICT services is useful. Business services are produced by enterprise business processes and provided by enterprise to its customers. ICT services are provided by enterprise ICT department or by external provider for business processes support. In specific case both service types may merge (i.e. ICT service is provided directly to customer).

Number of different definitions of ICT service has been presented in literature, e.g. Řepa (2003), ITIL (2007), Gala (2007). Not only definitions as such but also terminology used as "ICT service" equivalent is different which makes the term fuzzy. Different approaches towards ICT service understanding are represented by following definitions:

2.2. ICT Service Definition in SPSPR Model

Basic concept of SPSPR model is represented by Figure 1. Model is used for solution of relationship between enterprise process management and enterprise ICT management. The basis of the SPSPR model is formed by five interacting layers (S-Strategy, P-Processes, S-ICT Services, P-ICT Processes, R-ICT Resources). ICT services in a model are taken as an interface between business and ICT departments (bold line in Figure 1), through which individual business processes or their partial activities are supported by ICT services. ICT service may be delivered internally or bought at ICT market. In the first case ICT department has to provide both ICT processes for service delivery as well as all necessary ICT sources (hardware, software, data, people) needed for ICT processes execution. Places suitable for use of metrics for quality, volume, efficiency and further characteristics of observed objects are marked by "clocks" in Figure 1.

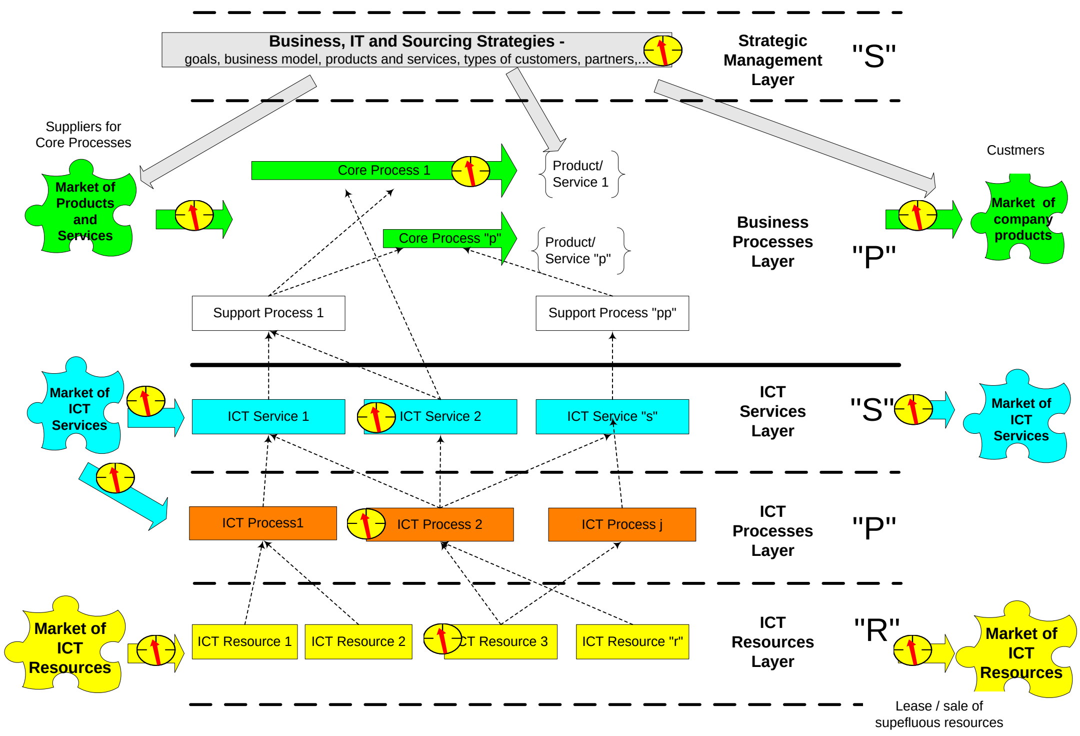

Figure 1: SPSPR Model

Based on this model and ICT services definitions mentioned above we present the following definition of ICT service:

"ICT service is represented by coherent activities and information delivered by ICT service provider to service consumer. ICT service is implemented by ICT processes, which consume ICT resources (hardware, software, data. people etc.) during their execution. Service is realized on the basis of agreed business and technological conditions."

Business and technological conditions are included in SLA (Service Level Agreement) and typically specify the following ICT service characteristics: service provider; authorized service consumers; localities, where the service is available; timing of service provisioning (e.g. 24x7, 8x5, daily from 8:00 till 12:00 a.m. etc.); service content (functionality, data, support, etc.); service volume (number of authorized users, data volume etc.); service quality (availability, response time, reliability, etc.); service costs (including additional penalties e.g. for provider noncompliance with service quality conditions); knowledge/technologies of service consumer necessary for service consumption; mechanisms for providing service continuity in case of accident; security rules and mechanisms (e.g. rules for consumer access to service); form, content and periodicity of service reporting and revision.

In SPSPR model, the following operations are defined for individual ICT services: service definition; service design; service implementation; installation, including channel selection for service delivery; maintenance, modifications, continuous improvement; standardization; customization; contract/agreement conclusion; operation and delivery to concrete consumer; scaling (management of service volume and of capacities necessary for its provisioning); service quality control; service costs and payments; suspension of operation.

The following operations/activities are implemented over all provided ICT services: services strategy; services architecture; services integration; services standardization (merging of several similar services into one service); services packet assembly (several services form a “service package” which is delivered and paid for as a whole).

3. ICT Services Classification

3.1. Introduction - Why ICT Service Classification

Services catalogue, i.e. list of services provided by ICT department, is an important prerequisite of Enterprise computing management based on ICT services. Catalogue good arrangement is the basic prerequisite of efficient ICT services management, as well as prerequisite of easy use of services. Therefore, proper selection of ICT services classification is an important task of catalogue creation.

Current approaches to ICT services management in ITIL, COBIT and TOGAF are oriented mainly at ICT processes (their quality, maturity, efficiency etc.). They don’t deal with classification of ICT services and with service architecture. ICT services structure in services catalogue are therefore solved differently by service providers and by service consumers. To our point of view this situation brings complications in orientation at ICT services market as well as in ICT services architecture design in enterprise.

As an conclusion, based on above mentioned arguments, we may declare that – Service Level Management i.e. management of ICT services delivery in enterprise, as well as support of easy orientation on ICT services market – are the main aims of ICT services classification.

3.2. ICT Services Classification in SPSPR Model

Number of different approaches may be used for ICT services classification. Five different approaches based on service content, way of service consumption, type of service consumer, and type of service provider, resources and knowledge required from provider are specified in Jelínek (2007).

For SPSR model, as well as for management of business ICT alignment, classification of ICT services based on service content is the main classification criterion. This criterion is oriented towards what is delivered by service provider to service consumer and towards relationship of delivered service towards consumer business. In SPRSP ICT services are classified in two groups, Based on service content, i.e.

- ICT services for business, i.e. services which directly support enterprise processes and end-users. They include information, application, and infrastructural, supporting and mixed ICT services.
- ICT services for enterprise ICT development. These services are used for advancement of current ICT services or for development of new ICT services and are not directly consumed by business. Development and delivery of software or of ICT infrastructure are particularly included. This group includes number of services, especially SW development, application implementation and integration, technology infrastructure advancement and consulting.

Because of primary orientation of this paper on business - ICT orientation, only ICT services for business are further described in detail.

3.2.1. Information Services

By information service the required information (e.g. current stock price, weather forecast, map of given locality, book, photo, film) is delivered by service provider to service consumer. Information should be delivered in required structure, format and time. By enterprise the information is used in information and decision processes. Service provider is responsible (as opposed to application services) for information quality (e.g. relevance).

These services present certain specific features e.g.

- Easy replication with low costs. Provider of lucrative service may benefit from high revenue.
- For some services the legislation (e.g. author law) may limit service consumers' way of using information.
- Though, the information is delivered by software application, the functionality of this application is not relevant for the user.

3.2.2. Application Services

Functionality of business application (e.g. accounting, CRM, e-mail, air-ticket ordering) represent the content of application service. Data, processed by application, may be fully owned by consumer (e.g. accounting, CRM), fully owned by provider (e.g. Google search engine) or combined from both sources (e.g. air-ticket ordering). Service provider is responsible for data transformation (provided by application); data owner is responsible for correctness (quality) of input data.

By application services oriented towards business processes application functionality may implement one or more activities of business process, i.e.

- Service may support only selected activities of business process (e.g. ordering of goods).
- Or a service represents an entire business process (e.g. internet banking).

Application service may often be delivered as a whole together with supporting services (e.g. training, help desk, customization). SaaS (Software as a Service) – e.g. Salesforce CRM - may be regarded as modern and popular way of application service delivery.

3.2.3. Infrastructure Services

Implementation and operation of ICT infrastructure (e.g. servers, networks, operating systems, databases) required for application processing represent the content of infrastructure service. By Ross (2002) these services include:

- Services for technological resources administration. They include e.g. provisioning and administration of end-user devices, implementation of platform for new business applications development and implementation.
- Communication channels services, which include management and integration of all electronics communication channels used for enterprise communication with consumers. They include e.g. Internet (Web, ICQ, e-mail), phone, EDI (Electronic Data Interchange).
- Communication services oriented towards provisioning of communication links, by communication networks, between individual places of business applications processing.

- Data administration services, which provide an environment for data management (i.e. accessibility, storage, archiving, replication, restoration after failure etc.) independent of applications.
- Services for risk management and ICT security. They are used for provisioning of specified level of information security, which is represented by set of features (e.g. integrity, reliability, non-repudiation etc.) as well as provisioning of ICT trust environment for all parties (customers, partners, employees, owners).

Cloud computing present different approach towards infrastructure services classification by specification of two types of these services, i.e.:

- IaaS (Infrastructure as a Service), which include services without development platform and integration tools.
- PaaS (Platform as a Service), which include services including development platform and integration tools.

3.2.4. Supporting Services

These services are needed for user support of information, application and infrastructure services. They include namely training, implementation, application customization and integration, help desk services, consulting services for service design, preparation of service contract or for tender organization and execution.

3.2.5. Mixed Services

Often the above mentioned services are tightly connected in practice, resulting in mixed services.

4. ICT Services Architecture

4.1. ICT Services Architecture in SPSPR Model

ICT services architecture comprise definition of individual ICT services used by enterprise and their relationships. Services dependency, i.e. situation when existence of certain service is determined by existence of another service (e.g. infrastructure service as prerequisite of application service), is depicted by service links.

There are different aims of using ICT service architecture by service consumer (enterprise) and by service provider. Service consumer aims at provisioning and integrating (either internally or externally) all ICT services required for business processes. Service provider aims at delivering services portfolio with greatest revenue, taking into account consumer segments and territory.

Individual ICT services are mapped to other model objects in SPSPR model. By mapping to business processes or enterprise departments the service consumer (i.e. department or process) is determined. Mapping to ICT processes determines which ICT processes take part in service creation and delivery. Mapping to ICT applications determines by which applications the service is provided.

In SPSPR model the ICT services and their architecture represent the main communication tool for communication of business departments and ICT department. In this way the ICT services “hide” ICT processes and ICT resources (including application architecture) for business users. This situation brings following two significant benefits of SPSPR model:

- All technical details of ICT services provisioning, including specification of which application the functionality of information and application services is provided, are excluded from the interface between business and ICT department (see SLA structure in section 2.2). This problem is solved by ICT department and by its ICT strategy.
- Information, application and technological architectures of those ICT services, which are – based on sourcing decisions – delivered by external providers, need not be solved in detail in enterprise.

4.2. ICT Services in TOGAF and ITIL

TOGAF (Open Group 2009) and ITIL (2007) are currently the most frequently used frameworks for Enterprise computing management. TOGAF is oriented towards design and implementation of ICT services as products for business goals. ITIL is mainly oriented towards delivery of these ICT services to users and customers. TOGAF is based on Enterprise Architecture (EA) repository, ITIL is using information storage in form of Configuration Management Database (CMDB).

There is lately and intention for interconnection of both frameworks. Braun and Winter (2007) declare, that "In case of EA being the central enterprise engineering concept and ITIL being the dominant operational model for IT, ITIL has to be sufficiently integrated into EA" and also propose interconnection of EA and ITIL meta-models (see Figure 2).

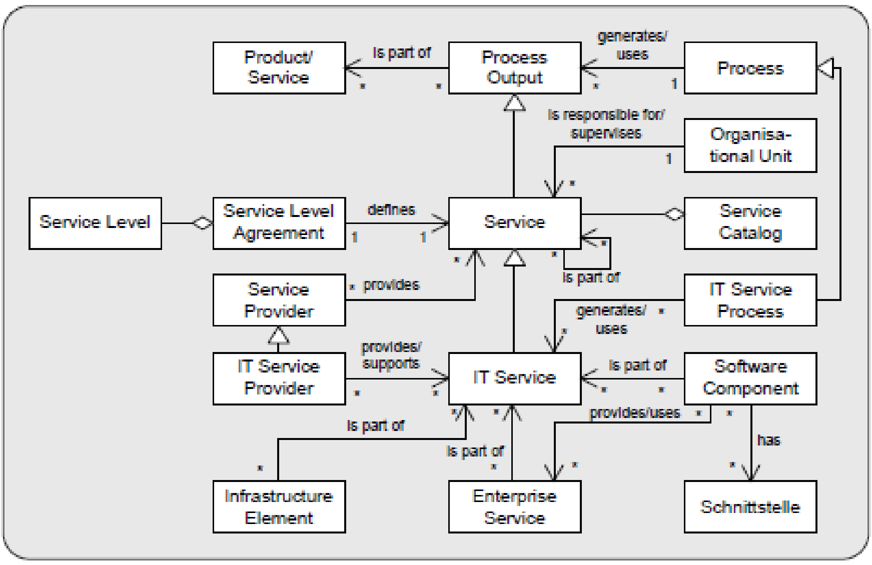

Figure 2: EA and ITIL metamodels integration, Brown and Winter (2007)

Although both frameworks (ITIL and TOGAF) include ICT services and their catalogue, as key meta-model element, they don't mention ICT services architecture. However they deal with business, application, information and technological architectures.

There are different points of view towards ICT service architecture use in frameworks like TOGAF. By Hrabě (2010) "If it possible to view enterprise as system of systems, than ICT services are not its subsystem (on the contrary to ICT as a whole), therefore it has no own architecture and it is not possible to describe and model this architecture". "Services are used in enterprise in number of different types and categories and ICT services architecture is not possible without inclusion of links with number of objects from different areas of enterprise architecture. Therefore it is not necessary and makes no sense to search for neither specific (isolated) general services architecture nor ICT services architecture.

From our point of view the ICT services architecture inclusion in TOGAF could be beneficial. In this case two new phases i.e. ICT business services architecture design and Decision on ICT services sourcing would be included between two existing TOGAF phases i.e. Business architecture design and Information and application architecture design (see Figure 3).

Hamlett's (2007) requirement for inclusion of outsourced ICT services scope into enterprise architecture concept would also be solved by this modification.

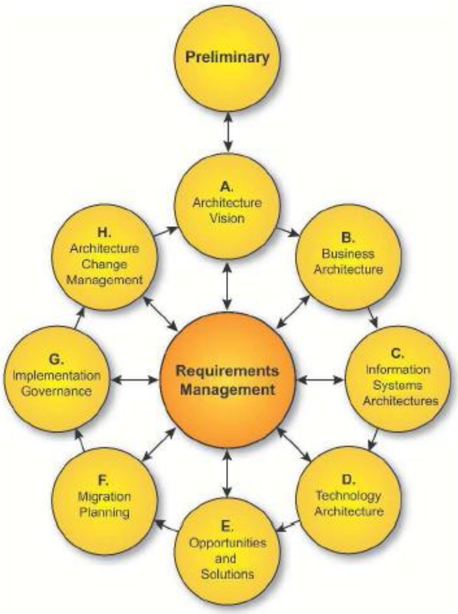

Figure 3: TOGAF - Architecture Development Method, Open Group. (2009)

4.3. The Role of ICT Service Architecture in SPSPR Model

The purpose of dividing business management into five layers (see Figure 1) is following:

- Clear identification of responsibilities of different levels of enterprise managers.
- Transparent way of decomposition of enterprise business goals, up to the layer of ICT management.
- Schema creation, which enables to create a set of metrics for success evaluation of individual process types and responsible managers. See places marked by clock in Figure 1.

Strategic business management is fully in competence of top-management. It is responsible for setting the business goals and priorities and for creating conditions and resources enabling achievement of these goals. It means that its tasks consist of setting products and services the organization will produce, core customers – those the business is orientated on, main business partners (esp. for finding one's position in a value chain). It is also responsible for creating and sustaining resources (people, knowledge, finance, technology, etc.) necessary for achieving goals.

Enterprise fulfils the business goals by means of core business processes. Design and management of business processes in such a way, that organization fulfils the strategic goals is the main task of second level – i.e. *level of core and supporting processes*. Main activities at this level are the following: a) definition and optimization of business processes, b) operational management of processes and capacities, c) processes monitoring d) process execution and e) sources management.

The manager responsible for the process definition and optimization is responsible for suggesting the process (individual activities, their sequences, etc.) in such a way that the process leads to the production of competitive product/service in the optimal time, volume, quality and at acceptable costs. The following metrics may be used to measure the efficiency: volume of sold production/service, profit from the sale of product/service, etc.

Now we are coming to the first important characteristics of the SPSPR model, which is the reaction on current trend in division of responsibilities between business and ICT managers. A part of the process definition must also be the suggestion of ICT services that will optimally support the business process. This is, in fact, an explicitly described responsibility of a process manager (owner) for "ordered volume and ordered quality" of ICT services. The process manager has to calculate an acceptable (limit) cost of ordered ICT services. The cost of ICT services is one of the business process cost items and once it becomes too high, the final product/service would be no longer competitive at the market. This is one of the key points of the model. When it is not possible to ensure required ICT services for this limited cost, then it is crucial to adjust the main process and its requirements for ICT services (see Figure 4).

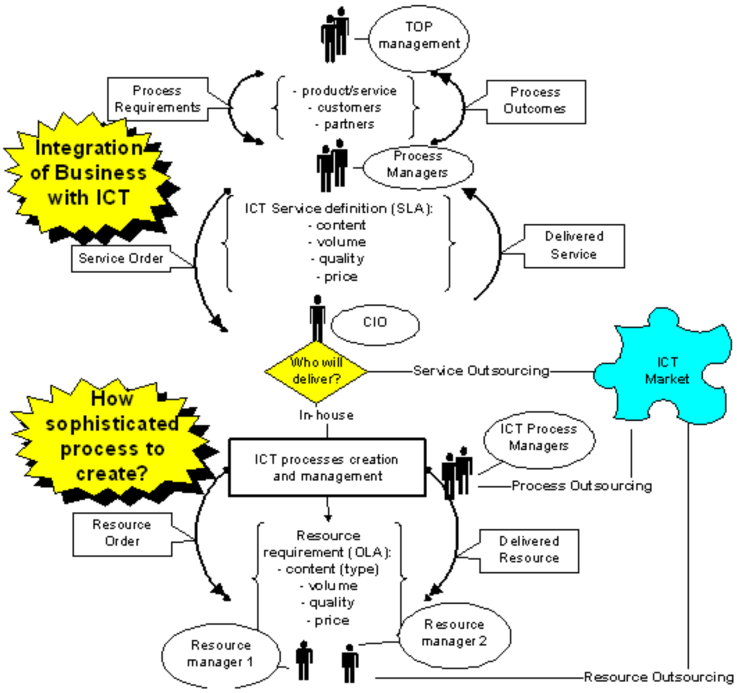

Figure 4: Interfaces between layers in the SPSPR model.

The process manager is buying the necessary ICT services from the ICT services manager(s). In the case of the centralized model of ICT management, the CIO is the one in charge of all ICT services. He also decides the form (internal / external / combination) of their assurance. However, in the case of the decentralized model, the Process manager can himself also approach the external providers of ICT services and buy the service from them. In each model, it is advantageous to apply the same ICT services definition and its structure for both, internal and external providers. Once we apply the same structure of the service definition, then it is relatively easy to decide whether to purchase the service from an internal or an external provider.

Having done this, we have managed to reach the third layer of business management – the layer of information services. ICT service definition should have the same structure for service provided internally as well as for service provided externally. In this case the consistent criteria set may be used for decision, whether we buy the given service (e.g. functionality of application for production logistics) internally or externally.

The ICT services manager is responsible for the delivery (operation) of the contracted services. In case the manager decides to purchase the ICT service from an external provider, the problem of information service management reduces to the contract making and control of its carrying out. The contract includes SLA for all contracted services. When the service is ensured by in-house provision, the CIO is obliged to ensure required ICT processes and provide required ICT resources.

The criterion of ICT services manager effectiveness and efficiency is not only the measure of fulfilling the service parameters as agreed within SLA, but also achieving such service costs that are lower or equal to the contracted price, and at the same time are comparable (by using benchmarking) with the prices of similar services on the IT market.

ICT service is produced by ICT processes (e.g. change management, incident management, etc.). These processes, managed by ICT process managers create the fourth model level. Importance of ICT processes quality increases especially with the following parameters of ICT services:

- Importance of business process, which is supported by given ICT service (critical business processes need services with high quality).
- Number of service users; the more users are using given service the more mature ICT service ought to be.
- Requirements on service quality (availability, response time, security etc.).
- Total number of ICT services (for increasing number of services also requirements on their integration as well as on corresponding processes and resources are increased).
- Total volume of ICT resources, which are consumed by ICT processes.

From above description it may be seen that the maturity of ICT services should grow with the number of internally provided ICT services and with the level of SLA parameters.

ICT resources management is the last management layer in SPSPR model. Resources include namely: technology infrastructure (hardware, network, and system software), application software, data, and material and ICT personnel. Managers on this level exercise classical ICT professions such as: application administrator, network administrator, database administrator, etc. Their responsibility is to operate and maintain the resource at acceptable costs. Activities belonging to the administration of technological resources are as follows: observation of resource utilization and its capacity changes consequent with changes in service requirements, observation of developing trends and planning of time – when the resource is going to be upgraded, etc. Human resources management deals with recruiting new employees with required qualifications, career development planning, retraining, etc. The criterion of resources manager effectiveness and efficiency is acquisition; maintenance and development of resource at the level that is, in the matter of quality, comparable with the quality available in the market, and in the matter of capacity, corresponding with the requirements of internally provided information services.

Responsibilities of ICT department towards business may be deduced from SPSPR model. From this point of view the main responsibilities are the following:

- Cooperation on business strategy.
- Cooperation with business managers, in order for them to use properly ICT potential for support of their business processes and business goals (by formulation of requirements for ICT services).

- Review of consistency and implementation ability of required services.
- Delivery of agreed upon services in agreed upon time, content, quality, volume and costs.
- Costs of internally provided services should be equal or lower than services market costs.

Secondary responsibilities include mainly:

- Proper choice of sourcing for ICT services, processes and resources.
- Quality (proper maturity) of ICT processes.
- Information system integrity.
- ICT costs should correlate with enterprise performance, e.g. volume of delivered ICT services should react on seasonal business changes.
- ICT flexibility towards changes in business requirements.

5. Conclusion

Possible approaches towards ICT services classification and architecture and their role in ICT – business management are proposed in this paper. Approaches used in our SPRPS model are described in greater detail as we feel they may be of general use. We are convinced that approaches described in this paper may bring the following benefits for enterprise computing management:

- Clear responsibility definition in relationship towards ICT for various levels of enterprise managers and specialists.
- Transparency of the way of enterprise business goals decomposition to the ICT operations management.
- Development of schema from which the metrics of success of individual process types and responsible managers may be deduced.
- All technical details of ICT services provisioning are excluded from the boundary between business and ICT department which makes business managers specification of ICT services requirements easier.
- Detailed information, application and technological architectures of those ICT services, which are on the basis of sourcing decisions delivered by external provider, need not be solved inside an enterprise.

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Human Resources in ICT

HUMAN RESOURCES IN ICT – ICT EFFECTS ON GDP

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Keywords

ICT sector, human resources in ICT, information economy

Abstract

Increasing impact of the ICT sector on the whole world economic is more and more visible in our period. Not only in the time of prosperity, but also in turbulent times of recession and crisis derives majority of business activities and economy sectors benefit from ICT services. Systematic research work in the area of human resources in ICT and contributions of ICT sector to economy is running on FIS for a longer period. There are presented here two main fact and aspects of ICT – the influence of the actual ICT on economy – number of ICT experts in Czech economy and its effectiveness from the point of view of added value to GDP.

This contribution was prepared with support of the Czech Science Foundation GACR – research project 402/09/0385 - Human Capital in IS/ICT Operations and Development: Competitiveness of Czech Tertiary Education Graduates.

1. Introduction

Economic theory attributes an important role to the ICT take up of businesses for increased efficiency, innovation and growth. Therefore, the take up of ICT by world businesses is crucial for the raising of productivity, potential and future growth prospects. In the context of the current economic and financial crisis, it is important to remember the central role played by the production and take up of ICT in driving innovation, productivity and growth. There are visible three main impacts of ICT on economy:

- ICT- producing industries contribute directly to productivity and growth through their own rapid technological progress (Doucek, 2009),
- ICT use improves the productivity of other factors of production (or inputs) (Delina, 2004; Delina, Grohol, 2003; Doucek, 2009),
- there are ‘spillover effects’ (effects of emergence) on the rest of the economy as ICT diffusion leads to innovation and efficiency gains in other sectors (Delina, 2004; Delina, Grohol, 2003; European Commission, 2009).

The ICT influence on normal life of corporations in Europe is well visible on following Figure 1.

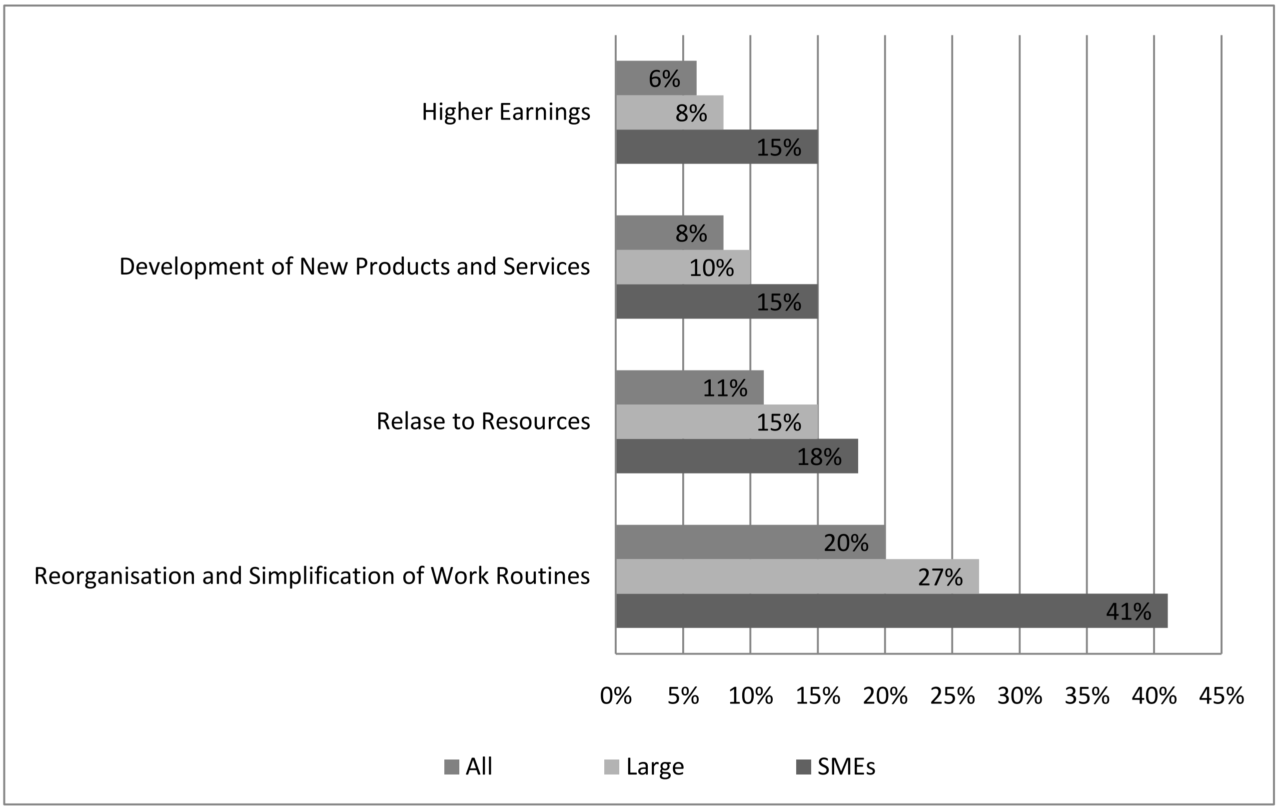

Figure 1 Perceived Relevant Benefits of ICT Deployment - Percent of Enterprises for Which the Listed Benefits are Relevant (European Commission, 2009)

ICT benefits for business are normally expected to realize through processes efficiency, innovation and market potential (Mohelska, 2009). Presented chart shows that enterprises perceive ICT more as a tool for increasing productivity and reducing costs, rather than an instrument for raising the number of reachable customers and the related turnover of the enterprises (Figure 1). Other aspects of ICT improvement especially of ERP systems are well presented in (Sudzina, Pucihar, Lenart, 2009). But what are main impacts of the ICT on economy?

2. Contribution of ICT Sector to Czech Economy

The Czech Republic as a member of European Union is able to benefit from its position in this alliance. On the other hand it has limits generated by legal and normative frame of the Union. During measurement of readiness and abilities of the Czech economy in relation to ICT is important to know how many persons work in ICT sector and what is the share of this sector on the whole state economy; respectively on the GDP (Fiala, Langhamrová, 2009). Number of active population working in ICT sector – ICT experts in Czech Republic since 1993 up to 2009 is shown on following Figure 2.

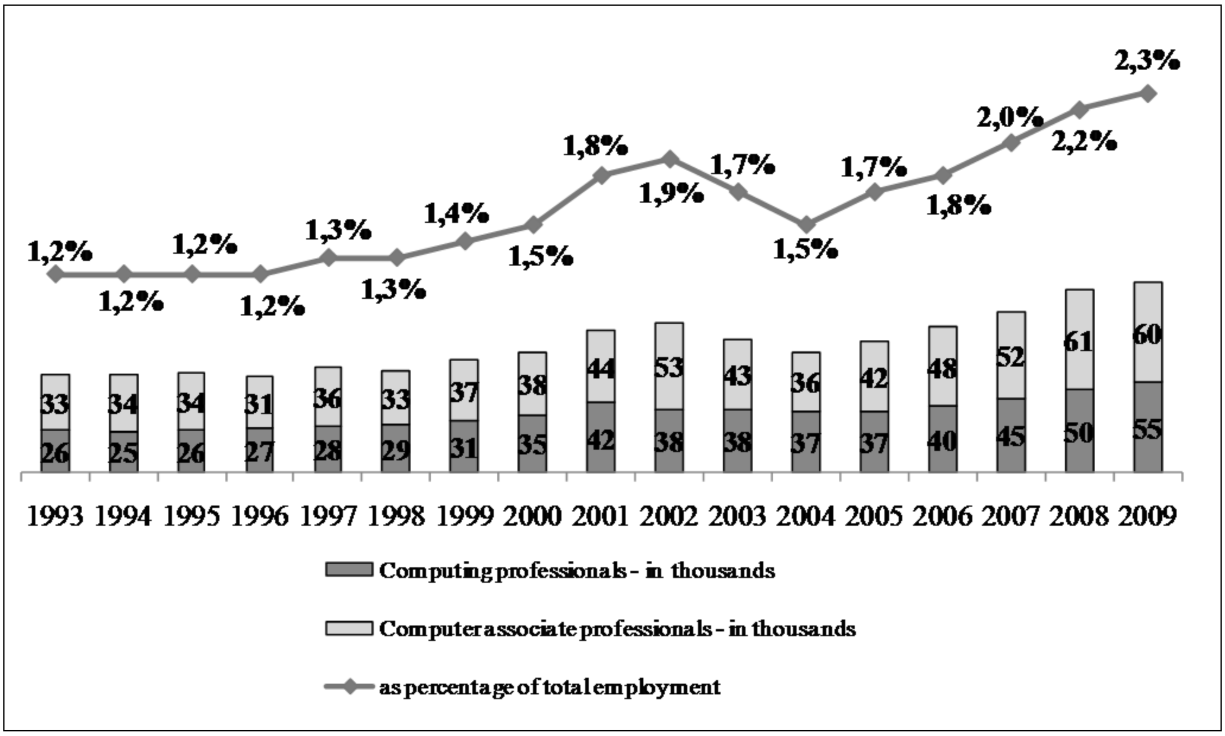

Figure 2: ICT Experts in the Czech Economy (CZSO, 2009)

2.1. Wages in ICT

The first indicator of ICT situation in Czech Republic is related to money - especially to wages. Typical situation in the Czech economy is presented on Figure 3.

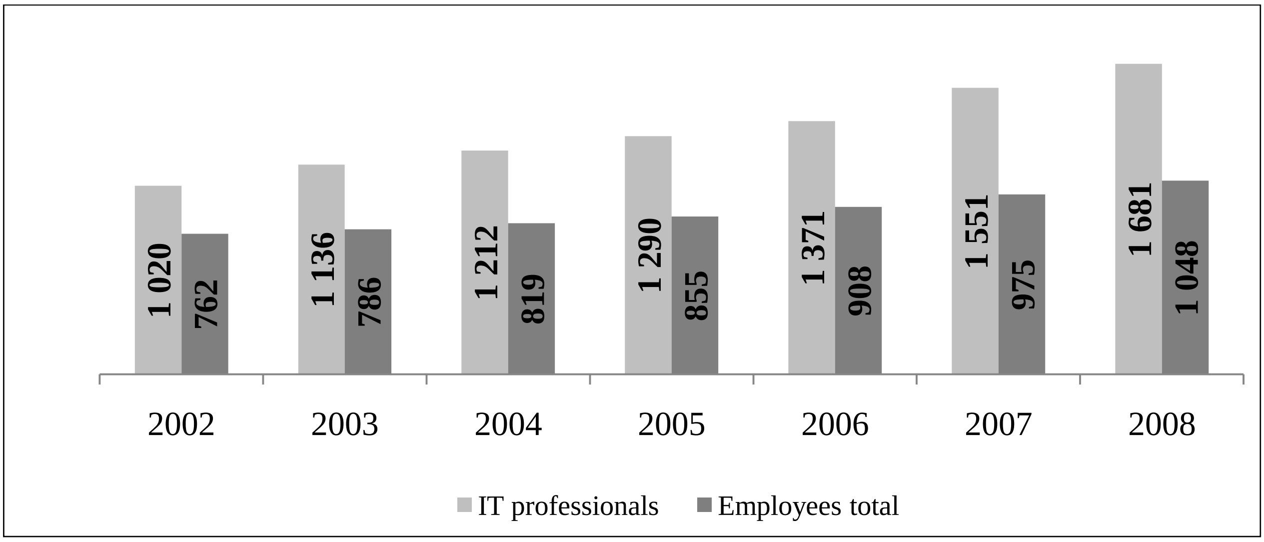

Figure 3: Average Gross Wage in EURO in Czech Economic and for ICT Experts (CZSO, 2009)

Average gross wage in ICT sector is increasing more quickly than wages in the whole economy. More detail analysis of this fact is presented in Table 1.

	2002/2003	2003/2004	2004/2005	2005/2006	2006/2007	2007/2008
Employees total	3,2 %	4,2 %	4,4 %	6,1 %	7,4 %	7,5 %
IT professionals	11,4 %	6,6 %	6,5 %	6,3 %	13,1 %	8,4 %

Table 1: Growth of Wages in Czech Economy in Percents (Author)

The level of information economy is also visible from the rate of ICT professionals on the whole employed population. The number of ICT experts is permanently increasing, but the real final effect of this increase is presented on Figure 7.

Gross Wages by Regions

Typical feature for ICT expert's wages in the Czech Republic is that they are higher than state average (Figure 3) and increase higher than in average of the economy (Table 1). Other aspects of wages influence on economy are for example presented in (Hanclova, 2006). Only for information the sector with most fast increase of wages is finance sector (banks, insurance companies, investment and stock companies etc.). Wages for ICT experts are not the same all over the whole territory of Czech Republic. Map of the average wages (in Euro) in Czech regions is visible on the Figure 4. It presents situation in year 2008 – start of crisis and was officially issued by Czech Statistic Office in the last year. More detail analysis of selected aspects of financial crisis impact on ICT sector is in (Doucek, Nedomová, 2010).

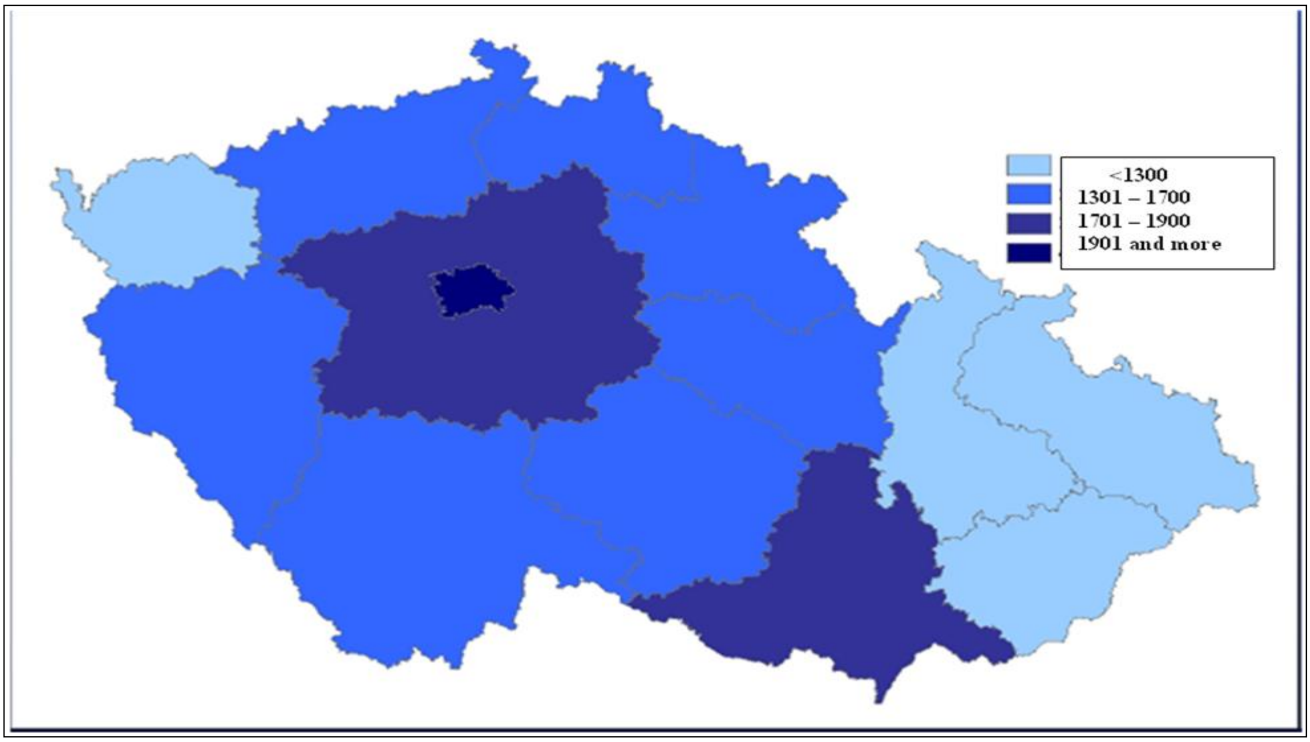

Figure 4: Average Gross Wage in EURO in Czech Regions for ICT Experts in 2009 (CZSO, 2009)

Absolutely highest income for ICT experts is in Prague (higher than 1901 Euros). Two regions immediately behind Prague are Middle Czech Region and Brno Region. On the opposite side of wage spectrum are regions of Olomouc, Ostrava and Zlín (de facto Northern and East Moravia) and Region Karlovy Vary (Carlsbad) with lower wages – less than 1300 Euros in month.

Partial Conclusions – Wages in ICT

We have only results for the end of the growth period, but nevertheless are visible some new trends. There was identified one trend in Czech economy in the first quarter of 2009. Although is increasing the unemployment rate in Czech economy, average wages were higher than in the last quarter in 2008. The reason is compensation money for these persons that are separated from employment. These fired persons, according to valid Czech acts, become compensation money for more months (this period depends on the age of person or on employer) and this money come as input data into static surveys…. and the average wage rises. Data for period 2006/2007 represent overheated boom of ICT. Other aspect is the inflation rate as a mean for increasing of GDP (2006 – 2,5 %, 2007 – 2,8 %, 2008 – 6,3 %) (European Commission, 2009).

2.2. Added Value Produced in ICT Sector in Czech Republic

Another synthetic indicator of the ICT sector contribution to the economic growth is share of added value of the ICT sector on the whole GDP. The development of the contribution of the ICT sector to Czech economy is split into two categories – contribution of ICT manufacturing (computer and other hard ware components assembling) and ICT services contribution. ICT services are more effective form by what ICT sector influences economy. It is an area of activities with large share of qualified work (on the other hand is more intensive on knowledge and on the level of ICT skills) and by this way it assures greater share of added value with comparison to assembling of hardware – Figure 5.

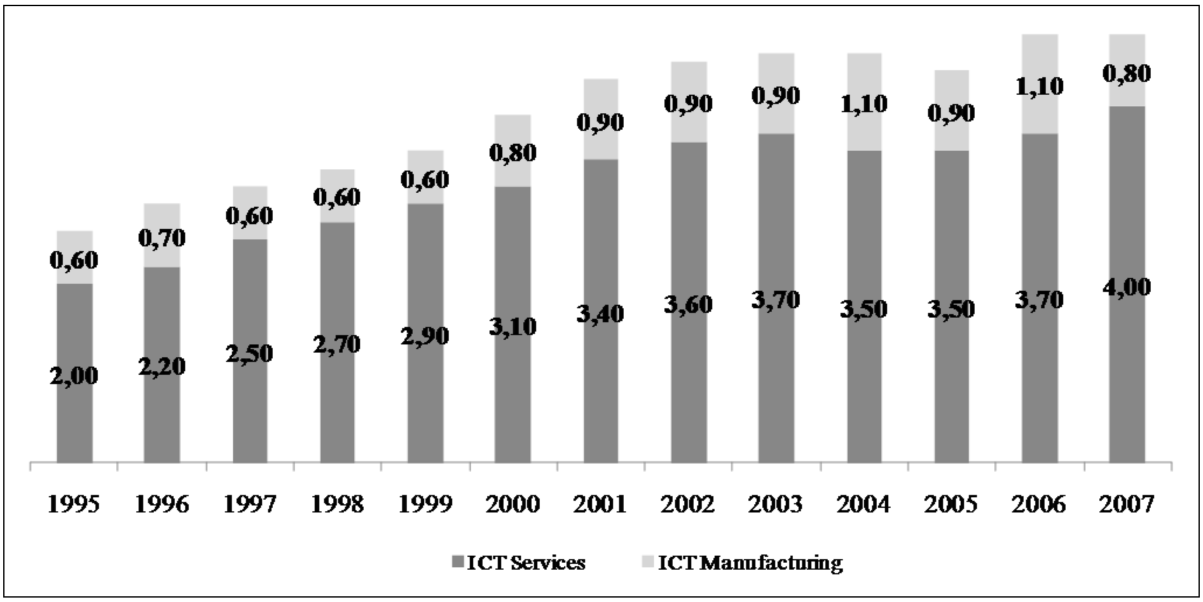

Figure 5: Annually Structure of ICT Sector Added Value to GDP of Czech Republic (CZSO, 2009)

The effect of ICT services increases permanently since 2005 in the Czech economy and is sharp connected to international and transnational corporations that moved their ICT business activities on the territory of Czech Republic (for example DHL, IBM with IBM Park in Brno and other corporations (Štefaník, Hřebíček, Ráček, 2007). Effect of Czech ICT sector in comparison to other selected European countries is shown on Figure 6.

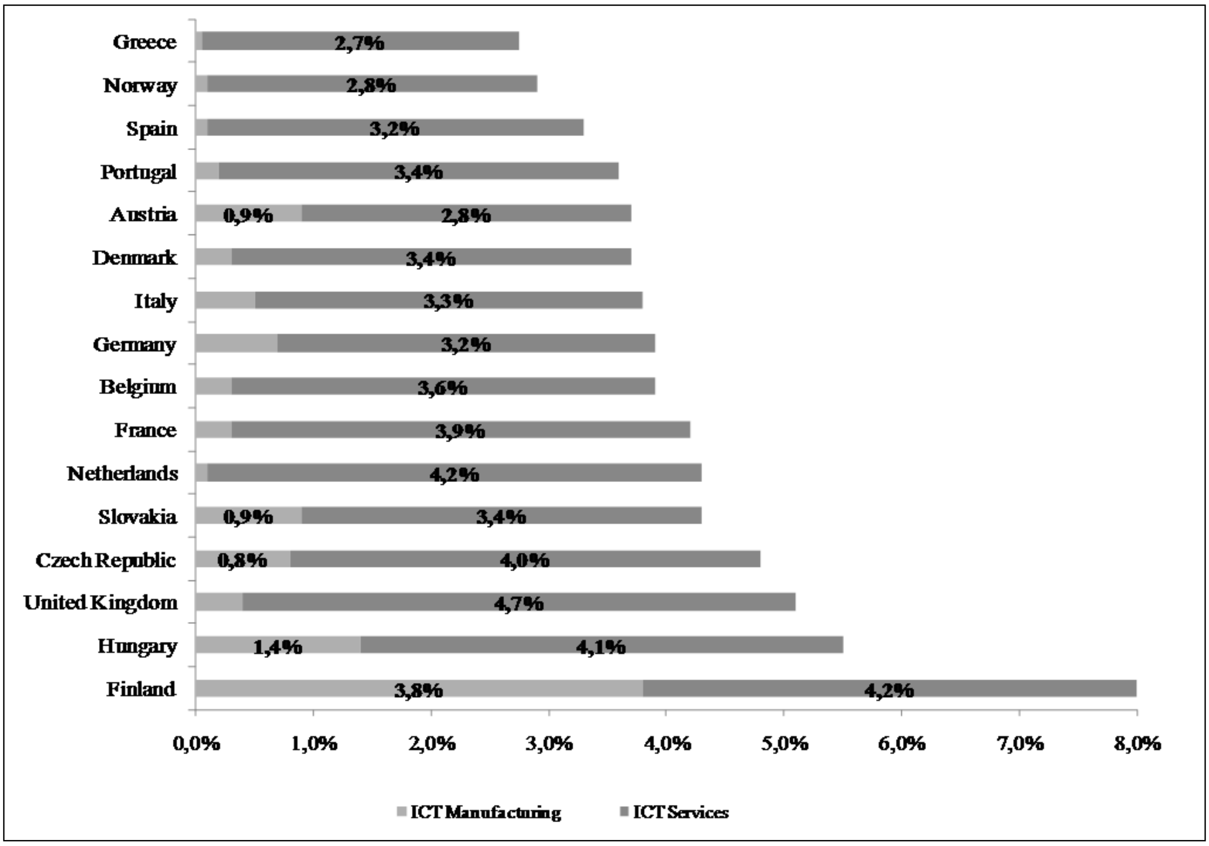

Figure 6: Comparison of ICT Sector Added Value to GDP for Selected European Countries - 2007 (CZSO, 2009)

The largest contribution of ICT sector to GDP in EU is in Finland – 8 %, where is also large ICT manufacturing industry. The largest ICT service industry is in the United Kingdom – 4,7 % of UK's GDP. From the Figure 5 is visible that there are only few countries, where the share of ICT services on GDP is more than 4 %. Behind the UK are with 4,2 % Finland and Netherlands, followed by Hungary 4,1 % and Czech Republic 4,0 %. For other countries is the share lower than four percents.

Partial Conclusion – Added Value

Based on above presented data – especially on Figure 2 and Figure 5 – is no problem to calculate the index of ICT expert's effectiveness – better said the rate of added value contribution of GDP generated by one percent of active working population in ICT. This ICT experts work is spread in all sectors of the Czech economy, wherever they work. Development of this index is shown on Figure 7.

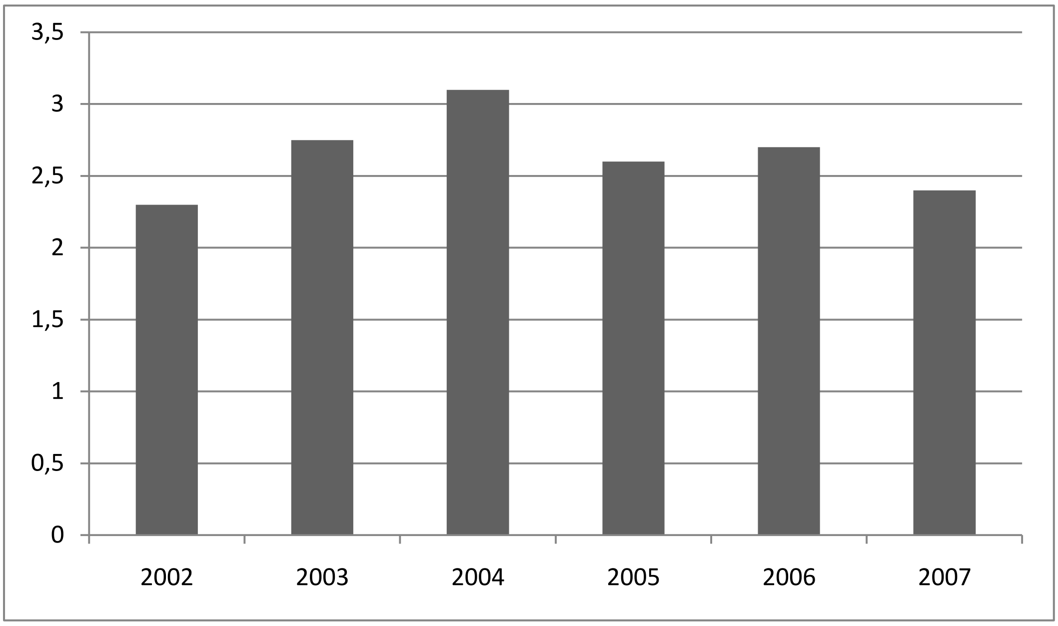

Figure 7: Effectiveness of the ICT Experts in Czech Republic (Author, Data CZSO)

Effectiveness of ICT expert's work (from the point of view added value to GDP) is slowly falling down in the Czech economy during years 2006 and 2007. The effect of contribution to added value to GDP has also another factor as is the rate of investments into ICT or growth of the GDP by other means, for example balance sheet of export and import, foreign investments etc. But main message concerning the increasing number of ICT experts in economy is that is not important the number of them, but more important is their contribution to common benefit of the whole society.

Do not call only for number of ICT experts and do not measure the maturity of information society by this metric, more important is, what they do and what is the final benefit of their work.

Another aspect of ICT contribution to GDP is effectiveness measurement of ICT sector. Comparison of this indicator is shown at Figure 8 for selected European countries and for the year 2007 (newer data are not available).

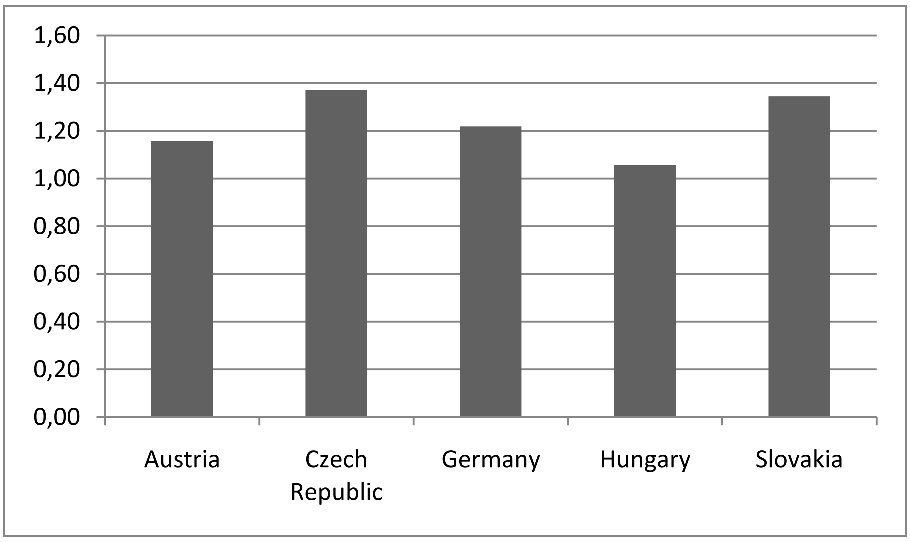

Figure 8: Effectiveness of the ICT Sector in Selected European Countries (Author, Data Eurostat)

2.3. ICT Expenditures - Selected European Countries

Other point of view on ICT sector effectiveness is measurement of investments flowing into the ICT sector (Maryška, Helfert, 2009; Novotný, 2009). Following Figure 9 shows the rate of investments in period from 2006 to 2008 into the ICT sector as a percentage of country's GDP in selected European countries.

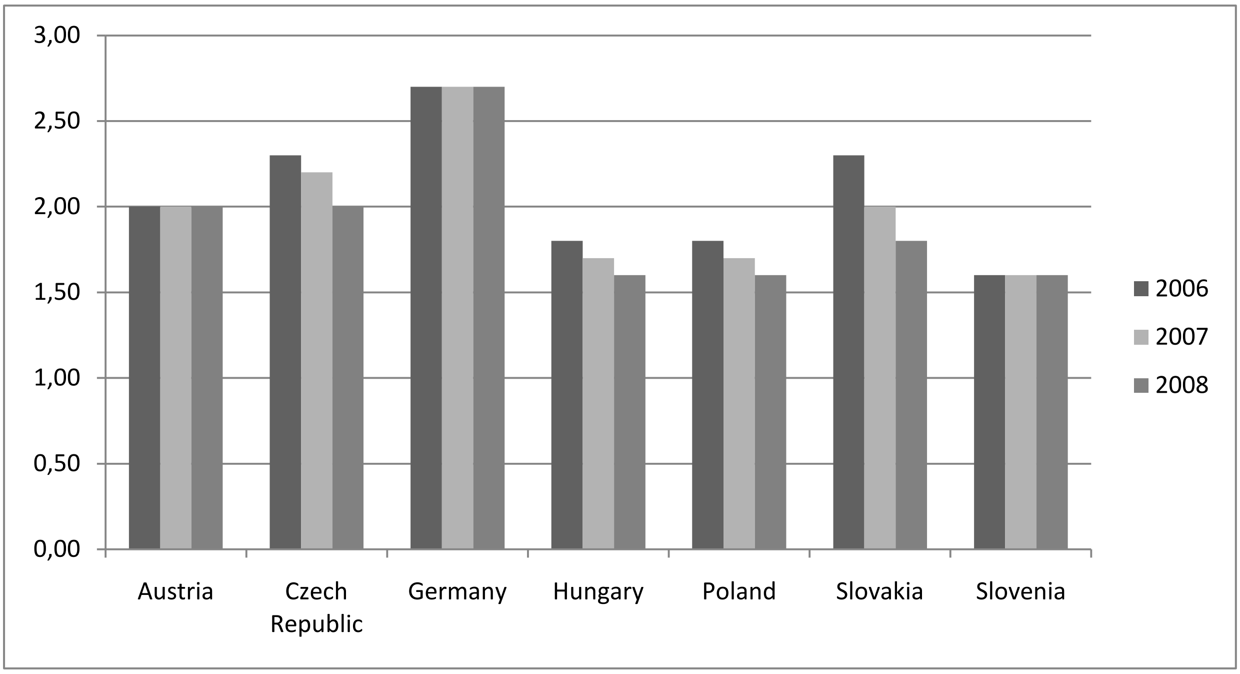

Figure 9: Rate of Investments in the ICT Sector in Selected European Countries (Author, Data Eurostat)

From Figure 9 is visible that in all selected countries is the rate constant (Austria, Germany, Slovenia) or takes slowly reduced trend (other countries). Decreasing volume of investments in ICT sector is bad signal for the future, because ICT sector (especially ICT services and its quality and maturity) has large impact on the whole economy - majority of business activities and economy sectors use ICT services (Figure 1).

Partial Conclusion – Added Value

Ongoing economical situation reduces investments (or are constant) into the ICT sector. This fact for selected countries could induce backward behind leading countries in ICT manufacturing and ICT services as well in the world in the future.

3. Conclusions

This short overview of some ICT industry factors having influence on GDP and on economy of the whole state is shows some aspect of ICT industry in the Czech Republic and in the Middle Europe. Very often are presented some quantitative ICT indicators – as number of ICT experts, number of ADSL connections, share of companies using e- commerce, e- government services etc. But for good manager is more important to calculate some qualitative indicators – as effectiveness of ICT sector, rate of investments etc.

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VIRTUAL ENTERPRISE MANAGEMENT – SOME REMARKS

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Keywords

Virtual enterprise, virtual organization, management, communication, security

Abstract

Virtual enterprises are such entities, which, from the point of view of their service to the customer, appear to be one entity, but in fact are formed from several autonomous entities or partners. A virtual organization or enterprise removes many barriers, such as time and location. It emphasizes concentrating on new services and products, especially those where intensity of information and knowledge increasing. Virtual enterprises start from remote workers to fully distributed firms. Virtual enterprise operations group their activities into projects where teams work in an interactive and parallel way, thus forming management change. Management of virtual enterprises and organizations supports these teams by communication and security in such organizations

1. Introduction

The concept of virtual organization was not unknown in the former Austria - Hungarian Empire. It was domestic workers (namely textile workers) who put their products on the market usually by middlemen. It was a remote working from today's view. As an industrial revolution increased these organization types has been suppressed. New renascence and wide spreading old ideas of the domestic work was supported by technical progress in Information and Communication Technologies (ICT) and today's view on the business organizations and knowledge of their needs.

1.1. Related works

Basic definition of a virtual enterprise can be found in the Business dictionary (2010), but much work has been done to highlight the gathering of people with shared interests and the development of this process Dirksen & Smith (2002), Prusak (1997), Kisielnicki (2002), Pankowska (2007). A problem with sharing of information is partially solved by Zhang Y. &, Xiao (2009), Čapek (2004, 2007), and communication problems are partially described in Miller (2009) and Yates, K, (2006). The risks were discussed by Zhang H, (2008). The trusts and threats were discussed by Zejda (2010) and Valasek (2007). Duranske (2008) covered the complexity of virtual worlds, virtual reality, and virtual law. More about modeling of virtual companies can be found in Yang Y., Ji T (2009) and Wang G., Wang D., & Song B. (2001).

2. Definition of a Virtual Enterprise and Virtual Organization and Main Preconditions for Operating

In literature one can find a great deal of definitions, for example, the Business dictionary (2010) shows that a virtual enterprise is ”Ad hoc alliance of independent experts (consultants, designers, developers, producers, suppliers, etc.) who join to pursue a particular business opportunity. Virtual enterprises have little or no physical presence or infrastructure, rely heavily on telecommunications and networks, such as the Internet, and usually disband when their purpose is fulfilled or the opportunity passes. Agile, flexible, and fluid, they are extremely focused and goal driven and succeed on the basis of little investment requirements, low start-up and overhead costs, and fast response time. Geographically dispersed members of a virtual enterprise collaborate on the basis of their core strengths from wherever they are and whenever they are able to do so and may become competitors in pursuit of another opportunity. Virtual enterprises are also called “virtual company” or “virtual corporation” and the same source as virtual organization (VO) states that:

- VO does not have a physical (bricks and mortar) presence but exists electronically (virtually) on the Internet.
- VO is not constrained by the legal definition of a company.
- VO is formed in an informal manner as an alliance of independent legal entities.

Byrne at al., (1993) show that virtual organization can be divided into groups according to clusters (according to clusters does not make sense) and identifies the following types:

- *Alliance.* Free group for pragmatic reasons, organization has a flexible structure based on outsourcing parts of the processes, activity, and partners (PC manufacturing, custom manufacturing). Virtual Corporation (the supplier - manufacturer-retailer) may be an example.
- *Dislocated organization.* The organization whose members are geographically far apart, although it appears together as a single organization (Remote Computing), with the real headquarters. Teams meet once in a while, the workers are dispersed, and they are managed by electronic and mobile communications. The operation of the company is based on the use of intranet.
- *Invisible Organization.* This type of organization, devoid of any physical structure, exists only thanks to electronically provided services or products.
- *Actual Virtual Organization.* This type of organization provides a new way of trading. The alliance combines dislocation and invisibility and has a flexible organizational structure capable of rapid change and adaptation.

Technology and technical requirements for the operation of virtual organizations are very demanding. The organization must be ensured:

- Permanent connection of workers on the Internet, using off-line and on-line communication.
- Safe remote file sharing network, distributed systems.
- Safe remote access for security work in client-server mode.
- Safe remote access from anywhere.
- Security and operating of virtual private network.

Technology and security systems are focused on availability, integrity, and confidentiality of shared information. The management focus is on loyalty of company employees and their computer literacy. The management of virtual organization seeks and provides new forms of management. We can conclude that the terms of virtual organization and virtual enterprise mostly denote the same structures.

3. Management of Virtual Organization

Virtual organizations may be the answer to the search for new organizational models in traditional competition. Virtual organization offers reduction of costs, increase of productivity, and use of skills, knowledge and competencies of human resources without spatial constraints. The Internet and its convergence with other information and communication technologies provide unique opportunities for entrepreneurship. Its contribution is mainly in marketing and communications. It has become a powerful management tool. However, it is necessary to look at it as a tool. How useful it is depends on the conditions under which it is used. The management of collaborative teams uses the Internet and determines the content of a remote management team. The management of virtual organization must focus on maximizing the advantages of the Internet and minimizing its inadequacies. Nowadays the leading remote teams programme focuses on developing the necessary skills to build a high performance team, especially by emphasizing the communication competencies. Basically, virtual organizations form value-added partnerships of units, which are autonomous but depend on their purposes and given circumstances. Lewis and Weigert (1985) state that the pillars of virtual organizations comprise: 1) standardizing interactions, 2) standardizing metadata 3) treating knowledge separately from the individual 4) abstracting information from operations. Virtual organizations are the ideal form for optimal knowledge sharing and innovation. According to Dirksen & Smith (2002), Prusak (1997) and Kisielnicki (2002), the real value of the virtual organization is in the spontaneous gathering of people with shared interests and aims emerging during the development process. They know their mission and vision, and they follow them to achieve their strategic goals. Pankowska (2007) gives an example of Virtual University as virtual organization governance. Possible roles within virtual enterprises are shown in figure 1.

The virtual organization technologies are important, but equally important is management. Settings of processes, communication, and cooperation must focus on eliminating the weaknesses of virtual organization. Weaknesses in the system are based on the lack of social and face to face contact. Therefore, human resource management is very important for the functioning of virtual organizations. Management and cooperation are both based on mutual communication. Therefore, communication is of the utmost importance in virtual organization.

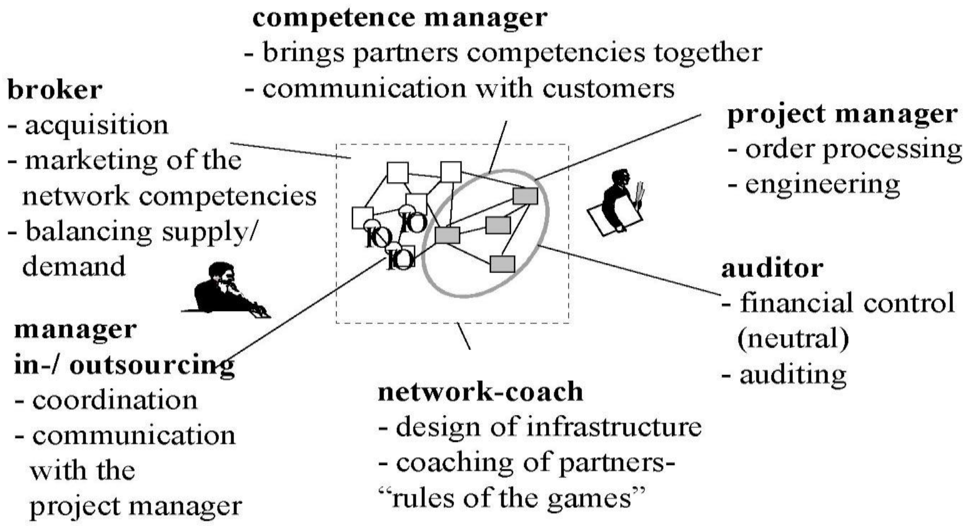

Figure 1 Example of roles in virtual enterprise according to Katzy & Schuh (1999)

3.1. Isolated Individuals Lost in the World

The situation of isolated member of a virtual team was described by Brake (2008). Each member is subjected to isolation. The member's work is only a fragment and must fit into the team's work (overall goal). It is dependent on electronic communication and, unless it is clear and unambiguous, it can often be confusing. Following are the three biggest challenges for management: isolation, fragmentation, and confusion. To overcome these challenges, Brake (2008) makes these recommendations for management of virtual organization:

1. Corporation. Building trust within the organization is one of the main tasks for management. People never meet face to face but they have to rely on each other. All members need to feel that their work is important for the organization´s success.
2. Convergence. It is necessary to combine individual efforts throughout the organization.
3. Coordination. It is important to create conditions for overcoming the barriers of differences of place and time. The work flow system can eliminate delay in time and shorten distance in the space.
4. Capability. The total capability of the organization is the sum of individual talents. This idea is important for the selection of individual talent, which should complement each other, and enhance and create good base for operating of the organization.
5. Communication. It is necessary for all members to share the same understanding
6. Cultural Intelligence. All members must feel respected in a team culture.

Brake (2008) identifies and summarizes the main task of management of virtual organization. He also shows important keywords in the context of virtual organization: discipline, teamwork, mutual respect, work effort, and the joy of shared success-guiding principles that set the relationship of the members. Communication has an important role for management of virtual organizations.

4. Importance of Human Resources Management and Communication

The Virtual organization redefines the human resources management, it places greater demands on management of people that other types of organizations. The lack of social face-to face contact requires very clear and practical rules for managing people, strong corporate culture built on mutual trust, independence and common goals. Recruitment and selection of co-workers must reflect the work of the virtual organization. Defined powers and responsibility, organization structure, division of labour, job description and setting rules of communication have greater significance in virtual organization. The support and assist the lead manager has also huge importance for work of each member. The base of team cooperation is effective communication. Communication is the bridge between management of people and business strategy; it is the bridge between mutual expectations of people and organization and between their mutual requirements. Virtual context complicates communication in every conception. For example, the lack of social contact clearly eliminates the opportunity for feedback which is a very important part of communication because it offers clarification and explanation. Lacking face to face contact, communication in virtual organization is mostly dependent on electronic communications. Even video-conferencing is not as effective as face to face communication. Communication in virtual concept is extremely important and thus needs to be more sophisticated. In virtual enterprise, information sharing is the basis of cooperation. Information sharing can increase partners' ability for collaboration and timely response, lower management costs, enhance market competitiveness, and expand profit margins Zhao & Xiao, (2007).

The problems of information sharing within virtual enterprise by using the simulation technology of Multi-Agent are solved by Zhang & Xiao (2009). However, they can either share information in accordance with the agreement. The agreement was not mentioned in the text (strategy A) or shares the information partly by covering up or providing false information (strategy B). Therefore, each individual has two strategies: A and B. By using Multi-Agent Simulation technology, one is able to observe the rules of each individual's actions. Then let the individuals interact under these rules in computer, in which some features emerge as a whole.

The management is also responsible for prevention of miscommunication spreading. They should prevent the creation of information noise and vacuum, which lowers the effectiveness of control and function of the company in general. The results of miscommunication have far reaching effects on the team and each member's activities and behavior. For example, Jackson (1987) describes the potential results of ineffective communication as:

- decrease of motivation;
- indecision – decrease of decision ability;
- passivity;
- frustration.

Effective communication can only be achieved in an environment where there is mutual trust. Trust in the workplace influences work attitudes and behavior Čapek, (2004, 2007), it strengthens organizational identification, which will help organizations meet some of the most critical challenges given the virtual context, such as ensuring coordination and control. Organizational identification accomplishes these feats through its influence on employee's expectation, motivation, and consequent behavior Wiesenfeld at. al. (1998). Effective internal communication proceeds in company´s environment that is designed by concrete conditions. These conditions are the premise of effective communication is explained by Holá (2006):

- The corporate culture based on ethics and morale values.
- Full management responsibility. Unified management team must be engaged in a new set up.
- Defined work organization and organizational structure.
- Personnel policy based on mutual respect between company and employee.
- Effective internal marketing, mainly internal Public Relations.
- The communication abilities and skills (competencies) of the managers.
- Open communication, including feedback.

The company management must accept responsibility for correct internal communication process. The level of communication can be improved by setting communication standards, internal marketing, and the use of information and communication technologies. It is more important to set the rules and principles of organizational communication in virtual context than common business Sproul & Kiesler (1991).

For practice communications one must take into account the geographical placed of the members of virtual organizations. If is supposed that hypothetic virtual firms has members placed in towns incorporated in Table 1 and from management needs the mangers required at least four hours to common communication. From Table 1 is clear that is for that virtual enterprises impossible make common communication for all members together within “usual” working hours. This fact must be taken into account when one deals with virtual firms from around the world.

4.1. Our Own Experience with Virtual Organization

If the distributed enterprises is not taken into account where distributed enterprises are organized by following matters: e.g. headquarters is placed in one town and/or country and affiliated branch or branches of this enterprise is placed in different towns or countries, as is nowadays very common in supranational companies, is hardly to possible find within the Czech republic real virtual organization. If we think over this facts mentioned above, is possible as example of the virtual organization take into account large consortia created under TEMPUS scheme, where one of the authors play role as main coordinator.

Place	Time	Place	Time
Prague	8:00	Sao Paulo	3:00
Sydney	16:00	Montreal	2:00
Shanghai	14:00	Mumbai	12:00

Table 1 Selected places within Time Zone

5. Conclusion

Virtual organizations are still not frequently found in the Czech market. There are many barriers, including legislative ones. All of them come from traditional cultural and historical-social conditions.

- The discipline of employees and their willingness to sell their own work. There are necessary arrangements "worker offers and sells its own workforce" in Czech labour market must be set up.
- High demands on computer literacy.
- High demands on personnel issues (it is important to built and develop employees´ loyalty and organizational identification) bring new forms of management. The departments of human resources have to work differently, more focusing on people than personal agenda and the managers must change their own attitude for control; the physical inspection is necessary to replace the control results and objectives.

Improving the quality and quantity of work "at home", higher productivity, reduction of overhead cost (redundant), and more efficient work is paving the way for the future working environment – virtual environment. The management of virtual organization must focus not only on utilization of technology but also on management of human resources and communication issues.

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POPULATION PROJECTION OF THE NUMBER AND AGE STRUCTURE OF ICT EXPERTS IN THE CZECH REPUBLIC

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Keywords

Population projection, population ageing, ICT experts

Abstract

This paper concerns a demographic projection of ICT experts computed by the classical component method. Migration is not taken into account. The number of ICT experts will grow in the next two decades, but their age structure will change. Later they will be ageing more rapidly than the total population of productive age. In the late 30s many ICT experts will reach the retirement age, the number of ICT experts will therefore decrease.

This article came into being within the framework of the long-term research project 2D06026, "Reproduction of Human Capital", financed by the Ministry of Education, Youth and Sport within the framework of National Research Program II.

1. Introduction

The ageing of population is a phenomenon concerning all economic developed countries, including the Czech Republic. One of the consequences of population ageing not so often mentioned is the ageing of labor force which can result in a lack of employees in some professions, a lack of the human capital. Therefore not only projections of the whole population but often special projections of the development of the number and age structure of employees (or more precisely of potential employees) of various professions are computed. At the present time, one of the most important questions is the projection of human resources in the ICT branch. See, e.g. Doucek, Novotný & Voříšek (2009).

This paper concerns a demographic projection of ICT experts. The projection is an update and extension of the former author's projection – see Fiala (2007).

2. Methodology

The projection of ICT experts has been based on the projection of the population of the Czech Republic computed by the classical component method with simplified migration – no emigration supposed, immigration equal to net migration. For more particular methodology of population projections see, e.g. Bogue, Anderton & Arriaga (1993). The computation has been based on latest available data of the Czech Statistical Office. The initial sex-and-age structure of the Czech population was that of 1st January 2010. Main assumptions of the expected development of mortality, fertility and migration are very similar to those of the latest population projection of the Czech Statistical Office. See www.czso.cz.

Latest demographic data of the year 2009 show that after several years of relatively rapid fertility growth the total fertility rate that year has been a little bit lower than in the year 2008. The scenario of fertility development was therefore based on the assumption that the total fertility rate will in next 50 years continue to grow very slowly from present value 1.5 to the value 1.7. The fertility structure is supposed to converge to the fertility of the Netherlands. (The Netherlands' fertility is very often used as a pattern of the fertility model in the future. In this country the transition of the fertility has been finished and the fertility seems to be relatively stable).

The increase of the life expectancy is supposed to be continuing all the time. The life expectancy in 2060 is supposed to be about 86 years for males and about 90 years for females. The difference between the life expectancies of females and males is therefore supposed to diminish.

It is very difficult to predict migration at the present time. See, e.g. Arltová & Langhamrová (2010) or Kačerová (2008). Data of the last year indicate rapid drop of net migration in comparison with years 2007 and 2008. One of the main reasons for this may be the continuing economic crisis. Because of this fact the projected annual net migration is supposed to be only 30 000 persons per annum. The demographic structure of immigrants is supposed to be the same as in the previous years.

The initial estimate of the number and age structure of ICT experts has been based on the population structure of the population of CR on 1st January 2010 and on the proportions of ICT experts in particular age groups (see Table 1).

Age Group	**ICT Experts**	**Total population**	**Proportion of ICT Experts (%)**
22–24	12 220	429 537	2,84
25–34	50 587	1 734 334	2,92
35–44	25 634	1 479 161	1,73
45–54	16 822	1 389 242	1,21
55–61	5 541	1 078 076	0,51
Total 22–61	110 804	6 110 349	1,81

Table 1. ICT Experts in the Czech Republic in 2008 (Czech Statistical Office, Labor Force Sample Survey)

We can see that the highest proportion of ICT experts in population is in age groups 22–24 and 25–34 years. (These are the youngest age groups having possibility to reach tertiary education level.)

In the projection we have supposed that in each age cohort of the Czech population born after 1985 (i.e. reaching 25 years of age in 2010 and later) the proportion of ICT experts will be constant on the level of 2.92 % at the age of 25 years of the cohort. At the same time we are assuming that each ICT expert is considered to be an ICT expert until he dies or until he reaches the retirement age regardless of his actual occupation. (The projection so gives the number of potential human resources for ICT, not the number of people actually working in the ICT branch). Emigration or immigration of ICT experts has not been supposed in the projection. (It means that the number of emigrated ICT experts is supposed to be approximately equal to the number of immigrated ICT experts as well as their sex and age structure is supposed to be very similar.)

The proportion of men among information scientists is certainly higher than the proportion of men in the population. On the other side the life expectation of persons with higher education is somewhat higher than the life expectation of the whole population (regardless of education). In particular the life expectation of men with secondary or university education is roughly at the level of the life expectation of women regardless of education. For the projection of the mortality of information scientists were therefore used the assumptions of mortality for women in the CR (regardless of education).

3. Main Results

At the present time the ICT experts are "younger" then the total population of productive age (see Figure 1). The age distribution of the total population of productive age is relatively uniform – the proportion in each age group (with the exception of 60+) is between 20–30 %. On the other hand almost 70 % of ICT experts are younger than 40 years; the proportion of ICT experts older than 50 years is only about 15 %.

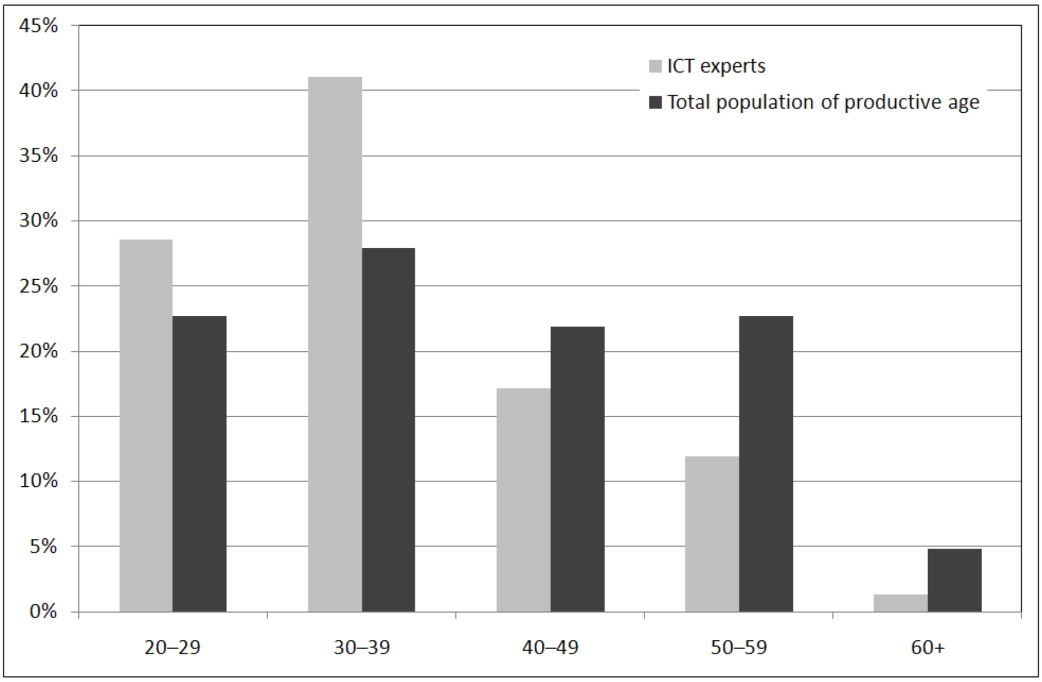

Figure 1: Age structure of ICT experts and the total population of productive age in 2010 (Author)

The number of new young ICT experts will depend mainly on the number of new graduates. Under the projection assumption that the proportion of young people studying informatics will remain constant the development of the number of graduates will be directly proportional (with several years delay) to the number of young people at the age of 19. This number will be rapidly decreasing in the following years. (The reason for this is the deep in natality in the late 90s). The number of 19years people will drop by about 40 % in this decade and the expected growths in the 20s will be followed by a decrease again. See the Figure 2.

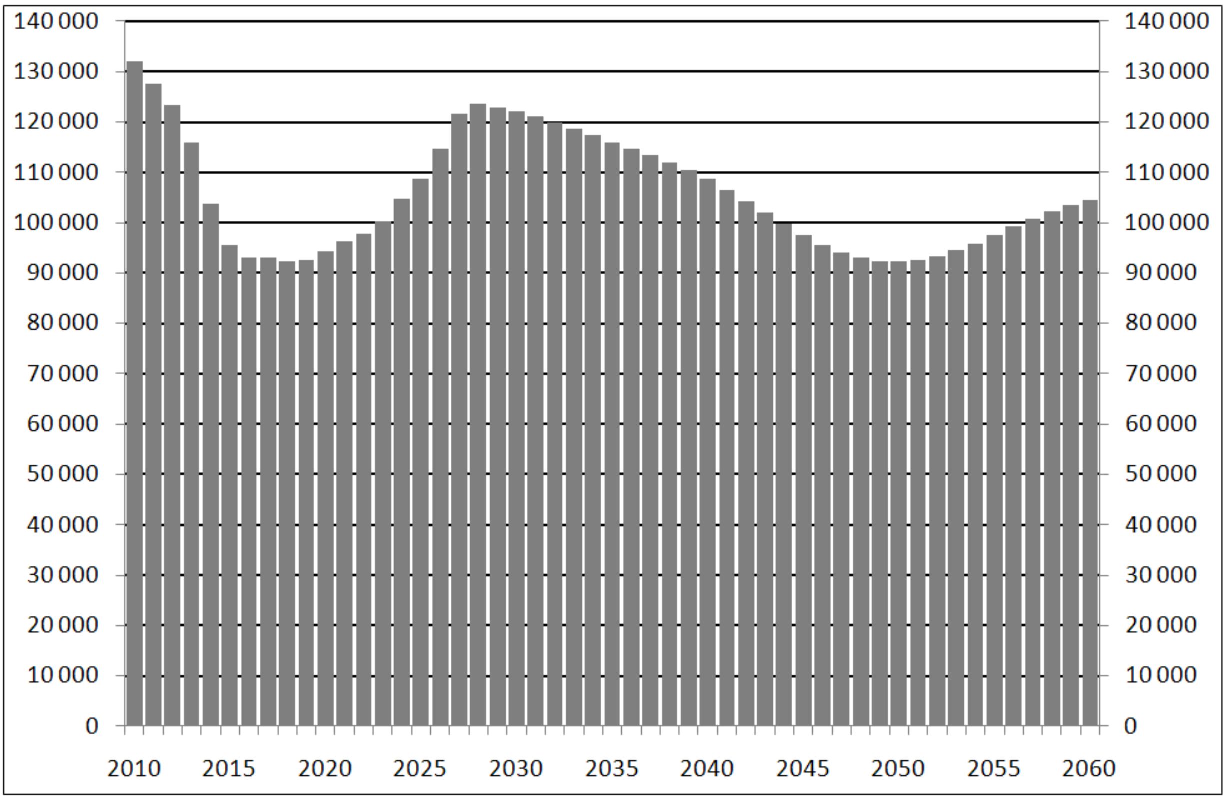

Figure 2: Expected development of the number of 19years people (Author)

On the other hand the number of retiring ICT experts will be relatively small in the next two decades, smaller than the expected number of young people reaching the ICT education (see the Figure 3). This is the main reason that despite the expected decrease of the number of new young ICT experts the total number of ICT experts will continue to grow (relatively rapidly) in the next two decades. The annual increment in the following years will be higher than 3 000. The number of ICT experts will increase from the present value of about 120 000 to about 170 000 of people. See the Figure 4.

More particular results of the projection are presented in the Tables 2 and 3.

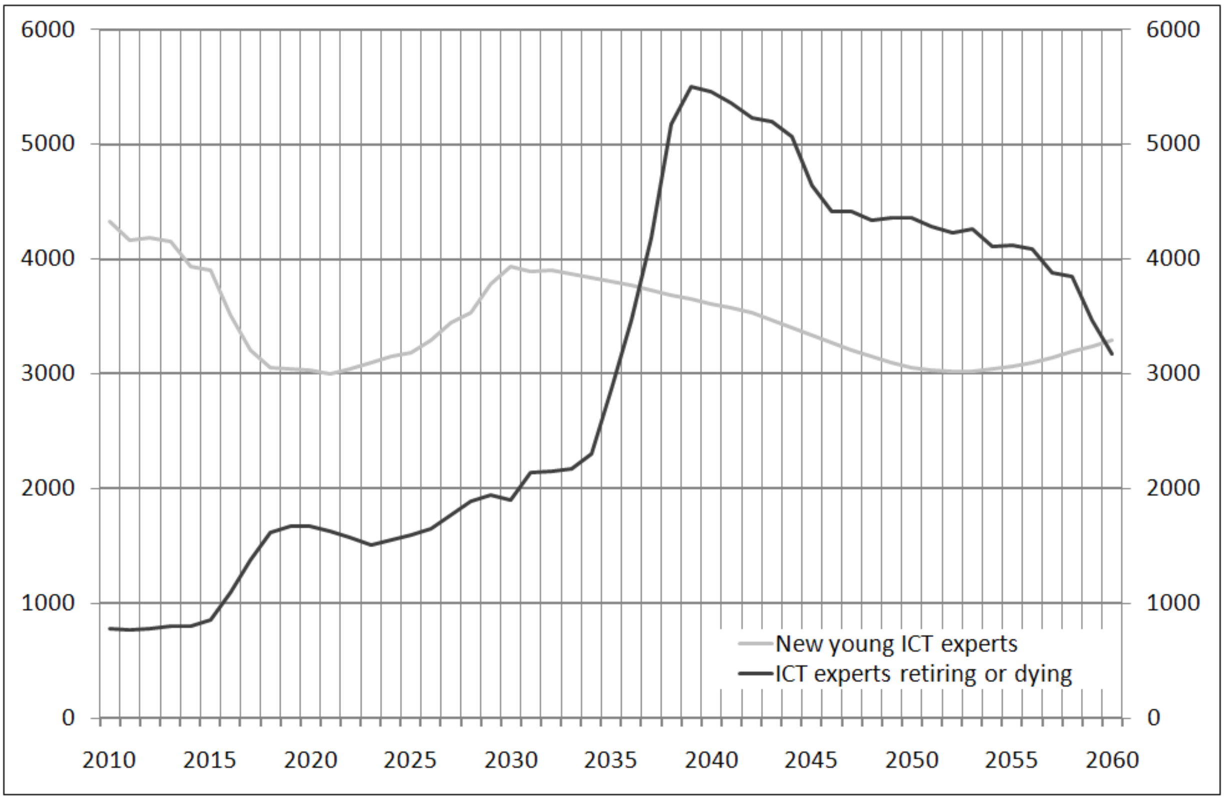

Figure 3. Expected changes of the number of ICT Experts in the Czech Republic in 2010–2060 (Author)

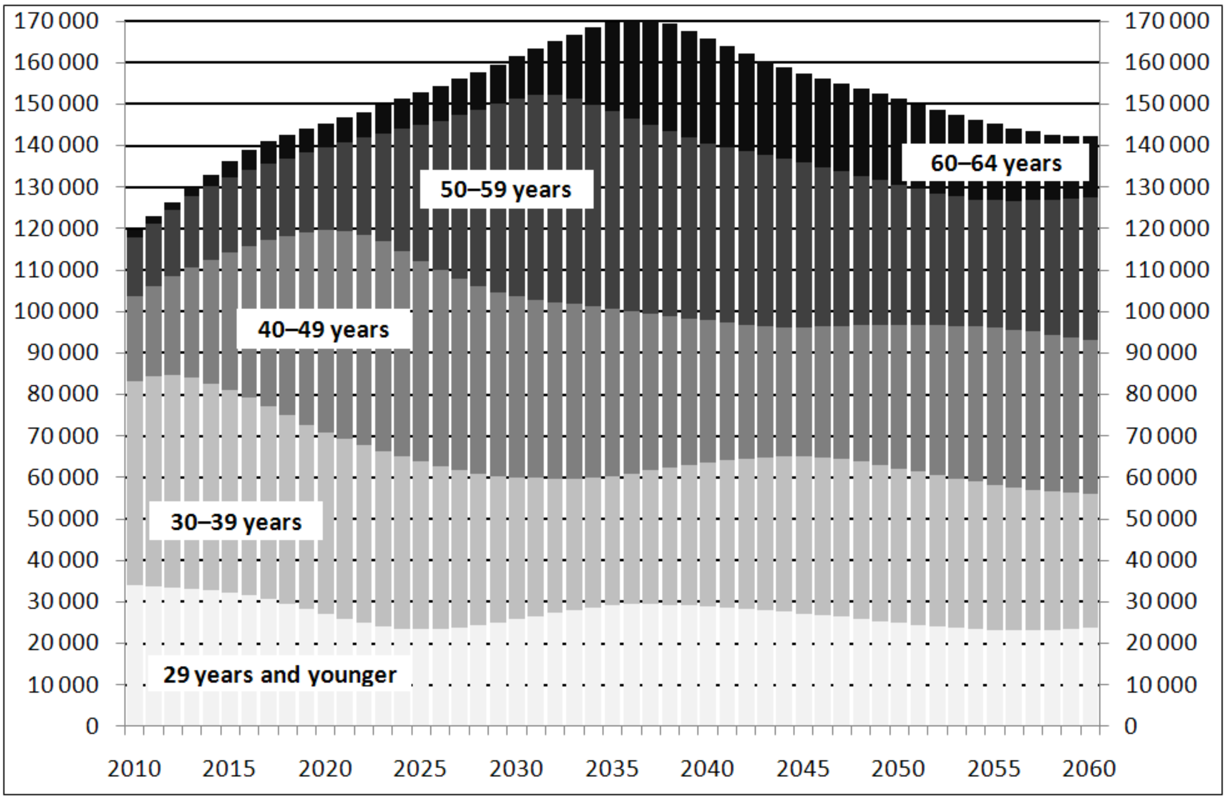

Figure 4: Expected development of the number and age structure of ICT experts and in the next 50 years (Author)

The population of ICT experts will be ageing. The rapid decline of the number of young people in the following years will result in the drop of the proportion of young ICT experts. In 2030 the proportion of ICT experts younger than 30 years will be only about 15 %. At the same time more than 35 % of ICT experts will be older 50 years, i.e. in pre-retirement age. (See the Figure 5.) Let's remark that people at the age 50–59 years in 2030 belong to the numerous cohorts born in the 70s. Several years later the proportion of ICT experts older 50 years will reach even 40 %. (See the Figure 6.)

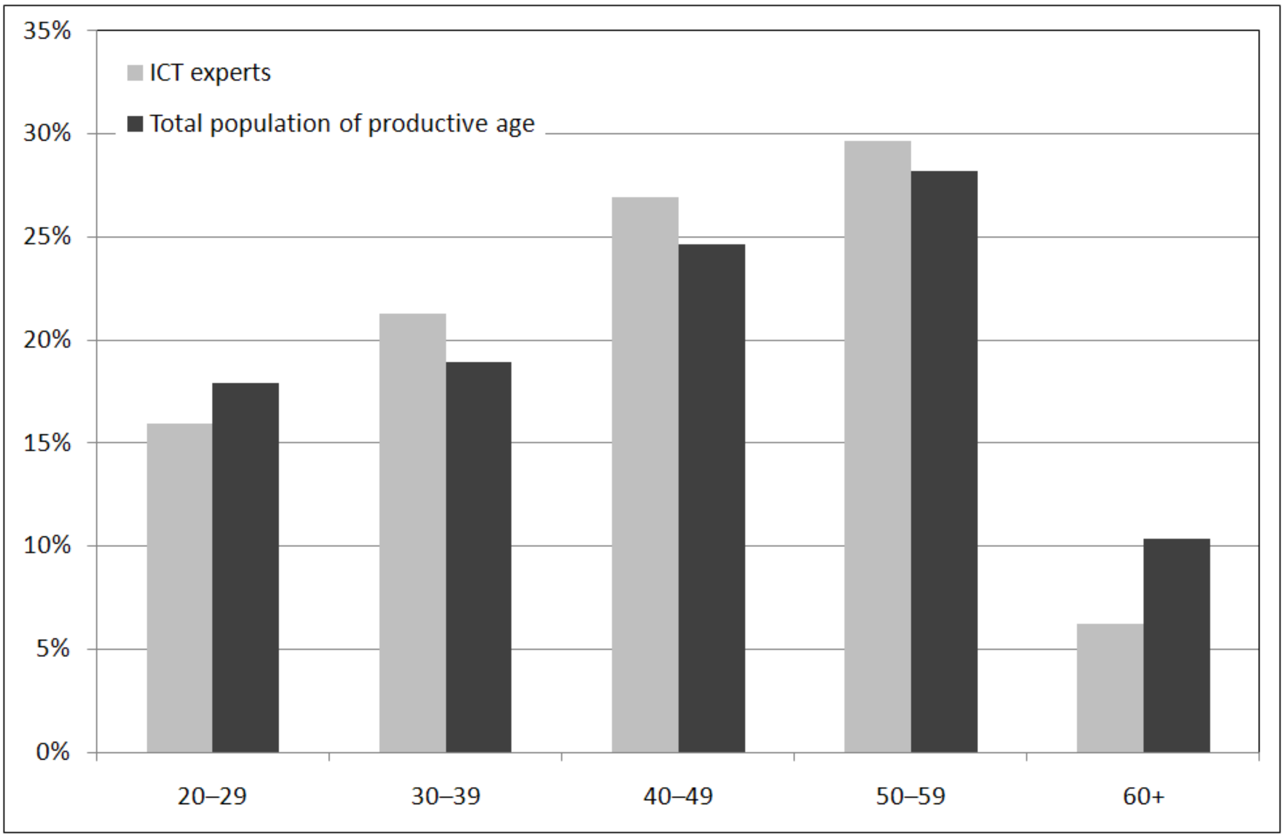

Figure 5: Age structure of ICT experts and the total population of productive age in 2030 (Author)

The average age of ICT experts will since the late 20s be permanently higher than the average age of the total labour force (Figure 7). The reason for the higher value is the fact that mortality of ICT experts (having tertiary education) is supposed to be a little lower than the mortality of the whole population.

The trends of the development of the number of ICT experts will change in the 30s. The number of ICT experts retiring will rise very rapid (providing that the retirement age will not grow over 65 years). While in the early thirties the number of retiring ICT experts will be about 2 000 per annum, several years later it will be higher than 5 000. (See the Figure 3.)

The number of ICT experts will decrease continually until 2060 to about 140 thousands.

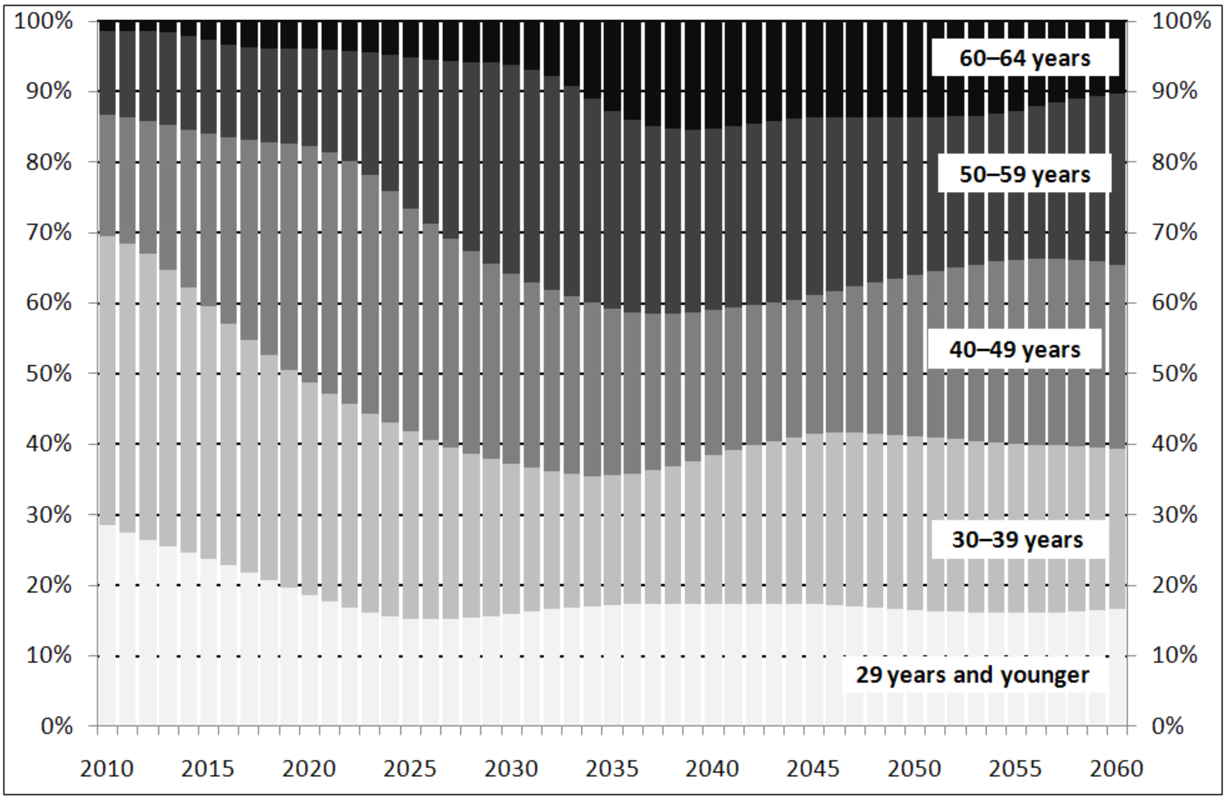

Figure 6: Expected development of the number of ICT experts and in the next 50 years (Author)

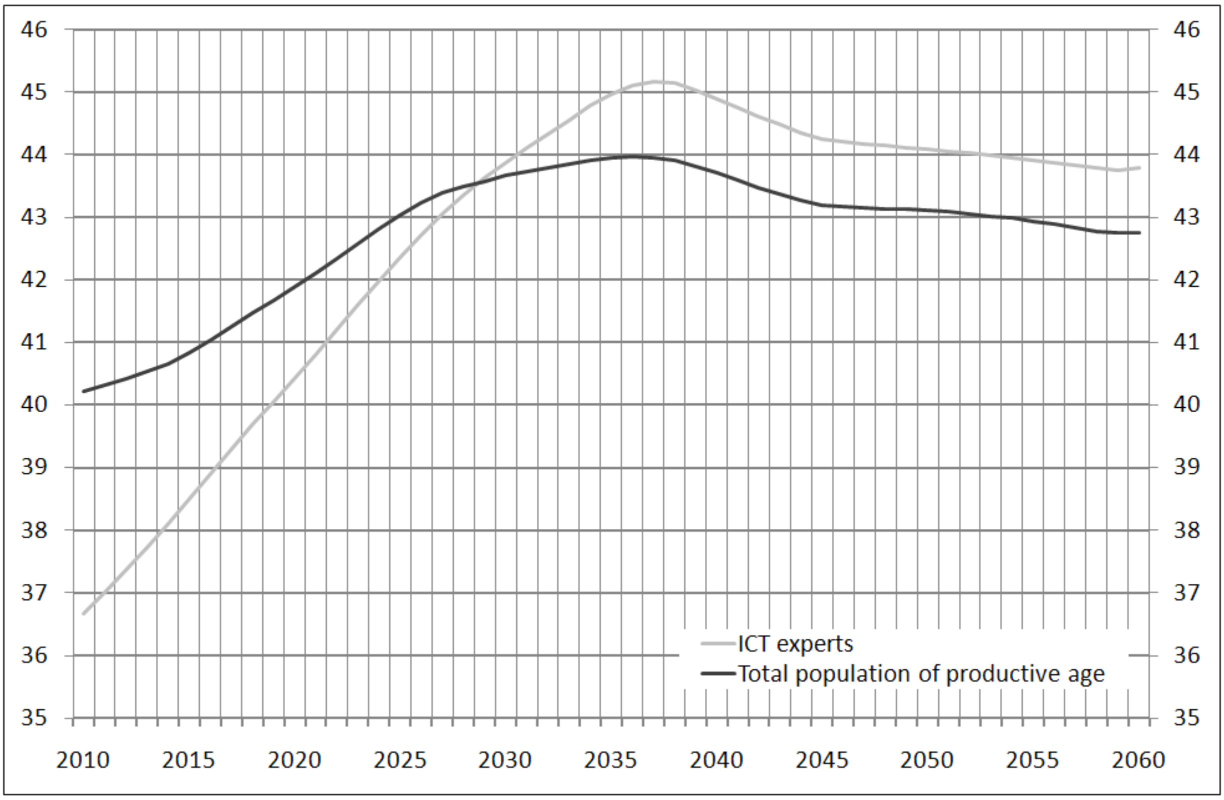

Figure 7: Expected development of the average age of ICT experts and the total population of productive age (Author)

More particular results of the projection are presented in the following two tables.

Age	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060
20-24	12 132	11 244	8 369	8 555	10 172	10 693	10 143	9 453	8 537	8 279	8 826
25-29	21 986	21 059	18 779	14 828	15 603	18 467	18 706	17 753	16 440	15 033	14 915
30-34	26 405	22 341	21 422	19 150	15 210	15 986	18 848	19 090	18 141	16 831	15 427
35-39	22 642	26 345	22 296	21 383	19 119	15 188	15 966	18 826	19 070	18 124	16 817
40-44	10 794	22 553	26 249	22 223	21 320	19 068	15 152	15 932	18 791	19 038	18 096
45-49	9 684	10 724	22 426	26 111	22 119	21 231	18 996	15 101	15 885	18 741	18 992
50-54	8 790	9 571	10 612	22 220	25 889	21 951	21 086	18 879	15 019	15 808	18 660
55-59	5 504	8 627	9 415	10 456	21 934	25 580	21 716	20 884	18 716	14 904	15 700
60-64	1 590	3 628	5 783	7 928	10 093	21 524	25 138	21 381	20 596	18 483	14 738
Total	121 537	138 108	147 369	154 880	163 489	171 722	167 792	159 346	153 244	147 295	144 232

Table 2. Expected number and age structure of ICT Experts in the Czech Republic in 2010–2060 (Author)

Period	2010–14	2015–19	2020–24	2025–29	2030–34	2035–39	2040–44	2045–49	2050–54	2055–59
New ICT experts	4 151	3 344	3 064	3 447	3 888	3 728	3 518	3 212	3 034	3 150
Retiring or dying	788	1 324	1 586	1 770	2 134	4 237	5 262	4 434	4 249	3 881
Increment	3 363	2 020	1 479	1 677	1 754	-509	-1 744	-1 222	-1 215	-731

Table 3. Expected changes of the number of ICT Experts in the Czech Republic in 2010–2060 average values per annum (Author)

4. Conclusions

Under the assumptions of the projection (i.e. stable proportion of ICT experts in all future age cohorts and no migration of ICT experts) the number of ICT experts can grow in the next two or even three decades by about 50 thousands. But their age structure will change, the average age of ICT experts will rapidly increase, they will be ageing more rapidly than the whole population of productive age.

The real development will probably be not as simple as the assumptions of the projection. There arise many important questions.

How many ICT experts are needed in the Czech Republic? And how many will be needed in the future decades?

Will be fulfilled the assumption of stable proportion of ICT students and graduates? How will the universities react to the rapid decrease of the number of young people in the following years? Will be the number of admitted students proportionally reduced? Or will it permanently remain as high as at present time?

Will there be an important change in the migration trends in the next future? The data for the first quarter of the year 2010 indicate very low net migration (even much lower than expected in the projection). Will the migration significantly change the number and age structure of ICT experts?

In any case the projection indicates that in the next two decades the number of ICT experts in the Czech Republic will grow. But it is necessary already at present time to see for measures how to eliminate the ageing of ICT experts and their numerous retiring in the later thirties.

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ICT KNOWLEDGE ANALYSIS OF UNIVERSITY GRADUATES

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Keywords

Human resources in ICT, knowledge potential of university graduates.

Abstract

This paper provides an analysis of university graduates at ICT specialist market and analysis of the skills required by ICT professionals when entering the ICT labour market in the Czech Republic. The university graduates analysis is focuses on universities effective in the ICT education area and compares their study programs (203 programs – 2006, 195 programs - 2009) with requirements of businesses (1002 businesses). It describes typical "product" of Czech education process in the area of ICT skills. General conclusions show that majority of graduate bachelors (at about 85%) in the Czech Republic do not have knowledge profile to enter business as qualified employees without expensive additional training. At master level the same applies for at about 40% of graduates.

This contribution was prepared with support of the Czech Science Foundation GACR – research project 402/09/0385 - Human Capital in IS/ICT Operations and Development: Competitiveness of Czech Tertiary Education Graduates.

1. Introduction – Characteristics of Investigation

In the year 2005 the team of employee at the Faculty of Informatics and Statistics University of Economics, Prague has started solving questions and problems of human resources in the area of Information and Communication Technologies (ICT). All of these questions and problems are solved in the context of the research project "402/09/0385 - Human Capital in IS/ICT Operations and Development: Competitiveness of Czech Tertiary Education Graduates". The main project goals were comparison of skills required by businesses on ability, skills and knowledge university graduates (at bachelor and master level) that are provided to students by universities effective in IT education area. From the year 2005 were researchers also interested in macro economical questions that are connected with influence of ICT sector on Czech Republic's economic indicators.

In the context of the grant project MŠMT (year 2006) and later in the context of grant project GACR (year 2009) were realized two surveys among universities providing IT related study programs. Each of the survey was based on "exhaustive survey" among Universities effective in the IT education area and their study programs. Each of selected universities was sent standardized questionnaire. Universities were asked for filling in the questionnaire for each IT related study program they provide. After defined time the questionnaires that have been sent by universities back to researchers, were processed by tools for data processing and data analysis (ETL and data-mining)5.

2. Survey Methodology and Their Evolution

2.1. School Selection

The university graduates analysis is focuses on universities effective in the ICT education area in the Czech Republic. These universities were contacted via questionnaire mentioned above. Preliminary data sources for selected universities effective in the ICT education area in both surveys were registers that are administrated by Czech Ministry of Education – see (MSMT, 2010).

We identified (through the analysis of data sources) approximately 7.800 study programs in year 2006. Study programs were identified as "IT related study program" in case the name of the study programs contains part of word "informa". From selected IT related study programs were excluded study programs related to library science. Mentioned criterion defined all study programs that were included in the main category 18 – Information Technology. This criterion defines other study programs where Information Technology was combined with different study programs (for example teaching related study programs). To the set of all IT related study programs were added also another study programs which study program code wasn't 18 or was empty but study program name containing some of the following words: "informa", "počítač", "softwar", "computer", "program" and various combination of words "výpočet" and "technik". In the analytical phase we have used another data sources for example web sites selected universities and data sources provided by Institute for Information in Education. This information was used for verification that identified study programs are really IT related study programs. In the first survey (through above mentioned process) we identify 259 IT related study programs (responses from 205 study programs). Set of selected study programs was checked for relevance their study programs in both surveys. This relevance was based on verification that a name of the IT related study programs contain some of mentioned words but their study area and courses wasn't related to IT. Decision the study program is or isn't IT related study program was based on judgement the study program name, subjects provided by university to their students, are IT related. In case of doubts we checked study plans of this study programs. (Doucek at all, 2007)

In the second survey we have identified 196 IT related study programs. The control mechanisms were based on the same principles mentioned above.

Changes in count of identified IT related study programs was caused by opening new study programs on current universities, possibly to open new IT related study programs on new founded universities (Unicorn College etc.) and cancellation of five years study programmes.

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[5] More about analysing and ETL and costs connected with this activities in (Maryska, 2009).

2.2. Communication with Universities – Questionnaire and Knowledge Domain

Each of universities effective in IT related are were asked via unified questionnaire that contain in the first survey (2006) following set of questions:

- Identification data about the university and study programme,
- Number of students studying defined study program (number of new (entrance) students, number of all students, number of graduates students)
- Method for evaluation students that are studying defined IT related study program (ECTS credits, credits of direct lectures per semester etc.).
- Knowledge domains (17 knowledge domains – Figure 1) that are evaluated as a sum of credits that are lectured in defined IT related study programmes. Number of all credits that are represented by total sum of credits in each knowledge domain. (Doucek at all, 2007), (Doucek, 2009), (Vorisek, 2006), (MSMT, 2010)

Each of universities effective in IT related are were asked via unified questionnaire that contain in the second survey (2009) following set of questions:

- Identification data about the university and study programme,
- Number of students studying defined study program (number of new (entrance) students, number of all students, number of graduates students)
- Method for evaluation students that are studying defined IT related study program (ECTS credits, credits of direct lectures per semester etc.).
- Sum of all credits for study subjects which have to be fulfilled in this study program.
- Knowledge domains (16 knowledge domains – Figure 1) that are evaluated as a sum of credits that are lectured in defined IT related study programmes. Number of all credits represented by total sum of credits in each knowledge domain. (Doucek at all, 2007), (Doucek, 2009), (Vorisek, 2006), (MSMT, 2010) Mentioned credits were divided into two groups: obligatory and optional.

Figure 1shows knowledge domains filled in by sum of credits according to the methods mentioned above.

First column (in Figure 1) contain knowledge domains used in the first survey in year 2006 and the second column comprise knowledge domains used in the second survey in year 2009. Bold font rows represent knowledge domains that are specific only for one of mentioned surveys (in the second survey knowledge domain weren't used or contained different knowledge or were replaced by new – different knowledge domains).

Year 2006	**Year 2009**
MS01 Process modeling	01 Process modeling
MS02 Application functionality	**02 Functionality and customization**
MS03 ICT Service definition and operation	**03 Management IS/ICT**
MS04 Architecture analysis and design	04 Analysis and desing
MS05 Software engineering	05 Software engineering
MS06 Data engineering	**06 Data and information engineering**
MS07 ICT Infrastructure	07 IS/ICT knowledge
MS08 Operational excellence	08 Operational excellence
MS09 Communication and presentation skills	
MS10 Team leadership skills	09 Team leadership skills
MS11 ICT market knowledge	10 ICT market knowledge
MS12 Organizational management methods	11 Organizational management methods
MS13 Enterprise finance and economics	12 Enterprise finance and economics
MS14 Sales and marketing	13 Sales and marketing
MS15 Statistics	**14 Mathematics**
MS16 Law	15 Law
MS17 Business sectors	16 Business sectors 1
	16 Business sectors 2

Figure 1: Knowledge domains used in the first and in the second survey

The most important changes in the second survey (year 2009) were changes in knowledge domains 02, 03 and knowledge domain 16. Universities effective in IT related area can choose business sectors according to the standardised classification OKEC in the knowledge domain 16 „Business sectors“. Universities cannot choose more than two different types of business sectors according to the orientation their study programs. Knowledge domain is prepared for cases the other knowledge domains don’t cover information from all courses provided by universities in analysed study programmes. After finishing evaluation of the second survey we consider segmentation according to the OKEC as wrong solution for better specification of knowledge’s provided by universities to students. OKEC classification isn’t enough clear and doesn’t cover all other study courses variations provided by universities effective in IT related area.

Changes made in knowledge domains between years 2006 and 2009 have the following goals:

- Make the knowledge domains more general,
- Make a questionnaire more suitable to universities necessaries and customs.

Changes in the knowledge domain were based on researchers experience from universities feedback to survey in year 2006.

Another changes in questionnaire (new questions „number of lecturers“ etc.) were added with effort to receive better information about personal ensure analysed study programs and guess count of students that must be lectured by one lecturer.

After finishing the second survey and analysing all outputs we have identified also some unsuitable changes in the second survey. These must be overhaul before another survey in the future.

3. Survey Evaluation

3.1. Questionnaire Recoverability

In year 2009 questionnaire were sanded to 32 universities effective in IT education area. From the whole amount of sanded questionnaires were returned 94 filled in questionnaires. Filled in questionnaires were processed and then made their evaluation.

Questionnaires evaluation was made trough the analytical tools provided by Microsoft SQL Server platform. In the first survey were used platform MS SQL Server 2000 and in the second survey we used the same platform but in higher version –MS SQL Server 2005. Analysis based on using mentioned platforms were based on data-mining (DM). DM principles are great amount. Our analyses of data acquired from the questionnaires were based on clustering methods in both surveys.

3.2. Lesson from Surveys

Data sources and questionnaires that were used in survey, has to be changed for following surveys. Changes in questionnaire and data sources are bring about feedback from survey participants and also coherence survey researchers knowledge. The mentioned facts allow us identify changes made in some questions in questionnaires didn't produce expected effects. Changes give rise to make survey more difficult to understand and definiteness questionnaire and at the end also lead to make survey more difficult to evaluation. Understand ability and not definiteness was identified through respondents questions on methods how should be questionnaire fill in.

The basic mistake we made was description of principles for filling in questionnaire in the second survey. We didn't define adequately how should be filled in sum of credits in each of knowledge domains in questionnaire. All knowledge domains were divided into obligatory and optional courses that are provided by universities and credits were filled in to both groups. The consequence was that some universities filled in knowledge domains by the maximal sum of credits students can use in defined study programs. We can mention situation when in study program students can use 20 credits for optional courses provided by university and these 20 credits were filled in to each of knowledge domain.

Another experience was classification of knowledge in domain 16 (this classification was made according to the OKEC). This experience was asked on analysis of questionnaire we received from respondents. Nevertheless mentioned and for survey interesting sectors in OKEC have been included in other 15 knowledge domains in questionnaire. This finding was validated through questionnaire analysis. The knowledge domain 16 was filled in only in two questionnaires from all others we receive from universities.

We have identified necessity to make other changes in future questionnaire and methodology. Changes will be carrying out in the context of experiences and new awareness we received through the results analysis from the first and the second survey. Changes in methodology and questionnaire we identified as necessary are changes in:

- Definition how should be questionnaire filled in.
- Questionnaire structure (we have to modify questions, change segmentation credits on obligatory and optional in knowledge domains.
- Definition of knowledge domains.

- Techniques we are using for contacting universities effective in IT education area (not only through the email, but also through on-line questionnaire on web sites etc.).

3.3. Differences in Surveys/Methodologies with Impact on Results

Let's summarize consequences above mentioned changes in methodologies on project results. Changes were realised between surveys realised in year 2006 and 2009.

Impact of Changes in Questionnaire

Changes we made in questionnaire – especially in knowledge domains in year 2009 give us more detailed information about knowledge provided by universities effective in IT education area in selected study program. We have segmented selected study programs and also universities into defined clusters via data-mining tools. More detailed information we received are based on separation all knowledge domains on obligatory and voluntary courses subsidized by specify sum of credits. Separation on voluntary and obligatory subject gave us new opportunities to comparing study program. For example is comparing in separation on voluntary, obligatory and total sum of credits. Realised changes made the survey results more comprehensible to schools which can easier identify differences in clusters (for example evaluation of knowledge in optional courses).

Credits divided in knowledge domains on voluntary and obligatory are, according to our opinion, one of the most important facts that influence finding-out only two cluster at bachelors level (BcA09 and BcB09), only three clusters at master level (MgrA09, MgrB09 and MgrC09). In this case the subject lectured by universities are so similar at all selected universities and the number of credits assigned to this subject aren't so different that Data-Mining tools can't identified more clusters than mentioned two and three clusters at bachelor and master level.

Consequences of Changes in Count and Structure of Respondent Answers

Changes in respondent's structure were really significant because in year 2009 joined to our survey Masaryk University. This university sanded us specification of 25 their study programs. In the context supra mentioned, questionnaires from the Masaryk University represent almost 27% from all received questionnaires.

This can be one factor responsible for change and improving graduates knowledge structure.

We identified also another factor that can be taken for cause of changes in knowledge structure. These factors are, according to our opinion, foundation and cancellation some study programs – especially on private universities effective in IT related area and than also cancellation of 5 years study programs that are replaced by bachelors and master level study.

Influence of Changes in Technical Devices Used for Survey Processing

Influences of changes in technical devices used for survey processing were reduced by way of clustering accomplishment. This clustering was carried out new technology tools also at data from year 2006 (see chapter "4.2 Changes in distances").

4. Survey Results

Through the analysis we find out following findings:

4.1. Comparison of Knowledge in Years 2006 and 2009

We have find out in the second survey two clusters of bachelors study programs. Identification of two bachelor's study program was based on application of above mentioned analytical tools for data mining on acquired data. Count of cluster was reduced from four (in the firs survey) to two clusters (in the second survey) in comparison with the first survey. Fact is that one of the most important reasons why we can't compare clusters from the second survey with identical cluster from the first survey.

On condition we compare student's knowledge in mentioned clusters (cluster BcA09 and BcB09 from the second survey in year 2009 with clusters BcVosA-BcVosD from the survey in year 2006) we can declare, that the changes in knowledge of bachelors study programs graduates have positive trends. We can identify increase in student's knowledge especially in cluster BcB09. In comparison with other study programs, study programs in cluster BcB09 provides to students significantly more range of knowledge that are demanded of firms. This conclusion is based on mentioned results we find out (see Figure 2).

In the graph Figure 2 we can see columns with prefix „X". This columns means that knowledge domain was analysed only in the first survey in year 2006. In case any knowledge domain has only two columns (see knowledge domain „03 Management IS/ICT), it means the knowledge domain was analysed only in the second survey in year 2009.

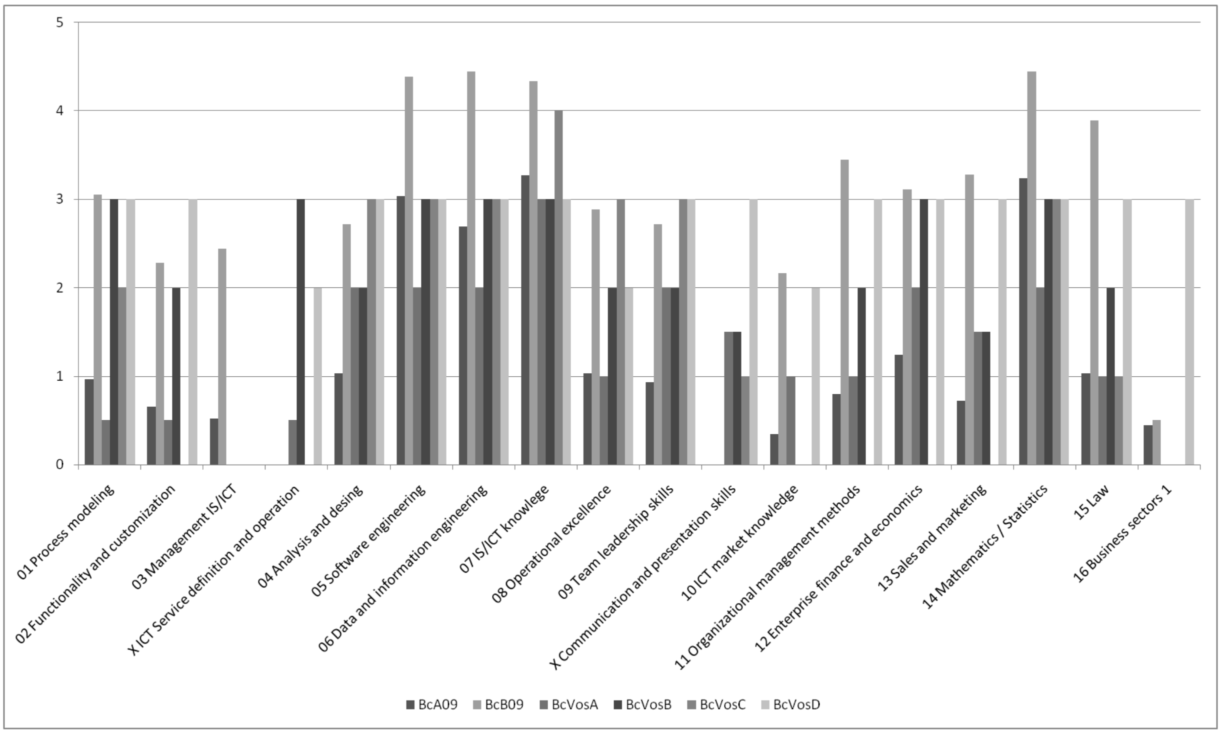

Figure 2: Confronted results from both surveys – Bachelor's level study programs

In year 2009 we find out three clusters of master study programs (in year 2006 we find out four clusters) in the second survey. The comparison shows in following graphs is based on the same principles we mentioned in previous part of this paper where we make comparison of clusters bachelor study programs.

Clusters of master study programs signed as MgrA09-MgrC09 were identified by way of clustering using information from the questionnaire in the second survey in year 2009. Clusters MgrA-MgrD was identified in the first survey in year 2006.

Knowledge domains with prefix „X“ and knowledge domains only with two columns were clarified above and this clarification is valid also for following graph at Figure 3. We can identify increase in student’s knowledge but the increase isn’t as important as in bachelor study programs (see Figure 1). We can identify that much more knowledge provided by selected universities to students is in cluster MgrC09 (see Figure 3).

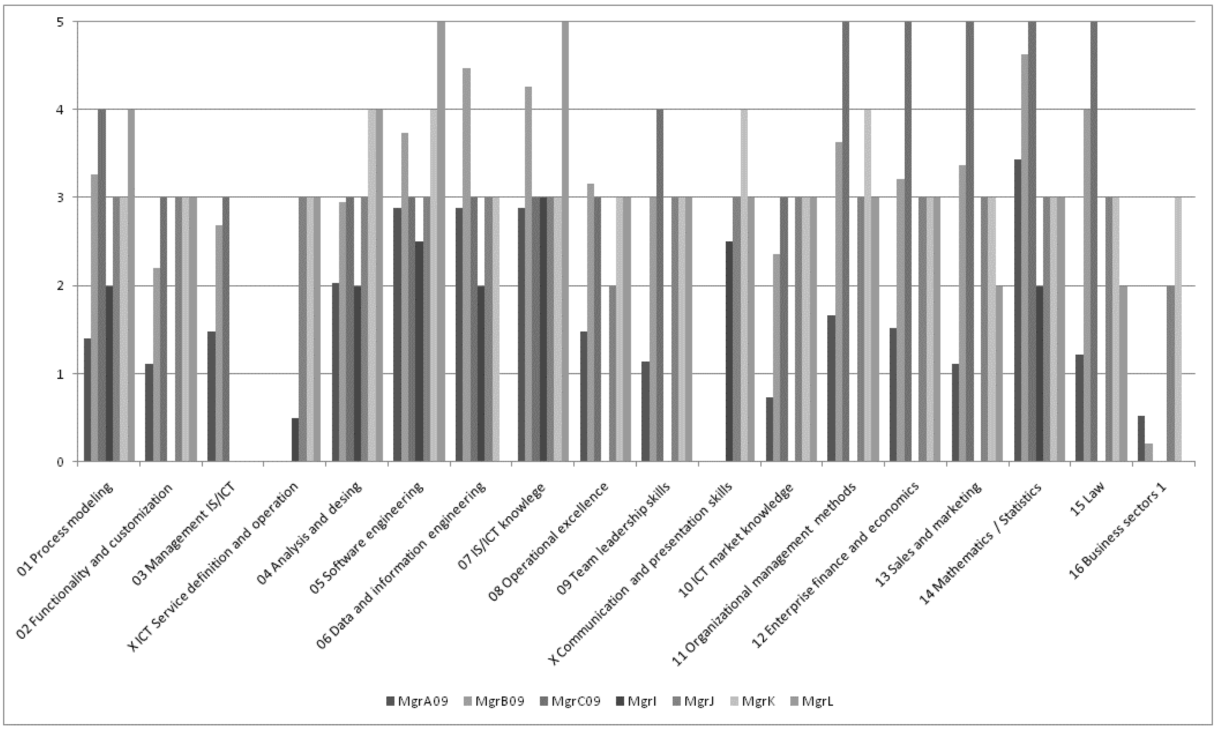

Figure 3: Confronted results from both survey– Master’s level study programs

4.2. Changes in Distances between the Bachelor and Master Level Programs and Business Requirements

We have analyzed the distance between the knowledge profiles of university programs and business requirements for the particular business role.

As an example of the results we have included to this paper tables showing the distances between the bachelor and master level programs and business requirements for roles in columns (see Figure 4 and 5). Distances are expressed in the number of additionally required intensive training days.

We can declare in the context above mentioned graphs, that the distance between the business requirements for the particular business role and knowledge profiles of university study programs (graduates of study programs) is smaller. The evolution in knowledge has positive trend and number of additionally required intensive training days for graduates is smaller. This conclusion is valid for bachelor study programs and also for master study programs.

We used for clustering different technologies in the first survey. We have re-clustered data from the first survey in 2006 (with respect to different technologies used for clustering in 2006) via technologies used for the second survey. This step excludes influence of different technologies used for clustering. The distance between the bachelor and master level study programs and business requirements for roles in the following tables are based on analysis through MS SQL Server 2005

The distances with grey background represent data from year 2006 (the first survey).

We can see significant pull up knowledge of graduates in defined profiles in Figure 4 and 5. This is based on comparison results from the first survey in year 2006 with results from year 2009.

	Distance (in number of required additional training days)					
Bachelor level programs segment name	Business Analyst	Manager of development and operational of IS/ICT	IS/ICT dealer	Developer - IS Architect	Administrator	Advance user, methodist
BcA09	130	175	130	159	97	77
BcB09	65	103	65	80	42	27
BcA	155	200	155	188	122	95
BcB	111	156	111	146	79	58
BcC	120	165	120	156	88	60
BcD	119,5	164,5	119,5	141,5	86,5	66,5

Figure 4: Distance among the bachelor level programs and requirements for each of defined roles

	Distance (in number of required additional training days)					
Master level programs segment name	Business Analyst	Manager of development and operational of IS/ICT	IS/ICT dealer	Developer - IS Architect	Administrator	Advance user, methodist
MgrA09	130	175	130	167	97	70
MgrB09	47	85	54	77	31	16
MgrC09	24	40	32	56	24	8
MgrA	155	200	155	188	122	95
MgrB	95	133	102	110	63	58
MgrC	125	170	125	160	92	60
MgrD	118	163	118	138	85	66,5

Figure 5: Distance among the master level programs and business requirements for each of defined roles

Distances initiate in previous Figures 3 and 4 are extended by following Figures 6 and 7.

At Figure 6 we are comparing knowledge of bachelor study programs graduates with requirements businesses. There is evident at the Figure 6 that cluster Bc09A cover businesses requirement only in two knowledge domain. Cluster Bc09B cover businesses requirements better, but there are also few domains that aren’t covered enough.

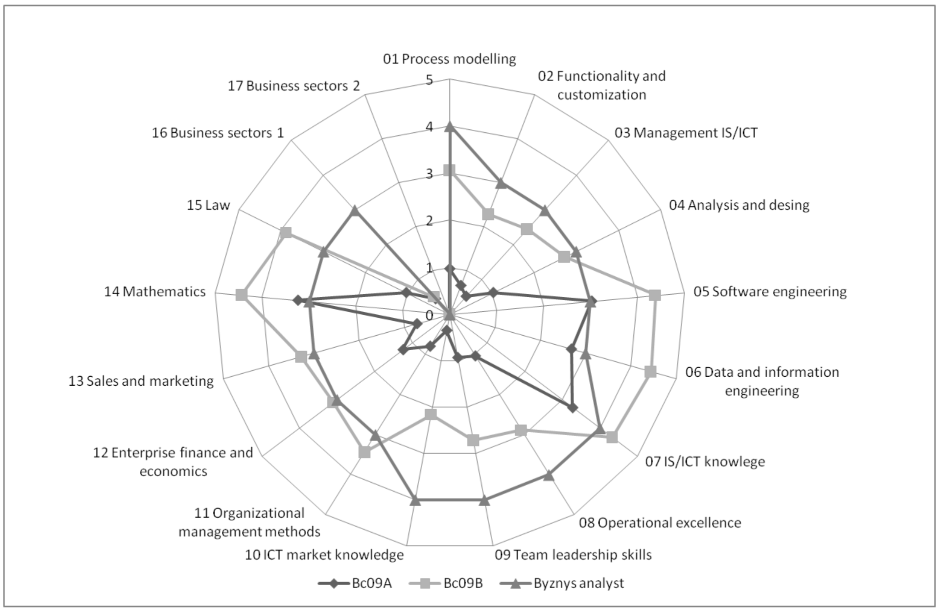

Figure 6: Comparison of businesses requirements and graduates knowledge in clusters at bachelor level

At Figure 7 we are comparing knowledge of master study programs graduates with requirements businesses. Graduates from cluster Mgr09C exceed businesses requirements almost in all knowledge domains. On the contrary cluster Mgr09A doesn't cover businesses requirements in almost any knowledge domain.

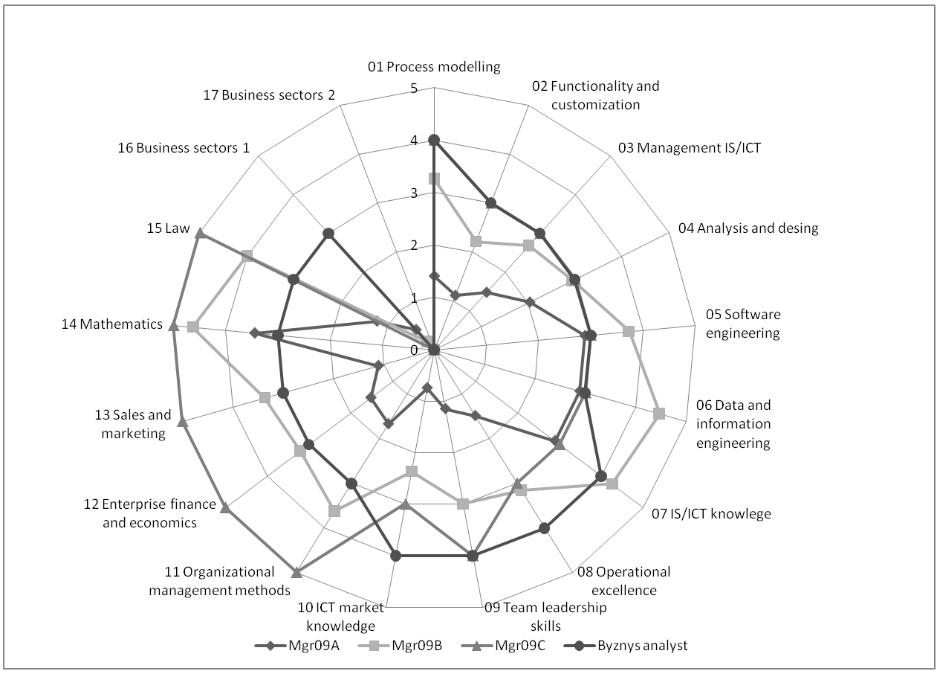

Figure 7: Comparison of businesses requirements and graduates knowledge in clusters at master level

5. Conclusions

Results from the second survey in both types of study program (bachelor and master study program) prove that the evolution in the distance between the student's knowledge and business requirements are smaller. This could be cause for example by advances in the study programs structures and courses that are provided in selected study programs.

Businesses requirements are exceeded by knowledge of graduates especially in cluster Mgr09A.

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RELATION OF INVESTMENT TO ICT, HUMAN CAPITAL AND ORGANIZATIONAL CAPITAL

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Keywords

Investment to ICT, net present value, CBA, human capital, organizational capital

Abstract

Presented paper sketches the relationship between investments in ICT and human and organizational capital, or their interdependency as the case may be. The paper uses real knowledge with the ex ante assessment of project efficiency in the field of ICT, with a special regard to the public sector in the Czech Republic. There are mentioned some general methods of evaluating the ICT influence on organization efficiency at first. Then, there is briefly presented basic methodology mandatorily used for project co financed by public (EU) funds. For illustrating the usual procedure of evaluating differences regarding the impact of human and organizational capital, there are mentioned three examples of ex ante evaluating the efficiency of ICT projects financed from the public funds: Building metropolitan area network; Building a technological (ICT) center of a town; Extension of the data warehouse of a higher territorial self-governing unit. As a conclusion, there is presented the extended formula of the net present value of project cash flows as the sum of particular discounted cash flows relating to the investment and the sum of discounted changes in organizational capital generated by the investment.

1. Introduction

The purpose of the presented paper is to sketch the relationship between investments in ICT and human and organizational capital, or their interdependency as the case may be. The paper uses real knowledge with the *ex ante* assessment of project efficiency in the field of ICT, with a special regard to the public sector in the Czech Republic. The aim of the paper is to advance a potential addition of usual criterial indicators (for assessing investment efficiency) with the dimension of human or organizational capital for a wider expert discussion and further elaboration.

In the text of the paper itself, we first briefly mention – as an introduction into the context – some general methods of evaluating the ICT influence on organization efficiency. Consequently, we outline some experience with the *ex ante* assessment of the efficiency of real projects in the ICT field in the public sector in the Czech Republic (including the basic methodology). Further on, we mention some procedures of assessing the efficiency of investments in human capital. At the end, we propose one of the easiest possibilities of a more detailed (formal) elaboration of the criterial indicator NPV with the component of human/organizational capital.

This paper is a partial output of the solution of the research plan No. 402/09/2057 "Measurement and management of the intangible assets impact on enterprise performance " financed by the Czech Science Foundation.

2. Evaluation of the IS/ICT Influence on Organization Efficiency

The most used methods of the evaluation of the IS/ICT influence on (financial) enterprise efficiency can be divided into financial, measurable nonfinancial and soft ones.

The most used financial methods are:

- The payback period
- NPV (net present value)
- Cost-benefit ratio
- Profitability
- IRR (internal rate of return)

The most used measurable nonfinancial methods are:

- The reduction of the running development and production time
- Decreasing the number of claims
- Increasing the number of customers
- Enlargement of the market share
- Shortening the downtime of a production device

Among the soft methods there are:

- Improving the enterprise reputation
- Customer satisfaction
- Increasing customer loyalty

In the following text, we focus only on the financial criterial indicator net present value (NPV) – for its clear and evident value as well as for the frequency of its usage.

3. Ex ante Evaluating the Efficiency of ICT Project Financed from Public Sources

When planning any project it is reasonable to evaluate its expected efficiency (direct financial or indirect) already in the pre-investment phase. In the public sector in the Czech Republic, this type of evaluating and examining investment efficiency has not been by far a standard procedure, nevertheless, with regard to co-financing a number of projects from EU Structural Funds, submitters of such projects are forced by the obligatory methodology to process feasibility studies, including the evaluation of the financial and socio-economic utility of the project.

Because of the experience of one of the authors of this paper (since the year 2001, he cooperated in the pre-investment preparation and evaluation of a number of ICT projects in the public sector), we can mention some observations gained by evaluating real projects *ex ante*.

Firstly, it is appropriate to describe briefly the basic evaluation methodology:

Apart from technical, organizational, budget, time, personal and other requirements, there is another integral component – the feasibility study of assessing the planned project feasibility, where standard criterial indicators (most often NPV, IRR, the payback time, ROI) are used. With regard to the particulars of public projects, or to their usually noncommercial orientation as the case may be, the evaluation itself is executed in two lines: in the classical financial line on the basis of expected real cash flows of the project (investment) implementer and in the line of all the project impacts (financial as well as non-financial) on all subjects touched by the project (so called socio-economic level = CBA).

The cost-benefit analysis (CBA) is a standard technique determined for calculating costs and benefits, and therefore, it serves as a source for qualified decision-making. In this analysis, we try to express all the project impacts in money values (to monetarize), where it is possible so that we were able to compare positive as well as negative impacts on the common (monetary) basis.

Because of the above mentioned criterial indicators, we focus in the following text mainly on the net present value, which for the purpose of any further elaboration is outlined despite it being widely known.

Net Present Value (NPV):

The net present value of project cash flows is the sum of particular discounted cash flows relating to the investment. It can be calculated by means of the following formula

$$NPV_t = \sum_{t=0}^{n} \frac{CF_t}{(1+r)^t}$$

(or as the present value of operating flows – the present value of the input investment), where:

NPV_t is the present value of all the cash flows emerging from the project from the time period 0 to "*n*";

CF_t is the flow of the investment;

r is the discount rate;

t represents the time period;

n is the last time period.

A project is effective if its *NPV* is greater than 0. Consequently, the project is even more profitable if it offers a higher net present value.

It is necessary to specify a proper discount rate for the time differentiation of cash flows. Capital costs are used as the discount rate (which expresses the opportunity cost). If the investment is financed solely with own capital, then the cost is the required minimal capital yield. In case only foreign resources are used for financing, then the cost is the credit interest. Most frequently, yet, the investment is financed from multiple resources, then the average capital cost is in the works; it is calculated as the weighted arithmetic mean of the costs on particular financing resources.

Capital costs generally mean for the investment implementer the cost which must be paid for gaining various forms of capital, which can be used for investment financing. It is clear from the above mentioned that a universal formula cannot be simply written because it would always depend on the particular way of investment financing. When dealing with the projects financed from public funds (which we are interested in), the above mentioned formula can be extended with one more element, and it can be specified more:

$$r = WACC = w_c * k_c * (1\text{-}T) + w_v * k_v + w_p * k_p,$$

where

WACC weighted average cost of capital;

w_c, w_v, w_p the weights of particular capital components (i.e. the percentage of the overall resources for foreign commercial resources, own and foreign public ones);

k_c the pre-tax interest rate of new credits;

T the percentage of the taxation of the investor's incomes;

k_v the rate of costs on the own capital (required profit);

k_p the rate of costs on the public fund (ordinarily set in an administrative way by the subsidy provider).

With the exception of the discount rate, the second input element is the estimation of particular project cash (or near money in case of CBA) flows – this field will be, but, left aside for the time being.

Real Case Studies

For illustrating the usual procedure of evaluating differences regarding the impact, we will mention three examples of ex ante evaluating the efficiency of ICT projects financed from the public funds. We are not going to present the particular calculation form to protect internal information of those customers whom the study has been processed for; we will be limited only to a general characteristic of the project, i.e. to listing basic inputs into the calculation of *NPV*.

The projects in hand are:

1. Building metropolitan area network
2. Building a technological (ICT) center of a town
3. Extension of the data warehouse of a higher territorial self-governing unit

1) Metropolitan area network

The aim of the project is building a classic closed metropolitan area network of a smaller town based on optical cabling in the urban area with a solution of the connectivity to backbone networks, including the regional network ROWANet II. The main advantage of the project was making public administration more efficient and decreasing financial demands of using telecommunication services of the public sector in the town area.

The above mentioned metropolitan area network offers the following essential services

- data services of the network ROWANet, portal solution for the access to important information
- backing data bases
- access to the Internet
- video services, video conferencing, e-learning programmes, ipTV, voice services, IP telephone
- stabilization of telephone providing (consolidation of particular organizations' small lines)
- security services – linking to a centralized control console of a security agency

- town camera surveillance system

The total investment intensity of the project was some millions of Czech crowns. The input data in the calculation of the net present value was as follows:

- Investment costs
- The balance value of the investment
- The running costs
    - Electric energy
    - The maintenance of active network components
- Cutting costs on telecommunication services

All the inputs in the calculation of *NPV* are influenced basically by technical parameters of the whole network.

2) Technological (ICT) town centre

The project of Technological Centers and Electronic Records within the Area is a part of the project of regional centers, so called eGON centers. They have their technological, educational and administrative function, and are an integral bearer and a disseminator of the eGovernment concept within the area.

The aim of the project of building a particular town's technological center and records is, above all, to provide the town, its contributory organizations and municipalities situated within its administration zone, or are a part of the micro region with robust, differentiated and stable technical architecture able to spread.

On the basis of technical architecture and infrastructure built in this way, it is to offer key services for municipalities and contributory organizations:

- Non-guaranteed storage site;
- Records services for municipalities and contributory organizations;
- Geoportal.

In the future it is capable of spreading with the services:

- Camera system;
- Data storage;
- Virtualization technology;
- Editorial system;
- Digital technical map;
- Managerial IS;
- Electronic post boxes;
- Services based on virtualization technology;
- Czech Point@Home;
- Hepldesk;

- Storage;
- Official notice board.

The total investment intensity of the project was some millions of Czech crowns. The input data in the calculation of the net present value was as follows:

- Investment costs
- The balance value of the investment
- Operating costs
    - Maintenance
    - Energy
    - Distant administration
    - Personal costs
- Cutting the costs when comparing to outsourcing of the whole solution.

Majority of the inputs into the calculation of *NPV* is influenced mainly by technical parameters of the given technological center. Its usage efficiency is, yet, noticeable dependant on human capital. The efficiency itself has not been assessed considering the project being raised by external circumstances (legal regulations) from the point of view of the town.

3) Extending the data warehouse of the Vysočina Region

The aim was to deepen and extend information tools of the Vysočina Region, above all towards municipalities, contributory organizations and citizens of the region. The integration of the data from different sources increases dramatically information utilizability, utilization percentage and informational value, and it speeds up the decision-making processes of the Vysočina Region as well as of other subjects, and last but not least, it increases the level of education and of the satisfaction of citizens' information needs.

The aim is also a centralized multidimensional database of all relevant data from the field of regional public administration. The purpose is even the system users' training, increasing the citizens' and municipalities' awareness in the relation to the regional public administration, making the citizens' access to information easier, making the decision-making processes of the Vysočina Region itself as well as of other subjects better and faster, increasing utilizability, utilization percentage, speeding up the communication and, last but not least, increasing the quality of provided information services.

The total investment intensity of the project was some millions of Czech crowns. The input data in the calculation of the net present value was as follows:

- Investment costs
- The balance value of the investment
- Cutting personal costs

The expected personal costs cutting was estimated in the following three manners – pessimistic (= sparing one job); medium (= sparing 3 jobs); and optimistic (= sparing 7 jobs). The *NPV* value of the medium and optimistic way is positive. The final project efficiency is, thus, basically influenced by the factor of human capital (the efficiency of the given tool usage).

It is clear from the above mentioned features how the outputs and, therefore, the final efficiency are influenced by the knowledge and skills of operators or users during the implementation itself and operating given projects (investments). The benefits of a closed metropolitan network are generated especially by savings from the link rental and other telecommunication services; so the development is quite predictable. On the other hand, the effects of introducing and extending the data warehouse of a higher territorial self-governing unit are completely dependent on the knowledge and skills of particular users and organizational habits and rules, i.e. on the human and organizational capital, which are influenced back. These pieces of information lead to the consideration of more suitable internal structuring the methodical scheme for evaluating efficiency.

4. Including Organizational Capital

Based on the experience with *ex ante* assessment of project efficiency as well as with the following *ex post* assessment, it is obvious that for many investments in ICT the final efficiency is influenced by the human factor or rather human and organizational capital. In the previous paragraphs we tried at least to outline the varied influence extent of the above mentioned by means of comparing three different projects.

The standard calculation of the net present value in the financial analysis takes into account real financial flows of the project in the investment as well as in the operating part, the changes in human and organizational capital have naturally some effect on the future financial flows in the enterprise; this is, but, hard for quantifying.

In our paper we would just like to refer to these problems and to mention the basic operating scheme.

The concept of human capital was developed most by Gary Becker (Becker 1997). The capital supply of the following period equals creating the personal capital in a given period plus the non-depreciated part of capital in a given period. It can be expressed in a formal way as $P_{t+1} = x_t + (1-d_p)P_t$, where d_p is a constant rate of depreciation and *x* is an amount invested in the personal capital.

The social capital represents, then, the influence of other people on a person's utility. Creating the social capital can be expressed as $S^i_{t+1} = X^i + (1-d_t)S^i_t$, where d_s is the rate of depreciation of the social capital and $X_i' = \sum_i x_i$ is the outcome of a person's choice of *j* network members and his/her social capital.

The related concept is, then, the organizational capital, which consists according to Black and Lynch (Black 2005) of three components: workforce training, employee voice, and work design (including the use of cross-functional production processes), which altogether form synergic effect.

Suggested internal gross structuring of the NPV estimation with regard to investment impacts on human and organizational capital

The extended net present value of project cash flows is the sum of particular discounted cash flows relating to the investment and the sum of discounted changes in organizational capital generated by the investment. It can be calculated by means of the following formula

$$NPV'_t = \sum_{t=0}^{n} \frac{CF_t}{(1+r)^t} + \sum_{t=0}^{n} \frac{\Delta O_t}{(1+r)^t}$$

(or as the present value of operating flows – the present value of the input investment), where:

NPV_t is the present value of all the cash flows emerging from the project from the time period 0 to "*n*";

CF_t is the flow of the investment;

ΔO_t are the changes in organizational capital;

r is the discount rate;

t represents the time period;

n is the last time period.

Needless to say, it is necessary to elaborate the above mentioned component of organizational capital further and to structure it internally for the prospective practical usage.

5. Conclusion

The whole paper deals with the relation of investments in ICT and human and organizational capital in the context of the standard methodology of evaluating economic efficiency of projects financed mainly from public funds. Following the introductory recapitulation, we sketched some results of ex ante evaluating real projects, which pointed out the appropriateness of bigger internal structuring the methodical computing pattern. It is just a very rough scheme. When applying we always come to the basic problem of quantifying the value of human and organizational capital, or their changes as the case may be, but the proposed structure, in any case, contributes to non-marginalization of an important dimension of investment projects, especially in the ICT field.

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HUMAN RESOURCES MANAGEMENT IN ICT CONTEXT– THE DRIVERS OF PERSONNEL PERFORMANCE

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Keywords

Human resources management, information systems, HRIS, performance management, process

Abstract

In this article, we elaborate on some presently important perspectives of human resources management in the ICT area, i.e. in the particular field of companies (departments), oriented on delivery of information and communication technology products. Our main focus is personnel performance and the role that modern ICT systems, especially human resources information systems or HRIS for short, can play in its build-up and support in the ICT enterprise. First of all, the role of human resource managers in ICT enterprise is defined. Consequently, the basic business processes that they are responsible for are identified and the relevant performance drivers that can improve the enterprise outputs are evaluated. These factors are also put to a relation with a concept of component IS and the contribution of ICT tools to enhancing the managerial tasks of HR responsible personnel is described.

This article was created and presented on the IDIMT conference thanks to the finances provided by IGA grant „IGA – 32/2010“.

1. Introduction

Whereas this article covers an initial phase of our ongoing research, its goals are mainly to present our insight into the respective area, give an overview of contemporary trends and identify purposeful courses of further investigations. The following research questions are resolved:

- Which human resource management practices contribute most to organizational outputs, i.e. overall enterprise performance?

- What is the role of modern ICT tools in supporting these "HR-managed" performance drivers?

For the purpose of giving satisfactory answers to these questions, the article has the following structure: first of all, the general role of human resources manager (in the ICT area) and relevant HR business processes are defined; secondly, a component structure of information system (IS) in an ICT enterprise is described with accent to human resources management requirements; thirdly, the possibilities to support the HR business processes and fulfill the related managerial needs by means of modern ICT tools are discussed.

2. Human Resources Management

There are many different general definitions of "human resources management" (or HR, personnel management, staff management etc.). As the business environment changes, the terminology also evolves and reflects the new challenges that have to be outdone in the human resources field. In this article, we develop our understanding of some "human resource management" perspectives – performance and usage of ICT tools – on the basis of a classical definition by Cherrington (Cherrington, 1995): "Human resource management is responsible for how people are treated in organizations. It is responsible for bringing people into the organization, helping them perform their work, compensating them for their labors, and solving problems that arise". Notwithstanding that this definition is rather universal, it is in conformance with a concept of decentralized, delegated personnel management responsibilities that we tend to support. It also clearly defines the main factual, administrative and formal duties of any manager, responsible for carrying out specific human resources tasks.

However, we think that it is necessary to confront the above stated definition with some more recent burdens laid on the shoulders of managers, involved in human resources – the contribution to enterprises' overall performance and the necessity to employ modern HR information system. Copeland points out in (Grensing-Pophal, 2008) that HRIS helps to "attract and hire a greater share of high performers; … reward and retain high performers; … monitor the effects of new policies and programs and react swiftly to trends and results; … drive member satisfaction, profits and long-term success." In conformance with this quote, we consider the issues of performance management, HR management and ICT tools interconnected and therefore they will be discussed jointly. Also, in order to narrow our research subject, it should be stated that we approach ICT tools as both a subject that is managed and an instrument that helps managers to deliver effectively.

The role of human resources managers covers a wide area of tasks and duties – no matter whether they are carried out by an HR specialist or a line/project manager. As already discussed in (Oškrdal, 2010), one of the best ways to describe the responsibilities of any staff member is to derive his/her appropriate role from business processes, i.e. define the position by applying the process approach to management. In this article, whereas we have to keep the given extent, we will pick a set of business processes on the basis of literature instead of designing them from scratch. For example – based on (Armstrong, 2009), (Marques, 2010) and (Brooks, 2006), we can consider the following business processes, performed by managers in human resources:

- interviewing and recruiting,
- managing personnel evidence,
- providing, presenting and delivering medical, dental, vision, life, and other ancillary benefits,

- facilitating job trainings and certifications,
- instituting programs for retention and growth of employees,
- designing administrative and supportive processes,
- evaluating employee efficiency,
- establishing tools and guidance for management reviews,
- preparing and reviewing capacity planning,
- setting up motivation programmes,
- constituting organizational policies,
- providing support for new-hires,
- controlling worksheets.

Although the list is already long, it is definitely not complete. If human resources managers are to function as a part of top management in the enterprise (and also fully support its strategy as described in (Mildeová, 2005)), the need to support the business processes by means of ICT tools is unquestionable. Brooks (Brooks, 2006) confirms this thesis and at the same time, emphasizes the growing importance of HR management – "obtaining the right tools is essential for HR to manage day-to-day activities on a number of fronts – to decrease costs, save time, and increase accuracy, while giving HR the resources to assess big picture needs and aid in advancing their increasingly more strategic roles." Speaking of the ICT area enterprises, the persistent challenges of satisfactory results unambiguously shift the focus towards the processes of motivation, quality and controlling.

3. HR and Corporate IS Structure

On the basis of suggestions concerning HRIS from (Roberts, 2006) and (Arnold, 2007), actual architecture designs of several ERP systems and a more general approach by (Voříšek, 2008), we have designed a component structure of a corporate information system that we consider adequate for a mid-sized ICT company (common EU definition: 50 - 250 employees, turn-over up to 50 million EUR) with a strong role of human resources management and performance management. The presented structure of "modules" represents a conceptual schema that is intended to be supported either by an integrated system or a set of custom software tools, depending on the preference of the enterprise. In our consequent research, we plan to design the personnel management and performance management part by means of requirements and suggestions for a new customized tool, but for now, we'll omit this and focus on the contextual issues. As Hurley-Hanson and Giannantonio (Hurley-Hanson, 2008) point out: "It is not adequate for a competitive business to not be equipped with the latest in informational technology when dealing with a vast amount of data and personnel … What is of vital importance, then for business, is for every organization to be self-prepared through their own HRIS systems and other IS systems." So no matter what the specific implementation means are, the conceptual schema that we propose is shown on Figure 1.

Figure 1 Corporate IS - conceptual schema

The top level of schema represents the steering board level, focused on leading the enterprise and defining future steps. The mid level shows components of corporate information system that support processes with direct added value – in our opinion this includes the personnel management. The bottom level represents shared (lower left), supportive (upper left), production (lower right) and evidence (upper right) modules that are necessary for a routine operation of the enterprise and delivery. While designing this schema, our goal was not only to divide the structure of corporate IS to specialized "modules", but also to group related areas covered by various IS means. Detailed description of all parts of the IS structure is beyond the intended extent of this article, nevertheless, we can use this basic conceptual schema to predict and design main bottom-up and top-down dependencies of personnel management, the roles that ICT has in it and the implication their joint can have for the performance. In the following chapter, the schema will be also used as an intuitive guidance for identification of human resources management tasks with strong/mediocre/weak support in corporate IS.

4. HR and Performance Drivers

Before we take a closer look on the specific connections of HR, ICT and performance, a short excursion to recent trends shall help us focus on material problems.

First of all, let's have a look on how the HR managers perceive the ICT tools in general. Several authors noted that this is now in a state of "renaissance of confidence", because with the upheaval caused by both integrated ERP systems and specialized HR applications, even the HR managers feared of being replaced by some "tool". Brooks (Brooks, 2006) describes this phenomenon and points out correctly, that the right approach is maximizing the benefits that ICT can bring to specific problem areas, not avoiding them in order to preserve current status. This is by all means true, but not sufficient when we need to identify the real performance drivers – to accept the contribution of ICT is only the first step, knowing how to use them effectively is a completely different issue.

But Brooks (Brooks, 2006) also took this second step in his research and highlighted the following areas as those with highest potential when using new internet-based HR systems:

- simplify administrative,
- ensure security of valuable information over antiquated paper formats.

These tasks help to free up time for critical management tasks and thus lever the importance of HR. Thus the finally represent an initial identification of the areas - performance drivers - that we want to elaborate on; but definitely, we need more such findings.

Ferguson and Reio (Ferguson, 2010) formulated and proved in their study a "hypothesis of human resource processes/practices contribution to organizational outputs, i.e. job performance and firm performance" and pointed out the following performance drivers:

- define organizational policies and procedures that serve to positively motivate workers and
- maintain learning and development activities that stimulate optimal task and contextual job performance.

Following a different approach in the public sector area, Reddick (Reddick, 2009) adds in his survey the following suggestions about which areas are really verified to bring the highest benefits by HRIS, used by enlightened HR managers:

- align employee activities with the needs of customers or clients,
- support advanced strategic decision-making tools.

This is another important ingredient that we will take into consideration. And at but not at least, to acknowledge the most recent trends responding to global crisis, an upheaval towards the usage of HRIS is noted by Hurley-Hanson and Giannantonio (Hurley-Hanson, 2008), urging the companies to pay attention also to security (as already listed) and the necessity of "being prepared for anything". In times of crises, the HR managers and HRIS can ensure quick return to adequate performance levels if they:

- ensure swift communication with employees and
- support disaster recovery.

In our survey that is now being conducted among Czech companies, the following aspects have been also already identified by the HR managers as important HR performance drivers (though we can consider them only as preliminary results that yet need to be confirmed by broader audience):

- define personal performance metrics and
- streamline communication.

We will now consolidate and confront these findings with the original definition of HR business processes and ICT structure that we have presented earlier in this article.

The following table Tab 1 puts these elements into logical relationships and marks the preliminary results.

On the left side, HR business processes (summarized and rephrased) are listed.

On the top, the performance drivers (summarized and rephrased) are shown.

In the central section, the parts of corporate IS used for the delivery of business processes are shown. The meaning of a simple cell – such as the upper left corner – is: "if you want to improve the performance of Interviewing and recruiting process by boosting the Simplifying administrative driver, you have to empower the Documents component".

performance driver \ business process	simplify administrative	ensure security of valuable information	define organizational policies and procedures	maintain learning and development activities	align employee activities with customer needs	ensure swift and direct communication	support disaster recovery	define personal performance metrics
interviewing and recruiting	documents	documents personnel	knowledge base			personnel	personnel intranet documents	
managing personnel evidence	personnel documents	personnel documents	knowledge base intranet	personnel		personnel intranet knowledge base	personnel intranet documents	personnel performance managemnet
managing benefits and setting up motivation programmes	intranet	personnel	intranet	intranet	personnel	intranet		performance management
facilitating job trainings and certifications	personnel	personnel	personnel	personnel	planning and forecasts	groupware		personnel
designing supportive processes and organizational policies	intranet knowledge base	quality	knowledge base intranet		quality	intranet knowledge base	intranet	performance management
evaluating employee efficiency and employee morale controlling	worksheets attendance tasks	perfomance management	worksheets performance management		testing	performance management		performance management testing
establishing tools and guidance for management reviews	personnel	reporting performance management	strategic scorecards	personnel				performance management
preparing and reviewing capacity planning	planning and forecasts	personnel	planning and forecasts	planning and forecasts	projects	tasks		
providing support for new-hires	intranet	intranet	knowledge base intranet	knowledge base intranet	projects tasks intranet	intranet knowledge base		performance management

Tab 1 Relations between processes, drivers and tools

Let's briefly summarize: the table represents an overview of "how are HR business processes in an ICT enterprise covered by means of corporate IS and what is the level of support the HR managers can get from various IS modules to enhance corporate performance". Some interesting remarks should be pointed out on its basis:

1. The most important “modules” of a corporate information system for human resources managers are Personnel, Performance management, Intranet and Documents. Also Knowledge base, Strategic scorecards and Planning and forecasts are of some importance. These “modules” cover the majority of HR business processes.
2. Insufficient ICT support for human resource managers is in the fields of disaster recovery, definition of organizational procedures and aligning employees with customer needs; obviously these performance drivers are not properly enhanced by ICT tools and remain in people’s hands.
3. There is surprisingly small usability of special ICT tools, required for production in an ICT enterprise, for corporate personnel managers. The only identified direct input is provided by Testing “module”, whereas the remaining parts remain out of scope of personnel managers. This leads to a conclusion that the HR business processes and their role in an ICT enterprise are very likewise when compared to other business branches.

But the most important conclusion is represented by the table itself – it provides guidance for human resources managers that seek to improve their productivity by application of appropriate ICT tools. In an upcoming research, we also plan to evaluate the relevance of individual IS components and their contribution for identified performance drivers.

5. Conclusions

We have defined the role of human resource managers in ICT enterprise, identified the basic business processes that they are responsible for and on the basis of recherché and several surveys, evaluated the relevant performance drivers that can improve the enterprise outputs. We also put these factors to a relation with a concept of component IS and described the contribution of ICT tools to enhancing the managerial tasks of HR responsible personnel. The results show an important, but not total dependence of HR business processes and their performance on the ICT. The reason for this is probably quite simple – the “core” of most of the processes is in soft skills of the people that perform them, not in a routine operation that could be handled fully by ICT means. Even in ICT enterprises, this fact remains valid and must be taken into considerations.

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HUMAN RESOURCES IN ICT – INFORMATION AND TECHNOLOGICAL LITERACY AS THE QUALIFICATION PREREQUISITES

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Keywords

Information literacy, computer literacy, technological literacy, information society

Abstract

In the article it is argued, that the main importance of human resources in ICT lies in the literacy of the people, not technologies. Various kinds of literacy – from information literacy to technological one – are discussed as qualification prerequisites of modern labour. Author later points out, that our educational system holds back and has troubles to accommodate changing nature of qualification requirements of the ICT industry. The new information society requires an entirely new concept of human labor, new conditions require "new people", and it redefines and significantly expands general training (educational) requirements. Former insistence on "factual" education ceases to be essential in the era of Wikipedia and Google and it turns out that for flexible and powerful grasp of new information technologies is essential to redefine traditional qualification prerequisites.

This article was created and presented on the IDIMT conference thanks to the finances provided by IGA grant „IGA – 32/2010“.

1. Information Society and its Challenges

Our current society, which we are living in at the end of the 1st decade of 21st century, is being often labeled as "Information Society" (replacing Bell's term "Post-Industrial"). The rapid technological development has produced a tantalizing array of new information and communication technologies (ICT) which have definitely transformed the approach to the way our society functions, the way we all behave and live our everyday life. In information society the *creation, distribution, diffusion, use, integration and manipulation* of information presents a significant *economic, political, and cultural activity*. There is a whole range of changes, which follow the birth of such modern concept of society:

1. There is a significant transition from the production of goods to the provision of services (in terms of both human labour force and industry output).
2. Knowledge (as information in context) becomes a valued and cherished form of capital.

3. Innovations become the predominant initiator of economic growth and source of competitive advantage.
4. Thanks to the trends of globalization and automatization (Brixí, 2009), the value and importance of manual labour declines, while advanced jobs (such as IT professionals) grow in value and numbers. There are substantial changes in the way labour (especially in the sphere of ICT) is managed (Oskrdal, 2008).
5. Brand new behavioral and information sciences and technologies are needed, developed and implemented to deal with new phenomena brought by the ICT development (e.g. social network systems, web 2.0, wiki systems, open-source as a brand approaches supporting knowledge-sharing (Oskrdal, 2009).

General access to information technologies is spreading rapidly, and not just in the developed countries. In 2005, the number of internet users in developing countries has reached 500 million, surpassing industrial nations for the first time. As of 2009 InternetWorldStats.com points out there are almost 2 billion of internet users, the biggest internet country being China (420 mil. of internet users) with India, Brazil, Russia, Iran or Indonesia at the top ranks of the list.

As the price of hardware is getting lower and lower, information technology (although not the most advanced) is getting accessible to the poorer and poorer. The flagship of this development is 2007 project OLPC – One Laptop Per Child (idea of the project is to create educational opportunities for the world's poorest children by providing each child with a rugged, low-cost, low-power, connected laptop with content and software designed for collaborative, joyful, self-empowered learning). This educational laptop for the price just under 200 USD was quite a success – 1,5 mil. of such PCs were delivered and handed out in poor countries, mostly in South America.

However – the long-heralded promise of ICT being the “savior” of underdeveloped countries remains out of reach for most of the developing world. For the information poor, economic and social gaps are in fact widening both within and between countries. It is clear, that just handing out the “hardware” is not enough, for real development, there is need for more – educated people. And this gap is not so easily overcome as the technological one – being the main reason, why Africa and South America are (despite development help) still left behind.

The information society requires an entirely new concept of human labor, new conditions require "new people" (sometimes called “digital citizens”), it redefines (and significantly expands) general training (educational) requirements. Former insistence on “factual” education ceases to be essential in the era of Google and Wikipedia (social relations and knowledge-sharing in wiki systems are covered by Pavlicek 2008, 2009) and it turns out that for flexible and powerful grasp of new information technologies is essential to *redefine traditional qualification prerequisites*. The world is getting smaller, communication is getting faster and cheaper, for the first time it seems that even language barriers are falling down thanks to automated machine translation (Varga, 2006) and establishing English as a modern “lingua franca” of information age.

2. Concepts of Literacy

On-going troubles of developing countries demonstrate that spreading the technologies themselves is not enough. Human factor (and its education) must be taken into consideration (for modelling human behaviour the system dynamics model can be used (Mildeová, 2006)). Historically (since 17th century), the sufficient education demanded just simple *literacy*: to be able of at least basic reading, possibly write, and perhaps count a bit (numeracy). However, to describe someone as a “literate” now means, he has achieved much more complex level of understanding – terms like “information literacy”, “technological literacy” or “technacy“ emerged.

2.1. Information Literacy

Information literacy is the ability to identify which information is needed, really understand how the information is organized (both internally and externally), identify the best sources of information for a given need, locate those sources, critically evaluate the sources, and be able to share that information. Information literacy skills are used not just for academic purposes (pedagogy, research, science …), they're used in everyday life of digitalized society too – the ability to find, evaluate, use and share information became an essential skill. It is even important factor of modern democracy – it allows fully participate in a democratic process as an informed citizen by understanding issues and voting.

As we are nowadays surrounded by a growing flow of information in all formats, it makes information literacy crucially important. It becomes essential to distinguish which information is correct, authoritative, current, and reliable, which could be biased, out of date, misleading, or false.

As described in Figure 1, information literacy can be shown in the form of 3-layered pyramid. At the base of it lie skills of practical work with new technologies. It means, that users can work with a computer, they know the routines of searching the information and command basic syntactic procedures of the content creation (in the era of web 2.0 also *active* process of *content creation* is due to interaction, interactivity important for informational confidence and information literacy).

Middle level consists of a good understanding of ICT principles – the principles on which technology stands, its limitations and their possibilities. Although such understanding is not absolutely necessary for everyday basic routine use of technology (on the ground level), lack of it definitely limits the ability of user to reach its full potential.

At the summit of the pyramid is the most important part - *critical thinking*; skilled, active and reasonative interpretation and evaluation of observations and information. Critical thinking calls for careful, deliberate determination of whether (and with which degree of confidence) accept, reject, or suspend judgment about a claim.

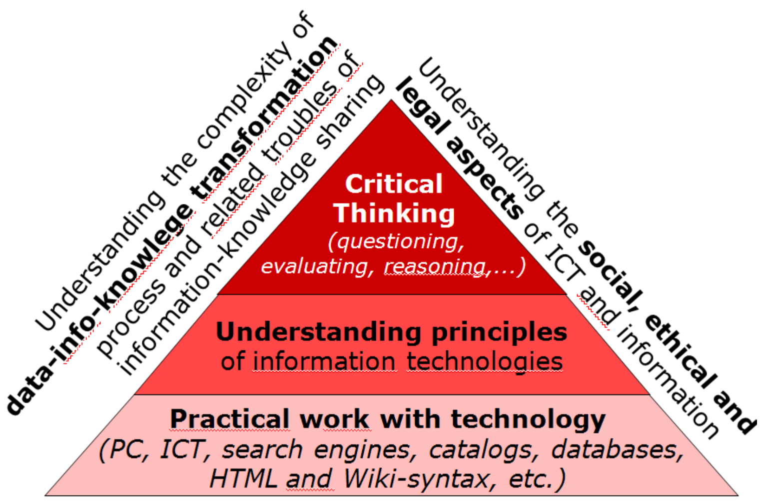

Figure 1: The pyramid of Information literacy

Critical thinking is the holy grail of information literacy and employs mental faculties to the fullest. Critical thinking uses not just logic (both formal informal) but takes into consideration also broad intellectual criteria such as clarity, credibility, accuracy, precision, relevance, depth or significance to the relevant topic. Critical thinking principles are universal, but its application to different disciplines (including ICT) requires a reflective contextualization.

The pyramid is surrounded by the environmental factor, such as understanding the complexity of data-information-knowledge transformation process (Rosicky, 2006) and related troubles of information-knowledge sharing or understanding the social, ethical and legal aspects of ICT and information. Although these factors are not in the heart of information literacy, they help to shape it and remind us of human perspective in information processing (Sigmund, 2008).

Process of critical thinking helps to reach a well-justified and most the time correct conclusion.

3. Technological Literacy

If information literacy is important in the sphere of work with information and knowledge, the same applies to the technological level. Different types of technology used to access, manipulate, and create information expand in society and technological literacy is ever more sought ability to understand and evaluate modern technology (mainly ICT). It complements technological competency (the ability to create, repair, or operate specific technologies, commonly computers). The U.S. Department of Education as early as 1996 defined technological literacy as "computer skills and the ability to use computers and other technology to improve learning, productivity, and performance". However, technological literacy is a much wider concept than computer literacy, although the two are often confused.

As with traditional term of literacy, which differs to many levels of being literate from the very rudimentary (signing the name, basic reading skills with no real comprehension of the text) to extremely sophisticated levels (poetry, comprehension of complex constructs in meaning and context), so too in technological literacy there are several levels. From skilled and knowledgeable use of basic tools for a job, use of basic SW to perform a simple task to sophisticated levels such as design and develop or evaluate appropriate technology solutions that are sustainable for specific and complex contexts in place or time.

Useful way to think about technological literacy is, that it is just as a component of the more general, or "cultural" literacy. Jr. Hirsch (1988) in his „Cultural Literacy: What Every American Needs to Know“ pointed out that literate people in every society and every culture share some body of knowledge that enables them to communicate with each other and make sense of the world around them. It is true that particular kinds of things a literate person knows varies from society to society and from era to era, so there could not be an absolute definition of literacy. In our modern society, however, cultural literacy must include a large technological component.

3.1. Standards for Technological Literacy

The International Technology Education Association (ITEA, 2010) even outlines following 20 standards in five basic areas of technological literacy:

Understanding the Nature of Technology - means the understanding of:

- characteristics and scope of technology
- core concepts of technology
- relationships among technologies and the connections between technology and other fields of study

Technology and Society - means the understanding of:

- cultural, social, economic, and political effects of technology
- effects of technology on the environment
- role of society in the development and use of technology
- influence of technology on history

Design – relates to:

- attributes of design
- engineering design
- role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving

Abilities for a Technological World represent following abilities:

- abilities to apply the design process
- abilities to use and maintain technological products and systems
- abilities to assess the impact of products and systems

The Designed World - develop an understanding of and be able to select and use of:

- medical technologies
- agricultural and related biotechnologies
- energy and power technologies
- information and communication technologies
- transportation technologies
- manufacturing technologies
- construction technologies

Although these standards are of quite general nature, on second thought they really quite well describe which direction should education concentrate on to produce valuable graduates.

4. Information and Technological Literacies and Education

How to develop and measure information and technological literacy? In case of development primarily role plays education. From elementary school, high school and university to lifelong education – it all leads to the improving of one's information a technological skills and abilities. Continuous education is the way to the personal development and knowledge building – there is no shortcut around this fact.

However, currently the educational system (at least in the Czech Republic) is undergoing a somewhat stormy period, when addressing how to actually best prepare graduates for the requirements of the practice. For example Doucek (2007, 2009) in his survey of how to improve ICT-related education identifies 17 specific knowledge domains in six basic roles of ICT worker (business analyst, manager of IS / ICT operation and development, ICT product and services trader, developer / IS architect, advanced ICT user ...). The main trouble seems to be turbulent development of ICT field and companies (Antlova, 2008), with which universities have trouble to catch up.

But the question is how (if even possible) measure qualifications?

The answer to this pressing question can be a variety of specialized tests, examinations and certificates (for example ECDL - European Computer Driving License); however at the end it seems that the best “test environment” is the work practice.

Current reality in the Czech Republic unfortunately witnesses quite a gross inflation of educational boom with titles and degrees (including some completely bogus ones). The quality of graduates is declining as rapidly as their numbers are growing. There is still a difference between good and poor universities, however even “stone” schools in their curriculums do not put proper emphasis on the individual work, the rigorous application of logic and critical thinking. Therefore lots of students obtain their title / degree without a really deep and coherent knowledge of a particular field. Such approach unfortunately affects also HR in ICT sector. The solution to this problem could be only appropriated educational reform (seems to be under its way), division of “practical” and “theoretical” Bc. degrees, and generally better quality control over the system.

Finally, however, generational replacement would probably solve (or at least ease) the problem. The fact is that every “new information medium” – all the way from printing press to television – has always been fully accepted only after the period of one or more generations. I would expect that even our “actual” trouble, brought to us by radical changes related to new ICT technologies, would eventually settle down. Current statistics already indicate that indeed the highest level of acceptance is among young-age groups. It is possible that in 20-30 years the topic of my paper would evolutionally (dis)solve itself. Same as for example topics of e-society (Doucek, 2004) discussed just 6 years ago seem to settle down.

5. Conclusion

In the article was argued, that the main importance of human resources in ICT lies in the literacy of the people. Various kinds of literacy – from information literacy to technological one – are needed as qualification prerequisites of modern labour in ICT sector. However, it seems that our educational system holds back and has troubles to accommodate changing nature of qualification requirements. Our hope therefore lies in the reform of the educational system and expectation of gradual self-evolution and generational replacement, in the same way, as any Kuhn’s “traditional paradigm shift” is achieved.

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Dependable Systems and Infrastructure Protection

CYBER-PHYSICAL SYSTEMS (CPS): THE "SYSTEMS – OF – SYSTEMS" CHALLENGES

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Keywords

Cyber-physical systems, system-of-systems, dependability, resilience, embedded systems

Abstract

The ubiquitous deployment of software-based systems demands increased dependability of these systems, including safety, reliability, availability, security, maintainability, survivability, etc. The design, operation, and protection of these systems have to take into account the complex interplay of software, hardware, networks, environment and humans acting in different roles, including unexpected, emergent system behaviour and unexpected behaviour or threats experienced from the real-world environment.

An additional dimension is added by the fact that we have not only to look at simple independent systems but on interlinked system(s) of systems, composed of (legacy) systems originally designed as independent systems), which interact in a much more complex manner, where it becomes much more difficult to separate different concerns regarding dependability properties. The interplay between humans, environment and systems must be considered in a holistic, interdisciplinary view for the distribution of tasks, mutual overriding mechanisms for decisions by humans, for performing interventions at system failures, etc. Systems must be robust to cope with these problems in an adaptive manner ("resilient systems), which is an ever increasing challenge for system design, verification, validation and deployment. Each of the "system of systems" has to follow its own strategy to avoid dangerous (critical) interactions respectively to tolerate them in an acceptable manner (risk reduction). Typical examples are critical infrastructures and their resilience requirements and protection, becoming interconnected and interdependent in a global context.

"Cyber-physical Systems" is a new term recently arising to describe the notion of "embedded systems" as a network of interacting elements within the physical world, comprising an intense link between the computational and physical elements.

Resilience is the persistence of service delivery that can justifiably be trusted when facing changes, i.e., the persistence of dependability when facing changes. Resilient embedded systems are the next challenge – adding new dimensions of complexity to manage!

1. Introduction: Cyber-physical Systems (CPS)

"Cyber-physical Systems" is a new term recently arising to describe better the notion of "embedded systems" as a network of interacting computing elements within the physical world, comprising an intense link between its computational and physical elements. This approach is closely related to the advances in sensor networks and robotics, consisting of more or less autonomous elements which integrated ad hoc into their environment and co-ordinate each other in an opportunistic manner.

The traditionally "embedded systems" are already, by definition, a combination of processors, sensors, actuators, "intelligence", "hidden computers" and massive deployment, with intensive interaction with an uncertain environment: "A physical process with dynamics, fault, noise, dependability, with power, size and memory restrictions (in general: resource restrictions)…" (Artemis). To be able to develop dependable systems from components with these characteristics, foundational system infrastructures and methods ((Kopetz, 1997), (Herzner, 2006)) are needed as core technology (e.g. systems following the time-triggered paradigm) (e.g. as developed in DECOS, partially funded by EU-IST-FP6-511764, and now further developed in projects of the ARTEMIS Joint Undertaking) (Artemis). These networked embedded software-intensive systems are already almost "omnipresent" – and key to most of the innovations today and in the future in almost all domains of our life.

Embedded Software constitutes a very specific and critical part of embedded systems. It provides new capabilities to HW transducers ("defines physical behavior of a complex non-linear device"), because of its potential criticality we need HW/SW co-design, and issues like dependability, low power, timeliness are becoming software issues with all the consequences. We need dependable system architectures to cope with the potential risks, including safety as well as security requirements and counter measures. Be aware, that security aspects are often neglected by safety engineers!

In case of cyber-physical systems, the aspect of system-of-systems becomes pre-dominant. In the past, systems where to a certain aspect self-contained, and subsystems were designed to contribute to the overall system as a component. In system-of-systems, many of the systems constituting the system-of-systems were originally designed to fulfill its own tasks, and were later integrated in a larger context into a system-of-systems, often called "legacy systems" in the new context. Besides the conventional embedded systems properties, ad-hoc communication, opportunistic co-operation together with vision, perception, situation awareness and intelligence add additional requirements on (wireless) communications, ubiquitous connectivity, safety and resilient behavior.

Cyber-physical systems can already be found in aerospace, automotive, process industry, civil infrastructures, energy, health care, manufacturing, but also in private spaces serving at home, in entertainment and for ambient assisting living (AAL) purposes. The EC in its Framework Programmes and the US National Science Foundation have both identified cyber-physical systems and systems-of-systems as key research areas. Their experts expect that new services, increased adaptability, functionality, efficiency, autonomy, safety and usability will be the result of the advances in technology. Advances are expected with respect to intervention (collision avoidance), precision (nano-technology, manufacturing, robotic surgery), operation in dangerous or inaccessible environments (rescue, emergency, catastrophe services, deep sea, mountains, mines) and co-ordination (traffic management and control air, sea and ground), buildings and energy, health-care covering different aspects.

Recent market research shows that 90 percent of innovation in the automotive industry is expected to come from electronics by 2010. These applications are usually summarized by the term “embedded system” and establish the next step of evolution of computer control systems. They are special-purpose computer-controlled electro-mechanical systems in which the computer is completely encapsulated by the device it controls or completely integrated in its environment ("hidden" computing).

2. Dependability and Resilience

2.1. Dependability as a Holistic Issue

Dependability is a holistic issue – it has to take into account hardware, software, communication, networking, interfaces, environment and humans (behavior and different mind models, human mistakes ((Parasuraman, 2000), (Selhofer, 2007)), all in different roles. Systems are not always critical by definition, often the actual criticality and dependability levels rise based on our desire for enhanced reliance on them!!

Examples are: safer cars imply more aggressive driving behavior after some time; or: (almost) perfect driver assistance systems may lead to too much reliance on them thus becoming safety critical. On the other hand, by their originally not implied usage or unforeseen combination of incidents not taken into account by risk and hazard analysis, systems become (more) dangerous: examples are the Kaprun cable car fire catastrophe, or the London Ambulance System Disaster: The ambulance car emergency management system was not considered safety critical – but because of ambulances not arriving in time or at all at the required location several people died! The same would be the case if security breaches, e.g. malicious insertion of wrong data or commands in a control loop, could cause dangerous situations (chemical reactor explosion, traffic jam, air traffic control, …), and nobody has thought it likely that someone could have interest in such an incident. Not only after 9/11 have we had to take into account malicious actions. Additionally, public acceptance (or non-acceptance), legal or environmental issues, liability, and social aspects influence system usage and dependability as well. One of the statements of the chairman of the IEC TC65 WG 10 working group on standards on security of industrial communication systems was: “We want to avoid that a chemical plant can become a bomb deliberately activated”.

For a long time, safety-critical systems were mainly proprietary, isolated from the environment and not coupled with other systems were a larger public has access to – they were not at all “systems-of-systems”. Each such system had a separate task to fulfill, and its safety functionality could be more easily separated from other functionalities e.g. comfort services. With ubiquitous computing, seamless connectivity, massively deployed networked embedded systems (Avizienis, 2001), use of public networks for critical controls, maintenance access from outside to critical systems, or even interaction between critical components or subsystems via public networks or wireless, the situation has changed dramatically: Security breaches may become safety critical, and safety problems or measures to maintain safety integrity levels may open loopholes for security attacks. Additionally, autonomous systems interacting with humans in a shared environment, and with humans adapting their behavior to the advanced abilities of such systems to prevent loss of life or limb, add a further dimension. Ambient intelligence in ubiquitous environments may even lead to loss of human abilities – what has already happened under certain circumstances: mental arithmetic and estimation of meaningfulness of results was considerably reduced by the massive use of electronic calculators, and the ability to remember numbers and complex issues was reduced by mobile phones’ storage and recall features and intensive use of internet (Google replacing permanently available personal knowledge). Therefore we have to take a holistic view of critical systems to be able to foresee their impact in the short as well as in the long term – not stopping their application, but evaluating the additional, in the short term often unforeseeable risks.

2.2. Dependability – Attributes and Terminology

As already outlined in (Avizienis, 2001), used in (Herzner, 2006), (Kopetz, 1997), or in the multilingual book “Dependability – Basic Concepts and Terminology” (J.-C. Lapries, A. Avizienis, H. Kopetz, U. Voges, T. Anderson, Springer), a set of basic definitions on dependability as an umbrella term of various system attribute (Figure 1) (not necessarily complementary, but in certain cases (application dependent) even contradicting) is provided, which fits best the goal of a “holistic system view”. In short, the most important ones are:

Dependability: Trustworthiness of a computer system such that reliance can be justifiable placed on the service it delivers. Thus dependability is an umbrella term for a set of sub-properties: availability, maintainability, reliability, safety, security (including confidentiality, integrity, and authenticity), survivability, (robustness).

Safety: Dependability with respect to non-occurrence of catastrophic failures (freedom from unacceptable risk, based on un-deliberate actions or events, “risk to life and limb”)

Security: Dependability with respect to unauthorized access or information handling (deliberate action!) (including confidentiality, integrity and availability/access)

Reliability: Dependability with respect to continuity of service (“time to failure”, probability)

Availability: (Readiness for use): The ability of a functional unit to be in a state to perform a required function under given conditions at a given time instance time or over a given time interval, assuming that the external resources are provided ((Chroust, 2008), (Schoitsch, 2009)),

Maintainability: (Easiness of maintenance): From a hardware/software systems point this includes more than just the preservation of the status quo of a system (as in (ISO/IEC (ed.), 1996)). It includes enhancements and modifications to perform new/additional functions to fulfill new requirements, e.g. upgrades and adaptations). In the system context (and context of the dependability definitions of (Laprie et al., (Avizienis, 2001)) it can be defined as "The ease with which a (software, hardware) system or component can be modified to correct faults, improve performance or other attributes, or adapt to a changed environment, for details see (Redmill, 1997), (Schoitsch, 1997).

Critical systems may be safety-critical (e.g., avionics, railway signaling, nuclear power plants) or availability-critical (e.g., back-end servers for transaction processing, mobile services).

Although this very clear terminology does exist since many years, the use of the terms is imprecise. Very often, the term “Dependability” is now used more or less as synonym for “Security”, even in EU-publications or standards.

Another important contribution of the referenced terminology was the “fault – error – failure - …” chain, which provides a deeper understanding of fault propagation, fault containment and fault consequences in critical systems: A fault in a hardware part, component or subsystem may lead to an erroneous state of this element of the system, which may lead to a failure of this element (the fault is the cause of the error respectively failure, the failure the consequence of the fault respectively error). The failing component constitutes a fault of the subsystem where it is embedded, and so on. This is important especially in case of security breaches: then a fault is inserted into the system (deliberately) to lead to a failure, which may impact safety of the system.

(…(((Fault → Error → Failure) = Component Fault → Error → Failure) = Subsystem Fault → Error → Failure) = …….)

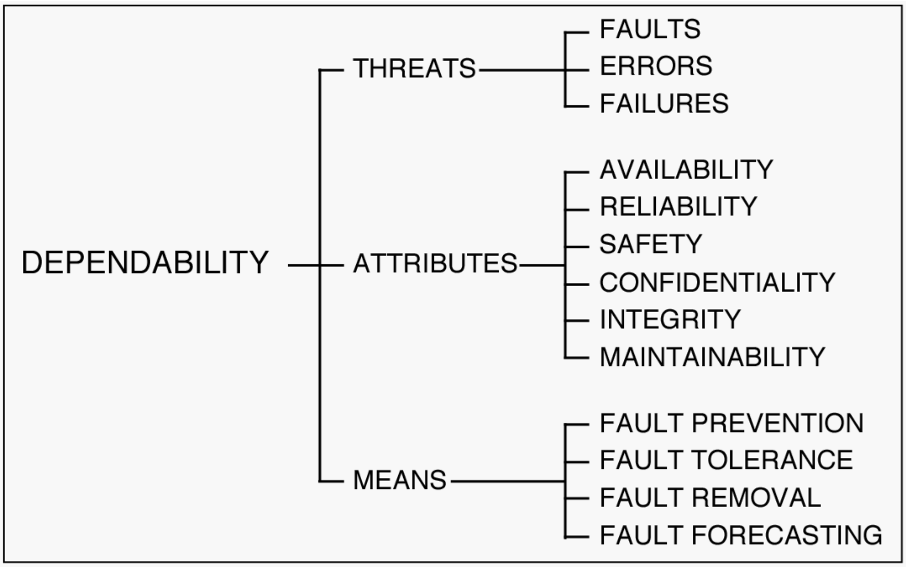

Figure 1: Dependability - Basic Concepts and Terminology

2.3. Resilience – Adaptability and Survivability

The latest evolution is characterized by putting intelligence (machine perception, situation awareness, computer vision, machine learning) on top of networks of embedded systems in order to enable them to behave autonomously as a system. The terms "embedded intelligence" or "ambient intelligence" are used for these systems. They require (and create) their own pervasive environment, which needs seamless connectivity to deploy its full potential – they are called “ubiquitous systems”, with demanding requirements driven by their domain of application, building the basis for “ambient intelligence systems” (AmI). There is evidence that these systems suffer from a significant drop in dependability and security in comparison with conventional systems, where these demands have been addressed over time. There is thus a dependability and security gap endangering the very basis and advent of Ambient Intelligence (AmI). For these systems, somehow operating in an undefined environment, attributes like robustness (well known from the past, before the terminology of “dependability” was created), some new attributes and properties were defined:

Survivability: The capability to withstand a hostile environment is the capability of a system to avoid or withstand a hostile environment without suffering an abortive impairment of its ability to accomplish its designated mission. This includes any kind of impairment especially from the environment, including security attacks etc.

Resilience: The persistence of service delivery that can justifiably be trusted when facing changes, i.e., the persistence of dependability when facing changes.

The failure of these systems can have and often has considerable financial, social and health consequences.

Safety standards rely on properties like “traceability” and “predictability” of requirements of systems and components – best is to be able to configure and predict behavior at system-design and build time in a static manner.

With the emergence of smart, autonomous (mobile) systems (“robots”, although this could be a large variety of machines, even interacting with humans in an active manner) with perception, cognition and understanding of environment and even humans, these properties cannot hold any longer. They have to cope with the "real world environment", which is clearly neither well nor completely defined. Again, the new paradigm of "resilient systems" has to be applied.

Resilience, as stated before, is the persistence of service delivery that can justifiably be trusted when facing changes, i.e., the persistence of dependability when facing changes. Resilience involves four major properties:

- evolvability, i.e., the ability to successfully accommodate changes, including adaptivity, i.e., the capability of evolving while executing., i.e. the ability of dynamical reconfiguration, what significantly complicates the behavior of a system,
- assessability, in both senses of verification and evaluation, requires integrating techniques for safety analysis, reasoning about fault tolerance, evolution and security into the engineering of such systems
- usability, and
- diversity.

The concept of "resilient computing" extends the concept of dependability considerably, adding a new dimension of complexity – a severe challenge for the future, demanding even more a *holistic system view to take into account the unexpected*.

According to the outcomes of the ReSIST Network of Excellence, there is a demand for a pervasive information infrastructure with *scalable resilience* for survivability. All of the various classes of threats have to be considered in this pursuit of scalable resilience: development or physical accidental faults, malicious attacks, interaction mistakes. Here again, besides technical issues, the human factor is a key issue ((Parasuraman, 2000), (Schoitsch, 2005)).

Resilience engineering, as per definitions given by Erik Hollnagel (Hollnagel, 2006a, 2006b) "aims to enhance the ability of organizations to create processes that are *robust yet flexible*, that can use resources proactively to accommodate for *external disruptions or internal ones* (e.g. production and economic pressures, human errors). In Resilience Engineering, failures do not the result of a breakdown or malfunctioning of normal system functions, but rather represent failure to adapt to real world complexity".

The concept of "resilient computing" (Figure 2) extends the concept of dependability considerably, adding a new dimension of complexity – a severe challenge for the future, demanding even more a *holistic system view to take into account the unexpected.*

For autonomous, mobile ("robotic") systems this means: Perception and cognition, reasoning and interpretation of scenarios from the environment need new methods to describe this scenarios in a formal manner (there does not even exist a modelling concept for vision systems which could allow simulation of scenarios and reactions triggered by vision and vision based perception!). Further on, this requires new testing and validation methods, and in the end new methods for tool qualification and system evaluation and certification – a requirement in case of safety critical interaction between autonomous (mobile) systems with humans and environment. A method to define "situation awareness" and for testing some approach to measure "scenario coverage" are needed. There is a lot of research necessary, and we are in fact at the dawn of a completely new era.

From one of our present research proposals, the following text is taken:

For autonomous systems with complex optical sensorium, cognition, behaviour adaptation, and acting capabilities, no objective measures exist to assess their functional correctness and the level of fulfilment of dependability requirements such as safety or reliability. For instance, which test cases – i.e. video sequences or corresponding scenarios – are needed to prove that a stereo vision algorithm used by a robot behaves as required in, say, 99,99 % of all situations it may be confronted with? Today, either public test suites are applied, which provide generic video images or scenes in a quality usually higher than those provided by the sensory finally implemented, or dedicated test data are captured by the development team or related persons. If the latter is not performed in an exhaustive – and thus expensive – manner, the resulting tests can only be considered as punctual, and provide little information about the covered fraction of possible sceneries the target system may experience. Therefore, it has to be investigated how test cases (i.e. input data for the sensors) can be generated for resilient real-world systems with measurable situation coverage, taking sensor characteristics like resolution, frame rate, and noise into account. Systematic analyses of the scenarios such systems can encounter have to be performed, for establishing formal domain models. From these models, the relevant test vectors will be derived by identifying equivalence classes of scenarios with respect to expected output (i.e., recognition and behaviour).

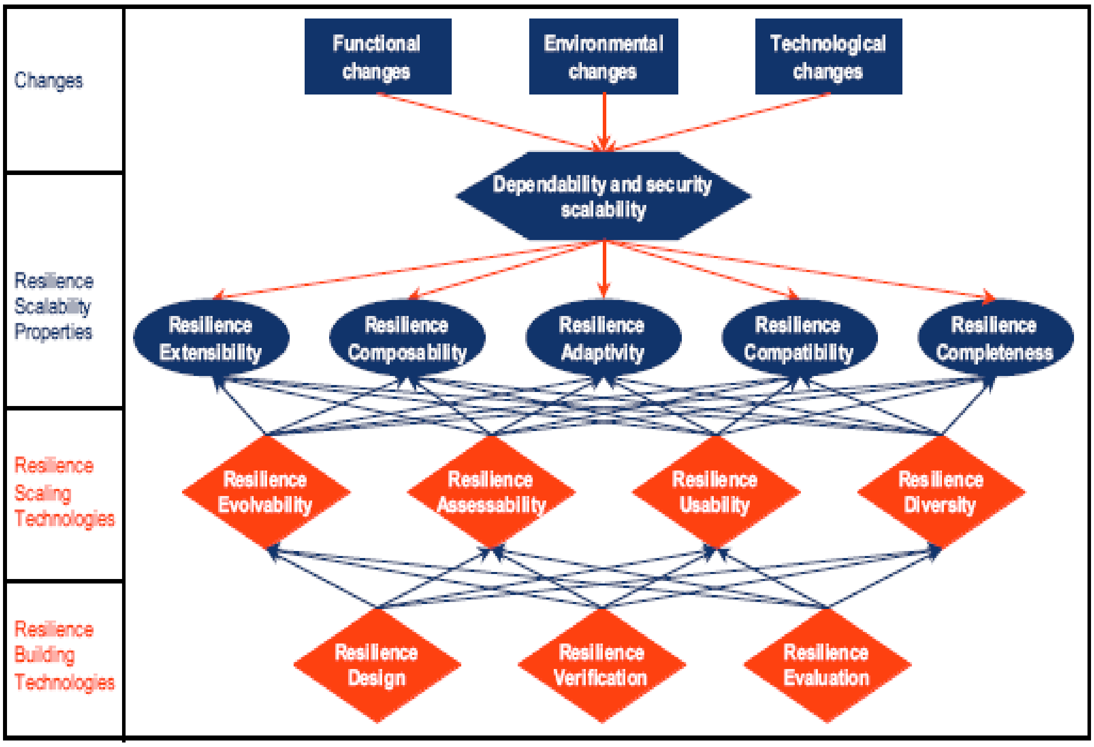

Figure 2: Scalable resilience (from (Resist))

3. Cyber-Physical Systems – Some Examples

3.1. Car-to-Car Communication

One example of cyber-physical systems with typical properties of a “system-of-systems” are advanced modes of traffic management using car2car communication.

In (Althammer, 2009), an example was discussed (COOPERS project), where advanced traffic management was utilizing car-to-infrastructure communication and data exchange for a centralized traffic management through a traffic control centre of the highway operator. Another not yet implemented possibility is using car-to-car communication (communication protocols are already defined as IEEE 802.11p in the US).

Fig. 3 and fig. 5 show two typical scenarios – one offering the possibilities provided by the approach in pre-warning systems in road traffic. At one workshop on traffic management, some car manufacturer even insisted on the statement that traffic control centres (TCC) and concepts like in COOPERS are obsolete with car2car communication – not taking into account the safety and security problems and the missing regional view of the traffic situation which can only be achieved by a at least regionalized TCC – or with enormous effort by a really decentralized "cloud" consisting of car computers which is unrealistic in the medium term (but this would be a really challenging cyber-physical system…). Both pictures are from a presentation at SAFECOMP 2004 (Herrtwich, 2004) (Potsdam) respectively ITSC 2005 (Vienna) from Daimler Research (Berlin).

Data from different roads

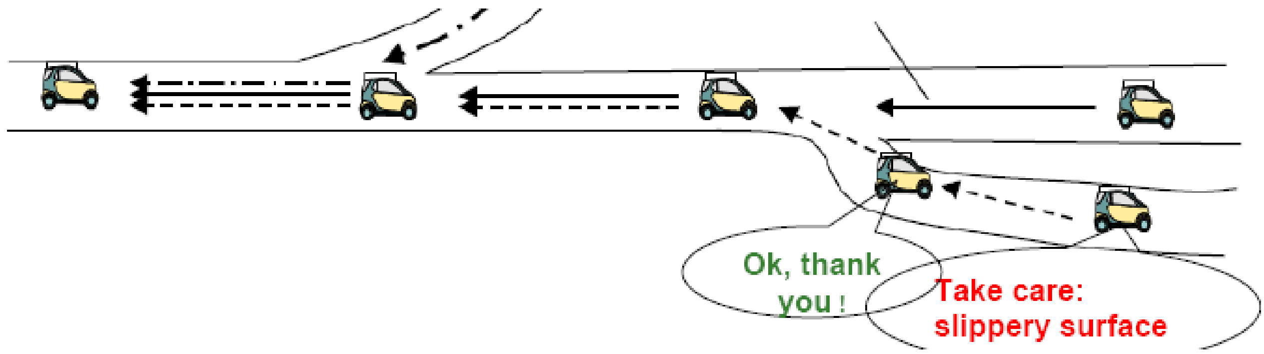

Figure 3: Car-to-car communication – upstream warning (Herrtwich, 2004)

The possibilities are manifold:

- Upstream warning
- Look ahead
- Look around the corner
- Platooning of cars at optimized speed/distance
- Increase throughput of highways & safety

The cyber-physical characteristics are manifold as well:

- ad hoc/opportunistic interaction: within a certain area the objects which interconnect are dynamically entering and leaving
- adaptive control of behavior of objects

This is not the case in all types of cyber-physical systems: smart grids for efficient power distribution have a predefined structure which is to a certain degree redundant, but rather static, the dynamic properties are defined by power load and supply.

Wireless communication between cars on a highway enables early warning if the first one in a long column of cars is braking so that all following cars can easily adapt. This makes higher throughput, shorter distances between cars and fewer accidents possible at the same time.

On the other hand, there are safety risks caused by defects in one of the three major components of cyber-physical systems which have to co-operate properly (see Figure 4):

- Computing elements (Microsystems, sensors, actuators)
- Control
- Communication

The first two are mainly error-prone due to HW/SW design- or specification errors, wear-out defects, loss of power etc., which are typical safety and reliability issues treated according to functional safety standards such as IEC 61508 (IEC, 2010) or ISO DIS 26262.

(Cyber-physical Systems workshop April 2008, St. Louis, USA)

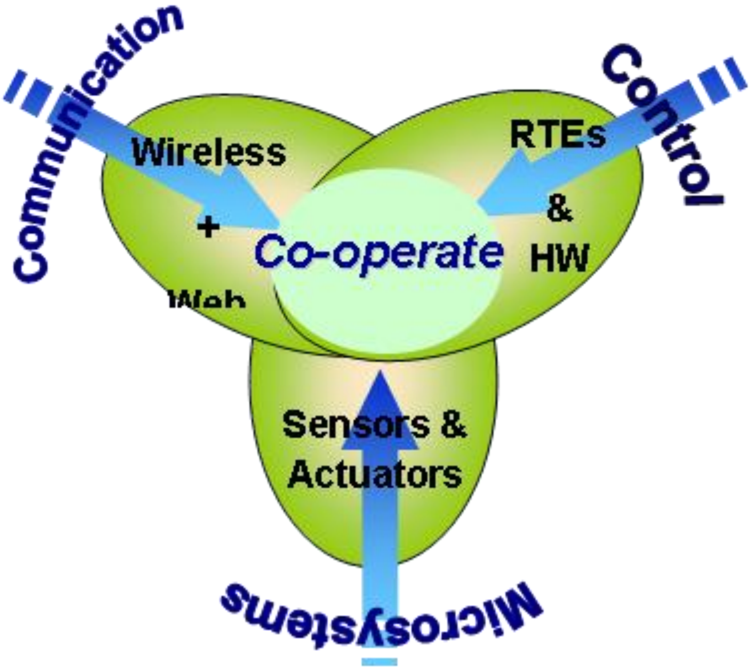

Figure 4: Security breaches endanger safety and privacy (from (Herrtwich, 2004))

Communication, especially wireless communications, may fail due to technical reasons (internal or external, i.e. because of defects, weather conditions, topographical reasons, which can be overcome by using different channels and means, e.g. GSM/UMTS, WiFi, microwaves etc. in a redundant manner) or by deliberate interference, which is considered a security risk impacting safety. Additionally, privacy concerns (often counteracting homeland security measure and vice versa) play an increasing role.

Imagine someone fakes such messages, resulting in an uncoordinated jam on the highway which may result in a catastrophic event. There are of course considerations how to avoid such problems – but all countermeasures have to take into account real-time and long-term usage (20 years!) requirements as boundary conditions so that simple encryption does not work (Herrtwich, 2004).

- Fake messages could cause severe damage
- Information of vehicle’s communication could be used against its driver or owner
- Vehicles could outlive their security solutions

Cost-effectiveness and mass deployment of critical systems in combination with non-critical systems is a trend, where many other application areas will benefit from, so that there is a clear need not only for application-specific ICT-technology, but for generic dependable ICT-technology (hardware, software, SoC (Systems-on-Chip), building blocks, communication) (DECOS, (Herzner, 2006)), which fulfils the requirements of generic functional safety and security standards as well as of sector-specific ones (certification to create trust in these systems!).

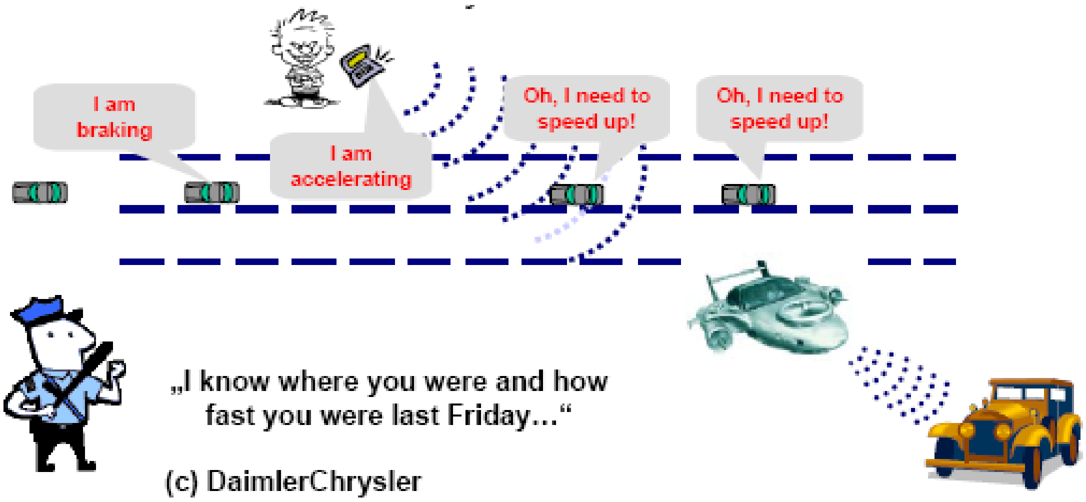

Figure 5: Security breaches endanger safety and privacy (Herrtwich, 2004)

3.2. Autonomous (Electric) Vehicles

Especially the huge effort undertaking in context of "Green cars" (e.g. EC Grenn car initiative, a Public-Private-Partnership for funding of relevant projects in the 7th Framework Programme as separate subprogramme, and similar efforts in US, China etc.) is directed at small electric vehicles for regional cheap and efficient transportation, utilizing all kinds of electronics and communication because being "electric" and trying to offer new features to attract customers.

Figure 6: Autonomous Electric Vehicle for Urban transport (General Motors, 2010)

One of these prototypes was displayed this year at World Expo 2010 in Shanghai, China, by General Motors (the picture is taken from a press release). The Experimental Electric Networked Vehicle EN-V (Fig. 6) is only 1,5 m long, 500 kg weight, equipped with advanced network technology, sensors and controls which allows autonomous navigation via GPS, 3G and WLAN, car-to-car communication, and communication to infrastructure and traffic management systems to avoid overloaded roads and traffic jams, and all kinds of collisions. The target group is people living in densely populated urban agglomerations with overcrowded transportation systems, especially roads.

3.3. Example for Risks of Networked Systems: Any Access Point is a Risk!

There is a simple rule when talking and assessing risks of cyber-physical systems: Any access point is a risk – and there are always access points, often for reasons of maintenance and repair, for monitoring or homeland security, or just to enable cyber-physical communication between objects at all!

One funny example was taken from an article in an automotive magazine where an engineer full of optimism talked about the possibility of avoiding call-backs of complete series of manufactured cars to the shop floors to correct some defect which might be safety critical under certain however unlikely conditions: To initiate software updates on-the-fly by wireless automatic downloads! Unfortunately, the risks as shown in Fig. 6 were not discussed at all… In the shop floor at least the motion of the vehicle during maintenance is under control (and should at least not affect the car owner!).

The same issues will arise in context of smart grids (efficient power distribution, but our civilization is very sensitive on loss of power because of almost all services and protective measures depend on appropriate power availability), highly automated process industry plants, power plants and manufacturing plants, in building automation and control (heat, cooling, elevators, fire alarm and fire fighting, doors/entrance and rescue), AAL (Ambient Assisted Living) and health-care (from remote monitoring to automatic or triggered intervention), large machinery and construction vehicles operating (semi-) autonomous, service robots in human populated environment and robotic farms.

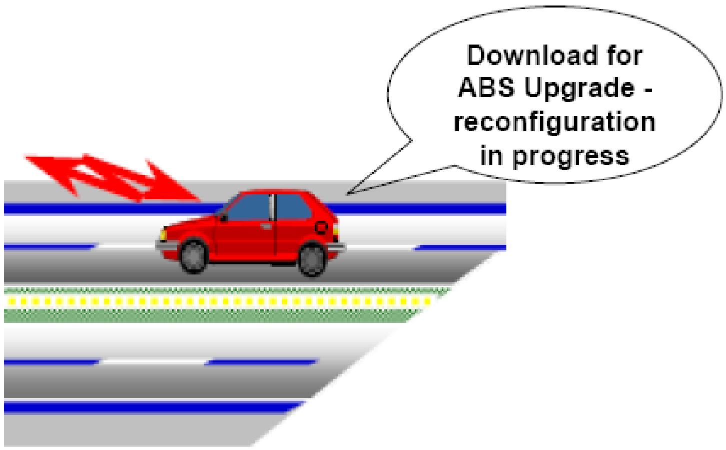

Figure 7: Field Update of Control Software??

Another story was on the internet this year (March 2010) telling a story which was not really "cyber-physical" in the full sense of the term but high lightens the vulnerability of systems which are accessible via remote wireless control although designed for another purpose (as far as I know similar concepts are thought about with respect to law enforcement and homeland security in some countries, so don't take it too easy). (See Fig. 7). Fortunately, it was not safety critical since it seems to have been a "no-start" condition and not a "stop"-condition, but one could image road traffic situations when the impossibility to start a car immediately may be safety critical. The article is a little bit shortened, but the rest is unchanged.

(see http://www.wired.com/threatlevel/2010/03/hacker-bricks-cars/)

Hacker disables more than 100 Cars remotely

More than 100 drivers in Austin, Texas found their cars disabled or the horns honking out of control, after an intruder ran amok in a web-based vehicle-immobilization system normally used to get the attention of consumers delinquent in their auto payments.

Police with Austin’s High Tech Crime Unit on Wednesday arrested 20-year-old Omar Ramos-Lopez, a former Texas Auto Center employee who was laid off last month, and allegedly sought revenge by bricking the cars sold from the dealership’s four Austin-area lots.

“We initially dismissed it as mechanical failure,” says Texas Auto Center manager Martin Garcia. “We started having a rash of up to a hundred customers at one time complaining. Some customers complained of the horns going off in the middle of the night. The only option they had was to remove the battery.”

Figure 8: Hacker disables more than 100 cars remotely in Austin, Texas

The dealership used a system called Webtech Plus as an alternative to repossessing vehicles that haven’t been paid for. Operated by Cleveland-based Pay Technologies, the system lets car dealers install a small black box under vehicle dashboards that responds to commands issued through a central website, and relayed over a wireless pager network. The dealer can disable a car’s ignition system, or trigger the horn to begin honking, as a reminder that a payment is due. The system will not stop a running vehicle.

The troubles stopped five days later, when Texas Auto Center reset the Webtech Plus passwords for all its employee accounts, says Garcia. Then police obtained access logs from Pay Technologies, and traced the saboteur’s IP address to Ramos-Lopez’s AT&T internet service, according to a police affidavit filed in the case.

Ramos-Lopez’s account had been closed when he was terminated from Texas Auto Center in a workforce reduction last month, but he allegedly got in through another employee’s account, Garcia says. He discovered he could pull up a database of all 1,100 Auto Center customers whose cars were equipped with the device.

First rolled out about 10 years ago, remote immobilization systems are a controversial answer to delinquent car payments, with critics voicing concerns that debtors could suffer needless humiliation, or find themselves stranded during an emergency. Proponents say the systems let financers extend credit to consumers who might otherwise be ineligible for an auto loan.

4. Conclusions

The same issues will arise in case of many other typical cyber-physical systems, e.g. in context of

- smart grids (efficient power distribution, but our civilization is very sensitive on loss of power because of almost all services and protective measures depend on appropriate power availability),
- highly automated process industry plants, power plants and manufacturing plants,
- in building automation and control (heat, cooling, elevators, fire alarm and fire fighting, doors/entrance and rescue),
- AAL (Ambient Assisted Living) and health-care (from remote monitoring to automatic or triggered intervention),
- large machinery and construction vehicles operating (semi-) autonomous,
- service robots in human populated environment and robotic farms.

It has been demonstrated, that mass deployment of networked, dependable embedded systems with critical control functions require a new, holistic system view on safety critical, security critical and survivable ("resilient", adaptable) systems. As a first step, the dependability and resilience attributes and requirements are discussed. As a second step, the risks and challenges of cyber-physical systems and ambient intelligence systems are explained via examples from the automotive field of applications.

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FAULT MONITORING FOR HYBRID SYSTEMS BY MEANS OF ADAPTIVE FILTERS

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Keywords

Hybrid systems, fault monitoring, adaptive filters

Abstract

Hybrid systems consisting of digital as well as non-digital components cause big fault diagnosis problems, due to the complex interaction of components within the systems. Often, the internal state of their components is only hardly, or not at all, accessible. In this paper it is shown that adaptive filters, well-known for their good fault masking properties even under hard real-time constraints, might also be used as a means for fault monitoring in such systems. Several schemes, laid out for fault monitoring only, or for fault monitoring in combination with fault correction, are described. The trace patterns left by fault effects in the time-dependent distribution of filter coefficient values appear to be an interesting means to support fault diagnosis.

This work was partially supported by Deutsche Forschungs-Gemeinschaft (DFG) under No. Ma 1412/8-1

1. Introduction

Mechatronic and embedded systems are characterized by a complex interaction of components from different technology areas: digital, analogue electrical and non-electrical (e.g. mechanical or optical) components. Often such components, within the system, are part of a subunit where the access to them is even hardly or not at all possible. Also as a result of the usually very heterogeneous system structure, on many of the components a multitude of different influencing effects can be acting (Schoitsch 2009).

Actually, such hybrid systems often do not operate reliably, as it is demonstrated by a rising number of car call back actions in the automobile industry, and a considerable number of defects having recently occurred during the operation of high speed trains. However, hybrid systems can only operate in a dependable manner, if the system structure as well as all influencing actuators have precisely been analyzed and taken into account for all phases of the system life cycle: design, production, operation, and maintenance.

Here, actually we have the situation that there is a lack of

- a consistent terminology describing and assessing fault effects in the area of embedded and mechatronic systems,
- reliable data bases about the numerical size of fault effect parameters,

- a well-established theory presenting a consistent toolbox of fault tolerance solutions, i.e. clear advice which method should be applied in a given fault situation.

Primarily, there are strong differences in the state of art of fault tolerance theory for the different technological areas involved in hybrid systems, especially between digital computing devices and the areas of sensor or actuator components.

Digital computing systems show the following properties: Usually, computing devices can be replicated in an arbitrary number, without physically hindering each other. Interactions between these devices mainly appear at well-defined interfaces, where data are exchanged between them. Even without additional hardware, many malfunctions in computing devices can easily be detected and classified. There exists a well-established general theory of fault tolerance of digital systems so that for given fault situations basic solutions can easily be selected, which usually already provide a considerable dependability improvement. Only if special requirements, e.g. with regard to costs, to dependability perfection or to fulfillment of performance restrictions are additionally imposed, specific properties of the system structure have to be considered.

For analogue electrical and optical actuators these principles are holding only partially, mainly because there might be hidden undesired interactions between certain analogue signals.

For mechanical components, again the conditions are more aggravating: Redundant mechanical actuators can hinder or block each other during requested movements; so it is more difficult to organize and synchronize the cooperation of redundant active mechanical components. Interactions might arise, where adjacent components exert mechanical influences on each other. Faults or latent faults are often difficult to diagnose. Especially, the effect of gradually increasing wear out faults, mainly due to the general phenomena of friction and of material aging, has to be taken into account. On the other hand, many of the latter effects can be handled by massive material redundancy, i.e. by a „brute force“ action which can drastically increase the durability of the component.

Also due to the lack of a general fault theory in this area, many fault handling practices have not been derived from general principles, but from specific structural properties and material parameters. So in the past, a number of isolated „island“ solutions have evolved.

At least for most mass applications of hybrid systems, it is required that the resulting product is available at cheap or moderate prices. This is demonstrated today by the market of digital devices as e.g. laptop computers, digital cameras etc. For such tools of daily life the user usually tolerates some „offline“ time intervals where the product is not usable due to a fault that occurred, including a repair phase. If, however, the same components are parts of much larger systems required to be highly available, such an impact would be much less tolerable.

To deal with faults in systems, there are two general concepts which might be applied:

- Static system redundancy: The system is identically or partially replicated. By deterministic means as e.g. majority voting or error correcting codes, the effect of the underlying system faults is masked for the operational processes of the system. As a consequence, in case of maskable faults the operation of the system has not to be interrupted.
- Dynamic redundancy: In case of faults the system operation is maintained by dynamically changing the system structure, e.g. replacing a faulty component by a standby component, or mapping the tasks of the failing component to the set of the remaining healthy ones („graceful degradation“).

As discussed above, for non-digital components their identical replication by means of actively working spare components is possible only to a limited degree, as the devices might hinder each other. So in the area of hybrid systems, to achieve fault tolerance, more often (except the massive replication of basic building material, as mentioned above) dynamic redundancy solutions have to be used. Such solutions rely on an efficient fault diagnosis.

This, however, creates problems, because of the usually extremely high numbers of components, and their complex interaction patterns. In spite of the considerable progress of testing algorithms, even for digital systems the exhaustive test of all components, e.g. transistor functions, implies an extreme testing effort. Therefore, such exhaustive tests appear possible only during the production phase of the system.

Thus, for fault diagnosis during the operational phase other alternatives have to be considered. Also for this area, in general two different main strategies are possible (Patton, Frank 1989):

- short diagnosis intervals within the operational phase; during these periods the system is offline.
- some continuous monitoring of the fault situation of the system, by means of additional diagnostic devices.

For both strategies, however, very time-consuming diagnosis methods cannot be applied. So, for such approaches we need diagnostic means which are

- algorithmically simple,
- do not imply complex external testing devices.

One general alternative is, not to try to inspect the internal state of the device, but instead to monitor its external behavior and to try to draw conclusions from that about its health state.

In this area of methodology, for the efficient control of devices, especially under real-time constraints, adaptive filters have turned out to be a very practical solution. In section 2 we shall show, how such filters can also be applied for the flexible and efficient local monitoring of system components. In section 3 some simulation results about that use of adaptive filters are discussed.

2. Adaptive Filters for Fault Monitoring of Hybrid Systems

2.1. General Principles

For solving many control problems, adaptive filters (Farang-Boroujeny 1998; Grosspietsch, Silayeva 2006) have evolved as an efficient means, especially in the field of controlling systems under real-time requirements. Adaptive filters are based on an algorithmically simple form of using a history array of sensed values of an input variable s(t) to derive, by some kind of weighted summing up of these values, the actually needed output signal y(t). In an update process according to a so-called adaptation algorithm, the coefficients of the weighted sum are changed until this sum sufficiently exactly reproduces the desired output y(t). So, the experience knowledge of the filter is stored in these coefficients, also called filter coefficients. For a detailed description of the properties and architectural structures of adaptive filters see e.g. Grosspietsch, Silayeva (2006).

Grosspietsch and Silayeva (2008) have been shown, how such adaptive filters can efficiently be used to maintain the function of an autonomous hexapod robot in case of many fault situations. This is achieved by changing, under the control of adaptive filters, certain operational parameters of the robot, e.g. the strengths of the servo motors in the joints of the hexapod legs. In this way, for many local component faults the controlling adaptive filters are able to maintain a continuous operation of the robot, without interrupts.

For correcting more complex faults stemming from the improper interaction of several components, in most cases it is difficult to organize a cooperation of various adaptive filters; here the use of neural nets is preferable. On the other side, the tradeoff of the neural net solutions is that the net is collectively trained by the input of many system parameters [5]; so the resulting net state models the collective system behavior, i.e. it is not possible to identify in the net the individual states of system components. Thus, neural nets do not support a local fault diagnosis for the components of the modeled system.

2.2. Fault Monitoring

In the following, it will be sketched how adaptive filters can also be used for monitoring the fault behavior of components in hybrid systems. This will be exemplified by the general example of a hybrid structure comprising an actuator, e.g. a servo motor, together with its controller. The controller usually is a digital device of relatively small hardware complexity, for which, as mentioned above, well-known fault diagnosis and fault tolerance techniques are existing. So the focus of investigation will be on how to provide fault monitoring for the actuator.

The basic strategy is quite simple: Fig. 1 shows a scheme to enable, for an actuator under management of its controller, fault monitoring. During an initial training phase where the actuator is assumed to be healthy, the adaptive filter RF (reference model filter) is trained to implement a model of the healthy actuator behavior. This training is performed by comparing, in D1, the output of RF with that one of the actuator, and, in case of discrepancy, updating the filter coefficients of RF according to its adaptation algorithm, until the difference is 0, or negligibly small. At the end of the training phase the coefficients of RF are „frozen“ to memorize this reference model.

For the purpose of fault monitoring, an additional adaptive filter MF (monitoring filter) is added. It is continuously trained to implement a model of the actual actuator behavior. The coefficients of MF and of RF are compared in D2; a difference means that the actuator is faulty. A first, rough diagnostic classification of the fault can be based e.g. on the Euclidian distance between the coefficients of the two filters (Mladenov, Mock, Grosspietsch 2008).

2.3. Fault Monitoring and Fault Correction

The monitoring filter can be used also in cooperation with an adaptive filter for fault correction. To exhibit that, as an introduction, first Fig. 2 depicts the scheme of an actuator with fault correction only, by means of an adaptive filter. This filter CF (corrective filter) is continuously trained to adapt its filter coefficient values to those ones of the reference model RF; so it reproduces a fault-free behavior of the actuator even if the actuator contains internal faults. To do so, CF causes, at the controller´s update interface, a change of the instruction pattern for the actuator, so that it, in spite of its internal fault, produces the desired output y(t).

In Fig. 3, in addition to the structure of Fig. 2, also the monitoring filter MF is integrated into the scheme. The filters RF, MF, and CF are trained in the way described in the preceding paragraphs. Their corresponding feedback loops shown in Fig. 1 and 2 are not exhibited here, just to keep the picture structure simpler. The monitoring filter is trained to model the corrected behavior of the actuator. A difference in D between the coefficients of MF and of RF would mean that the corrective influence of CF has not completely removed the fault behavior of the actuator.

It should be noted, however, that the described strategy causes one limitation: The actuator´s fault behavior that is successfully masked by means of CF, does not show up in the monitoring filter. Thus, under this working scheme, MF reveals only the uncorrectable part of the fault behavior.

To enable also a monitoring of fault effects which are concurrently masked by means of the corrective filter CF, we have to slightly extend the structure of the scheme of Fig. 3; this is shown in Fig. 4. Here, the actuator is, as in Fig. 3, controlled by the updated controller instruction. The monitoring filter, however, gets as input the initial controller instruction; so it simulates the operation of the faulty actuator without correction.

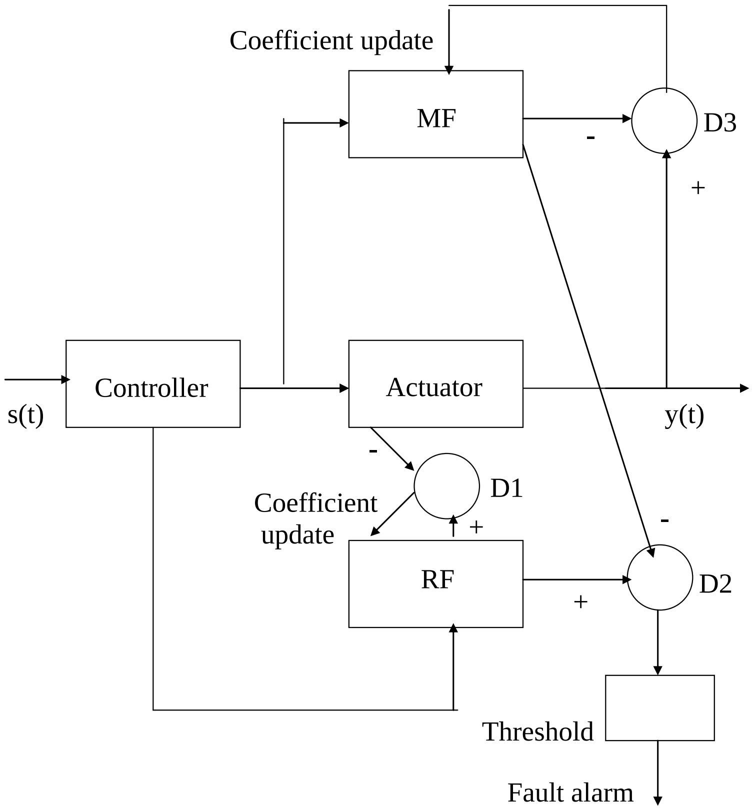

Figure 1: Use of adaptive filters to enable fault monitoring for an actuator

MF monitoring filter, RF reference model filter

s(t) instruction data for the controller, y(t) output signal

Circles represent comparison operations:

D1 comparison between the output of the actuators and of filter RF

D2 comparison between the filter coefficients of MF and RF

D3 comparison between the output of MF and that one of the real actuator

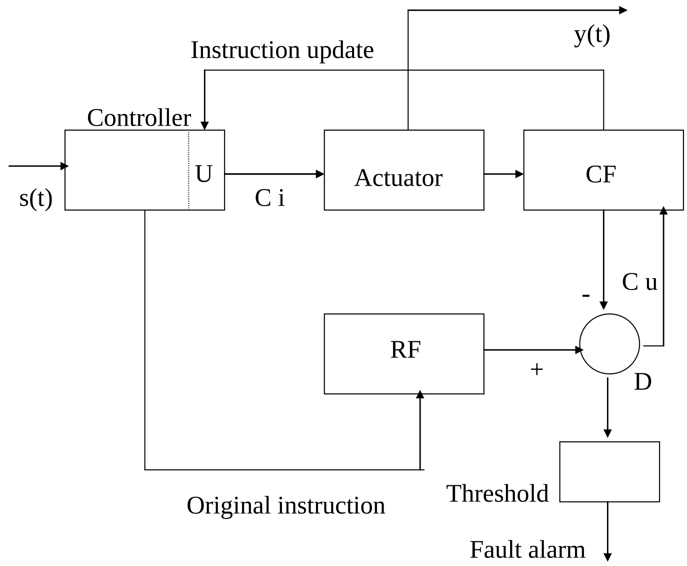

Figure 2: Use of adaptive filters to enable fault correction for an actuator

CF corrective filter, RF reference model filter

s(t) instruction data for the controller, y(t) output signal

U interface for modifying the controller´s instruction, triggered by CF

C i changed instruction, C u coefficient update, D comparison between the outputs of CF and RF

For keeping the picture structure simple, the feedback training loop for RF shown in Fig. 1 is not exhibited here.

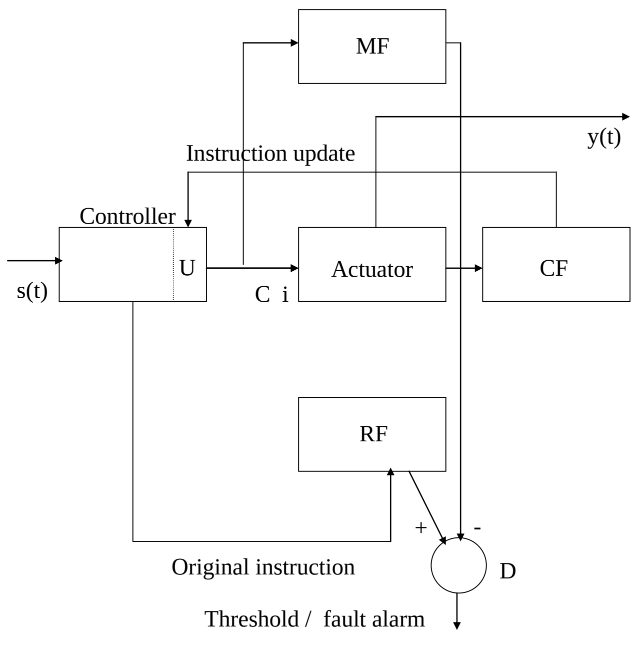

Figure 3: Cooperation of adaptive filters to enable fault correction and fault monitoring

CF corrective filter, MF monitoring filter, RF reference model filter

s(t) instruction data for the controller of the actuator, y(t) output signal

U interface for modifying the controller instruction, triggered by CF

C i changed instruction, D comparison between the filter coefficients of MF and R

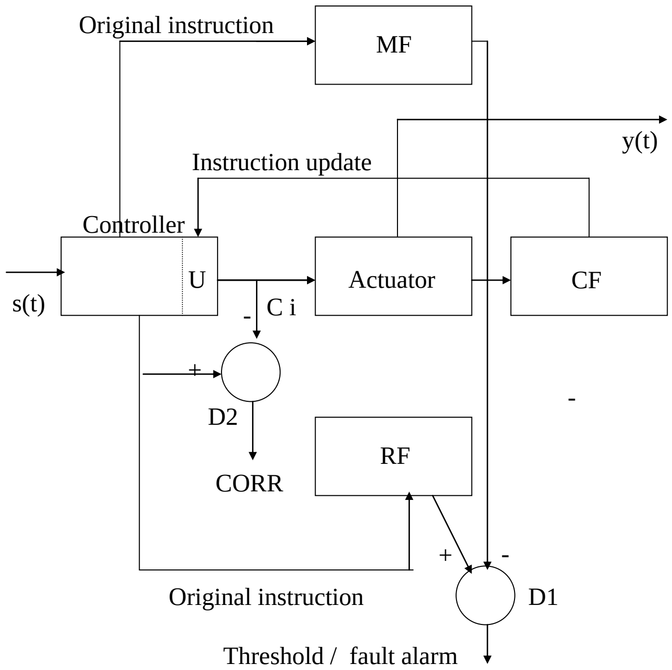

Figure 4: Cooperation of adaptive filters to enable fault correction and fault monitoring for an actuator

CF corrective filter, MF monitoring filter, RF reference model filter

s(t) instruction data for the controller of the actuator, y(t) output signal

U interface filter for modifying the controller instruction, depending on CF

D1 comparison of the filter coefficients of MF and RF

D2 comparison between original and updated instruction pattern

CORR signal that filter CF, by changing the instruction pattern, has triggered a corrective a

D2 compares these two different instruction patterns. So, if D2 shows a difference, this simply means that there is there is a fault situation in the actuator, which (at least partially) is masked by corrective actions of filter CF. This fault state can then e.g. be signaled to higher system levels, to trigger there a more detailed diagnostic analysis. The advantage is that these higher levels can then prepare a system repair, before several faults combine to impair the system more severely by uncorrectable fault patterns.

2.4. Implementation Aspects

It should be noted that all the additional elements of these structures (filters, comparisons) have a very simple algorithmic structure. They all consist of only a few instructions; in the filters, the instructions are carried out in loops. So, a filter, together with the associated comparison operations, can either reside in the actuator´s controller, or (under severe real-time constraints) in very simple additional controller units.

To summarize, by some additional, quite simple functional units we can provide a continuous monitoring of the actuator. The „soft computing“ properties of the filters, namely, making actuator faults gradually visible in the filter coefficients, are promising as they e.g. also enable to adjust the sensitivity of the monitoring, just by scaling down the threshold shown in the figures. So, they are more flexible than hardwired monitors with fixed fault detection thresholds.

Due to their simple structure, adaptive filters can be added to many components of the hybrid systems and can provide there the local monitoring and, also, as far as possible, the correction of faulty behavior. Thus, by masking component faults, they help to avoid situations, where several untreated local faults are combining to produce a non-manageable fault situation.

3. Application Examples

So far we have demonstrated that by the use of the monitoring filter MF and the reference model filter RF, faulty behavior can be detected, via the difference of their coefficient values. This distance can e.g. be measured by simple metrics like the Euclidean distance.

Of course, it would be interesting to get more information than just the existence of a fault. To investigate the potential for a more detailed diagnosis, experiments have been run, simulating the behavior of actuators, embedded into the filter structures described in section 2 (Mladenov, Mock, Grosspietsch 2008). The simulations were run over a certain interval of operation time of the actuators, with a fault injection at certain timepoints. As main fault examples the cases of a gracefully degrading servo motor (i.e. its motor strength getting continuously weaker) and a stuck servo motor were considered, i.e. two fault effects which are not fully correctable. Also the influence of additional noise was studied. Compared to the state of the non-faulty servo motor, quite different characteristic spectra of coefficient values resulted. So it will be a promising task to carry out and analyze further simulations, to develop some classification of the resulting time-dependent patterns. This could be the basis for being able to draw conclusions about the interior fault states of actuators just from the coefficient spectra of the associated adaptive filters, without needing to have access to the internal structure of the actuator.

Thus, investigations of the mentioned coefficient time behavior appear to be a promising approach to win more fault-related data not available so far. In this way they might contribute to the work of establishing a more general theory of dependability of hybrid systems. Also, it would be interesting to investigate, how far the described monitoring strategies can also be generalized and applied to the area of organizational units.

4. Conclusion

In this paper we have discussed the potential of using adaptive filters also for the fault monitoring of components in hybrid systems, especially actuators. It has been demonstrated how such a use of filters is possible on the one hand aiming for fault monitoring only, but also for fault monitoring together with fault correction. Simulation experiments have been sketched which exhibit interesting results how faults leave different traces in the time-dependent filter coefficient spectra. It will be the focus of further research to establish here more detailed classification criteria.

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ONLINE STORAGE ON COMPUTERS AS DISTRIBUTED LONG-TERM STORAGE SYSTEM

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Keywords

Long term storage, distributed storage, preservation of data

Abstract

Long-term storage is a widely discussed problem. The amount of digital data is growing faster every day. To avoid the loss of data or to avoid the inaccessibility it would be advantageous to have a reliable storage that also grows, storage without hardware and software limitations and with tolerable costs. An infrastructure that protects the availability and reliability of stored data for a long time.

Projects like SETI@home demonstrate that the internet community is able to share free computer resources like processing power over the internet, why not also free storage capacities.

We think that it is possible to share this free storage on machines that are online in the Internet and that this concept creates a reliable and secure distributed storage system to redundantly store data under the aspects of a long-term storage. The requirements and processes needed are discussed in this short paper.

1. General

We discuss the usability of free storage, i.e. unused disk space, which is available on Internet connected computers around the world for the usage as a long term memory. The aim is to store files reliably and cost effective in a distributed manner by a community effort, not on a proprietary system.

On every computer you find more or less free space on their storage devices, and many computers are constantly online in the internet. With appropriate driver software everybody could share his free space in a pool for long term storage. If one would store data redundantly on computers around the world, it should be possible to have uninterrupted access to this information. Effective replication strategies provide reliable correct data during their lifetime. Projects like SETI@home (Seti, 2010) or peer-to-peer networks demonstrate that the internet community is willing to share resources.

New security concepts are needed in such an environment. The preservation of data is done by redundancy and by fingerprinting, a hash code stored in a central database. The database itself should also be replicated. Management rules and access rights have to be defined. All together the result should be a protected infrastructure to persevered important data for the future.

Projects like OceanStore (Kubiatowicz, 1999) and their first realization steps Pond (Rhea, 2003) show the technical possibilities. The storage space in this distributed system would have no binding to specific hardware or operating systems. The hardware changes, renews and grows with every new client, who joins the project. This could be an ideal storage place for public documents.

Beside these technical aspects there is a big management issue, someone has to take care and decide what is stored, who has write access and who can read.

In the following sections we would like to discuss some main factors to achieve the aim.

2. System Outlining

2.1. Central Database

For storing and retrieving of files, a central database is needed; file object information and space object information are stored here. The database should be replicated and synchronized on multiple hosts like the root servers in the DNS system, in order to avoid a bottleneck or a single point of failure.

File objects, the saved files / documents, are listed here with their metadata. File name, author, relevance, locations, encryption, hash codes would be the typical attributes. Space objects represent the locations with a unique identifier, status, and storage capabilities. When a registered client reports his available space, it is stored here. Used space is recorded here with the corresponding metadata.

In principle this model is already realized with the Google file system (Ghemawat, 2003) or the HDFS from the Apache Hadoop project (Hadoop, 2008). These are master-slave cluster file systems, with data servers for storing and a name server, the master, for organizing and indexing. Yahoo (Hadoop, 2009) shows the function ability with an installation of 4000 servers.

The disadvantage with GFS/HDFS is that it uses only one name server and therefore the administration of storage members is limited to the capacity of this name server. To overcome this, the database could be organized in a hierarchical structure, a top-level database organizes the regions and the region databases provide the service for the local clients. With this structure we follow the principle of data locality. Hosts that provide space for storing should be able to log in locally. These hosts, the registered clients, report their stored data or their free space. A file or document with regional relations is then stored in the same region. The probability is high, that a file with regional content is often requested for read in this region. For a worldwide storage space we have to take the different time zones and work times into account. We can expect a high availability for a regional file, when we have work time in this region. So it makes sense to store locally, but for files with worldwide interest it is also possible to retrieve them from any location via a recursive query over the top-level database. A similar system is used for the check in and allocation of mobile phones.

2.2. Security

Security issues are often discussed problems for distributed systems like this distributed storage. So what are the risks and how to overcome them? If you store distributed, there is no inside or outside anymore, classical scenarios like firewalls or gateways are not available. Also the responsibilities are distributed; we see a lot of administrators with different access possibilities handling such distributed systems.

Out of these circumstances a different security concept is needed, a security by design.

Looking at the aims: integrity of stored objects or data, confidentiality of management data and availability and reliability. For public data and documents the confidentiality of stored objects is not needed, but with extended management could also be achieved.

For integrity the files to be stored should be stored encrypted in principle. In addition, they should then be divided into at least two fragments. These fragments are stored in different locations. Thus, with the retrieval of data, the hash code stored in the central database verifies the individual parts and then the parts are assembled and decoded. Changes in the data, deliberately or by mistake, can be detected and remedial actions for the correction are possible by redundant copies.

The management data, like storage places and hash codes should be confidentially stored on the central servers, with this, we uncouple the information itself from the management information. Only with controlled access over the central servers should it be possible to retrieve content rich data.

Availability and reliability are key issues in distributed systems and are discussed in the next section.

2.3. Storage Reliability

An important criterion for the reliability of storage space is the online time of each machine. With a two-step scoring system a machine can be classified how long it is online and whether it is regularly turned off or not. The first parameter stores the average time the machine is online. It is calculated from the ratio online / offline per day, e.g.:

0 min / 24h = 0 up to 24h / 24h = 1 .

The second parameter is important for those computers that achieve a ratio of 1 or close to 1. These computers will normally be continuous operation servers. So this parameter categorizes the system availability if it is online for more than one day. We provide an example set of categories: A zero corresponds to machines that are regularly being turned off on a daily basis. Computers achieve a value of 1 after 7 days, a 2 after 14 days and a 3 after a month of continuous running. If the system is turned off or goes offline, this factor is decremented. The parameter with value 2 or 3 prevents that a server falls directly into a lower category when it has maintenance or if it is booted. With this scoring system it is possible to divide machines into two classes: the server class and the class of desktop and laptop machines. This information helps to decide where data should be stored, as discussed in the next section.

2.4. Distribution of the Data

To effectively use the available space, distribution strategies must be developed so that stored data can be reliably stored and retrieved in adequate time. The base load and thus the basic security of the data must be carried by the server class. Any data that must be available around the clock in the shortest possible time should be stored here with triple redundancy. Thus, double failures could be tolerated. If a storage location is offline for a long time, a replication event should then ensure that the desired numbers of redundant copies are recreated.

Data that are less time critical can be replicated on the class of office computers and the class of desktop and laptop hosts. A time zone strategy can be taken into account that the data is available all around the clock. One strategy could be that the system creates 5 or more replicas. Another strategy is to replicate the data in the course of 24 hours to ensure that zones with high activity, i.e. with many desktop computers turned on, have also the data replicated on their systems. With this strategy much higher network traffic could expected.

2.5. Communication

The free communication between two hosts on the Internet is reasonably restricted by firewalls and gateways. To gain the necessary routes, one could use the HTTP protocol which is usually not blocked. The initial communication then proceeds from the storage location, it reports that it is online with its ID, its reliability status, and free space. In response acknowledge message follows, or a request to retrieve data or a package of data to save.

The frequency of status messages can be adapted depending on the relevance of the storage location. Locations with large data sets and high relevance communicate in shorter intervals than those with less storage traffic. With growing online storage and increasing communication traffic the number of database replications needs to grow to provide scalable data and information flow.

While storing of data should be limited to specific user accounts, the reading of public data should be done in a P2P kind of communication process. This helps to speed up the communication and helps to reduce the workload on the central databases. As discussed in section *2.1 Central database* the data should be kept local, this shortens the communication path for most of the queries.

A proxy cache memory for frequently accessed file information from the central database server could also enhance performance.

3. Available Space

The first question is: how much space can we expect and at which time of the day is it available. The factors which are coming into effect here are the number, type of machines and their specific average spare capacity and their location.

As a first simplification we suggested a classification of machine types: the server class with 24h in operation, the office computers, which are calculated 8h running and the home and mobile computers, which are valued with 2h online per day.

The number of machines and the bandwidth available at their sites has been calculated from sales figures of GFK (GFK, 2009), Gartner (Gartner, 2006), IDC (IDC, 2008) and figures from the OECD (OECD, 2008). The storage capacity of the equipment reflects the standard configurations of the respective sales period.

The free capacity of the storage media is supposed to be 10% of the total capacity as a first approximation. The mission time of a server is assumed to be at least 3 years.

The server class can be estimated most simply, they are 24-hour operation and assumed that all servers are connected to the internet. If we very conservatively estimate a machine life time of 3 years the calculation in Table 1 shows the estimated availability of disk space in beginning of the year 2009. So, if we could realise to get 10% of installed capacity we come close to 1 exabyte.

The calculation of the space of the desktop and mobile PCs will depend on several factors. These are not usually run in a 24-hour operation, but are dependent on the time zone in which they stand, the local availability of an appropriate range of internet access and the period of use.

Year	2006	2007	2008
Standard hard disk capacity	240 GB	320 GB	500 GB
Server sold (pieces)	8.000.000	9.000.000	10.000.000
Storage capacity in Terabyte	1.875.000	2.812.500	4.882.812,5
10% free capacity in Terabyte	187.500	281.250	488.281,25
free capacity server Worldwide (10%) in Terabyte	934.600		

Table 1: Calculation free capacity 24 h online server

4. Conclusion

With little investment a lot of storage space could be acquired.

The storage pool grows with new generations of hardware. Much of the software needed to create such a system is already developed for similar problems. The online time of computers and their bandwidth to the Internet is constantly growing.

The limitation is in the willingness of the people to share their free space. So to provide an incentive, everyone who donates disk space get easy access to the public store.

Wuala (Wuala, 2010) discusses an online storage system that was mostly developed at ETH Zurich (Swiss Federal Institute of Technology) and provides online storage either by trading idle disk space or by buying additional storage. With more than 200,000,000 files already stored there it shows the possibilities in that market.

Built in support for such a system into the operating systems could ease the usage for the user.

So far, we have only outlined the concept and some possible implementation directives of such a system. Obviously, more theoretical and experimental work is needed, e.g. to provide probabilistic guarantees of availability given some replication factor, or to tune the system to a tolerable level of overhead given the dynamic nature of the internet.

Currently, as a first step, we are working to simulate such a system with the GoldSim (Goldsim, 2010) simulator, to evaluate whether our proposed categories and replication factors would lead to a stable system.

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CRITICAL AREAS OF EARLY WARNING SYSTEM

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Keywords

Warning system, crisis, information, distribution, radio-help, positioning

Abstract

Crisis has become an everyday's part of our lives. The level of economic and human losses during such events is largely dependent on the timely distribution of relevant information about threats and appropriate guidelines to all real and potential victims. The article brings view on the history and current status of early warning system in the Czech Republic as major information channel in terms of danger or crisis. On several examples are defined serious critical areas of current warning system, e.g. lack of information channels during electrical black-outs and absence of positional based broadcasting. The authors outline possible alternatives based on the synergy in application of existing technological tools with respect to real problems in selected areas as e.g. transport and distribution of electricity.

1. Introduction

Today, as we continually learn about new crises, disasters and calamities with tragic consequences, we find it increasingly difficult to get our bearings in the new situation. Moreover, we become largely immune to this type of engulfing information. Despite of this fact, it is clear that in current super-high-tech world we still have no efficient way of distribution of relevant information to entities - individuals, companies and organizations, for which it is often vitally important.

2. History and Present

The origins of building early warning systems for large groups of population could be found between the two world wars last century. Especially the development of aviation and its use for military purposes put pressure on the creation of early warning systems for the protection of inhabitants. Thanks to the aviation industry, military operations could use weapons with a large radius, however - particularly at the beginning - with a minimum capability of directing air strikes solely at military targets (whether intentionally or unintentionally). For these reasons, at the turn of 1930's, militias were being created to get a protection against air attacks. These efforts culminated in 1934 when organizing of passive defense received a legal framework, first in France, followed by Germany, and a year later in several other European countries. On April, 11th 1935, an organization of Civil Anti-Aircraft Protection was established in Czechoslovakia under Act no. 82.

One of the key roles of the new organization was to build a warning system to inform the citizens on an impending or existing danger. Later on, this system was defined as an early warning system, which is also included in Appendix I to the Geneva Conventions of July 8th 1977. Under Act no. 239/2000, in a peace time, the Fire Rescue Service of the Czech Republic is responsible for its operational, organizational, and technical provision.

One of the base requirements of such warning system was to build an extensive network of warning hooters. As compared with the initial devices, the present hooters and the often related municipal broadcasting systems have been much improved. Currently, the Czech early warning system consists of more than 6,000 terminal devices that allow, in addition to manual activation, remote initiation through a unified warning and notification system consisting of 93 notification centers deployed all over the Czech Republic. The main purpose of the system is to inform citizens about general threats and to summon the Fire Rescue Services in the event of a fire. It should be noted, however, that a system meeting the needs of a single-purpose mass warning can no longer satisfactorily respond to the growing number of new threats that are emerging as a result of new technological, transportational, social and political development.

3. State of Art of the Czech Early Warning System

On November 1st, 2001, the existing system of warning signals was replaced by only three different sound signals representing general danger, fire alarm and equipment testing. Despite of this simplification, very few people can differentiate among three sounds signals of hooters, let alone to know how to react in a particular situation.

In practice, therefore, these warning signs go unnoticed by most of the people mainly because of the absence of additional verbal information. People usually think that this is equipment testing or a Fire Rescue Services being summoned due to a fire or an accident. Although the new hooters can provide voice information in addition to a siren signal, only less than 20% of warning points are equipped with them. Thus, provided that a siren can be heard within a radius of 1 km, currently, general information on a danger can get to less than a quarter of this country. Additional verbal information – given an optimistic assumption that it can be understood up to a distance of 500 m – will only cover 1 percent of its area.

Aside from the small awareness of the meaning of warning notifications mentioned previously, a major problem of the current system is that it can only draw attention to existing situations without warning against an approaching danger. Other major attributes restricting the use of an efficient warning system include:

- messages being not precisely targeted - due to the fixed infrastructure, it is not possible to direct information only to specified areas. The system also fails to deliver the warning information repeatedly such as to the people approaching an affected area
- the information content of a message being low – only electronic hooters are able to provide additional verbal information about a state of emergency. In most cases, people have to obtain additional information on the current situation through other media
- lack of feedback control of the state of unified early warning and notification system – information only flows from the operating terminals to the final devices. Thus, it is not possible to directly verify whether the final devices have carried out the task required and determine their operating status. Although this limitation is now partially limited by a new parallel system of final device monitoring, only a very small part of the infrastructure is currently equipped with it.

4. Actual Risks and Threats

The current concept of warning information system brings potential benefits in areas such as those with hazardous operation in the event of industrial accidents. This may be successfully applied in towns in which people, having long experiences and knowledge about the most likely problems (such as in Usti nad Labem with its chemical plants), can adequately respond to a warning alarm.

However, nowadays, there are a number of risks, related to rivers, roads, railways, climatic events, terrorist attacks, and others, that may cause emergency situation in any place of this country. The economic and human losses resulting of such events largely depend on how fast the relevant information about threats and instructions gets to all real and potential victims of crisis situations.

5. Selected Examples of Weak Points of the Current Warning System and Possible Solutions

Due to broad expansion of information channels, we learn about natural disasters and emergencies more and more frequently. Despite the enormous development of communication technologies we have not yet an effective location based address system to provide the population with an early warning. The current early warning system works flawlessly according to the original specification, but this model is currently far away of the information needs as well as possibilities of modern ICT. Basically it can efficiently meet its original purpose – i.e. warn against air strikes in times of war. But it fails in cases of such major operations as to efficiently manage and coordinate population due to sequenced evacuation with regard to avoid panic.

5.1. Specific Features of Transport Systems

Transportation is one of the typical areas that the existing early warning and notification system cannot cover or where it completely fails as such. The overloaded transport infrastructure is a source of daily accidents. In 2009, more than 35,000 people died and 1.5 million were injured in about 1.15 million traffic accidents on the EU roads. If the rescue teams and the affected drivers had been informed in time, extensive material damage and tragedies could have been avoided. According to experts “about 2500 lives could be saved annually within the EU and the severity level of injuries would drop by 10-15%” (European commission, 2010, p. 1).

Today most accidents are reported to the emergency operation centers through mobile phones either by the people involved in or by witnesses of the accidents. Problems, however, occur if a situation is to be clarified to determine an adequate intervention (exact location and direction of the vehicle movement, degree of damage and injuries, elimination of repeated reports of one accident, etc.). Speedy intervention is a key success factor and any delay has a direct negative impact on the outcome of the entire rescue operation. According to a survey conducted in Sweden to determine the chances of surviving a serious road accident “only 48% of the people die in a result of sustain fatal injuries. Among those seriously injured, 5% die due too late given of first aid or because the scene of the accident having been not precisely located, 12% could have survived if they had been transported to hospital in time. Another 32% could have been saved if they had been transported more quickly to better equipped traumatological units.” (SafetyNet, 2009, p.19)

Currently, there are several projects at various stages of solutions trying to solve actual problems of transportation in order to reduce property damage and protect the health and lives of road users.

5.1.1. eCall (Emergency Call System)

A project co-financed by the European Union aims to create a system that enables automated sending of accident reports, including information about its exact location on the pan-European emergency phone number 112. As soon as an eCall device installed in your car senses an accident, it automatically calls the closest emergency centre providing it with the exact geographic location of the accident scene and with other data. With the same effect, eCall message could also be made manually by the driver or front seat passenger pushing a button to establish standard mobile communication with an emergency centre providing it with additional information about the current position. This is convenient if, for instance, you are witnessing an accident. By 2014, all the new vehicles should be equipped with an eCall system and its installation in the existing cars is being also under consideration.

Although this system brings significant improvement in terms of saving lives and providing rapid medical care in the event of an accident, it has not the capability of informing the approaching drivers who are potentially in danger. If the existing information channels were used, such information could be available within 5 to 10 minutes after receiving data on an accident using RDS-TMC reports and traffic reports of some radio stations. Each of these distribution channels, however, has specific limitations and the time of providing of needed information is in current traffic load less than insufficient.

5.1.2. Radio Traffic Terminal

"Information about serious traffic accidents could be better spread using radio traffic terminals, such as eCall extensions" (Skrbek, 2009, p. 127). A radio traffic terminal is broadcasting device receiving information from an exclusive communication channel. It provides a forced voice session, activated only in a particular geographical area thus delivering warning messages only to the relevant recipients. In practice, we may be able to provide a road user, depending on his current position and travel direction, with automated information on a danger ahead (traffic accident) almost immediately. The radio traffic terminal system uses HD-Radio technology or digital broadcasting enhanced by a GPS system. Assuming the data for a warning session being collected from a widespread eCall system, the new based warning system could be very efficient to help radically decrease the number of chain crashes on the roads.

5.1.3. Smart Road Restraint Systems

In addition to timely reports of accidents, the project aims to eliminate damages to property and losses of human lives by promptly distribution of preventative warning information. The proposed system gains information on the current traffic situation through the existing visual and sensor infrastructures (motorway camera system, radar system, bottleneck and weather monitoring) spreading it among the traffic participants. It also seeks for opportunities to exploit new materials and technologies to increase the safety of passengers (eg. better energy absorption through deformation zones of vehicles etc.). This project is also financed by the EU funds.

6. Distribution of Energy

Demands for energy of our post-industrial society have been growing steadily. Issues of energy security are dealt with by experts at the governmental level. So far, the Central European region has been spared a destruction or damage of the backbones of energy infrastructure. Nevertheless, we have already been facing situations (e.g. an interruption of the gas supply through Ukraine in

January 2010) in which large conurbations are threatened by a shortage of energy with not only economic but also health consequences. For our reasons, we will focus our stress to electrical energy blackouts, which, if lasting too long, may cause serious problems also with other energy resources. An overloading of electric distribution networks leading to long-term black-outs is only a matter of time. That this scenario is not unrealistic may be illustrated by a failure occurring e.g. in Italy in 2003 when its population of 55 million was left in darkness for 9 hours.

As, by the principles governing the operation of an electric distribution networks, it is necessary to maintain the production-to-consumption ratio, the situation is also complicated by the green energy from solar panels and wind generators. Their profits vary over time so that their supplies have to be compensated for by regulating other energy resources. Other factors added such as power line disturbances or quick increase in energy consumption due to weather fluctuations (air conditioning, heating) and other random events, further electric distribution networks outages may be imminent.

In the event of a longer black-out, the situation is gradually getting considerably worse:

- Black-out lasting several hours – this may be seen as just an inconvenience resulting in traffic complications (traffic light malfunction, restrictions on public transportation and railway transportation), public lighting malfunction, inability to watch television news, traffic restrictions, etc.
- Black-out lasting several tens of hours - petrol stations not working, traffic is suppressed due to lack of fuel, hospitals switch to emergency programs and accept only emergency cases, the supply of heat is limited, no gas for heating, most of the shops are closed, no radio broadcasting, mobile networks and land lines are down, banks and ATMs are out of operation
- Black-out lasting several days - disrupted water supplies, lack of stock and cash, population safety is at risk

Ms. Dana Drabova (head of committee for nuclear safety) stated during her lecture at the Technical university of Liberec, 1.4.2010: “Fortunately, the Czech Republic has yet been spared of a total electric black-out, but, according to top managers of energy industries, five times in the last two years, it has been within minutes of an total electric black-out and it is only a matter of time when this will really happen”.

This situation has a natural impact on the possibility to provide information through the communication media, when radio and television broadcasting as well as the Internet and mobile networks are disabled. In such situation of a complete power black-out, it is necessary to have a universal communication channel to pass coordinating information to inhabitants and to calm down the situation. Unfortunately, such a channel does not yet exist.

7. Possible Way Out – Radio-Help

“The Radio-Help system is based on a usage of receiver of analogue signal with the composed digital modulation (technology of HD RADIO or Digital Radio Mondiale) or fully digitalized broadcasting with a position determination based on GPS coordinates” stated Skrbek (2009, 127). The HD Radio technology, developed by iBiquity Digital Corporation was selected in 2002 in the U.S. as key technology for digitizing the radio broadcasting. Currently, this technology is used by a high percentage of the U.S. radio stations. The HD Radio technology works by superimposing a digital signal onto an analogue one. Using this method of modulation, it is possible, besides the analogue and digital radio broadcasting to transmit also a wide range of other data such as information on traffic, or the coordinates of a dedicated recipient/listener.

Integral component of a Radio-Help digital session are chains of positional codes identifying the areas of forced receiving, i.e. those at which the broadcast is directed. The receiver is continuously kept in a standby mode and, on registering any broadcast on a predefined frequency; it matches its GPS coordinates with those of the area included in the broadcast. On an exact match, a forced broadcast session is activated. After the transmission is ended, the device is put back into a standby mode using receiving switch-off codes. Subscribers of Radio-Help outside the defined areas are not disturbed by these warnings or alert sessions.

The above principle implies that it is possible to simultaneously broadcast multiple separate sessions into several areas. The current long-wave radio senders, for instance, could be used for the broadcast since, due to the transition to UKW bands, they gradually fall out of use. In this case, only the one central low-frequency transmitter would be sufficient to cover the entire Czech Republic.

Thanks to advanced technologies with most of the new mobile phones being equipped for receiving terrestrial broadcasting and GPS signals, this solution should not be technically difficult. Also the installation of Radio-Help receivers on home electronic devices (radio, TV, CD players, ...) would not be a major problem. In such case, as it is a stationary device, it would be sufficient to enter the current GPS coordinates when initializing such devices using, for instance, maps or other GPS devices. Also keeping these devices in a standby mode should be simple.

The advantage of this solution in the event of a long power black-out would be the possibilities to permanent inform the population about the current situation from central (governmental) information point. The system also allows for direct broadcasts to a specific receiver, which could be used for passing specific information only to specific individuals or groups - such as the municipality or other public servants.

8. Conclusion - Further Critical Situations

A number of further situations and application areas of Radio-Help may be listed. Here are some more examples:

- Local floods – coming unexpectedly, they cause substantial damage. Recognizing them and distribute appropriate information early may result in a radical cost savings thanks to adopting appropriate proceedings in time. In the case of bigger flooding due to energy black-outs the traditional communication channels are not accessible (TV and radio broadcasting, mobile phones and Internet).
- Snow break disaster – they have been complicating not only road, but also air, and railway transport lately. Although being informed on the current status and development may not bring a radical reduction in costs, it still greatly contributes to stabilizing the situation in the affected areas (such as restrictions on cars entering the affected areas, etc.)
- Terrorist attacks – under the current legislation, the communication traffic may significantly be reduced in these cases. By the law the police can switch off cellular networks, block the Internet and other communication media. In such case, the existence of a central information channel is also extremely important.

All such situations, although very different in nature, have one problem in common - how to ensure real-time dissemination of relevant information to the affected areas. Introducing Radio-Help might, in principle, fully meet the requirements of adequate, locally defined information spreading in all the above-mentioned situations.

It is possible to find similar aspects in the process of implementation of new generation of early warning systems in society and application of advanced ERP systems in companies – according to Antlová (2008) and Johansson, Sudzina (2009). The current problem of Radio-Help is not the technology itself but human (resp. managerial) aspect based partially on non adequate knowledge and understanding of the ICT potential, but mainly on the resistance against changes of current system and fears of potential loss of good managerial positions as is mentioned in Doucek (2009).

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Factors of Regional Development in the Context of Globalization and International Integration

FACTORS OF LOCAL AND REGIONAL DEVELOPMENT IN THE CONTEXT OF GLOBALIZATION AND INTEGRATION

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Keywords

Factors, local, regional, development, globalization, integration

Abstract

The article concentrates on the contemporary factors of local and regional development. Nowadays we can observe that interregional differences does not decrease, although particular states in European Union, but not only, provide the regional policy. The principle of regional policy is increasing and dynamic the development. The instruments which will be chosen by local and regional authority should be appropriate and suitable to our knowledge about factors which influence on this process.

Scientific work financed from the resources for education in 2010-2013 as a research project of Ministry of Science and Higher Education no. O N115 311238, Local and regional conditions for the functioning of military units situated within the territory of the country.

1. Regional Development in the Context of Globalization and Integration

Changes currently taking place in regions are to a high extent a result of globalization and international integration. Wilkin defined globalization as a process „extending and intensifying production, trade, financial, informational and cultural bonds between parties at a global scale (...) the network of contacts, relation and transfer condenses, (...) the power of interaction between parties in the global economic system intensifies" (1997, p. 119). The triggers for intensification of bonds between parties at the global scale were political changes and technical progress (Czerny M., 2007, p. 16, 26). However, one of the consequences of globalization processes is an increasing competition between business entities and its shift from price competition with a low level of investments to innovation based competition with product diversification and a high level of investments.

Globalization is more likely to conduce big and economically strong entities. Those parties acting in the global market profit form preferential conditions offered by certain locations to increase the effectiveness of their activity – cost reduction and sales increase. The dominating influence of transnational corporations is worried about by particular countries as well as small and medium enterprises (SME). Questions emerge regarding the influence of the corporate assets over the economy of a developing country: to what extent do they support the modernization of local economy, and to what extent do they bring benefits from cheap labour and natural resources only to corporations? (Czerny, 2007, p. 41 and next). On the other hand globalization creates opportunities not only for corporations, but also for small and medium enterprises (SME), cooperating with one another in various networks (clusters). Simultaneous cooperation and competition of entities acting in a network increases their chances for being effectively competitive in the global market. Public authorities also participate in the process of creating networks through integration of the economic and academic environment for the sake of co-acting in development of the region. The scope of SME cooperation within a network involves production, subcontracting, distribution, marketing, retail, innovative activity, information and experts exchange, as well as trainings (Jewtuchowicz, 2005, p.180-186). Integrated environment in the region supports the development of regional identity and the use of characteristics of regional economy to enhance the competitiveness of the region. It also creates an opportunity to resist negative tendencies towards uniformization of values and norms, consumption patterns as well as lifestyles and behaviors. It may also prevent negative consequences of restructuring and modernization of large companies, which cause local plants' shut-downs and redundancies (Jewtuchowicz, 2002, p.214).

Globalization processes take place alongside with international integration processes, involving uniting of national economies in order to harmonize actions previously taken autonomically. Countries integration not only allows them to cooperate in order to overcome negative tendencies resulting from competition increase. It also helps to initiate international production and exchange processes. Integration processes involve almost all continents, yet they vary in terms of scale, scope and pace. The most advanced process is taking place in Europe, where since the mid twentieth century structures have been built and policies have been created to support the social-economic development of member states.

When it comes to differences in social-economic development of EU countries and regions, regional policy activities are of particular importance. Activities in this field were initiated through establishing the Directorate General for Regional Policy with the European Commission in 1968, followed by creation of European Regional Development Fund in 1975. The current shape of the regional policy is a result of changes gradually introduced since the mid 1980’s in terms of goals, rules and instruments.

It is one of the EU priorities, as far as regional policy (currently the cohesion policy) is concerned, to strengthen the interregional cohesion. It is reflected in the treaty „EU (…) shall work for the sustainable development of Europe based on balanced economic growth and price stability, a highly competitive social market economy, aiming at full employment and social progress, and a high level of protection and improvement of the quality of the environment. (…) It shall promote economic, social and territorial cohesion, and solidarity among Member States” (The Treaty of European Union, art.3).

The cohesion policy aims at strengthening interregional convergence, increasing the competitiveness and employment level, as well as intensifying territorial cooperation. The principles of the EU cohesion policy stated in Strategic Guidelines for Cohesion Policy for 2007-2013 reflect the priorities of the Lisbon Strategy, such as: making European Union an attractive region for investment and work, spreading knowledge and innovation in order to make the economic growth more dynamic and to create new jobs (2007, p.5). Realization of the above mentioned priority is possible through assets of structural funds: European Regional Development Fund (ERDF), The European Social Fund (ESF) as well as The Cohesion Fund (CF). For the programming period of 2007-2013 there is about 308 bln euro estimated to be spent through the cohesion Policy, over 52% of which will be granted to the new member states, whose development level is far lower than the EU 15 countries (Growing regions, growing Europe, 2007). Those assets will constitute a vital development trigger in these regions.

Development processes take place in a complex and diverse way depending on a particular territory's characteristics. There are numerous theories on local and regional development, which identify and interpret the development disproportions of regions. Special emphasis is placed on identifying and defining the influence of particular factors on the development of territorial units as well as on how to effectively use those factors to intensify the development and resist barriers.

Factors promoting development, particularly emphasized in literature include: diversified economic structure, investments, highly developed technical infrastructure, knowledge and innovation, natural resources, activity of business institutions and local governments as well as social assets. From local and regional economy point of view, presence of particular factors or the ability to obtain them determines development perspectives of particular region. Similarly shortage or an unfavorable structure of factors, the lack of links between elements/resource as well as inability to organize activities at the local and regional level may jeopardize development and result in territorial retardation in comparison to other areas. It needs to be emphasized, that conditions determine chances and/or threats for development. Therefore, they are a target of local government activity. It means that a negative structure of factors should be subject to transformation.

2. Factors of Local and Regional Development

2.1. Knowledge and Innovations

Knowledge is generated and proliferated through the educational system and is acquired through action. The educational system shapes the abilities, develops cognition and understanding of phenomena and interrelations in the modern world, and prepares people to live as active citizens in a democratic society and to carry out the future profession. Its task is to create the conditions for individual development and to stimulate the research and innovations which are beneficial to society and economy.

The level of citizens' education (especially the level of their competences, ability to cooperate and creativity) has the significant effect on local and regional development. The acquired and developed competences may be considered in two aspects. The first one – individual – concerns the possibility to direct one's own professional carrier, the second one refers to the effectiveness of economic subjects, within which the individuals carry out their tasks. As a result of cooperation and sharing, the individual competences produce the new, better result (synergy phenomenon) for an organization, better than the one obtained from individual action. Enterprises that generate high economic effectiveness search for the new technological and organizational solutions, which could be applied to the economic processes and thus create opportunities to maintain or strengthen the position on the market. These new solutions are the effect of knowledge accumulation within an organization. If such solutions appear and are disseminated by the educational system and economic practices, then the level of knowledge is increasing among the society. Employees of an enterprise "armed" with new knowledge will use it while working on subsequent projects: improving the products' quality and adapting them to individualized needs, ensuring on-time deliveries and service quality, lowering costs of production. These actions are favorable to the growth of local market's level of participation in international trading and to the distribution of work; they also determine the increase of investors' interest.

On a regional scale, the synergy effect results from the cooperation between enterprises, universities, developmental and research units, business environment institutions and territorial self-governments. The orientation and amalgamation of these organizations' efforts is conductive to the concentration of knowledge, experience and expenditure in developmental spheres, decrease in costs of managing separate projects and proliferation of innovative solutions.

2.2. Diversity of Economy Structure

As far as socioeconomic development is concerned, differentiated structure of economy is required. Such a structure shows higher level of resistance to fluctuations of economic conditions. It is characterized by numerous relations based on cooperation and competition of subjects, which facilitates the processes of learning and following good practices, and also intermingling and creation of the new spheres of activity within particular sectors. Over a larger time span, the differentiated structures protect against huge employment fluctuations and are favorable to the process of adapting the production to individual needs of the clients.

The differentiated economic structure helps to neutralize unfavorable tendencies formed within different sectors. For example, low efficiency in Polish agriculture production process that is the result of labour overconsumption, breaking-up of farmsteads, low investment expenditures, long production cycle, direct use of natural resources and weather anomalies – is not a sufficient determinant of regional development. In relation to this, agricultural policy of the European Union is largely focused on diversification of development concerning rural agricultural areas and on relating the income support for the farmers to the care for natural environment, breeding of animals and also the production of safe food (the rule of cross-compliance).

Whereas, while analyzing the industrial sector and its contribution to the process of development of a given territory, the focus should be directed on its share in gross added value, the number of the employed, investment expenditures and the creation of innovative products within the industry. As far as regional development is concerned, the size and the structure of the past investments condition the size of future productions. Moreover, the innovation expenditures of enterprises, which determine the acceptance and success of products on national and international markets, play an important role. The development of exporting sector is projected onto the income situation of the households and subsequently, onto the increase of regional demand.

Presently, the service sector – which performs the dominant role with regards to generated Gross Domestic Product, gross value added and number of the employed in developed countries is assigned with a large importance regarding local and regional development. Firstly, the source of this sector's development is the condition of enterprises which intensify their potential using consulting, marketing, IT, legal and financial services. Secondly, it is the amount of households' income, which determines the demand for educational, health-related, touristic, telecommunication, banking, transporting and trading services. Moreover, the service sector delivers an array of innovative solutions, which are not only the results of "planned" actions within enterprises, but are also resultant of new solutions that emerge as derivates of dynamic transformations taking place in modern societies. These are for instance, the solutions that emerge as the citizens use the Internet-related services – e.g. community services that become the source of high income for their owners as time goes on (Bauman, 2009, p.120-121).

2.3. Investments

Investments dynamize the economic development, which in turn facilitates the further influx of investments and intensifies its attractiveness with regards to investments. Investors search for the locations which, from the assumed aim's perspective, will strengthen their competitive advantages. In many cases, the combination of quantitative and qualitative factors that are the constituents of investment atmosphere, determines the choice of location (Dziemianowicz, Jałowiecki, 2004, p. 24-30). Advantages that result from the regional influx of investments include:

- restructuring of enterprises
- expansion of contacts with foreign companies
- attracting cooperating and competitive companies to a region
- transfer of technology and advancement of research-developmental activity (R+D)
- increase in export of processed products
- increase in productivity through the use of modern methods and techniques of managing
- qualitative transformations on job market
- increase of citizens' income
- increase in consumption and investment demand
- improvement of social atmosphere

Simultaneously, the location of investor may cause negative effects to appear in a given territory. These are namely: bankruptcies of local enterprises, increase of unemployment, decrease of income, influx of so-called "dirty technologies" that cause the increase of pollution in natural environment and worsen social atmosphere.

2.4. Technical Infrastructure

Technical infrastructure determines the conditions of regional economic activity, it stimulates socioeconomic development and facilitates integrative processes on interregional and international scale.

The elements of technical infrastructure determine the communicative accessibility of particular places located within given space, the costs of transport for manufacturers, prices for customers, natural environment condition and the safety and quality of life in a given region. The proper use of infrastructure shortens the flow time of products, services and manufacturing factors. The positioning and technical condition of regional manufacture determines its accessibility for the external entities and conductivity of the area that is significant for local entities. In the regions which are poorly connected with other regions, there are serious developmental barriers. For this reason, the creation of technical infrastructure, including transportation, is treated as a primary condition to trigger these processes.

At present, telecommunication and IT infrastructure, which conditions the flow of information, are play an important role in shaping and developing the level of regional competitiveness. Information is becoming the basic product that determines the development of new forms of population's activity. Friedman indicates it in the following way: "Enterprises place the production, research programmes and marketing in various countries and despite this fact they still are in control of them, as if they were situated within the single area, because of computers and teleconferences" (2001, p.13-14). Revolutionary transformations within ITC sector have influenced the improvement of processes associated with the organization of manufacture, work and communication, benefiting the creation of competitive potential among enterprises. Nowadays, enterprises can be located in less-developed regions and use the available resources without losing their advantages and these regions can participate in the international economic processes due to the access of IT networks.

2.5. Local and Regional Self-Governments

Territorial self-governments perform an immensely important role in creating socioeconomic development. Self-governments carry out a series of tasks, whose effects are reflected in the living conditions of societies and the functioning of enterprises. They are responsible for providing the proper business atmosphere, which attracts investors and helps the enterprises located within a region to increase their potential. The span of tasks carried out by self-governments is amazingly broad – this indicates the complexity of regional economy management. Self-governments cooperate with non-governmental institutions while carrying out the public activities. In the economic sphere, they use the support of business-related institutions, whose range of activity includes the activation of job market, providing enterprises with the financial and content-related aid, creation and flow of information and novel technologies and also providing the friendly business atmosphere. Self-governments offer a broad array of supportive instruments to regional entrepreneurs:

- extension and modernization of technological infrastructure
- informational and promotional instruments
- favorable financial conditions to initiate and extend activity
- legal and administrative instruments

The activeness of authorities reflected in application of particular instruments facilitates the increase in effectiveness of enterprises' actions and is one of the elements that attract the new regional investments.

2.6. Business Environment Institutions

Business environment institutions are one of the significant factors of local and regional development. They participate in the process of creating the environment which is favorable to the development of entrepreneurship and innovativeness.

Emergence and development of business environment institutions in Poland was related to the revamping of socioeconomic system, which consisted in the state's withdrawal from the activities performed within socioeconomic sphere and from a series of regulations that deepened the economic malfunctioning.

Problems that had surfaced in the first years of system transformation, namely: unemployment, hyperinflation and bankruptcies of enterprises, intensified the economic crisis. Business environment institutions emerging at that time had been supporting the process of embedding the rules of market economy and the creation of democratic society.

Due to the functions performed by business environment institutions (informational, initiating, transformative and coordinative), it seems that they are deeply rooted in the Polish socioeconomic reality. To some extent, these institutions connect the intentions of government institutions with the activity of local communities and enterprises. The support of the regional restructuring processes requires the adaptation of tasks carried out by business environment institutions to the specificity of regional economy. By cooperating with self-government authorities, business environment institutions can operate in two directions: improving the level of development within the less-developed regions or supporting the competitiveness within the regions of varied structure. For these reasons, the institutions focus on the effective use of endogenous and exogenous regional resources (if it is possible to attract them) and their rational interrelating. Effective use of internal resources of a given territory takes place through:

- activation of job market – support in establishing companies
- support of enterprises' innovativeness – proliferation and transfer of new technologies, support of enterprises' research-developmental activities and coordination of cooperation between scientific and economic surroundings
- strengthening the advantages of enterprises by providing specialist services

As far as interrelating of internal regional resources with the external ones and their use according to the principle of sustainable development is achievable due to the following actions:

- adaptation of office, warehouse and manufacture spaces to the performance of new economic functions, with the use of national and foreign funds
- promotion of the existing potential; and attracting investors to a region
- production of cooperation and partnership network between regional and external entities, promotion of positive action models, initiation of cooperation between enterprises

2.7. Social Capital

Social capital refers to such features of organized society as: trust, commonly accepted standards and durable interrelations between particular entities. It is a resource that is created by different groups of people and can benefit the society. Bartkowski claims that "Social capital is not a separate and previously unknown form of capital. It is not a distinctive category, but influences physical and human capital and through the amalgamation with them, it facilitates their effectiveness. It is their social and interpersonal supplement that enables more effective activity (...)." (2007, p.57). The accumulated social capital enables spontaneous cooperation between members of a group who, through the sharing of knowledge, information and experience, are able to solve the emergent problems more effectively. Work in a group helps them to identify the elements that are missing or are scattered around the environment and to trigger a network of interrelations in order to attain them at a faster rate. Therefore, from the knowledge management perspective, the existence of socially-oriented groups may be favorable to acquisition, accumulation and practical usage of knowledge, pertaining to different kinds of human activity. These groups, through fulfilling their own goals or acting out in the name of a broader scope of community, influence the increase of openness and trust in contacts between the individuals, which enables more effective use of limited resources in economy.

The significant role of social capital derives from the fact that the societies, whose members can to and want to cooperate, are able to accommodate to changes within their surroundings quicker (Yamagishi, Cook, Watabe, 1998, p.165-191).

In practice, the creation of social capital is not easy due to the current, fast rate of changes. As underlined by Bauman, the high changeability of our habitat surroundings is considerably impeding the processes of experience exchange, stabilization and preservation of certain patterns and attitudes – all the things that are perceived as the basis of this capital (2009, p. 113). Facing something like "lack of experience continuity" we strongly feel the temporariness of different solutions and we lose our identity. The answer for these progressing changes is not a restrain from cooperation, but its intensification. Here, there is a space for territorial self-governments, business environment institutions, local communities and entrepreneurs that should create and use the mechanisms of cooperation in order to coordinate the resources, efforts and energy for a given number of undertakings. The awareness that further development of society and economy depends mainly on the material wealth and immaterial values – knowledge and social capital, is necessary.

These values require sufficient time to emerge and proliferate in order to, i.e.: create trust in communities, establish standards of cooperation and platforms for the sharing of knowledge.

2.8. Resources of Natural Environment

One of the factors that determine the development of municipalities, districts and regions is the condition of natural environment and the related touristic attractiveness. The condition of natural environment influences the regional quality of life and is decisive of the level of attraction with regards to the entities that come from the outside of the region and are interested in accommodation or work. Thus, a natural environment may be viewed from the perspective of entrepreneurs, citizens and self-government authorities. Entrepreneurs conduct their business activity using natural resources, landscape, climate, historical and cultural qualities. Citizens appreciate the qualities of nature, which are a value in themselves and determine the quality of their lives. Some of the citizens in large cities consciously chose the suburban areas, which are located outside the centres, for accommodation in order to limit the inconveniences of living in a city (e.g. higher pollution, the weakening of immunity).

Irregular location of resources and natural qualities within space are treated by self-governing authorities as conditions to carry out a policy of regional development that generates advantages or disadvantages within a given territory. Irregular location of resources produces varied accessibility, quality and costs of attaining the resources, payments for their usage, accepted limits of pollution and costs of conditioning and removal of pollution effects. The features that distinguish a territory from other regions can attract tourists that want to visit a particular part of the country. Development of tourism depends on, i.e.: equipping the area with proper infrastructural devices, efficacy of promoting the existing qualities, caring about the maintenance of good environmental condition and organizing the accompanying events that diversify the time spent by tourists in a region. Development of tourism is favorable to creating new posts, increasing the population’s and local budget’s income, and also to attracting investors to a region.

3. The Level of Interregional Diversity in Poland

Presently, it can be said that there is a relatively high level of socioeconomic diversification within the Polish regions and that there are differences at the level of competitiveness (table 1). Central, local and regional authorities also cannot ignore the progressing developmental disproportions within the regions. Mazowieckie voivodeship may be one of such examples. While being the country leader with regards gross domestic product per capita, it is simultaneously characterized by a high internal diversification. Ciechanowski, Ostrołęcki and Siedlecki districts register very low GDP per capita, number of foreign investors and high rates of unemployment and a negative migration balance.

Voivodeship	GDP per capita in current prices , in PLN in 2007	Gross added value per 1 employed person, in PLN in 2007	Rate of unemployment, in % (31.XII.2008)
Dolnośląskie	**33567**	**86756**	**10,0**
Kujawsko-pomorskie	26801	69477	13,3
Lubelskie	20913	52084	11,2
Lubuskie	27350	75316	12,5
Łódzkie	28371	65961	9,2
Małopolskie	26456	65523	7,5
Mazowieckie	**49415**	**100878**	**7,3**
Opolskie	25609	73585	9,8
Podkarpackie	20829	52944	13,0
Podlaskie	22896	59677	9,7
Pomorskie	30396	80772	8,4
Śląskie	**32761**	**81945**	**6,9**
Świętokrzyskie	23741	57236	13,7
Warmińsko-mazurskie	22961	67676	16,8
Wielkopolskie	**32266**	**72334**	**6,4**
Zachodniopomorskie	27708	77540	13,3

Table 1. Socio-economic situation in polish Voivodeship (Source: Statistical Yearbook of Voivodeships, Central Statistical Office, Warsaw 2009, p. 71, 89, 90.)

Next to the Mazowieckie voivodeship, at the top of the voivoedship development ranking, there are the following voivodeships: Dolnośląskie, Śląskie and Wielkopolskie, a little further on: Pomeranian. These Voivodeships register the highest GDP per capita and the lowest rate of unemployment (especially Wielkopolskie and Śląskie). Juxtaposition of these two indexes is significant due to the fact that the growing level of goods and services in regional economy (GDP) corresponds to the high level of work resources usage. In other words, it means that relatively greater amount of population takes place in the process of "enriching" than the number registered in other voivodeships. Leading voivodeships also register a high index of gross value added per capita, which is another indication of higher efficiency of these regions' employees. High efficiency is associated with i.e. the level of education, methods of work organization, but also – which is important with technical and technological equipment of enterprises (being i.e. the results of investments of national and foreign entities). The poorest results with respect to level of socioeconomic development and work efficiency are registered by the following voivodeships: Lubelskie, Podlaskie, Podkarpackie, Świętokrzyskie and Warmińsko-Mazurskie. The three voivodeships listed as last are in especially unfavorable situation due to the poor usage of work resources.

4. Summary

Significant diversifications of intra and cross-regional nature determine the need to introduce the regional policy in order to reduce the disproportions in places, where the level of socioeconomic development is low and simultaneously to dynamize the development of areas extensively-developed. This means that the regional policy implemented both at central and self-governmental levels can acquire a regulatory variant, which is characterized by the active role of state and the transferring of resources to problematic regions; and a polarizing variant based on market solutions, in which the public authorities are focused on creating the legal framework for efficient functioning of self-governments, enterprises and citizens. In 2000-2006 the regulatory variant was the prevailing one in practice. Currently ongoing period of programming requires the equilibrium regarding the support of tasks carried within these two spheres. This conditioning is a need to fulfill the assumptions of the Lisbon Agenda and a need to increase the level of the EU's social, economic and territorial cohesion.

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MIGRATION – SOURCE OF HUMAN RESOURCES

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Keywords

Czech Republic, migration, human resources, age structure

Abstract

The number of long-term or permanently residing foreigners in the CR exceeded in the 2008 the amount of 437 565. Age structure of foreigners staying in the CR for more than 1 year substantially differs from the age structure of the population of the CR. The Czech Republic seems to be an attractive place for EU-15, A8 and third country nationals. The proportion of foreigners has grown in the last years. The ratio of foreigners to the labour force in the Czech Republic, in other words to the economically active citizens at the age of 15 or older, has been on the rise for the last years. Supply has responded to changing demand for new workforce. Unfortunately we have no data about immigrants' education level. This article came into being within the framework of the long-term research project 2D06026, "Reproduction of Human Capital", financed by the Ministry of Education, Youth and Sport within the framework of National Research Program II.

1. Introduction

Migration between countries is a historically long-term phenomenon which is affected by economic, social, demographic and other influences and which can have different social consequences – it may lead to development, but also stagnation and recession. Its existence is influenced by a number of factors. The impulse to migrate can be due to personal, natural climatic, social, political or economic reasons.

2. Materials and Methods

Data concerning the employment of foreigners within the Czech Republic are derived from the Czech Ministry of Labour and Social Affairs' records on valid work permits granted to foreigners and pieces of information on taking up of work by citizens of the EU/EEA and Switzerland, on books of employment offices, as well as from records on foreigners holding trade licences granted by the Ministry of Trade and Industry of the CR. The CZSO obtains data on the number of foreigners from various sources: the Alien and Border Police of the CR provide data on permitted residences and visas over 90 days. The last data source for this article is demographic statistics.

3. Results

Age structure of foreigners with the residence permit as well as all foreigners in the CR substantially differs from the age structure of the population of the CR, which can be explained mainly by economic reasons foreigners have for coming to the CR (to earn their living). Big are mainly age groups in junior productive age (20-39 years) – over 50% of foreigners belonged particularly to this age group. Very small shares in comparison with the structure of population of the CR can be found among children and those in the post-productive age (fig. 1).

A considerable change of conditions for the employment of foreigners was brought on by the European Union entrance on May 1, 2004 and a new employment act. This change was concerned with people who were employed in the Czech Republic. Before the EU entrance the foreigners except the citizens of Slovakia were allowed to be employed only on the condition of a working license and a residence permit presentation. After the EU accession the citizens of the members of the EU and the citizens of Norway, Liechtenstein, Iceland and Switzerland are not considered foreigners in the sense of the employment act by that way that they have a position equal to the citizens of the Czech Republic. The citizens of other countries may be employed only on the presentation of a working license and a residence permit, unless provided otherwise.

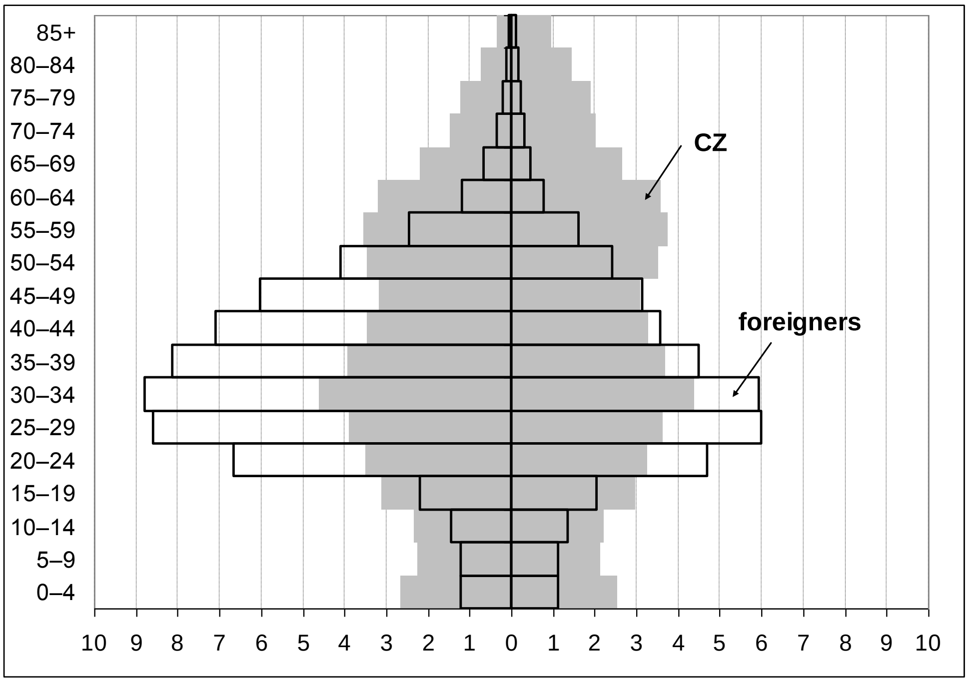

Figure 1: Age distribution of foreigners, 1st January, 2008; Sources: Foreigners in the Czech Republic 2009, CZSO

The most frequent purpose of residence of foreigners is employment, which is more registered form men (about 40% of men stated that the purpose of residence is employment); another important purpose of residence is family reunion, which is, on the contrary, much more frequently recorded for women (40% of women). Further, many foreigners state as a purpose of stay business activities (performed on the basis of a trade licence) or settlement (based on permanent residence permit).

The EU entrance had an impact on those with a trade license, too. Since May 1, 2004 there has been an updating of the trade law which in effect makes the conditions of the citizens of the Czech

Republic and of the EU member states equal in the area of entrepreneurship based on a trading license.

The foreigners who are economically active in the Czech Republic may be divided into two parts. The first part consists of those who are employees, officially referred to as foreigners filed at labour offices. The second part is made up by those with trade licenses. The data for the first group is collected by the Ministry of Labour and Social Affairs while the data for the second group is gathered by the Ministry of Industry and Trade.

The first group, regular employees outnumbered those with trade licenses for all the years since 1997, however, the ratio of these two groups has been changing. The highest ratio of employees was reached in 1998 - almost 72 %. From 1999 to 2004 the ratio of employees was about 62 %. One year after the EU entrance the share of employees increased up to 69 %. The share of foreigners with trade licenses is therefore 31 % (table 1).

The Czech Republic seems to be an attractive place for EU-15, A8 and third country nationals. The proportion of foreigners has grown in the last four years: from 2.4 % in 2003 to 4.2 % in 2008 (241 934 at the end of 2003 to 437 565at the end of 2008). Access to the Czech labour market is free for all EU-15 nationals since the day of accession. Meanwhile the country is also actively recruiting skilled workforce from outside the EU by the pilot project "Selection of Qualified Foreign Workers". So far the project is open for citizens of Croatia, Kazakhstan, Belarus, Moldova, Serbia, Monte Negro, Canada, Ukraine, Russian Federation, India, Macedonia and Bosnia and Herzegovina; graduates of the Czech universities coming from all countries (who graduated in 1995 or later); graduates of the Czech secondary schools from all countries, who finished their studies and passed the school leaving exam in 2000 or later. The pilot project has the objective of encouraging foreign professionals to come to the Czech Republic and stay in the country with their families. After two and half years of stay, the participants who have met all project conditions may apply for permanent residence in the Czech Republic.

Starting from July 1 2007, highly qualified workers category includes the pilot project participants with university level education who are working on the positions requiring university level education and corresponding to their qualification. Together with project participants, their family members will also be allowed to settle in the Czech Republic and to obtain permanent residence there. Applicants must be secondary school graduates. Applicants must find legal employment in the CR on their own and they must obtain at least 25 points in the computerized selection procedure reflecting various criteria as qualification, practice, language skills, family situation etc. Foreigners interested in the pilot project can search for job offers in the above offer in vacancies database for foreigners. Pilot project thus connects employers from the Czech Republic with qualified workers from abroad.

Workers from Germany and the United Kingdom are the most frequent ones from EU-15, while from among the Accession States, it is predominantly Slovaks (99 637, 2006 31 December), who come to work in the Czech Republic. This is all the more understandable, as there is practically no language barrier between Slovaks and Czechs and given the common history of the two countries, Slovaks are hardly ever considered by Czechs as foreigners. Almost one third of the foreign population living in the Czech Republic works in Prague or Central Bohemia. They take jobs both as skilled and unskilled workers.

The number of foreigners registered by labour offices (until October 2004 the offices registered exclusively persons with the status of the employed) was falling rapidly in the second half of 1990´s down to 93.5 thousand in 1999. After a temporary increase in 2000-2001 their number decreased again to 101.2 thousand in 2002; this development was influenced exclusively by the drop in number of working Slovak citizens. Since 2003, however, a slight increase in number of working employees is obvious; it totalled 108.0 thousand as at 31 December 2004. In 2005, there was a sharp increase in the number of foreigners registered at labour offices (including part of entrepreneurs) by 43.8 thousand and in 2006 by additional 33.3 thousand up to 185.1 thousand. Number of foreigners registered at labour offices increased to 284.5 thousand (table 1). Draft estimate for 2009 is without changes in despite of crises.

The number of foreigners with status of the employed depends on the situation in the labour market. Areas with low percentage of unemployment usually report higher number of foreigners with work permit granted or registered with employment offices (Praha and neighbouring districts of the Středočeský Region). A big increase in the number of working foreigners was recorded in Plzeň and in many districts of the Královéhradecký Region and the Pardubický Region last years.

Country	2002	2003	2004	2005	2006	2007	2008	Index 2008/2007
Total	101 179	105 738	107 984	151 736	185 075	240 242	284 551	1,18
EU 27, total	71 347	72 815	75 017	96 423	119 915	144 594	140 917	0,97
Slovakia	56 558	58 053	59 819	75 297	91 355	101 233	100 223	0,99
Poland	7 338	7 403	8 882	12 635	17 150	23 642	20 680	0,87
Germany	1 306	1 412	1 303	1 743	2 384	2 847	2 774	0,97
Other countries, total	29 832	32 923	32 967	55 313	65 160	95 648	143 634	1,50
Ukraine	19 958	22 489	22 399	40 060	46 156	61 592	81 072	1,32
Viet Nam	150	237	183	256	693	5 425	16 254	3,00
Mongolsko	1 185	1 388	1 585	1 800	2 815	6 897	12 990	1,88

Table 1: Foreigners registered at labour offices: by citizenship; 31 December; Sources: MPSV CR, SSZ

The growth recorded for the last two years and factored both in the group of the EU citizens and citizens of other countries are related to the legislative duty to register business associates and members of co-operatives at labour offices. In the end of 2006 of the total number of 185.1 thousand persons registered at labour offices over 5 thousand had status of associates (2.8%) and 13 thousand had status of co-operative members (7.0%).

The number of foreigners holding trade licence culminated in the late 1997 (next to 63 thousand persons) for the first time, rising almost 3.5 times compared to the end of 1994. The year 1998 saw a drop of almost one third on the previous year. This trend of the number of these working foreigners has been affected by the amendment to the Trade Licensing Act in 2000. This act making stricter the condition for obtaining long-term visa for the purpose of business, associated with the amendment, led to a relatively high drop in the number of these persons in 2002. From the following year, however, the number of entrepreneurs was increasing. In 2006, the number of foreigners-entrepreneurs, however, dropped little below 66 thousand. In the end of 2008 it reached its historically highest level (more than 77 thousand persons), (Table 2).

For the development of the economy not only material or financial resources are important, but also human resources. The outlook for the population development of the Czech Republic after 2010 is not optimistic, despite recent improvements in the natural development balance and its current slight surplus. Many policy makers believe that international migration can ensure population replacement in the long-term perspectives. How many net immigrants would the country likely need to eliminate changes to the Czech Republic's population size and age structure caused by expected negative natural growth? Despite the fact that age structure of net immigrants is composed of people in the age of economic activity migration is not solution to expected changes – population decline and ageing resulting in a decrease in the labour force.

Country	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**Index**
								2008/2007
Foreigners, total	60 532	62 293	65 219	67 246	65 722	68 785	77 158	1,12
EU 25, total	12 082	13 335	14 437	14 709	14 033	14 807	15 923	1,08
Slovakia	7 175	8 123	8 757	8 719	8 282	8 684	9 255	1,07
Poland	1 081	1 126	1 251	1 294	1 238	1 289	1 364	1,06
Germany	949	1 005	1 103	1 164	1 200	1 261	1 361	1,08
Other countries, total	48 450	48 958	50 782	52 537	51 689	53 978	61 235	1,13
Viet Nam	20 081	20 964	22 046	22 620	22 910	24 437	32 139	1,32
Ukraine	19 047	18 752	19 486	21 135	21 325	21 927	21 213	0,97
Russian Federation	1 667	1 622	1 611	1 482	1 279	1 228	1 262	1,03

Table 2: Foreigners holding valid trade license: by citizenship; 31 December; Sources: MPSV CR, SSZ

And who is the ideal immigrant? Someone, who finished his university education in their native country. But unfortunately we have no information about immigrant's education level.

Foreigners in the Czech Republic enjoy the same rights and duties in education as the Czech citizens do in the area of basic, secondary, higher professional and university education. He/she shall pay a fee for study under bachelor's, master's or doctoral programmes, if the university runs a study program in a foreign language.

Since academic year 2003/04 number of foreigners at Czech public and private universities has doubled. They take bachelor's and master's education programmes full-time and account 8.0% of all public and private university students. Foreign students make up 9% of all students first enrolled to public and private universities. Of the total number of university graduates, 6.3% are foreigners. The highest proportion of foreigners is enrolled for health services, medicine and pharmacy. Natural sciences and technology (which includes information scientist) is on the second place.

4. Czechs in Foreign Country

According to P. Adamek, given the Czech workers' unwillingness to migrate, estimates about the low mobility rates of the country are confirmed. There were 31 234 Czechs employed in the EU-25 Member States during 2005 (later data are not available), mostly in the United Kingdom (17 600), Ireland (5761), Italy (4217) and Germany (2010). While the conditions of accessing to the labour market in Ireland and Italy were completely opposite (free access in Ireland and work permit system with quotas in Italy), the two countries have a similar number of Czech workers. This shows that there was no direct correlation between the application of Transitional Arrangement and the choice of migrants.

5. Discussion

Residence requirements for naturalisation vary considerably from country to country within the European Union. Just to give you a sense of the outliers, the requirement can range from fifteen years in Austria to only four years in Ireland (Waldrauch, 2006).

In the Czech Republic, it takes only five years of permanent residence to get citizenship. But if you are an immigrant non-related to a permanent resident or a Czech national, it takes additional ten years to gain this permanent residence, which is a binding prerequisite for obtaining citizenship. Hence, in the Czech Republic, the hidden total of the stay requirement for this category of immigrants is fifteen rather than five years, although this will soon change.

It takes fifteen years to gain citizenship and become fully legally integrated. Fifteen years!

Despite the fact that age structure of net immigrants is composed of people in the age of economic activity migration is not solution to expected changes – population decline and ageing resulting in a decrease in the labour force.

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TRENDS IN UNEMPLOYMENT IN THE CZECH REPUBLIC AND REGIONS

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Keywords

Unemployment, registered rate of unemployment, general rate of unemployment, labor force survey, unemployment by regions

Abstract

Unemployment is one of main macroeconomic indicators. Rate of unemployment presents share of those individuals who want to work but cannot find a job. The article describes trends in unemployment in the Czech Republic since 90th till the middle of year 2010 with special attention to regional differences. Trends in regions reflect development in the entire Czech Republic. Differences among regions reached even 13 p.p. In the Czech Republic, northern regions have higher rate of unemployment compared to middle and southern region. The most affected regions are Ústecký, Moravskoslezský and Olomoucký; the less affected are City of Prague and Středočeský. Basic statistical calculation introduced in last chapter shows that searching for a clear and significant predictor is not successful – certainly education or economic performance measured by GDP are not suitable to explain variability and changes of dependent variable – unemployment rate on its own. There is complex of factors that influence labor market together and affects each other.

Supported by research project 2D06026 Reproduction of Human Capital financed by Ministry of Education, Youth and Sports within National program of research II.

1. Introduction

The unemployment as a macroeconomic phenomenon belongs to important and closely monitored indicators of each economy. Unemployment is formed on labor market while labor supply and demand interfere. Labor supply is composed of individuals seeking a job with. (Mach, 1998; Holman, 2001). Unemployment affects performance of each economy and is affected by economic performance, respectively. It is directly connected with social and consequently political stability (Buchtová, 2002).

Some level of unemployment is considered as unavoidable in any economy and certain degree of unemployment is perceived as normal or even healthy – it may indicate difference between supply and demand (from various reasons) and individuals who seek better job opportunity or companies seeking better employees. On labor market there is necessary to distinguish between voluntary and involuntary status of unemployed person. Official statistics should include only those individuals who want to work but cannot find a job. Besides them, there is group of people on labor market who do not seek a job, who are unemployed voluntarily.

Based on voluntariness and reasons, there are following types of unemployment (Jírová, 2002):

- Frictional unemployment – is attributed to individual's decision, is given by people's change of job, as a consequence of migration, for example. This type of unemployment is always present in economy even in state of full employment. Usually, it is a short-term event.
- Structural unemployment – is implication of different requirements corresponding with education structure, qualification, skills' set; it implies form mismatch between supply (i.e. unemployed individuals) and demand (i.e. required skills needed for available positions). It usually lasts longer than frictional unemployment. Structural unemployment could be influenced by active tools of employment policy, for example by retraining schemes.
- Cyclical unemployment – reflects economic business cycles and fluctuations – booms and recessions. Economic crisis is main reason why unemployment in 2009 and 2010 increased.

2. Measuring Unemployment

An indicator *unemployment rate* is calculated for measuring and monitoring of unemployment. There are two main methods of obtaining this indicator in the Czech Republic.

2.1. Registered Rate of Unemployment

Ministry of Labor and Social Affairs centralizes data from regional Bureaus of labor where are unemployed people registered and get jobseekers' allowance. *Registered rate of unemployment* is calculated monthly as number of available job seekers registered at labor bureaus over workforce.

Available job seekers are those individuals who are registered at labor bureaus and are able to start a new job immediately when there is any suitable job available (Beránková, 2004). Workforce is defined as total number of employed individuals including working foreigners; and total number of available registered job seekers. It is calculated based on moving average for last four quarters or last twelve months.

The methodology has changed in July 2004. Since that number of available registered job seekers is used in numerator whereas total number of all registered job seekers had been used prior to that. This method did not correspond with ILO and Eurostat recommendation. As the result, registered rate of unemployment jumped down by 0.7 p.p.

2.2. General Rate of Unemployment

Czech Statistical Office conducts periodical survey regarding labor force. Labor Force Survey is realized quarterly among 0.6 % permanently occupied flats and more that 50 thousand people aged 15+. It follows definitions and recommendations of ILO and Eurostat. (Methodological description of indicators of LFSS, 2010).

There are surveyed characteristics of economical activity and non-activity such as actual employment structure by gender, age, qualification, industry, type of work load, workforce mobility, unemployment structure by social status, professional and qualification structure, length of unemployment, etc. including special ad-hoc modules. Results are then recalculated for entire

Czech population according to population statistics and migration balance. Finally, they are presented as average values for given quarter.

2.3. Registered versus General Rate of Unemployment

Differences between these two indicators exist (Havlíček & Králíček, 2007) and are caused by both those individuals who are registered at labor bureaus obtaining benefits but not really seeking job and those who do seek job but are not registered. Some of people from the first group work in grey economy or are not interested in having job. Changes in registered rate are partially caused by changing calculation method and changing rules for a) being registered and b) obtaining unemployment allowance.

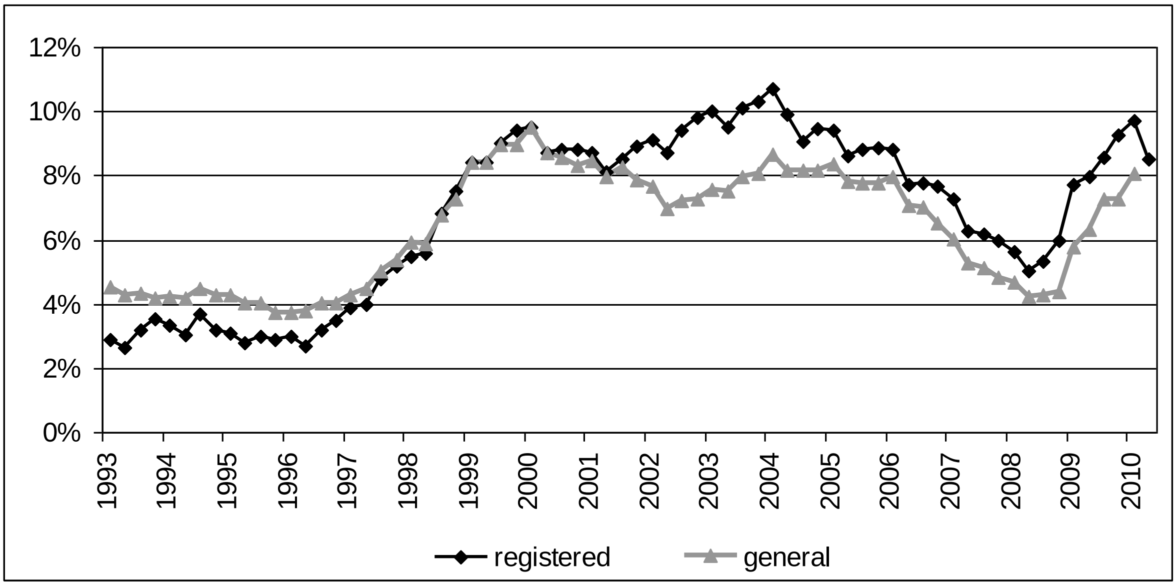

Figure 1: Trend in unemployment rate – registered versus general rate of unemployment (Czech Republic, Jan 1993 – Jun 2010), Source: Ministry of Labor and Social Affairs, Czech Statistical Office

3. Trend in Unemployment in the Czech Republic

The Czech Republic is small and open economy. Such as, global trends and business cycles overflow into the Czech Republic fast and with no barrier. For example, both economical boom and crisis appeared after when it had showed in large European economies like Germany. Simultaneously, the unemployment reacted soon. This effect is called ‘import of (un)employment’ or ‘(un)employment overflow’.

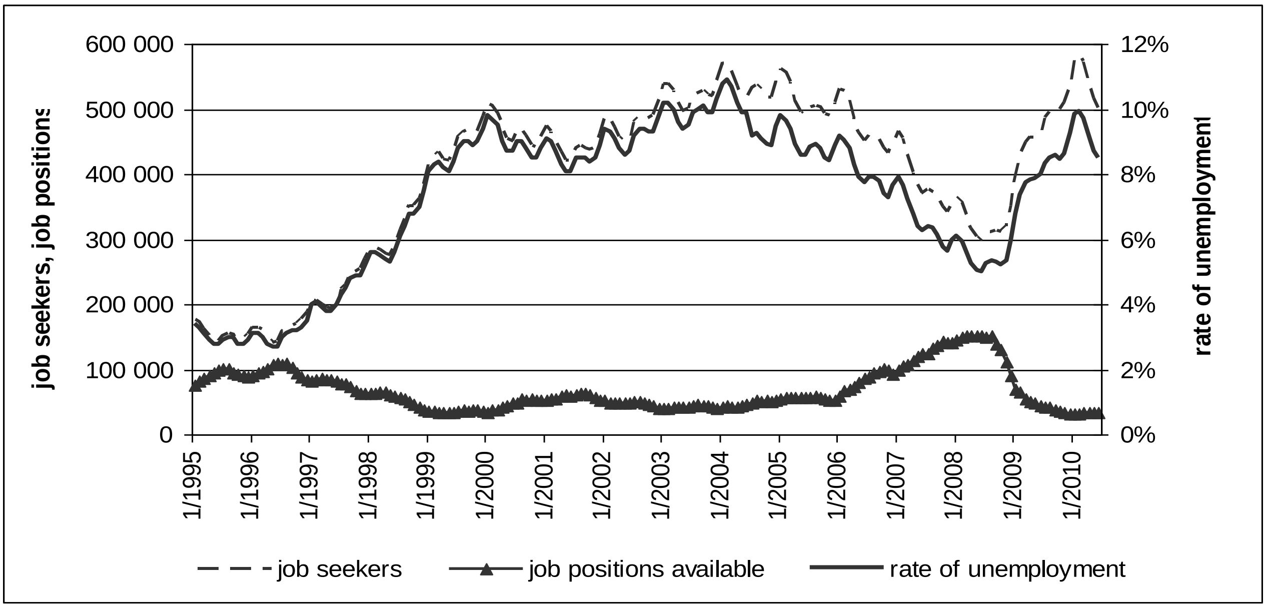

Figure 2: Trend in rate of unemployment, job seekers and job positions available in the Czech Republic (Jan 1995 – Jun 2010), Source: Ministry of Labor and Social Affairs

3.1. Trend in 1990 – 1996

Rate of unemployment remains almost constant at the level of 4 % with seasonal fluctuations. Newly established private sector absorbs employees of state companies, ownership of many businesses changes. In contradiction to other central European countries, industries in the Czech Republic continue in historical trends.

3.2. Trend in 1997 – 1999

Economical crisis culminates, GDP and investments decline and rate of unemployment grows to the level of 10 %. Necessary reorganization of economy (industries and companies) starts. From demographic view large groups of people born in 70’s (boom generation) come to labor market and intensify disproportion between labor supply and demand. Consequently, seniors often choose early retirement. Lack of job positions affects pension system which is since now under substantial pressure.

3.3. Trend in 2000 – 2004

Rate of unemployment oscillates between 8 % and 11 % with seasonal fluctuations. Restructuralization continues and restriction of agriculture and heavy industry deepens with negative impact in some regions together with inconvenient qualification structure. Newly, globalization emerges including globalization of unemployment when local labor market’s problems overflow to other countries.

3.4. Trend in 2004 – 2008

Czech Republic enters European Union (EU) in 2004. Therefore, method of calculation changes resulting into artificial decrease of unemployment rate by almost one percentage point. Further, rate of unemployment declines from 10 % to 5 % thanks to economic boom, European countries record high GDP growth rate, labor demand exceeds labor supply and average wages grow.

3.5. Trend in 2009 – 2010

Business cycle brings recession and crisis that affects world's economies and labor markets since the end of 2008. Rate of unemployment in the Czech Republic grows since November 2008 and number of job positions available declines very fast. Up to now, maximal unemployment in the Czech Republic was recorded at the end of February, 2010: 9.94 %.

4. Regional Differences

Regional labor markets differ in terms of structure of labor supply and demand. Regional diversity is caused by different industries and companies existing in region and their development potentiality, different structure of labor force (education, skills, experience, age and gender structure, expectation regarding wage), mobility and other features. Each region has its own history, economic, demographic, social and geographical conditions and micro-regions, which all together define attractiveness for both investors and labor force. Consequently, all these factors reflect into regional differences in competitiveness.

From economical point of view some regions were affected by massive reduction in agriculture, construction, mining and heavy industry particularly in 90's (regions Severočeský / Ústecký, Severomoravský / Moravskoslezský, Jihomoravský). In spite of various supporting programs and active employment policy' tools used, general differences among regions remain.

Region	1997	1998	1999	2000	2001	2002	2003	2004	2004*	2005	2006	2007	2008	2009
Praha	0,6%	1,5%	3,1%	3,6%	3,4%	3,6%	3,9%	4,3%	3,6%	3,4%	3,0%	2,5%	2,1%	3,0%
Středočeský	3,8%	5,1%	6,8%	7,1%	6,6%	6,8%	7,2%	7,4%	6,6%	6,3%	5,7%	4,6%	4,0%	5,8%
Jihočeský	3,0%	4,4%	6,2%	6,0%	5,4%	6,0%	6,4%	6,9%	6,1%	6,3%	6,0%	4,8%	4,0%	6,5%
Plzeňský	3,4%	5,0%	6,9%	6,9%	6,2%	6,6%	7,3%	7,5%	6,7%	6,4%	5,9%	4,9%	4,2%	7,0%
Karlovarský	3,5%	5,5%	8,0%	8,3%	7,9%	9,3%	10,2%	11,2%	10,2%	10,2%	9,5%	8,0%	6,9%	9,9%
Ústecký	8,5%	11,1%	14,6%	16,0%	15,6%	16,3%	17,4%	17,2%	15,9%	15,4%	14,5%	12,2%	9,9%	12,4%
Liberecký	4,0%	5,7%	7,7%	6,9%	6,6%	7,9%	9,2%	9,4%	8,4%	7,8%	7,4%	6,5%	6,0%	10,0%
Královéhradecký	3,2%	4,7%	6,9%	6,6%	5,7%	6,6%	7,4%	7,9%	7,1%	7,3%	6,6%	5,2%	4,2%	6,8%
Pardubický	4,0%	5,2%	8,0%	8,4%	7,6%	7,9%	8,7%	9,2%	8,3%	8,3%	7,3%	5,8%	5,0%	8,0%
Vysočina	4,9%	6,1%	8,4%	8,2%	6,8%	7,4%	8,5%	9,0%	8,3%	8,2%	7,4%	6,1%	5,2%	8,7%
Jihomoravský	4,2%	6,3%	8,9%	9,5%	9,1%	10,2%	11,1%	11,3%	10,3%	10,1%	9,2%	7,6%	6,2%	8,9%
Olomoucký	6,2%	8,4%	11,3%	12,0%	11,4%	11,6%	11,9%	12,2%	11,2%	11,0%	9,6%	7,4%	6,2%	10,2%
Zlínsky	3,9%	5,5%	8,0%	8,4%	8,1%	9,2%	10,3%	10,5%	9,4%	9,2%	8,4%	6,6%	5,5%	9,1%
Moravskoslezský	6,7%	9,3%	13,4%	15,1%	14,9%	15,2%	16,4%	16,9%	15,4%	14,7%	13,4%	11,0%	8,4%	11,1%
CZECH REPUBLIC	**4,3%**	**6,0%**	**8,5%**	**9,0%**	**8,5%**	**9,2%**	**9,9%**	**10,2%**	**9,2%**	**9,0%**	**8,1%**	**6,6%**	**5,4%**	**8,0%**

Table 1: Average annual unemployment rate in the Czech Republic and regions (NUTS 3, 1997 – 2009), Source: Ministry of Labor and Social Affairs, * new method of calculation

The most affected regions (NUTS 3) are Ústecký and Moravskoslezský, particularly districts (NUTS 4) Most, Teplice, Chomutov, Louny (Ústecký region), Karviná, Ostrava, Bruntál (Moravskoslezský region), Jeseník (Olomoucký region) and Hodonín, Znojmo (Jihomoravský region).

On the other end of this sequel are City of Prague, Středočeský and Jihočeský regions. All these regions were not affected by heavy industry reduction and they benefit from tourism. In the long-term the lowest unemployment rate is in districts Praha, Praha-východ, Praha-západ, Mladá Boleslav, Benešov, České Budějovice, Plzeň-město, Hradec Králové, Beroun, Pardubice and Plzeň-jih.

4.1. Trends in Regional Development

Overall trends observed in the Czech Republic are present in all regions as well. The highest levels of unemployment are reached by region Ústecký (previously Severočeský) and Moravskoslezský (previously Severomoravský); lowest levels have regions City of Prague, Středočeský and Jihočeský. The biggest difference appeared in 2003: 13.5 p.p.

Paradoxically, the general rule "The Rich North/The Poor South" does not hold here.

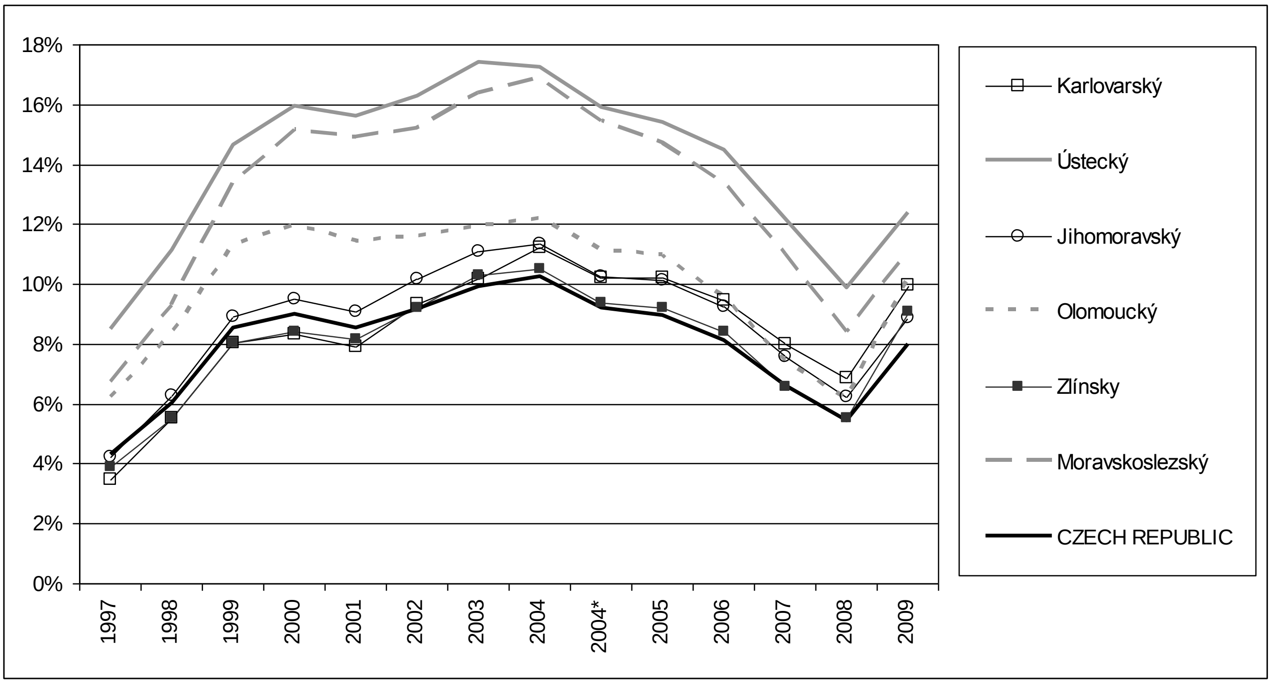

Figure 3: Average annual unemployment rate in the Czech Republic and regions above CR (1997 – 2009)

Source: Ministry of Labor and Social Affairs

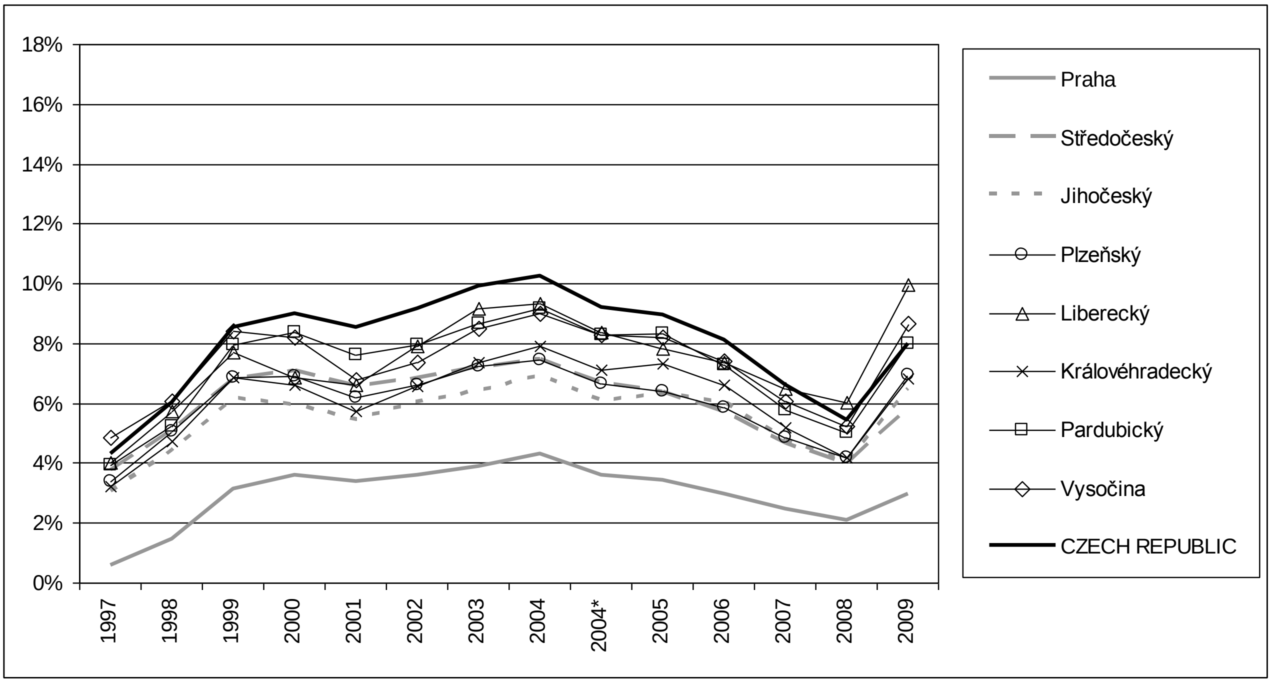

Figure 4: Average annual unemployment rate in the Czech Republic and regions below CR (1997 – 2009), Source: Ministry of Labor and Social Affairs

4.2. Unemployment and Education by Region

Statistical calculations introduced in chapters 4.2 and 4.3 do not include City of Prague as it has extraordinary attributes in education and GDP and interferes calculations as an outlier.

Relation between unemployment and education is presented further. In the figure there is indicator of unemployment (rate of unemployment relative to the level of the Czech Republic) versus percentage of highly educated people (bachelor or master degree) relative to the level of the Czech Republic. According to simple linear regression there exists only week relationship statistically insignificant (R^2 = 4.84 %).

Expected relation would be indirect proportion: the higher education the lower unemployment.

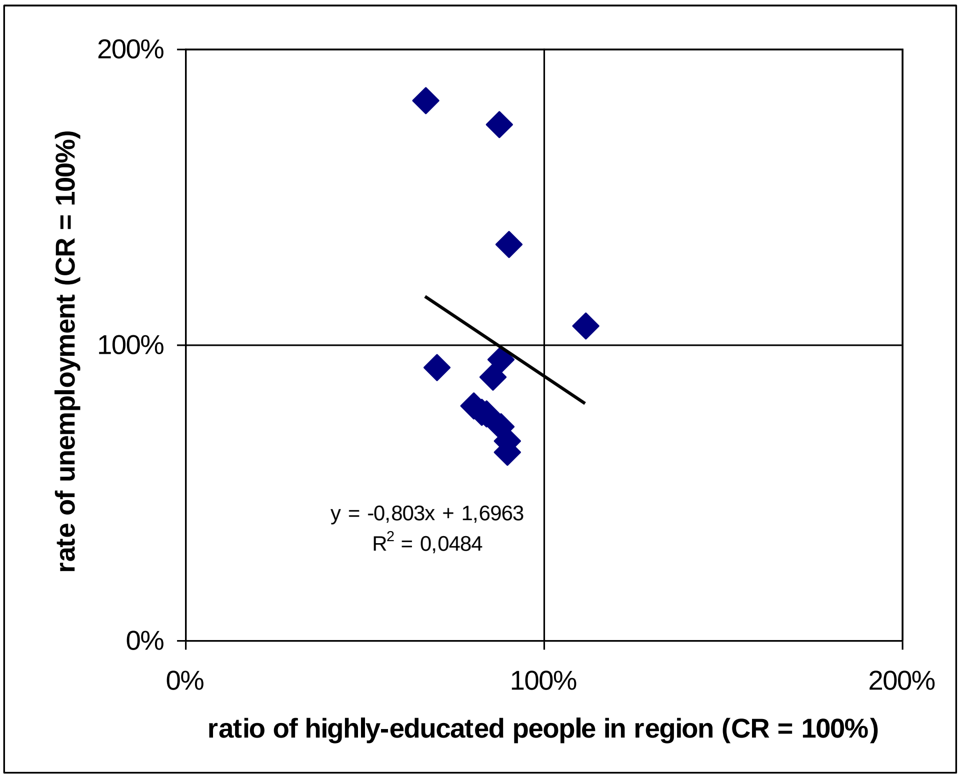

Figure 5: Average annual unemployment rate in the Czech Republic and regions below CR (1997 – 2009). Source: own calculation (education: Czech Statistical Office, Population Census 2001; rate of unemployment: Czech Statistical Office, average for 2001);*without City of Prague

4.3. Unemployment and GDP by Region

Relation between unemployment and GDP (i.e. economic performance) is presented by following figure. In the figure there is indicator of GDP per capita relative to the level of the Czech Republic. According to simple linear regression there exists only week relationship statistically insignificant (R^2 = 19.48 %).

Expected relation would be indirect proportion: the higher GDP the lower unemployment.

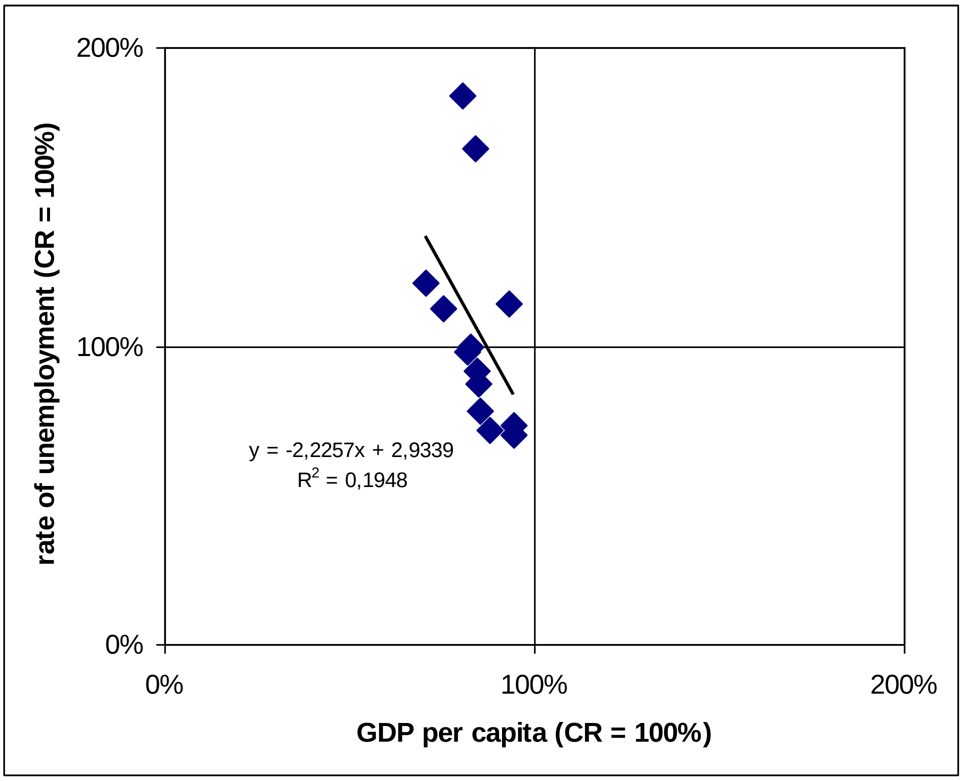

Figure 6: Average annual unemployment rate in the Czech Republic and regions below CR (1997 – 2009), Source: own calculation (GDP: Czech Statistical Office, Regional National Accounts 2007; rate of unemployment: Czech Statistical Office, average for 2007),* without City of Prague

From previous two figures it is seen that selected factors do not affect rate of unemployment directly on its own. Effects of selected indicators are very week. It is more probable that factors influence indicators of employment and unemployment together in a complex way.

5. Conclusion

Within presented description of trends and levels of unemployment rate in the Czech Republic it was seen that trend valid for entire country repeats similarly in all regions (NUTS 3) and order of regions remains almost the same for entire selected period (1997 – 2009).

However, differences in unemployment among regions exist and last since 90's. Some regions have higher level of unemployment rate in a long-term such as regions Ústecký, Moravskoslezský and Olomoucký; some regions have low level (City of Prague, Středočeský region).

Searching for a clear and significant predictor is not successful – certainly education or economic performance measured by GDP are not suitable to explain variability and changes of dependent variable – unemployment rate. There is complex of factors that influence labor market, both labor supply and demand together and affects each other.

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Competitiveness of Tertiary Sector

CZECH TERTIARY EDUCATION ON THE WAY TO COMPETITIVENESS

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Keywords

Tertiary education, human capital, competitiveness

Abstract

The Czech system of tertiary education (TE) needs some changes on its way to increasing its competitiveness. At the beginning of 2009, the project Tertiary Education Reform has been started. The aim of the paper is to show some analytical connections of the changes planned with the reform of tertiary education and to show an example how the results from surveys and analytical studies can help for the political economy of the reform.

This article has been written under the support of Internal Grant Agency of the University of Economics, Prague, project No. 28/2010 „Economic and Demographic Aspects of Tertiary Education".

In this article the result of EUROSTUDENT IV survey are quoted. This survey has been supported by the project No. CZ.1.07/4.2.00/06.0003 Tertiary Education Reform.

1. Introduction

There are some of the goals of the planned reform changes:

(i) When the Czech TE system is very social-selective on the one hand and has a very high individual internal rate of return on the other hand, the efficient system of student financial support system should be introduced.

(ii) The accreditation process is very complicated and centralized; the central accreditation authority/agency should accredit the institutions and the general areas of study realized at these institutions, not the partial field of study.

(iii) Several institutions of advanced vocational training (colleges) should be included into TE system.

(iv) The system of funding of the institutions should be changed.

(v) The tuition fees should be established: it could increase motivations of the institutions, motivations of students, introduce the price signals etc.

(vi) Changes in governance of TE institutions are more than necessary: for the competitive system the balancing of powers and responsibilities is essential.

How to persuade the stakeholders about the feasibility (or the necessity) of these changes? We can use two extensive surveys.

2. Data and Methodology

In the end of 2009 results from the European survey EUROSTUDENT IV have been published (Matějů, Fischer, 2009a). EUROSTUDENT is a project which collects data about student life a and social and economic conditions of students in selected European countries. In the third round of the project 23 countries participated, in the fourth round nearly 30 countries participated.

The Czech Republic has got first results of this survey, which can be used for managing reform of tertiary education and results are also important for future discussions about tuition fees. This survey includes 11,743 observations: 89 % from public and state HEIs and 11 % from private HEIs. The structure of the sample is following: 68 % students of bachelors study programmes and 32 % students of masters study programmes. The detailed data from the survey are used for our analysis.

We also use some results from the survey of the academic staff (Matějů, Fischer, 2009b). This survey has been realised at spring 2009 and 6,099 teachers participated at this survey.

The selected answers to questions related to the reform goals are analysed.

3. Results

This section includes selected results of EUROSTUDENT IV survey from 2009. The first important information is about income of Czech students. The figure 1 describes structure of income of Czech students. The main part of income of students of public Higher Education Institutions (HEIs) is paid by their parents. For students of private HEIs, the most important part is from their own salaries and wages. The other parts of income (out of income from parents and own salaries/wages) are marginal for both groups of students and their share on total income is not so significant. Contrary to modern trends in tertiary education systems in more developed countries, the current structure of income strengthens the role of parents and weakens the independence of students.

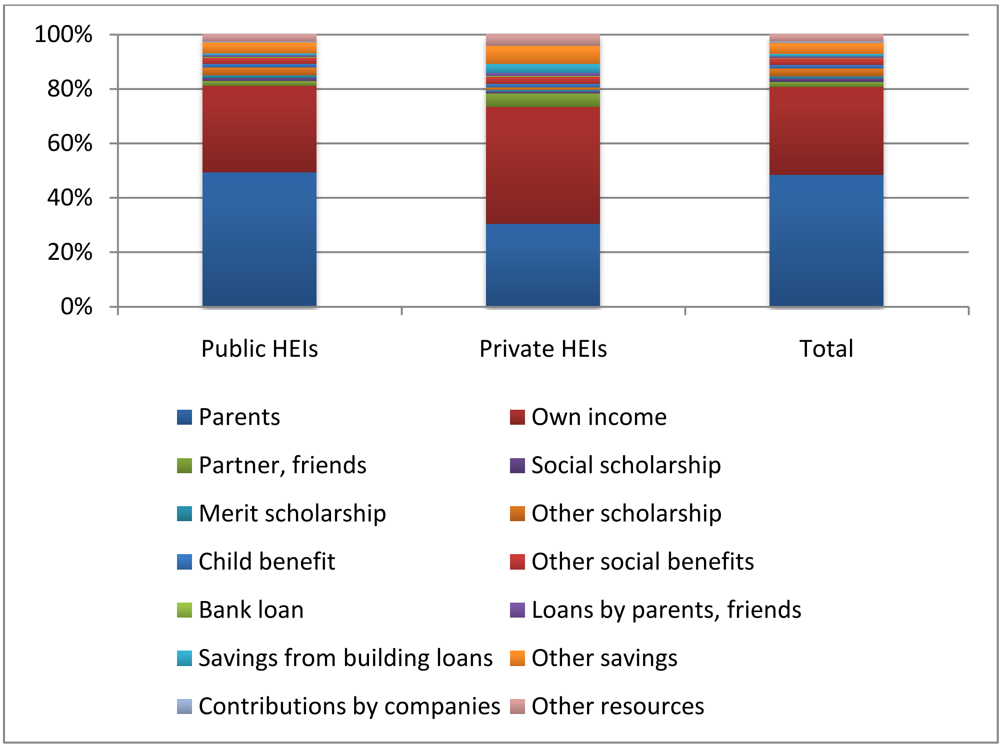

Figure 1: Structure of Income of Students, Source: EUROSTUDENT IV.

Student loans are not so common in terms of the Czech Republic. The results of EUROSTUDENT IV acknowledged it. The figure 2 describes how many Czech students has student bank loan or not. The results are very important for future discussion about implementation of tuition fees in the Czech Republic. We can also observe a resistance against getting any loan, despite the fact the rate of economic return to investments in human capital (bachelor or master degree) is very high in comparison with other EU countries.

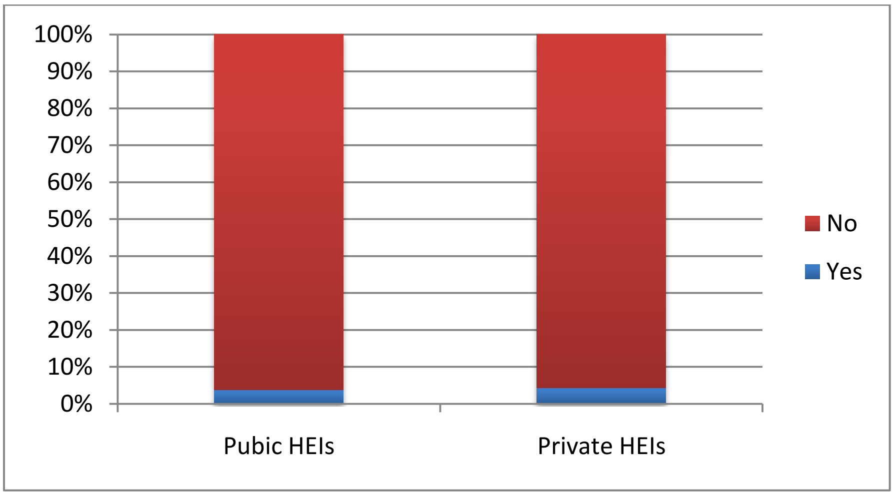

Figure 2: Answer to question “Do you have a Student Loan?”, Source: EUROSTUDENT IV.

For future discussion the willingness to pay tuition fees is very important. The EUROSTUDENT IV also recognized this possibility and the results are quite surprising. The deferred tuition fee (paid after the successful graduation and after achievement of given income threshold) is more acceptable than upfront tuition fees. The difference is significant. Almost one third of respondents accept payment of deferred tuition fees, what is a very surprising partial result of this survey.

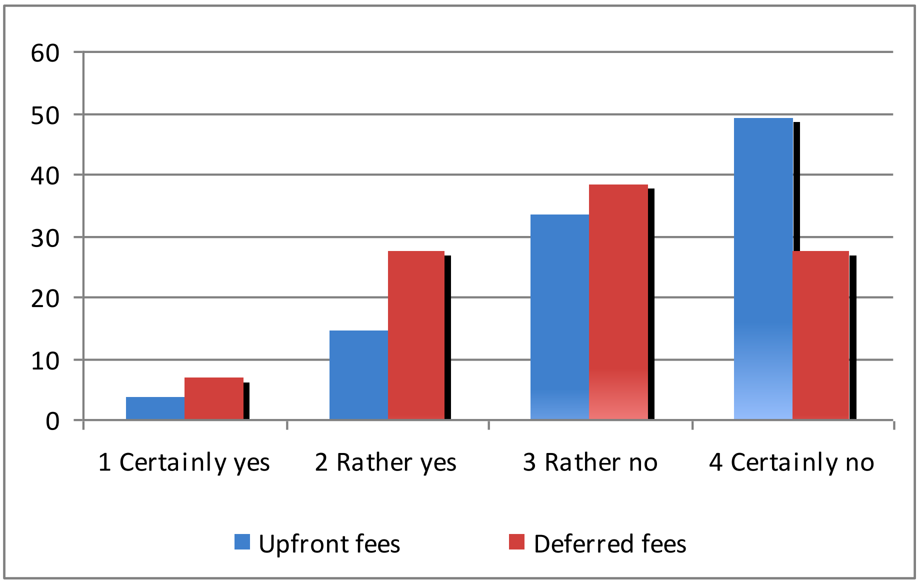

Figure 3: Answer to question "Would you agree with implementation of tuition fees – deferred or upfront?, Source: EUROSTUDENT IV.

For the discussion about tuition fees, we can use not only the data about willingness of pay by students – the questions about motivation of students, teachers and universities after tuition fees implementation on one hand and the empirical analysis about social selectivity and individual rates on return on the other hand are also very important for political economy of the reform.

From the point of view of motivation, there are at least three sources of motivation. Paying the tuition fee, the student will be motivated for successful graduation of his study, for responsible choosing of a study program. Teachers will be under the pressure from more motivated student who will ask for the quality of his study. Universities which could get additional income from deferred fee will be motivated for strengthening the position of graduates on the labour market (the income will be dependent of the graduates income).

This motivation is confirmed by both the surveys cited above:

47 % of respondents of academic staff survey (ASS) consider zero tuition fees as an obstacle for development of tertiary education system,

65 % of respondents of ASS think that tuition fees will increase the level of performance of student duties,

54 % of respondents of ASS think that tuition fees will increase the responsibility of teachers,

57 % of respondents of ASS think that tuition fees will increase the quality of tertiary education,

70 % of respondents of ASS support implementation of at least one form of tuition fees (52 % upfront fees, 57 % deferred fees),

70 % of respondents of students survey (SS) think that upfront fees will increase the level of performance of student duties, while 55 % of respondents think this in relation to deferred fees.

Many people (especially from the left-hand side of the political spectrum) say that the tuition fee will increase the social tension and also say the education should be at a zero price for students. If we use data, we would make another conclusion: there is empirical evidence that the internal rate of return from the investment in tertiary education in the Czech Republic is one of the highest among the OECD countries (see Figure 5). On the other hand, the social selectivity at an accession to the tertiary education is also one of the highest among other countries (see Figure 4). We can conclude that without tuition fees the poor pay the education to the rich and they get even richer. Is it social?

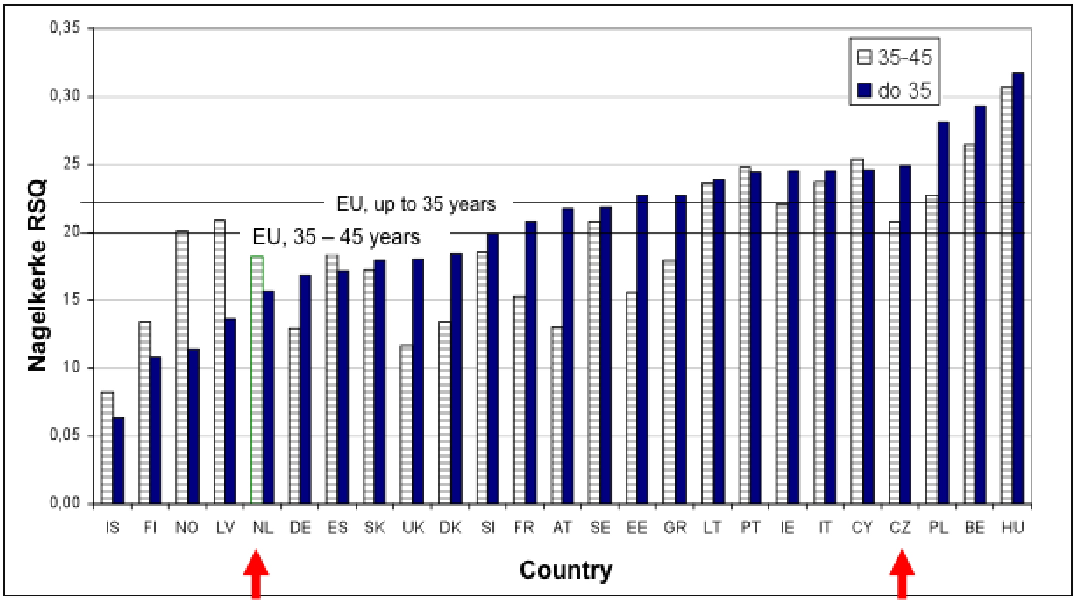

Figure 4: Determination of the tertiary education achievement by the education of father, mother and social group of father in the EU countries, Source: Matějů, P. et al. (2009b)

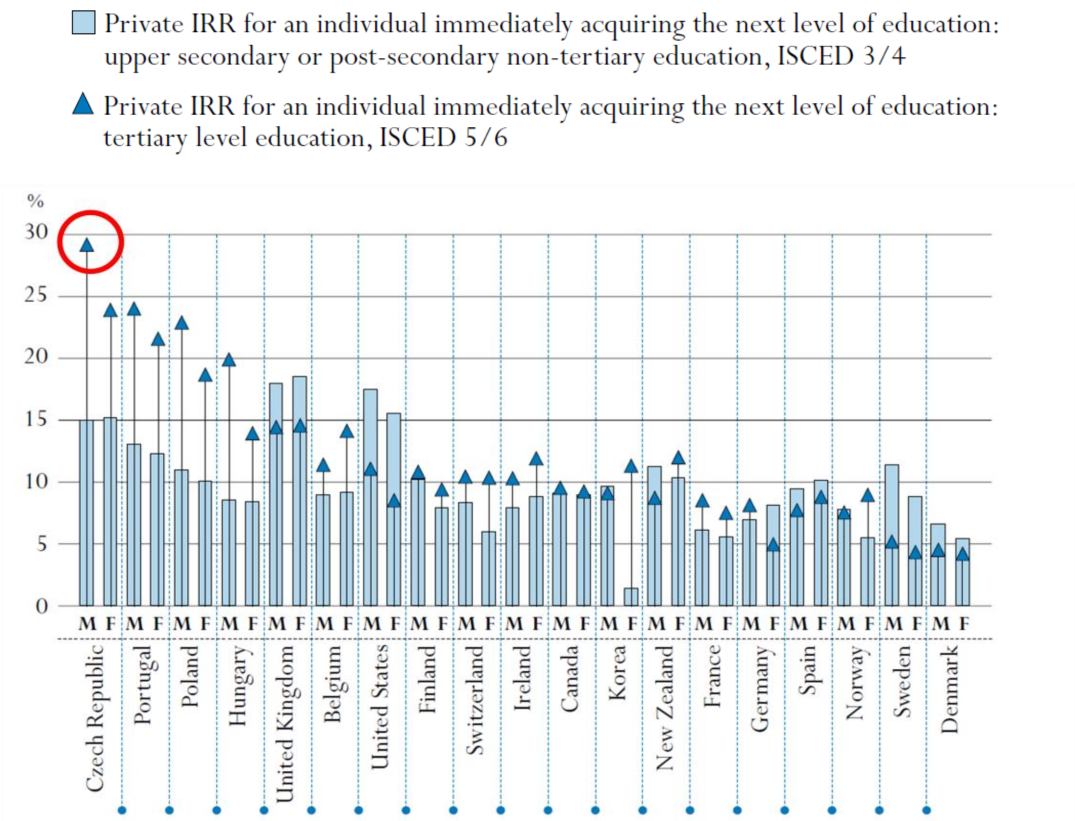

Figure 5: Private internal rates of return (IRR) for an individual obtaining upper secondary or post-secondary non-tertiary education, ISCED 3/4 and for an individual obtaining a university-level degree, ISCED 5/6 (2004), Source: OECD (2008)

4. Other issues

There are several questions to be answered concerning the Czech tertiary education and its competitiveness, not just questions linked to tuition fees and social conditions of student life. The most important thing is financial reform of the whole tertiary education, which should be based on qualitative indicators more than nowadays. The First steps have been realized in 2010 by incorporation of qualitative indicator, but its importance is still very marginal.

Hand by hand a system of financial help to students (including social and other types of scholarships) should be proposed. All these steps could lead to system of student loans with guarantee of state and lower than commercial interest rate.

5. Conclusion

The main goals of the tertiary education reform have been presented. There is obvious that empirical evidence is necessary for a successful political economy of the reform. There is an example how the data from surveys could help setting the reform changes and understanding these changes by both internal and external stakeholders.

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WHAT MEANS COMPETITIVENESS OF TERTIARY SECTOR IN REGIONS?

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Keywords

Regions, tertiary education, GDP, unemployment

Abstract

The aim of the paper is to describe differences between regions in the Czech Republic from the educational point of view. These regional differences in education level may cause divergence between regions in other spheres. It is known that lower education level of society causes lower productivity, higher rate of unemployment etc. But the basic question is, if these regions do or are trying to do some active steps to reach higher level of education.

This paper is prepared under the support of the project No. 2D06026 „Reproduction of Human Capital“ by the National Research Program II of the Ministry of Education, Youth and Sports of the Czech Republic.

1. Introduction

It is generally known the investment in human capital is one of the most profitable among other investment opportunities. Persons with a higher level of human capital have higher labor productivity and draw higher wages. They also have a lower risk of unemployment, higher quality and length of life and so on.

Nowadays, human capital is measured mainly by the number of years spent in the educational process. Almost all the people reach secondary level of education in most developed countries. According to this fact, it is also possible to measure the level of individual human capital by the entrance to tertiary education.

As we can assess the investment in the human capital at an individual, it is also possible to assess the societal profitability of this investment. How to measure it? One of the possibilities is to measure the structure of the population by the attained education level. The second one is to estimate the average length of education in population.

Is there any advantage for the Czech regions from the higher education level? Is there any difference between regions? Is the difference changing in time? Is there any relation with other social and economic indicators?

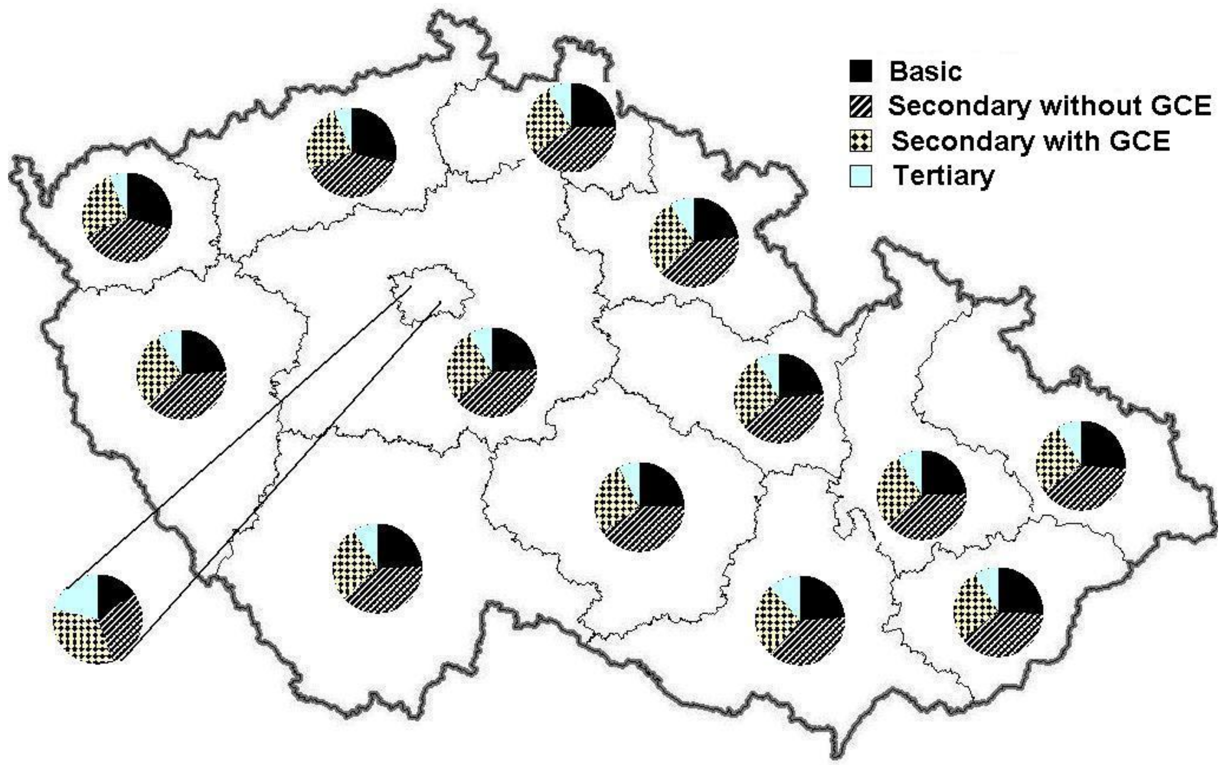

Figure 1: Education structure in Czech regions (NUTS 3), population 15+, 2001, Source: Czech Statistic Office, Census 2001

2. Education Level by Regions and a Level of GDP

There is some difference in educational structure between regions (see figure 1). Three regions are most different: Karlovarsky and Ustecky regions on the other side, where the educational structure is much worse than in the rest of the country (high share of people with a low education level and low share of people with a high level), and region Praha, where the share of people with tertiary level is very high.

Comparing the education level and the level of regionalized gross domestic product (RGDP), we can see the strong correlation (see figure 2). Regions with higher level of education have higher level of RGDP. RGDP is an estimate of GDP for regions. There are several methods, how to estimate the region amount of product, here we used combination of bottom up and top down methods, for more see Chlad, 2007.

The differences of time period between education level (1991 – 2001) and RGDP (1995 – 2005) is caused by very poor data sources. The sources for education level are from Censuses only, and the last census was in 2001 and before in 1991. There is no other reliable source for education level estimation. We cannot estimate RGDP for a period before 1995, because there is too low quality of regional data and on macro-economic statistics as well. So both periods are 10 years length and we assume that there is some lag in product change after the education level increase.

A hypothetical increase of the average length of education of 1 year could lead (ceteris paribus) to an increase in GDP of 150 %. By continuation of current increase of the education level, it could be reached in about 20 years, what means the impact on the year-on-year growth in GDP of 4.7

percent points. The different increase in education level in regions could lead to deepening of regional disparities from the point of view of economic growth.

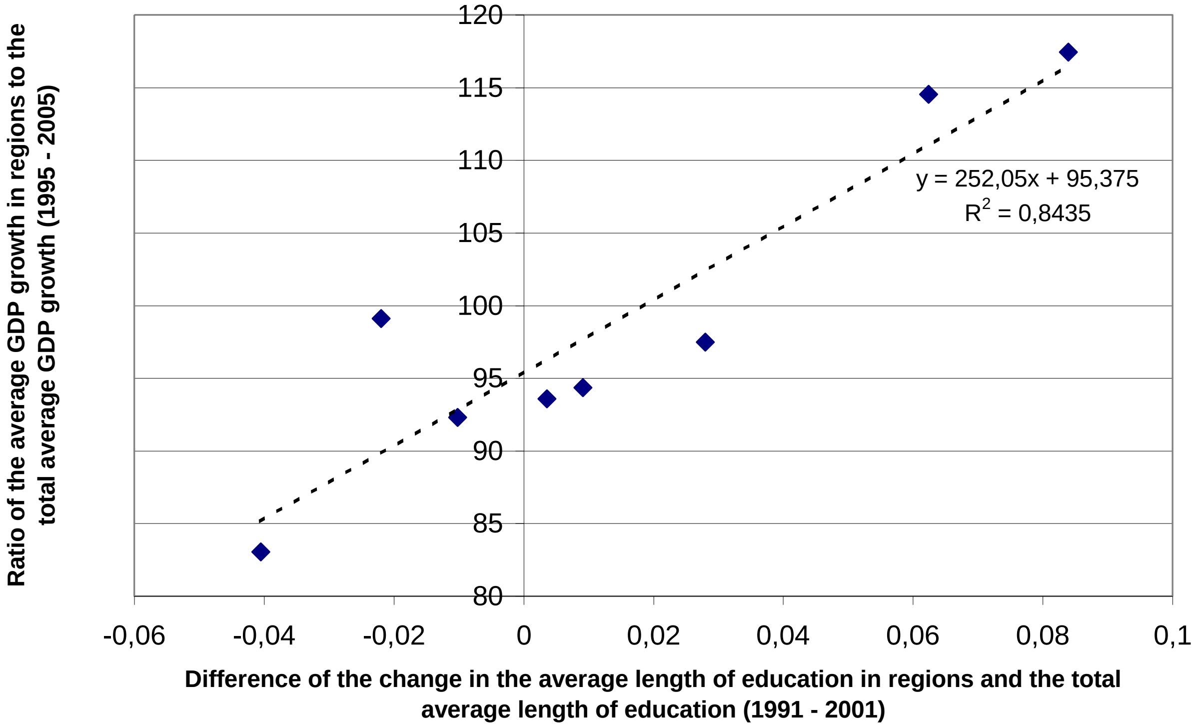

Figure 2: Relationship between RGDP and the education level Source: Czech Statistical Office, calculation of authors

3. Education Level by Regions and an Unemployment Rate

We can assume the similar conclusion when we compare regions from the point of view of unemployment, we can see a negative correlation between education and unemployment rate (see figure 3). Regions with higher education level thus have lower unemployment rate.

Higher level of education means that people spent longer time in education system and they are better prepared for labour market changes and they are more flexible and complex if they want to change their job.

On the other hand, better educated people are very attractive for employers and they can remove their factories to the regions with a better educational structure.

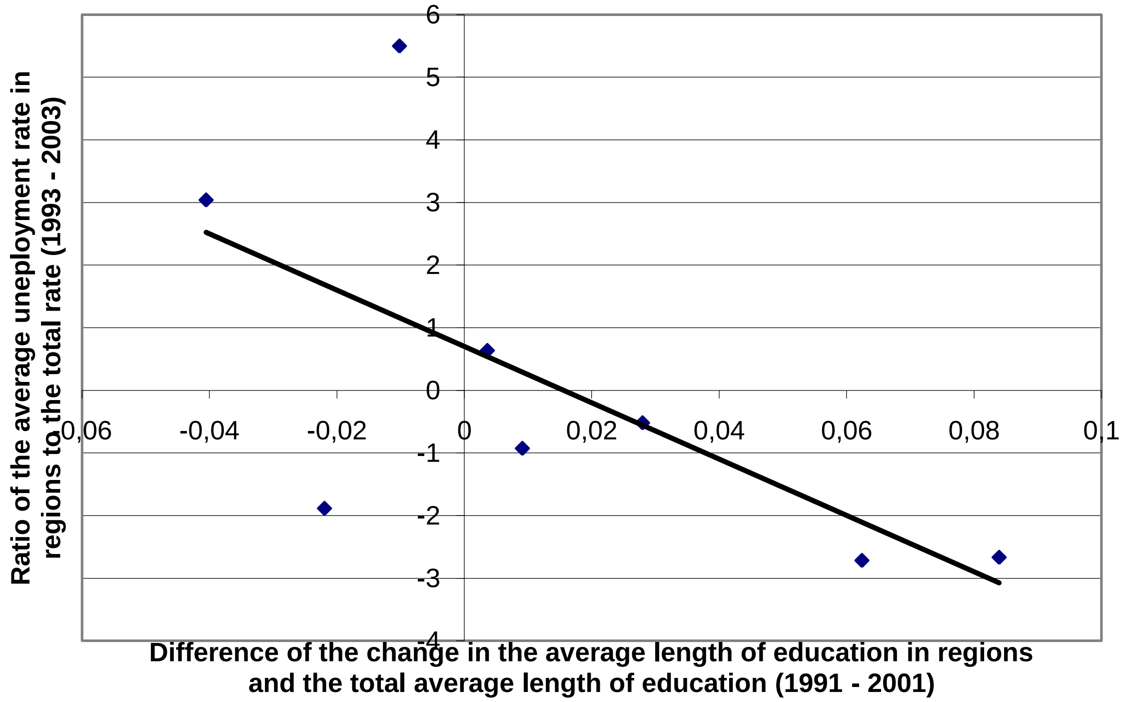

Figure 3: Relationship between unemployment rate and the education level in regions, Source: Czech Statistical Office, calculation of authors

4. Enrolments in Tertiary Education by Regions

The main question is if the regions with the worse level of education can converge to the average. We can analyze the structure of new enrolled in tertiary education by the regions.

We can compare the number of secondary education graduates who are enrolled in tertiary education institution to the population. Regions with worse educational structure are also different. Their participation in tertiary education, measured by ratio of new enrolled, is about at a half in comparison with regions with the best educational structure (see figure 4).

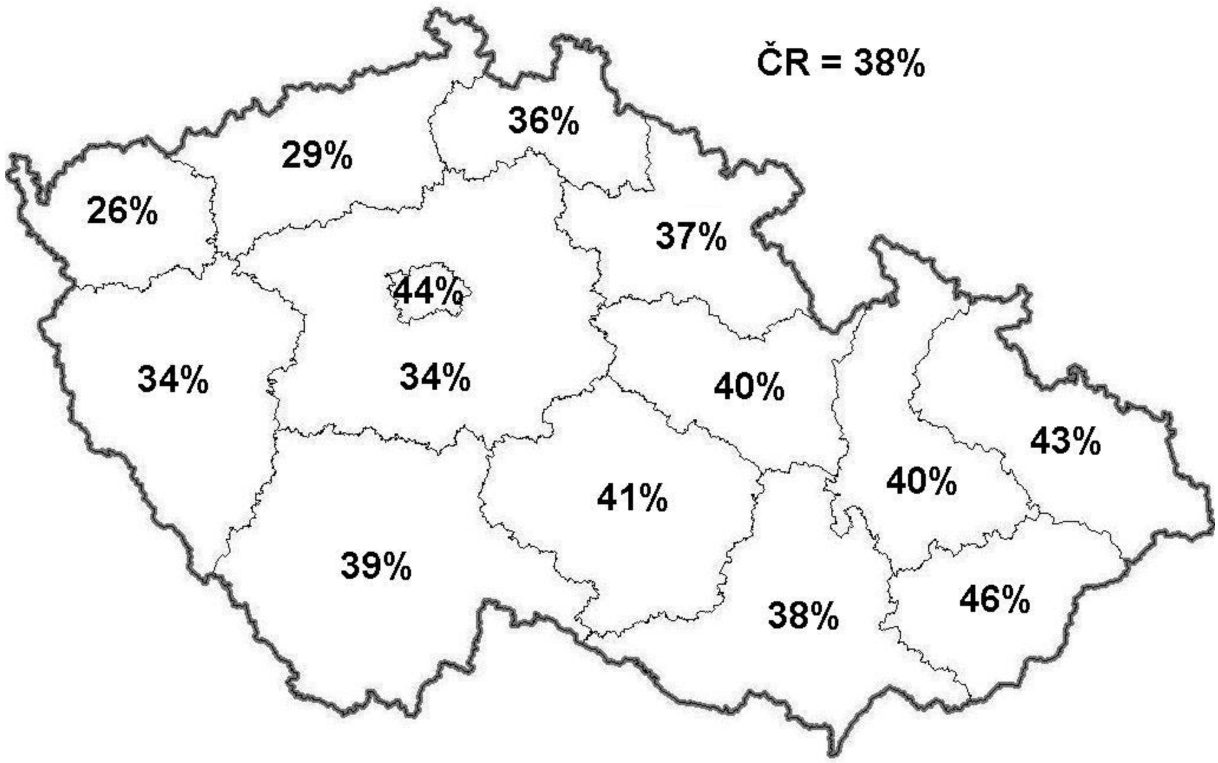

Figure 4: Ratio of new enrollments to total population in regions, 2009 Source: Institute for information on education (ÚIV).

5. Conclusion

We can conclude that the level of education is different between regions in the Czech Republic. In spite of the fact the education level influences other indicators such as unemployment rate or GDP, the differences in level of education will increase.

This hypothesis should be right and we can see that at this time, when there is some economic recession in the Czech Republic, the regions with lower education level have more complicated situation in comparison with regions where average education level is higher (especially we can see higher unemployment rate).

These facts should make signals for policy makers: education is one of the most important investments, investment in the future. From the regional point of view, we can see big differences between regions. The region politicians should think how to supply education for more people, not only at the highest level, the tertiary education, but throughout all the levels in the education system.

The solution of this problem could be in more extensive general education at the secondary level and the development of professional oriented degree at the next level. One way could be professional oriented bachelors programs realized on the universities and the other way, especially for the regions without universities or with small universities, could be in the colleges.

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DYNAMIC MODELS OF MANAGEMENT OF PEDAGOGICAL SYSTEMS

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Keywords

Pedagogic cybernetics, management, dynamic models, pedagogical systems

Abstract

This article discusses issues related to modeling teaching governance systems. In particular, it examines one of the classes of models – a model of double effect. Ultimately, scientific reasoning applies to the class of n-productive models. The research was based on the approaches of pedagogical cybernetics.

1. Dynamic Models of Management of Pedagogical Systems

This article deals with the sphere of pedagogic cybernetics and is dedicated to the modeling of managerial processes of pedagogical systems. We shall consider one of the classes of models in particular - a model of double result, and as a result, we shall spread our reasoning on the class of *n*-productive models.

Then we'll concentrate on the objects of education which, as a rule, carry out some interconnected social functions. They include an educational and upbringing activity, scientific work, professional training of the staff of the highest category - teachers and doctors of sciences in particular, by means of the system of doctoral studies, as well as other kinds of activity. All the above-mentioned functions can be classified as productive from the point of view of the common nature of social and economic processes.

When designing the double-product models in this article, we shall use the elements of a system-cybernetic approach to the management of educational objects, systems and processes, the foundation of which we have formulated in the monograph (Jablochnikov, 2009).

First we shall define the basic function of the object of modeling. Next we shall consider this function as productive and formalize it with the use of a special mathematical device. For a higher educational institution, such a function is an output of scientific and teaching production, as well as granting of the educational services. Thus, we shall consider the end result of the work of such a pedagogical system as a certain common product, which has two basic components.

We suggest that the main productive process in the given field of realization of our scientific research at all the levels of educational hierarchy, should be divided into two interconnected subprocesses: a production of means of the further output of educational and scientific production (the first group), and also a production of consumer products, used by the labour market and the society as a whole (the second group).

Such a production approach to the analysis of the phenomena and laws in the field of education, in our opinion is justified enough and effective, though we can predict the elements of criticism on the part of colleagues and even possible accusations of technocratic approaches. However, today's realities show, that education obtains features of a productive field of activity and even usual business more and more.

Next it is necessary to explain, what exactly, in our opinion, should be related to the above-listed components of pedagogical “production” process.

First, we consider it necessary to speak about the results of the realization of productive subprocesses, which together adequately reflect the global purpose of their organization as well as their mission. However, each of them characterizes an achievement of some local purposes and relates to the first or second group accordingly. After that, having classified the above-marked results, we can divide the subprocesses themselves in accordance with the similar traits and features.

First of all, it is necessary to attach the main product of pedagogical sphere – graduates of higher educational institutions, or their education, to be exact – to the group, which deals with the production of the consumer products. These products “are actively consumed” by the General European labour market and by the society as a whole.

Besides, the term “products of consumption” - not only of a labour market, but also of other social and economic spheres including the education itself, - may also refer to the so-called “intermediate products of consumption” (from the industrial point of view – “semifinished items”) which can get the status of “raw material” for different kinds of educational institutions in future, namely: graduates of various courses, including preparatory courses for entrants, students of institutes of improvement of professional skills and a training for a new profession, business schools, various trainings, etc.).

Second, in our opinion, all the collateral educational, scientific, industrial and other production, which is developed, planed and produced by educational institutions, as a result of realization of research-and-production activity (theoretical and practical results of scientific researches, modern developments, inventions, devices, systems, scientific and industrial services, etc.), should also be included in this group, but with a reserve, that further it will not be directly used in the sphere of education.

To the group, which we have preliminarily named as the output of means of production in the field of education, it is reasonable also to attach the products of activity of higher educational institutions, which provide their perspective development, evolutionary processes, efficient functioning support and stimulation of processes of self-development.

Such in particular are:

- Experts of the top skills (teachers, senior lecturers, doctors of sciences, professors) which have got this status due to realization of processes of preparation of the teaching-staff in higher educational establishments (postgraduate study, doctoral studies, etc.);
- New principles, technologies and means of training (a technique, curriculums including computer, simulators, classical and multimedia manuals, methodical developments, both the virtual and the real educational enterprises and complexes, etc.), designing and creation of which is realized owing to functioning of establishments of education;

- Other production, which has been made as a result of functioning of objects of an industrial and educational-scientific infrastructure;
- New educational and production objects, the structural and independent divisions, created at realization of the program of development of the supreme university, etc.

Development, designing and introduction of up-to-date systems of control of the quality in higher educational institutions, by means of the efforts of their personnel, can also be classified as an output of means of production in the field of education.

In our opinion, the division of productions of universities into two big groups according to the results of their realization of the primary activity is rather a convenient method from the point of view of the further formalization, carrying out of the analysis and efficient control.

It is rather difficult in practice, unequivocally to divide the real subprocesses according to such features, as each of them can be a source of creation of products of the first sort as well as the second one. In this, the philosophical essence of the unity of the whole and the individuality of its separate parts is shown.

In particular, productive activity of a separate teacher of a higher educational establishment or structural division (faculty, educational-scientific laboratory) can be a source of creation of both, products of the second sort - means of consumption (preparation of experts as a result of realization of educational activity and manufacturing of various scientific production), and products of the first sort - means of production in the field of education (work with competitors for the doctoral degree, as well as the development of educational and methodical manuals, textbooks, simulators, methods, means, technologies, devices for an intensification and modernizations of training, etc.).

It is rather hard to separate these two subprocesses, by virtue of the common intellectual nature of the teacher's activity within the framework of his work in a higher educational institution. It is difficult to do in time coordinates as well as in spatial. New ideas on creation of scientific production can arise in the intellectual surroundings of the teacher: during his immediate work in a scientific laboratory and be the result of his communication with students in an educational audience. Besides, the preparation of the modern qualitative expert without fail means to foresee his participation in a scientific activity under the direction of teachers of the top skills.

There can be quite a lawful question: "Why the given processes should be divided into two separate classes?" The answer to it is quite simple: "Two different classes of productions determine realization of different algorithms of positive development of pedagogical systems and processes, which we introduced in the monograph, due to the management of their "training" (accumulation of pedagogical experience) and effective influence and stimulation of self-development ("self-training")."

The double-product models that we suggest to be used are dynamic. Thus, sometimes teaching processes undergo evolutionary changes, and functions reflecting them, become nonlinear.

The essence of such a "nonlinear" evolution (in synergetic terminology – bifurcation) is that at a certain moment of time t_p there appear essentially new opportunities for the use of modern and powerful, from the point of view of efficiency of use, pedagogical, educational, scientific, industrial, organizational, economic means and tools in educational, scientific and other processes.

Readout of time in such a productive model $(t = 0)$ starts at the moment when the oldest "productive" capacity of an educational institution, one of those, which are used at the beginning of a period $T = (t, t'')$ and which are analyzed at modeling (a building is constructed the building or the educational block, the equipment is bought and put into operation), has been put into operation,.

According to the indexes of parameters of end-products of production processes, we shall define the quality of their realization or the efficiency of their management. Besides, we also need to define the characteristics (parameters) of productive subprocesses for the first and the second groups, on which it is necessary to concentrate our attention, concerning the formation of purposeful influence. Actually, we should understand unequivocally, what exactly needs to be changed (a result or a quality of the result) and also what it is necessary to influence for obtaining positive changes (parameters of management).

Classical setting of a double-product task in economic sphere, concerns the optimization of processes of creation of new workplaces. In this case such an approach is inefficient, as, in our opinion, a qualitative development in pedagogical field should be carried out not due to the increase in the number of employees, but through the modernization of pedagogical technologies of realization of educational and upbringing processes, as well as an optimization of administrative influence on scientific, educational and industrial activity of universities.

Later on, applying such an approach, we shall consider an educational system, which will consist of two subsystems. One of these subsystems, with the help of the products of the first sort, that have been created before, creates new products of the first sort (pedagogical, methodical, scientific, information, management technologies, tools, means, prepares the scientific and pedagogical staff of the top skills, creates new organizational structures, etc.). The result of functioning of the other subsystem are products of the second sort (it trains experts of the certain qualification and quality, as well as scientific, industrial and information production for other spheres of a socioeconomic life), using, thus, also products of the first sort.

Let $v_1\ (t)$ and $v_2\ (t)$ – be the instant speeds of the change in the amount of new products consequently in both subsystems, then

$$W_1(t) = \int_0^t \chi(\tau, t)\, v_1(\tau)\, d\tau \quad (1)$$

and

$$W_2(t) = \int_0^t \gamma(\tau, t)\, v_2(\tau)\, d\tau \quad (2)$$

W_1 and W_2 - volumes of products of the first sort, which are used accordingly in these subsystems, but χ and γ - factors of intensity of the instant use of products of the first sort, which are created at the initial moment of time τ, t_0 - the beginning of modeling.

Let's consider that during the whole period of time, which is under consideration, a continuous or a spasmodic updating of the various technologies, which essentially influence processes of creation of functioning products of university of both the first, and the second sort, is fulfilled.

Meanwhile, we shall use specific relative speeds as the basic parameters of efficiency:

$\rho\ (\tau, t)$ - speed of creation of products of the first sort at the moment t at the rate of a unit of these products, during the time τ which are actively used in the first subsystem,

$\beta\ (\tau, t)$ - speed of creation of products of the second sort at the moment t at the rate of a unit of products of the first sort during the time τ which function in the second subsystem.

Functions v_1 *(t)*, v_2 *(t)*, χ and γ are positive, that is why it is possible to push forward a hypothesis, that

$$v_1 = z\,v,\; v_2 = (1-z)\,v \tag{3}$$

where $v = v_1 + v_2$,

Thus z - is a distributive function, which accepts values in a range $0 \le z \le 1$.

Our double-product dynamic model of production processes of university for $t > t_0$ in view of the above-mentioned equations and restrictions, assumes the following air:

$$\begin{cases} v(t) = \int_0^t \rho(\tau,t)\,\chi(\tau,t) v_1(\tau)\,d\tau, \quad t > t_0 > 0, \quad 0 \le \chi(\tau,t) \le 1 \\ B(t) = \int_0^t \beta(\tau,t)\gamma(\tau,t) v_2(\tau)\,d\tau, \quad t > t_0 > 0, \quad 0 \le \gamma(\tau,t) \le 1 \\ A(t) = \int_0^t [\chi(\tau,t) v_1(\tau) + \gamma(\tau,t) v_2(\tau)]\,d\tau, \\ \mathrm{v}\,(\mathrm{t}) = \mathrm{v}_1(\tau) + \mathrm{v}_2\,(\tau), \\ W(t) = \int_0^t v(\tau)\,d\tau \end{cases} \tag{4}$$

where *W (t)* – is an instant total amount of products of the first sort, which are actively used in both subsystems.

As a whole, the system has the certain prehistory on a time interval $[0, t_0]$.

Thus, the first equation of the system (4) represents processes of restoration of the basic products of the first sort, which provide for an internal function of an object (maintenance of the normal activity and the constant development). The second equation of the system (4) reflects the creation of products of the second sort, which provide for an external function of the object (release of basic production and interaction with the environment).

The last three equations of system (4) are “balance”, the essence of which consists in distribution of means of realization of productions of an educational institution between the given subsystems.

Besides, it is possible to generate one more equation, generalizing in the system (4) the last two equations, namely:

$$\varPi(t) = \int_0^t [v(\tau) - \chi\, v_1(\tau,t)\, v_1(\tau) - \gamma(\tau,t)\, v_2(\tau)]\,d\tau = W(t) - A(t), \tag{5}$$

where *Π (t)* –is an industrial "potential" (stock) of the system which is not used for the present, but can be used in the future.

Some variants of realization of the mathematical model, which has been introduced, are possible under certain conditions:

1. When factors of intensity are stationary, namely:

$$\chi(\tau,t) = \chi(t-\tau),\ \gamma(\tau,t) = \gamma(t-\tau) \tag{6}$$

2. If products, created not later than the certain moment ή (t) <t, at the moment of time t are never used, but the ones, created after that moment are used in industrial activity of the university on 100 %

$$\chi(\tau,t),\ \gamma(\tau,t) = \begin{cases} 0, & 0 \le \tau \le \eta(t) \\ 1, & t \ge \tau \ge \eta(t) \end{cases} \tag{7}$$

3. The generalized case

$$\chi(\tau,t) = \begin{cases} 0, & 0 \le \tau \le \eta_1(t) \\ \chi(t-\tau), & t \ge \tau \ge \eta_1(t) \end{cases} \tag{8}$$

$$\gamma(\tau,t) = \begin{cases} 0, & 0 \le \tau \le \eta_2(t) \\ \gamma(t-\tau), & t \ge \tau \ge \eta_2(t) \end{cases} \tag{9}$$

For the third (generalized) variant our double-product model of the university activity obtains the following look:

$$\begin{cases} v(t) = \int\limits_{\eta_1(t)}^{t} \rho(\tau,t) v_1(\tau)\, d\tau, \\ B(t) = \int\limits_{\eta(t)}^{t} \beta(\tau,t)[v(\tau) - v_1(\tau)]\, d\tau, \quad 0 < \chi,\ \ \gamma \le 1 \\ A(t) = \int\limits_{\eta_1(t)}^{t} \chi(\tau,t) v_1(\tau) + \int\limits_{\eta_2(t)}^{t} \gamma(t-\tau)[v(\tau) - v_1(\tau)]\, d\tau, \\ \Pi(t) = W(t) - A(t), \quad 0 \le \eta_1(\mathrm{t}),\ \eta_2(\mathrm{t}) < \mathrm{t},\ \mathrm{t} > \mathrm{t}_0 > 0. \end{cases} \tag{10}$$

The analysis of the given mathematical model allows us to draw the following conclusions.

For the effective functioning of an educational system, it is necessary to provide for the balance of speed of restoration of products of the first sort, which are used for performance of internal functions to the support of its evolutionary development (in fact, a maintenance of processes of self-development), and speeds of creation of new products of the second sort, which are pushed forward to the performance of external functions of the system (interaction with an environment). Besides, the intensity of introduction of various technologies, used in production, and also the time of their "urgency" are rather important in this respect.

The problem of optimization of functioning of such a system, as well as the problem of the purposeful administrative influence, will be solved with the help of the classical methods of mathematical programming, due to the search of an extremum, which is corresponding to a function.

The system (10) can also be introduced in a discrete look. Then the integrated equations will become polynoms, the amount of members of which will be determined by periodicity of receipt of the information on parameters of processes, occurring during the functioning of the given educational system.

Besides, the transition from the double-product model (10) to *n-product* is quite possible. That will reflect the multidimensionality and complexity of teaching processes more adequately.

Is there anything else interesting about the above-mentioned industrial approach to the modeling of educational objects and processes? How to provide for the concentration of one's attention on management and optimization? The answer to the questions is in the structure of the represented mathematical model, one should just change reference points to some extent.

Beginning the development of the double-product model, we have suggested a simple and logical hypothesis: a productive activity of a university contains two basic components – the release of educative-scientific production and the output of means which support all the processes of functioning of an educational institution and its evolutionary development.

When composing such a model, we have established the fact that these two functions can be considered as the ones, directed in the outside (interaction with the environment, performance of a certain social and economic function), and in the inside of the structure (interaction with the internal structure, for the purpose of a support of processes of its functioning, modernization and development).

Now, keeping in mind the fact that the general system in the system-cybernetic approach to the management is conditionally divided into the controlling system and the controlled one, it is possible completely to connect all the above-stated information in the administrative system of coordinates. In this case, the set of the structural elements, means, tools and mutual relations, which provides for the performance of the basic productive function and interaction with the environment, output of products of the second sort, may be attached to the controlled part of the educational system, thus, everything that is definitely connected with the manufacturing of products of the first sort - to the controlling.

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LABOUR PRODUCTIVITY AND TOTAL FACTOR PRODUCTIVITY IN THE CZECH ICT

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Keywords

Labour costs, labour productivity, total factor productivity, ICT

Abstract

The paper is focused on the most important trends in the Czech ICT sector in relation to the economy as a whole. The aim of this paper is to analyze labour productivity in ICT and to measure the total factor productivity in the ICT sector in the Czech Republic and to compare it with the national economy. It concentrates on developments in the period between the years 2002 and 2007.

This paper has been prepared under the support of the project of the University of Economics, Prague - Internal Grant Agency, project No. 30/2010 "Multifactor Productivity Estimates".

1. Introduction

For the past few years, the role played by the information and communication technologies sector (ICT) in the reversal of the total factor productivity slow down has been an object of attention for many international authors. Effects on labour productivity and total factor productivity have been claimed as the main mechanisms of transmission of ICT productivity impulses.

2. Labour Productivity

2.1. Data and Methodology

For the analysis we use data from the Czech Statistical Office (2008b). This data set includes data on number of employees, turnover, labour costs (wages and salaries) and value added, in division to manufacturing and services. The data is also divided by the classification of economic activities (CZ-NACE) by 3-digits code.

For the analysis of competitiveness of the branch we use the simple condition

$$C_1/Y_1 < C_0/Y_0, \quad (1)$$

where C…labour costs

Y…value added

After an adjustment we can state

$$C_1/C_0 < Y_1 /Y_0, \quad (2)$$

which could be interpreted as a requirement of slower increase of labour costs in comparison with the change of value added.

After the division of both parts of the inequation by the labour force index, we get

$$C_1/C_0 : L_1/L_0 < Y_1 /Y : L_1/L_0 , \quad (3)$$

and after the algebraic adjustment

$$C_1/L_1 : C_0/L_0 < Y_1/L_1 : Y_0/L_0. \quad (4)$$

It means that average labour costs should increase slower than labour productivity. Alternatively we can consider compensation of employees as C, but in short time we can suppose the constant ratio of social contributions to wages and salaries. It implies that the inequation (4) expresses the relation between average wages and labour productivity.

Even if we compare the development of labour productivity and labour costs, we express the difference between the two quantities in question in percentage points for better interpretation.

2.2. Results

As showed in table 1, the number of employees in the period between 2002 and 2007 increased in both ICT manufacturing and ICT services.

	2003	2004	2005	2006	2007
Manufacturing	48,757	52,442	51,032	55,970	59,744
Services	58,279	57,943	61,284	66,520	71,192
Total	**107,036**	**110,385**	**112,316**	**122,490**	**130,936**

Table 1 Employees in ICT (persons), Source: Czech Statistical Office (CSO).

	2003	2004	2005	2006	2007
National Economy	15,936	17,006	17,827	18,975	20,360
ICT Manufacturing	16,721	18,599	19,393	21,113	22,389
ICT Services	33,156	35,144	37,545	38,883	41,188

Table 2 Average wages[6] in ICT sectors and national economy (CZK), Source: CSO, computations of authors

The difference between ICT manufacturing, ICT services and the national economy is obvious. Average wage for the whole national economy reaches 20,360 CZK in 2007 compared to 22,389 CZK in manufacturing and 41,188 CZK in ICT services. The reason for this divergence lies in the

[6] Computation of average wages is discussed in Fischer, Vltavská (2009).

higher ratio of value added in turnover and thus more qualified and skilled workforce is employed. The average wage in ICT services is about twice as high as in the national economy due to the excess of demand over supply of labour force. Focusing on average annual growth we can see the difference, too. ICT sectors developed in a dissimilar way to the national economy. While in ICT services recorded 5.6% as the average annual growth, the national economy grew by 6.3% in average and ICT manufacturing by 7.6%.

	2003	2004	2005	2006	2007
30 Manuf. of computers equipment	15,300	17,040	18,865	19,039	19,887
32 M. of radio, TV and commun. equip.	16,815	18,850	19,024	21,091	22,370
321 M. of electronic components	14,212	15,862	14,701	16,797	17,861
322 M. of communication equipment	23,244	27,206	29,762	30,660	32,471
323 M. of consumer electronics	15,921	15,847	17,063	19,164	22,750
332 M. of instrum. for measur., testing	16,375	17,545	18,854	20,424	20,989
333 M. of ind. process control equip.	23,695	25,628	27,401	29,498	31,332

Table 3 Average wages in ICT manufacturing by industry (CZK), Source:CSO, computations of authors

The table hereinbefore shows how average wages in individual branches in ICT manufacturing developed in the period between 2003 and 2007. Since 2004 the highest average wage among the branches in question had been reached within the manufacturing of communication equipment, whereas the lowest had been registered in manufacturing of electronic components in all years but 2004.

	2003	2004	2005	2006	2007
Praha	29,141	32,320	34,642	36,122	35,866
Středočeský	17,290	20,078	20,899	23,444	25,498
Jihočeský	13,762	15,352	15,494	17,074	16,591
Plzeňský	16,739	17,148	17,428	20,281	21,769
Karlovarský	14,918	17,339	15,651	16,036	17,125
Ústecký	14,792	15,490	16,909	18,010	21,196
Liberecký	13,990	16,145	15,904	17,020	21,110
Královéhradecký	14,962	16,097	18,031	19,085	20,431
Pardubický	14,735	15,565	17,201	17,948	19,244
Vysočina	12,999	15,204	19,970	20,225	22,869
Jihomoravský	15,537	17,562	18,403	19,544	21,554
Olomoucký	16,016	17,242	14,991	17,675	16,464
Zlínský	15,026	17,465	16,575	18,498	19,429
Moravskoslezský	19,916	19,981	21,580	22,811	21,288

Table 4 Average wages in ICT manufacturing by regions (CZK), Source: CSO, computations of authors

From the regional point of view - as in the national economy, Prague stands out the most. However, the difference in the ICT sector is higher than in other sectors.

The concentration of the largest national and international companies operating within the area of the ICT sector makes Prague a specific region and the national leader. The lowest average wages are paid in the regions of Olomouc, South Bohemia and Karlovy Vary. The source of the differences lies in various industrial orientations of the regions and also because of the lack of more qualified labour force. While the average annual wage growth in the national economy divided by regions is about 8%, it reaches 15.2% in ICT manufacturing in the region of Vysočina and 10.8% in the regions of Liberec. The possible cause may be that the developing new companies concentrate on ICT manufacturing and that the regions in question differ significantly in terms of education of the workers.

	2003	2004	2005	2006	2007
642 Telecommunications	35,401	38,254	41,079	40,238	41,921
72 Computer and related activities	31,550	33,230	35,539	38,167	40,857
721 Hardware consultancy	24,874	23,869	29,833	30,496	36,812
722 Software consultancy and supply	34,497	36,308	38,032	40,819	43,799
723 Data processing	26,372	26,117	28,124	29,837	33,989
724 Data base activities	20,544	20,400	22,349	24,777	29,495
725 Repair of computing machinery	23,003	23,603	26,767	29,804	26,144
726 Other computer related activities	27,168	17,657	18,194	16,344	16,771

Table 5 Average wages in ICT services by industry (CZK), Source: CSO, computations of authors

Higher share of value added in turnover causes average wages in ICT services to be much higher than in manufacturing and leads to hiring employees with better education and higher competitiveness. The difference among the branches of ICT services is quite gross. Software consultancy and supply reached the highest average wage among the branches of ICT services whilst the lowest was recorded in other computer related activities.

	2003	2004	2005	2006	2007
Praha	36,060	37,970	46,086	40,985	42,102
Středočeský	19,546	20,092	17,999	25,569	29,124
Jihočeský	18,163	19,879	21,060	22,640	23,880
Plzeňský	20,480	20,868	21,001	24,779	24,301
Karlovarský	16,446	16,590	26,615	28,795	27,947
Ústecký	18,358	18,830	20,447	21,296	21,174
Liberecký	17,515	18,452	31,207	27,801	28,116
Královéhradecký	19,358	21,525	27,517	28,137	28,095
Pardubický	17,680	18,742	18,301	19,061	20,062
Vysočina	17,568	18,566	30,526	28,098	29,107

Jihomoravský	22,370	23,235	23,607	25,270	28,013
Olomoucký	17,516	19,189	27,210	26,081	30,866
Zlínský	18,045	20,330	25,455	26,721	29,430
Moravskoslezský	18,345	19,255	20,392	21,041	21,459

Table 6 Average wages in ICT services by regions, Source: CSO, computations of authors

As in the ICT manufacturing, in ICT services within the regions the highest average wage is in Prague. The lowest average wage is in the region of Pardubice, Ústí and Moravia Silesia.

In the final part, we compare the relations between labour productivity and labour costs in ICT sector during the period between 2003 and 2007. We express the difference between labour productivity and labour cost in per cent for easier interpretation.

	Productivity	**Costs**	**Difference**
Total	3.02	7.57	- 4.56
by Industry (CZ-NACE)			
30 Manuf. of computers equipment	7.99	6.78	1.21
32 M. of radio, TV and commun. equip.	1.26	7.40	- 6.13
321 M. of electronic components	0.96	5.88	- 4.92
322 M. of communication equipment	0.39	8.72	- 8.33
323 M. of consumer electronics	3.27	9.33	- 6.06
332 M. of instrum. for measur., testing	2.22	6.40	- 4.18
333 M. of ind. process control equip.	9.58	7.23	2.34

Table 7 Change in labour productivity and labour costs – Manufacturing (2003 – 2007, average annual growth, %), Source: CSO, computations of authors

	Productivity	**Costs**	**Difference**
Total	2.66	5.57	- 2.91
by Industry (CZ-NACE)			
642 Telecommunications	5.78	4.32	1.47
72 Computer and related activities	6.15	6.68	- 0.53
721 Hardware consultancy	- 0.62	10.30	- 10.92
722 Software consultancy and supply	6.45	6.15	0.30
723 Data processing	5.53	6.55	- 1.02
724 Data base activities	2.76	9.46	- 6.70
725 Repair of computing machinery	2.81	3.25	- 0.45

Table 8 Change in labour productivity and labour costs – Services (2003 – 2007, average annual growth, %), Source: CSO, computations of authors

Differences between ICT manufacturing and ICT services illustrated by the table 12 are only marginal. In both sectors labour costs grew more quickly than labour productivity. In ICT manufacturing the annual gap between costs and productivity amounted to about 4.56 per cent. In ICT services the annual gap between costs and productivity reached 2.91 per cent. Therefore both ICT services and manufacturing could lose some of their competitiveness in the given period.

3. Total Factor Productivity

3.1. Data and methodology

Index of productivity of two factors originates from the following decomposition:

$$\frac{Y_1}{Y_0} = \frac{A_1}{A_0}\left(\frac{K_1}{K_0}\right)^{1-\alpha}\left(\frac{L_1}{L_0}\right)^{\alpha} \tag{5}$$

where

Y_1/Y_0 is the index of gross value added in constant prices of 2000,

K1/K0 is the index of net fixed assets in constant prices of 2000,

L_1/L_0 is the index of total employment[7],

A_1/A_0 is the index of total factor productivity,

α is the average share of compensation of employees on gross value added in current prices.

The analysis uses data from the Czech Statistical Office which involve gross value added, total employment and fixed assets in the Czech Republic in the period between 2002 and 2006.

3.2. Results

	VA	L	FA	TFP
ICT sector	21.60	3.41	0.05	17.54
Total economy	23.29	0.41	3.61	18.51

Table 9 Calculation of total factor productivity index in the Czech economy and the ICT sector, using total employment and net fixed assets as inputs, total growth from 2002 to 2006 (%), Source: CSO, computations of authors

Based on the results the gross value added of the whole economy grew 23.29% in the period between 2002 and 2006. The main proportion of this was constituted by TFP (18.51%). Net fixed assets and total employment represent a lower influence with 3.61% and 0.41% respectively.

[7] The European system of accounts (ESA 95) recommends hours worked as the labour input. But for ICT sector the data are not published.

In the ICT sector, the gross value added grew 21.60% in period between 2002 and 2006. The main proportion of this was constituted by TFP (17.54%). Total employment and net fixed assets represent a lower influence with 3.41% and 0.05% respectively.

4. Conclusions

In this paper we analyzed some trends in the ICT sector in the Czech Republic. In the first part of the paper we examined the development of number of employees in both parts of the sector and the average wages as well. By analyzing the difference between the development of labour productivity and labour costs we found out that the development in both parts of the sector is the same. That could mean worse trends in the ICT services and ICT manufacturing from the point of view sectoral competitiveness. In the following part of the paper we analyzed the total factor productivity and its development in the period between 2002 and 2006. We found out that in the total economy the main proportion on the growth of gross value added had mainly the total factor productivity then the net fixed assets and total employment in the total economy. In the ICT sector the main proportion on the increase of the gross value added had the total factor productivity then total employment and finally the net fixed assets.

Another interesting part of measuring TFP is to analyze the impact of human capital measured as the level of education on the total factor productivity. However, this will be part of further studies.

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Values, Culture, Ethics and Norms as Information Leading to Requisite Holism/Wholeness

HUMAN'S WELL-BEING: A CAUSE OR A RESULT OF HUMAN'S REQUISITE HOLISM OR BOTH?

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Keywords

Humans as multilayered entities, (personal) requisite holism, well-being, information

Abstract

Humans are multilayered entities. Therefore managers/organizations should look at humans as multilayered, not only as professional entities. In synergy, not only individually, we define humans as: (i) physical, (ii) mental, (iii) social, (iv) spiritual, and (v) economic entities, marked by requisitely, though not absolutely holistic pattern of relatively permanent characteristics, due to which the individuals differ from each other, and also as (vi) specialized professionals. All these and other attributes form synergies. Hopefully, they can evolve from data to become information with a crucial impact on success in life. As closer to matching the 'Law of Requisite Holism' it is, the closer to success is any activity and related information. Thus, we define the requisite holism of an employee as an individual existing and conscious of self in synergy of all six attributes. Well-being supports this attribute, which makes it – also – crucial information for management and employees.

Research is supported by: Javna agencija za raziskovalno dejavnost RS, temeljni raziskovalni projekt: 1000 - 09 – 212173.

1. The Selected Problem and Viewpoint

Organizational success depends also on their co-workers' personal requisite holism. We define it as an individual existence and consciousness of self in synergy of all six attributes as:

- Physical person, implementing active techniques to gain physical balance,
- Mental entity, enriching sentiment, perception, mind and will-power by life balancing techniques,
- Social entity, building quality communication with others by techniques of professional and working development and social integrity,

- Spiritual entity, longing after self-actualization and the sense of life, carrying it into effect by the techniques of spiritual development,
- Professional entity, as a specialized professional,
- Economic entity, striving to satisfy one's material needs as a person, family member, co-worker, and as a member of a wider society.

Well-being as a complex construct is more than the absence of illness or pathology. Well-being has subjective and objective dimensions. It should be measured in order to be considered by owners and managers as a critical information influencing success. It can be measured at the level of individuals, or organizations, or society; it accounts for elements of life satisfaction that cannot be defined, explained or primarily influenced by economic growth.

Many studies indicated significant life benefits for people with high subjective well-being. Thus, interventions to increase subjective well-being are important: people feel good about them-selves, have more positive work behavior, and exhibit other desirable characteristics. The environmental conditions directly impact quality of humans’ life and on their actual choices (e.g. where to live, work). Therefore, they affect human health and wealth. Their impact depends on the level of holism: too poor holism causes oversights and resulting failures.

2. Holism and Wholeness: The Law of Requisite Holism – Critical Information

Requisite holism belongs to preconditions of success in every action. In examining the individual’s holism of behavior and attributes backing it we are going to apply the views of several authors.

The viewpoint of Bertalanffy’s dealing with holism/wholeness (1968) is important, and so is the treating of the holism as requisite, too, such as studied by Mulej (2000), Treven and Mulej (2005), Mulej and Kajzer (1998a and b), Sruk (1995), Senge et al. (2005), Mautner (1995),… Mulej and co-authors (2000, p. 32) define the human holism as an approach as a synergy made of consideration of: (i) the whole (systemic), (ii) parts (systematic), (iii) relations (dialectics, interdependence), and (iv) realism (closeness to reality, materialism), as a dialectical system.

»Everything starts with understanding the nature of wholes, and how parts and wholes are interrelated. Our normal way of thinking cheats us. It leads us to think of wholes as made up of many parts; in this way of thinking, the whole is assembled from the parts and depends upon them to work effectively. If a part is broken, it must be repaired or replaced. This is a very logical way of thinking about machines. But living systems are different. Unlike machines, living systems, such as your body or a tree, create themselves. They are not mere assemblages of their parts but are continually growing and changing along with their elements.« (Senge et al., 2005, p. 5). – The latter definition is superficial information: holism means that all attributes from all viewpoints and all their relations and resulting synergies are considered (Mulej et al. 2000; Mulej 2007). This reality can of course not be captured by humans; therefore humans need Mulej/Kajzer’s law of requisite holism (1998). It requires combining the specialization and (dialectical) system style of thinking and acting into a capability, which is interdisciplinary, in order to exceed the boundaries of single sciences and poor link-up of sciences in interdisciplinary creative co-operation, yet not at any level but at a level of the “requisite holism” (Mulej et al. 2000, p. 65).

Namely, the perfect/total holism is not practicable and often not indispensable, while one-sidedness is insufficient many times. Therefore the individuals strive to be requisitely holistic, thus successful. They try to find a middle way between too much complexity and simplicity. But there is no a uniform, so called scientific solution to the concept of requisite holism, because of intertwining of science, intuition and happiness (Mulej et al. 2000, p. 73-74).

3. The Complexity and Requisite Holism of Individuals as Critical Information

Having in mind that the human is (in synergy) a physical, mental, social, spiritual, professional, and economic entity, implementing devotedly different life roles, she has to be requisitely holistic – she has to consider everything important to the highest possible level. Thus, the (requisite) holism of the individual should be supported by a set of techniques. They include techniques enabling physical balance, of life art, of personality development, of professional and working development, etc.

Once we define the requisite holism of an employee (RHE) as above: a synergy of six composed components, the issue is triggered: are they easy to attain and maintain? No, they are not. Hence, RHE of the individual as an employee should, and could, be supported by techniques including:

- Healthy food, Ayurveda, massage, aromatherapy, relaxation, breathing techniques, physical activity, observance of biological rhythm, additional medical treatments etc. supporting humans as natural person, implementing active techniques to gain physical balance;
- Life balancing techniques: emotional intelligence, focusing on the present moment, positive thinking etc for mental wholeness, enriching sentiment, perception, mind and will-power;
- Techniques of professional and working development and social integrity: education, training, gaining working experience within professional career, etc. support humans' social entity, building quality communication with others, etc.;
- Techniques of spiritual development: spiritual intelligence, meditation, mantras, yoga, logo-therapy, practical Buddhist principles for building balance, etc for humans as spiritual entities, longing after self-actualization and the sense of life, carrying it into effect;
- Partnership, parent-ship, employment, membership in associations and political parties, etc for humans as economic entities, striving to satisfy their material needs as a person, family member, as a co-worker and as a member of a wider society.

RHIE positively influences organizations' success by successful managing of stress, work satisfaction, and wellbeing. Conditions must be created for their implementation of the mentioned techniques for developing and strengthening of the requisite holism of individuals as employees; organizations will get, what they will enable and appreciate.

In this way the behavior of individuals, who are willing to practice interdisciplinary co-operation, becomes not only more socially responsible but also happier. Frey (2008, 1) argues, that happiness is considered by many as the ultimate goal in life. But it is hard to be happy without the requisite individual holism, because it is the requisite wholeness of outcomes that leads to happiness. Therefore this level provides for crucial information for managers and employees.

4. Well-being and Requisite Holism of Individuals

Well-being is a complex construct. Its meaning is contested and its key distinction is between: (i) hedonic and eudaimonic well-being; and (ii) objective and subjective measures (SDRN 2005, 4).

One knows also the relative well-being, which depends on one's comparison with people playing important roles in one's life (Revkin, 2005). Diener and Seligman show the following partial formula for high well-being (2004, 25; summarized after Prosenak and Mulej 2007a, 3): living in a democratic and stable society that provides material sources to meet needs, having supportive friends and family, rewarding and engaging work and an adequate income, being reasonably healthy and having treatment available in case of mental (actually: medical in general, N.B. by us) problems, having important goals related to one's values, and philosophy or religion that provides guidance, purpose and meaning to one's life. In our paper we will use subjective well-being.

4.1. Subjective Well-being

Subjective wellbeing (SWB) is the main topic in positive psychology (Musek and Avsec 2006, 51). Diener and Seligman (2004) define the subjective well-being as the evaluation of an individual's life taking into account her positive emotions, work, life satisfaction and meaning. For Musek and Avsec (2002, 10) the subjective well-being is the main notion, which combines a series of evaluations, which refer to the individual's life, cognitive and emotional, general and more specific.

The concept of SWB covers 3 components: (i) the positive emotions and humors, (ii) the absence of negative emotions and humors, and (iii) the evaluation of life satisfaction (Musek 2005, 178). The second factor of SWB tackles the emotional aspect of well-being, which is composed of 2 independent components – positive and negative effect. A measuring device had to be built for measuring the 3 above mentioned components in order to provide the requisite information. Watson, Clark & Tellegen (1988: summarized after Musek 2005, 178) mention that positive and negative affection (PA and NA) is measured by numerous instruments and most of the time the PANAS questionnaire (Positive Affect Negative Affect Scale) is used.

Diener and Biswas-Diener (2000; summarized from Musek 2005, 179) claim, that the dimensions such as optimism and the feeling of fulfillment should also be considered as parts of the concept of well-being. Therefore we can speak about the emotional components of SWB, which are composed of positive and negative effects, and cognitive components, which are composed of, for instance, life satisfaction. Although the mentioned components correlate, they do not have the same meaning (Diener & Biswas-Diener, 2000; summarized after Musek and Avsec 2002, 12)[8]. Anyway, it is not about money only. "Diener's research indicates that there is no sole determinant of SWB. Some conditions seem to be necessary for high SWB (e.g., mental health, positive social relationships), but they are not, in themselves, sufficient to cause happiness." (Eid and Larsen 2008, 5).

According to Diener and Seligman (2004, 1) a growing individual's income is increasingly less relevant for growth of well-being; interpersonal relations and satisfaction at work are becoming more and more relevant. As important non-economic indicators of social well-being the social capital, democratic management and human rights are mentioned, while at work non-economic factors impact both satisfaction and profitability. Diener and Seligman (2004, 1) claim that the expected (economic) results are most often under effect of well-being and not vice versa. They detected that people at the top of the well-being scale have more income and more success at work as those in the lower region of such a scale. Satisfied employees are better co-workers and therefore help their colleagues in various ways. Furthermore, people with a higher level of well-being have

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[8] This can be presented with a case of two people, who e.g. globally evaluate the subjective well-being equally, but with different components: one person has a higher level of positive affect, the other a lower level of negative affect. One must distinguish between emotional dimensions of subjective well-being and satisfaction; e.g. when we successfully finish a boring work we can feel satisfaction, although we would hardly speak of any higher level of positive affect.

better social relations. Such people are more likely to get married, stay married, and have a successful marriage. And finally, well-being is also connected with health and longer living, but the connections between them are far from being completely understood. Therefore a high level of well-being is not precious only in the context of well-being, but it can also be economically useful.

These facts show that information from monitoring of well-being at the organization and state levels is necessary for it to belong to the main topics in creation of the policy of management; accurate measuring of well-being provides a basis of such a policy (Diener and Seligman 2004, 1). Authors suggest that for the purpose of measuring of well-being, positive and negative emotions, commitment, purpose and meaning, optimism, trust, and a wide concept of a full life be used as variables. At the same time they point out that for the measuring of well-being researches are important about social conditions, income, physical health, mental disorders and social conditions. James (2007) warns that the border between well-being and the end of motivation because of one's affluence combined with complacency is not objective, but subjective.

One could add that on this basis one should monitor SWB; it supports humans' creative work and cooperation, which can then lead to an increased objective and personal well-being. Hornung (2006; summarized after Prosenak and Mulej, 2007b, 6) also finds: happiness is a humans' constant goal and comprehensive synergetic indicator of comprehensive well-being, good performance, physical, psychological, and social health. Hornung (2006, 334–337; summarized after Prosenak, Mulej and Snoj 2008, 6) states that for the good well-being the following needs should be met: material, informational and, at the level of individuals, psychological, security, needs for freedom and action, adaptability, efficiency, and needs for responsibility.

"In recent years, a form of well-being in addition to SWB has emerged from theorists such as Deci and Ryan (e. g., Ryan and Deci, 2000, 2001) and Ryff (1989) based on the idea of universal human needs and effective functioning. These approaches are labeled "psychological well-being" and are based in part on humanistic theories of positive functioning." (Diener et al. 2009, 251).

4.2. Psychological Well-being

The literature on defining positive psychological functioning includes many perspectives. First is Maslow's (1968) conception of self-actualization, Rogers's (1961) view of the fully functioning person, Jung's (1933) formulation of individuation, and Allport's (1961) conception of maturity (Ryff 1989, 1070). "A further domain of theory for defining psychological well-being follows from life span developmental perspectives, which emphasize the differing challenges confronted at various phases of the life cycle. Included here are Erikson's (1959) psychological stage model, Buhler's basic life tendencies that work toward the fulfillment of life (Buhler, 1935) and descriptions of personality change in adulthood and old age" (Ryff 1989, 1070). Musek (2005, 175) states that Jahoda (1958) has been probably the first author, who has, researching the positive psychic health, analyzed the existing scientific literature on variables related to normal, optimal psychic activity on one hand and pathologic psychic activity and emotional functioning on the other hand. She was particularly interested in optimal and successful functioning in respect of content and not only as an absence of a negative behaviour.

All of these insights are bases of a multidimensional model of well-being. Ryff and Keyes (1995, 720) included in the model of well-being six distinct components of positive psychological functioning. "In combination, these dimensions encompass a breadth of wellness that includes positive evaluations of oneself and one's past life (Self-Acceptance), a sense of continued growth and development as a person (Personal Growth), the belief that one's life is purposeful and meaningful (Purpose in Life), the possession of quality relations with others (Positive Relations

With Others), the capacity to manage effectively one's life and surrounding world (Environmental Mastery), and a sense of self-determination (Autonomy).

5. Implications of Well-Being and Information about It

Kahneman and Krueger (2006, 22) mention that acceptance of self-reported measures of SWB, despite many caveats that subjective measurement requires, could profoundly impact economics:

1. Subjective measures of well-being would enable welfare analysis in a more direct way that could be a useful complement to traditional welfare analysis.
2. The currently available results suggest that those interested in maximizing society's welfare should shift their attention from an emphasis on increasing consumption opportunities to increasing social contracts.
3. Focus on SWB could lead to a shift in emphasis from the importance of income in determining a person's well-being toward the importance of person's rank in society.

Although life satisfaction is relatively stable and displays considerable adaptation, it can be affected by changes in the allocation of time and, at least in the short run, by changes in circumstances.

Very important is the connection between differences in SWB and economic growth. Inglehart (1996, 518; summarized after Tomer (2002, 29) mentions that there is dramatic increase in SWB, when a country changes from poverty and scarcity to a productive industrial country. After a threshold, economic growth no longer seems to increase SWB significantly. Inglehart (ibid.) found that nations that have once put the highest priority on narrow economic achievement became economically secure and hence place a higher priority on non-economic, life-quality considerations, such as self-expression.

Many studies indicated significant life benefits for people with high SWB. E.g., individuals reporting high SWB had stronger social relationships than less happy individuals (Diener & Seligman, 2002). In longitudinal studies, people with higher levels of SWB were more likely to be married at a later measurement (Marks & Fleming, 1999; Lucas, Clark, Georgellis & Diener, 2003). A high individual SWB is a strong predictor of marital satisfaction (Glenn & Weaver, 1981). At work, employees higher in dispositional positive affect receive higher supervisor's ratings and better pay (Diener, Nickerson, Lucas, & Sandvik, 2001). In stressful circumstances, positive affect supports effective coping with problems and overall outcomes (Fredrickson & Joiner, 2002). High SWB is associated with lower levels of suicidal ideation and behavior (Diener & Seligman, 2002).

Thus, SWB is related to successful outcomes in a variety of life domains. People with high levels of SWB are more successful in relationships, more successful on the job, and better equipped to successfully cope with stress (Pavot and Diner, 2004, 116). Therefore organization have initiated intervening strategies for providing prime quality of work life to enhance well-being of employees at the workplace to attain higher productivity, improve performance, and increase retention of potential employees (Garg and Rastogi 2009, 1).

As SWB is important for several reasons, the interventions to increase SWB are important too: it feels good to volunteer more, have more positive work behavior, and exhibit other desirable characteristics (Diener et al., 2002, 69). Few direct intervention efforts have been implemented. This is a reason for programs (Fordyce, 1977) or examples (Pavot and Diener, 2004, 129-130) designed to boost people's happiness. Kasser and Sheldon (2009, 243) propose that businesses consider the possibility of »time affluence« as an alternative model for improving employee well-being and ethical business practice.

Monitoring of well-being at the organization and state levels provides information that is necessary for well-being to become a crucial topic for the creation of the policy of management; accurate measuring of well-being forms its basis (Diener and Seligman, 2004, 1). SWB, which supports people's creative work and cooperation leading to an increased objective and personal well-being, should be monitored on this basis.

Frey and Stutzer (2001, 22) identified the following examples of influence of happiness on important economic decision:

- *Consumption activities.* Kahn and Isen (1993) argue that happy persons are most likely to save and spend different proportions of their income, to distribute differently over time, and to acquire different combinations of particular goods and services than do less happy persons.
- *Work behavior.* Researches shows that happier individuals may differ significantly in behavior on the job. Literature on job satisfaction abounds (e. g. Warr, 1999), analyzing, for example, whether more satisfied workers are also more productive (Iaffeldano and Muchinsky, 1985).
- *Investment behavior.* Happier people have a different attitude to risk-taking than less happy people. Happier people may also prefer different markets and types of financial investments.
- *Political behavior.* Happy people are likely to vote for different politicians and parties and for different alternatives in referenda.

Very important is future research on SWB. Frey and Stutzer (2003, 3-4) argue that, further analyses of survey data will be worthwhile, e.g.:

1. To research the relationship between discrimination of women on the labor market and their life satisfaction (e.g. Clark, 1997),
2. To study the interdependencies in well-being at the family level (Winkelmann, 2002),
3. To understand how various indicators of the quality of life, e.g. crime, environmental quality or commuting, are related to SWB (e.g. Michalos and Zumbo, 2000),
4. To analyze whether social capital has positive external effects on people's well-being (e.g. Helliwell, 2002);
5. To study how happiness affects individual behavior – people's level of SWB may influence many important economic decisions, e.g. consumption activities, work behavior, risk taking in investment, or even political engagement and voting behavior;
6. To improve methods to research on well-being; etc.

5.1. Well-being and Affluence – a New Information and Dilemma

Porter (1990, 2006) showed already in 1990, that the development of competitiveness passed through four phases: from competitiveness with natural sources, over the one with investments, to the one with innovations, and then to the phase resulting from it, as the experience shows, the phase of affluence. The latter has always been an essential wish of people and at the same time also a dead alley: having all, what you consider necessary, you have no ambition any more to work in order to have more, because you already have everything (See: James, 2007). As the historical experience in similar situations shows, affluence is followed by ruining. No society can simply continue with investments, on which the traditional economy is concentrated, or solely with innovating, without reaching the affluence. A possible fifth phase is necessary; we see it in intertwining of creativity (for innovating and for other life contents, including the leisure time), social responsibility (to set wider goals, rather than narrow individual ones, which are O.K. only in the short-term and the consequences of which can be very expensive and even harmful in the long term), requisite holism, and the ethic of interdependence ('I need you and you need me, as we are different due to nature and specialization; let us therefore be less selfish for selfish reasons', to complete up each other by differences). This practice and resulting ethic is a base, that the social responsibility and creation make sense to us. In the most successful US regions (Florida 2005) the creative class prevails because there is a prevailing socio-economic concept, expressed by '3T', that is a synergy of the *t*olerance, which attracts *t*alents and therefore investing in *t*echnology makes sense.

There is also a threatening danger that people do not experience well-being in their perception.

The coming economic situation of the most advanced regions of the world that face affluence means: affluence makes their economic theory and practice lose ground – covering of needs with insufficient resources is no longer necessary, being the central topic of the economic aspect of life. Supply – under affluence – reaches beyond demand, even very much so. Therefore suppliers try to find their way by creating artificial and fictitious needs (James, 2007; Prosenak, Mulej, Snoj, 2008), total quality, low prices and broad range, etc; perhaps they include consideration of the natural environment, but more often they abuse it. Hence they threat health, well-being of co-workers and other people who cannot afford everything they see with others, etc.

Data that we have no room for confirm this threat clearly, e.g. in the 6 (six) decades after WWII only the number of humans has grown 2.5 times, use of natural resources 7 times, while the Planet Earth has not grown, but become depleted increasingly, allowing us to longer talk about the developed and underdeveloped countries, but of self-destroying ones only.

We are all on the same – sinking – boat, but on different decks. The poor ones cannot change the current trend, while the rich ones are not willing to change it. For humankind of the current civilization to survive climatologists warn of the need to reduce emissions in the air, water, and soil for 80%, which can be attained with the given technologies, but not without critical changes of the current consumption patterns and big structural changes in production and use of energy. Only the renewal of natural preconditions for our civilization to survive, after decades of competition by destruction of nature, would cost more than both world wars combined, in a best case scenario, if the action is undertaken immediately. Postponing the action may increase cost to beyond 20 % of the world-wide GDP. The current affluence makes GDP an obsolete measure of success, because it disregards crucial aspects of human well-being and happiness. They started only to work on new measures (See: Mulej et al. 2009, and references in it; Stiglitz, 2009).

The theory that the economic growth is unavoidable at any price (Baumol et al. 2007) is equally leading to a blind alley as is the neglecting of humans’ natural environment and happiness; it is related to the above cited piling up of tremendous cost threatening to cause poverty and no well-being of the generations to come. What leads to poverty and no well-being is their usual current combination in the synergy showing that only 15-20% of humankind benefit from the innovative society that ruins the natural preconditions of life of all 100%. Data that the income level of poor, and hence unhappy, people (and poor purchasers) in the entire world-wide population is higher than ever before in history, is exact in book-keeping terms only rather than in real economic terms (Mulej et al., 2009). The good picture is monetary only. Satisfaction with it is similar to satisfaction with being alive when falling from a high skyscraper and passing the second floor alive. Data is not requisitely holistic for the theory backing it to show the way out from the current blind alley.

A similar blind alley is the destruction of ambition by affluence; it is visible in abuse of drugs etc. rather than having the motivation for creation grow, while creativity is the central human attribute

(Guštin 2007; Mulej and Prosenak 2007; Šek 2007; Škafar 2004 in 2006). Such findings put questions that do not tackle knowledge only, but human values/culture/ethic/norms. The values/culture/ethic/norms direct acquisition and use of knowledge in interdependence with them (Mulej et. al. 2000, Mulej et al. 2008; Potočan, Mulej 2007).

6. Some Conclusions

Well-being is a crucial precondition of economic success, but it is neglected information in economic literature and related statistics, because it is not easy to capture in hard data. But: leaving well-being and related measurement and resulting information aside diminishes the requisite holism of organizational and societal decision making. Thus, oversights result and lead to mistakes, all way to economic and other crises, including the current one. Hard data are not enough for the information system in organizations and society to match its task. The requisite holism of individuals is an un-separable part of this story, but we detected hardly any references to it in the available international literature, e.g. on business economic and human resources management.

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ARISTOTLE, KANT AND MILL AS ETHICS OFFICERS: THE CASE OF SLOVENE ENTERPRISES

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Keywords

Business ethics implementation, case study, informal and formal measures of business ethics implementation

Abstract

Due to interdependence of human knowledge, values/culture/ethics/norms and outer conditions, ethics provides for crucial information on which application of knowledge and outer conditions depends a lot. Various researchers and scientists try to model and improve the designs of corporate ethics programs; considering various theoretical and scientific cognitions our main empirical research problem was focused on the state of the presence of the informal and formal institutional measures of business ethics implementation. The pre-designed questionnaire was used in conducting face-to-face interviews with 40 managers who were in most cases also owners of the studied enterprises.

1. Introduction

Due to interdependence of human knowledge, values/culture/ethics/norms (VCEN) and outer conditions, ethics provides for crucial information on which application of knowledge and outer conditions depends a lot. This makes managerial and other influences over VCEN crucial information, i.e. influential message, not data only as provided by e.g. ICT technology for humans to use by their VCEN and knowledge and tools. We will speak about ethics (standing for VCEN). The aim of this contribution is to shortly introduce the theoretical principals on business ethics. The article will show how the knowledge of Aristotle, Kant and Mill is used and present in the enterprises through the presence of business ethics implementation measures.

2. Overview of Ethics

As De Colle (2008) argues virtue ethics, deontological ethics, and utilitarianism ethics are often presented as different ethical theories by reason of the different criteria of judgment they are based upon. Aristotle's ethics of virtue, Kant's categorical imperative and Mill's greatest happiness principle are their different moral criteria to find an answer to the question what is the right thing to do when facing a moral dilemma. Based on Aristotle's, Kant's, and Mill's theories various authors developed the concepts of analyzing and fostering the ethical behavior in business (e.g. De George, Boatright, Beauchamp and Bowie, etc). However, there is no room to present our empirical research in detail.

3. Theoretical Background and Hypothesis Development

Implementing business ethics ought to be part of a change in enterprise policies and embedded in workplace routines (e.g. Belak et al., 2010). In implementing enterprise ethics, Murphy (1998) distinguishes between: *formal* and *informal* organizations. Other academics and acknowledged researchers, as well as scientists (e.g., Laufer, 1997; Trevino, 1990, 1992, 1999, 2000), have developed methods for implementing enterprise ethics and divided them into three categories: *the formal method* (or control) that includes training and courses on the subject of ethics, means of enforcement, conferences and ethics officers; *the informal method* that includes an example, set by the manager, and social norms of the organization; and *the personal method* which encompasses controls that lie within the individual rather than those determined by the organization (e.g. the personal ethical standards of an individual).

Informal methods play an important role in the socialization process, in which “other employees” or people, co-workers, etc. play a major role as “sources of, or references for ways of thinking, feeling, perceiving, and evaluating, and as an audience which may be physically present or absent in any interaction, but towards which an actor orientates their conduct (Casell et al., 1997). Mechanisms of informal control may include a social dimension through which superiors regulate the behavior of subordinates, or employees regulate the behavior of their peers through daily interaction in compliance with the enterprise’s norms or values. Adam and Moore (2004) argue that informal methods such as *the social norms of the enterprise* may reflect the enterprise’s values and rules of ethics. Enterprise members may be coerced by other members of the group, peers or superiors, to conform to the social norms. If not, they risk disapproval, or even rejection. In such a way, the social group exerts pressure on the individual to conform to the norms – but only to a limit. Different relationships (e.g. between co-workers, superior vs. team, superiors and subordinates, etc.) may develop in the frame of non-formal meetings such as coffee breaks, lunches, sport, etc. We can see that informal social norms play a crucial role in forming the social order in an enterprise (Adam and Moore, 2004).

On the other hand, managers have a strong impact on the behavior of their employees. This informal method is labeled as *the example set by the manager*, which is part of the formation of manager-subordinate relationships. The example set by the manager may be the tool advocated by the philosophy of the enterprise. “The role model” is also one of the roles that managers are expected to perform, since they can set the example for “proper and desirable behavior” for the employee to imitate.

According to Adam and Moore (2004), the enterprise can employ diverse mechanisms of control, ranging from documents that specify the ethical code of conduct, which are used in the course of training, through the evaluation of employees’ performance, and up to enforcement procedures. Some controls (e.g. those used in selection and recruitment routines) appear early in the process of evaluating candidate’s actions and attitudes. The three routines of formal methods (recruitment, selection, and training) are very important in the process of employee socialization, which takes place in the first year of their membership in the organization (2004). The importance of formal measures of business ethics implementation is supported also by Sims and Keon (1999) who argue that such measures are important form of communicating enterprise’s expectations for employee decision making. Such a high importance is given to the formal measures of business ethics implementation especially due to the researches on correlation between formal measures and performance (Fang, 2006; Morris, 1997; Verschoor, 1998; Wu, 2000; Ye, 2000), which revealed that the enterprises with well developed formal measures of business ethics implementation recorded better performances. The enterprises that stress ethics have better images and reputation and yield higher long-term interests. The researches showed that employees' ethical awareness and decision making intent are influential on company performance, where in the absence of ethics, the individuals tend to promote their self interests at the expense of others in the enterprise when resources are unevenly distributed.

In accordance with these findings, Morris et al. (2002) developed the framework of ethical structures, which originates from core values. In the author's opinion, ethical behavior of an enterprise is not possible without the implementation of ethical core values. Informal ethical structures are crucial for the emergence and actualization of formal ethical structures. Formal ethical structures cannot emerge if there is an absence of managerial concern about ethical problems or sincere ethical communication between management and employees. Furthermore, employees need to discuss ethical topics, and as a sign of approval of ethical behavior, such employees should be rewarded. Typical of informal ethical structures are various stories, legends and myths about the ethical behavior of individuals, communicated within a business. Morris et al. (2002) define informal ethical structures as structures that affect the atmosphere in a business, where formal ethical structures are considered as concrete and direct measures that establish ethical behavior: a mission statement, a code of conduct, policy manuals for ethical issues, anonymous hotlines, ethical standards, managers responsible for ethical issues, training programs on ethics, and sanctions for transgressions.

According to Thommen (2003), measures of business ethics implementation can be divided into two groups: *institutional* and *structural* measures. Under the term Institutional measures, Thommen (2003) understands measures and instruments that support enterprise credibility strategy implementation, such as: code of ethics, enterprise culture, SA8000, human resource measures. In general, he divides institutional measures into preventive and support measures. The first group of measures gives all enterprise stakeholders the direction of behavior: it supports the proper way of functioning, on one hand, and imposes sanctions for improper behavior, on the other. The purpose of preventive measures is obviously to prevent non-credible behavior. The second group of measures, the support measures, helps and supports the credible behavior. This group of measures enables the maximum credible functioning of the enterprise, and creates an optimal environment for obtaining credible functioning.

Belak's (2009) framework of business ethics implementation examines the informal and formal measures of business ethics implementation (e.g. Belak, Mulej, 2009; Duh, Belak, 2009; Duh et al. 2010; Belak et al. 2010), containing Thommen's (2003) institutional as well as structural measures of business ethics implementation, measures and instruments as defined by Morris et al. (2002), and measures as defined by other relevant literature on business ethics implementation (Laufer et al., 1997; Murphy, 1995, 1998; Trevino, 1990, 1992, 1999, 2000). The formal measures of business ethics implementation define several criteria for an effective compliance program (Laczniak et al., 1999; Morris et al., 2002; Thommen, 2003): a statement of enterprise's core values, a compliance manual, a code of conduct, a mission statement, anonymous hotlines, job descriptions, selection of employees, training in ethics, evaluation of ethical behavior, an ethics committee, an ethics audit, sanctions for ethics abuse, ethics standards and indexes, policy manuals for ethical issues, an ethics consulting service, an ombudsman and ethic advocate, and a manager responsible for ethical issues. These elements are indispensable when communicating moral expectations within the enterprise. The elements of informal measures contained in Belak's framework include informal norms, heroes and role models, rituals, stories, and the specific languages used, and define important parts of the informal culture. Core values, enterprise culture and climate, on the other hand, are part of both structures and represent the starting point of the model. Maister (2007) supports the importance of consistency between mission, vision, enterprise values, and culture. In our research framework, we determined ethical core values that enterprises follow, ethical climate as the atmosphere needed for ethical behavior, and enterprise culture that also defines the rules of ethical behavior, as the sole base and starting point of emergence of formal as well as informal measures of business ethics implementation.

Reffering to the De Colle (2008) argumentation we can state that having Aristotle as ethics officer the enterprise would make its efforts in building the manager with “good character”. Instead, to be effective a corporate ethics program designed according to Aristotelian ethics should focus primarily on creating an organizational environment that supports the development of good character for managers and employees. In author’s opinion this could mean engaging in ethics discussions, workshops and other training activities within the organization, rather than focusing on the creation of principles and rules of conduct to comply with. Further, having Kant as ethics officer the enterprise would be considered as a “moral community” based on organizational structure and rules that support human freedom, encourage workers participation and treat in a fair way all stakeholders. Kant as an ethics officer would foster the corporate values and principles through stated corporate Mission or code of ethics, identifying a set of principles-based ethics. Considering the greatest happiness principle, having Mill as ethics officer the enterprise would foster balanced approach between two core elements in designing corporate ethics program: moral education programs such as ethics training courses, specially designed to help managers and employees in acquiring the appropriate moral feelings; and sustainability management/ corporate social responsibility (CSR) processes such as sustainability reporting initiatives or CSR standards.

Based on the De Colle (2008) cognitions, Thommen’s model of credibility strategy implementation (2003), Morris’s et al. (2002) developmental framework of ethical structures, and framework of business ethics implementation developed by Belak (2009) and some other measures as defined by other relevant literature on business ethics implementation (Laufer et al, 1997; Murphy, 1995; Trevino, 1990, 1992, 1999, 2000) the theoretical framework of our research was made to determine which ethical theories are more present and used in Slovene enterprises in order to develop and grow sustainable.

4. Informal and Formal Measures of Business Ethics Implementation

Based on the research cognitions discussed previous in the text the informal measures of business ethics implementation examined in the empirical part of our research are: manager concern/role modeling, candid ethical communication, ethics as a topic of employee conversation, reward and penalty system, and communication of stories.

4.1. Manager Concern / Role Modeling

The importance of a manager’s clear commitment to ethical values has been subject to much research showing that it is especially important for top management/leaders to demonstrate ethical behavior. Trevino, Hartman and Brown (2000) distinguish two pillars of ethical leadership. The first pillar is a moral person with traits (e.g. integrity), proper behavior (e.g. does things in the right way) and decision making (incorporates values). The second pillar is a moral manager with several supportive characteristics, one of which is being a visible and positive role model in the firm. The importance of top management being good role models has been noted by other established researchers as well (Cavanagh et al., 1999; Morris et al, 2002). Managers who engage in immoral behavior encourage subordinates to do the same. Their words about ethics and morality will therefore not be taken seriously.

4.2. Candid Ethical Communication

Trevino's research (2000) establishes that another supportive characteristic of a moral manager is the ability to communicate about ethics and values with other members of the enterprise. The author argues that the message that values should guide all decisions must begin at the top. Furthermore, communication of management on all levels is necessary to close the gap between what is said and what is actually done in the firm. Candid communication is the only way to inspire employees and build their trust.

4.3. Ethics as a Topic of Employee Conversation

Informal conversations among employees play an important role in the ethical life of the firm (Trevino, 1999). This role can be viewed as positive, resulting in support for formal ethics activities, or negative, resulting in indifference or active resistance among employees.

4.4. Reward and Penalty System

A reward system is an important tool in rewarding the employees on specific occasions when they positively resolve conflicts or dilemmas by implementing ethical behavior. Trevino and Nelson (Trevino, 1999) argue that the ethics implementation tool should be used to a limited extent – but is important in influencing the preferred types of behavior in the future. One such type is exemplary behavior, a specific individual act that goes beyond management expectations and reflects the core values of the enterprise. On the other hand, such a system must assign punishment for misbehavior. Sanctions for code violations are necessary and must be enforced to the letter of the code (Trevino, 1992). Managers who avoid disciplinary situations may be sending a powerful signal to their subordinates that misbehavior is acceptable.

4.5. Communication of Stories about Ethical Employees

Employees who go out of their way to exemplify the core values are heroic figures, worthy of recognition in the enterprise. The mechanism for doing this is telling stories (Breuer, 1998). By transmitting what is proper behavior throughout the enterprise, they serve as an important resource for ethical purposes. Stories may be told about ethical leaders or by leaders to provide appropriate examples for others to emulate.

5. Formal Institutional Measures of Business Ethics Implementation

Based on the research cognitions discussed previous in the text the formal institutional measures of business ethics implementation examined in the empirical part of our research are: core value statement, mission statement, code of ethics, compliance manuals, and ethics standards and indexes.

5.1. Core Value Statement

Effective enterprises identify and develop a clear, concise and shared meaning of values/beliefs, priorities, and direction so that everyone understands and can contribute. Once defined, values impact every aspect of an enterprise, which has to support and nurture this impact or identifying values will have been a wasted exercise.

5.2. Mission Statement

A mission statement is a management tool that usually includes the enterprise's values and philosophy (Bart, 1997; Dalla Costa, 1998; Morris et al, 2003). According to Dalla Costa (1998), this tool is appropriate for enterprises that have a history of integrating values into their decisions, and not suitable for enterprises where such a history does not exist. Wheelen and Hunger (2004) argue that an enterprise's mission statement may also include a business's philosophy about how it does its business and treats its employees. This puts into words not only what the enterprise is now, but also what it wants to become – management's strategic vision of the enterprise in future. In the authors' opinion (Wheelen and Hunger, 2004), a mission statement promotes a sense of shared expectations in employees, and communicates a public image to important stakeholder groups in the enterprise's task environment.

5.3. Code of Ethics

A code of ethics as one business ethics implementation tool has been subject to much research in the past (Mathews, 1987; Morris et al, 2002; Murphy, 1995; Trevino, 1990). The research conclusions show that more than 90% of enterprises have a code of ethics or some type of ethics statement (Morris et al, 2002). Another important research insight is that the mere presence of an ethics code has a positive impact on enterprise ethics (Adams et al, 1996). The code of ethics is an instrument for implementing business ethics within the enterprise, as well as in the enterprise's environment. According to Thommen (2003), the code of ethics is the best known instrument for improving and achieving the enterprise's ethical behavior. It contains ethical principles that should be followed by certain enterprise behavior. Also in Staffelbach's (1994) opinion, the code of ethics is one of the most important instruments for business ethics implementation.

5.4. Compliance Manuals

Researchers in the field of enterprise ethics realized that many enterprises use compliance manuals to communicate relevant rules, to emphasize important policies, or to make these policies understandable (Morris et al., 2002; Trevino, 1999). Some researches show that such manuals are widely distributed in large firms (research on a sample of Fortune 500 Industrial and Service firms - Weaver et al., 1995).

5.5. Business Ethics Standards and Indexes

During the last decade, many varied initiatives and standards regarding enterprise ethical behavior and corporate social responsibility occurred. It is important to emphasize that shared and internationally accepted standards on enterprise ethics do not yet exist. However, there are several standards and initiatives in this field, which should be considered by examining the enterprise's ethical behavior. From the notion of corporate social responsibility (CSR), it is possible to derive the complementary concept of accountability, which means that the enterprise is held accountable for its actions. If enterprises want to manage CSR and sustainability issues and obtain the trust of their social stakeholders, they must not only communicate, but also give concrete evidence that they are committed to continual, long-term improvement. It becomes crucial to measure the enterprise's capacity to meet the stakeholders' needs, and to create a balance between what the enterprise offers and what it receives from the social system (Perrini et al., 2006). Many different approaches and the fact that it is generally a voluntary tool that measures the social results of enterprises – and thus subject to the influence of specific variables of a cultural, political, and economic nature – have made it impossible for a generally accepted model of social reporting to develop. To measure the performance of enterprises in matters of business ethics, several ethical indexes have been introduced in North America and Europe: the Domini 400 Social Index (DSI), the Citizens Index, the Dow Jones Sustainability World, the Jantzi Social Index (JSI), the Triodos Sustainable Investment Index, the Ethical Index Euro, the Ethibel Sustainability System, ASPI Eurozone, the CSR Rank of Slovenian Enterprises, etc.

6. Conclusions on Application of the Quoted Ethics' Development Tools in ICT Practice

Our research showed that managers of the Slovene enterprises could be considered as good role models, where on the other hand they do not put enough effort to foster communication on ethical problems between managers and employees or only among employees either. However, the managers do not approve unethical behavior of the employees. In a frame of formal institutional measures of business ethics implementation our research cognitions show that the level of presence of such measures is low. Considering these research cognitions we could conclude that Slovene enterprises (at the moment) are focused in ensuring and creating such organizational environment that supports the development of good character for managers and employees, however, without the support of the majority of formal institutional measures of business ethics implementation. If we consider the influence of data as sources of information, we see no reason for any of the findings in our contribution to not apply to ICT practices.

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VALUES-CULTURE-ETHICS-NORMS (VCEN), KNOWLEDGE, INFORMATION, INNOVATION AND CONSCIOUSNESS SOCIETY

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Keywords

Knowledge, consciousness, values, culture, ethics, norms, VCEN

Abstract

It is in human nature to do good things. Socially accepted values, culture, ethics and norms (VCEN) tell us what it means to do good things. People often understand the set VCEN as information which gives us directions for our good deeds and actions. If we are critical to what we have just said, then we can say that this is not true for many modern humans. Yes, it is true, that people usually want to do good things, but there is another question: do we succeed in it. The modern consumer way of thinking brought us to a crisis of global dimensions. We often hear it is all about VCEN crisis. Have humans really set the wrong VCEN? Definitely not. VCEN stand on firm foundations, which were built from generation to generation, until today. We have to be more critical of our understanding of VCEN and even more critical of our realisation of VCEN. We have to see the difference between people's knowledge of VCEN and consciousness of VCEN. Knowledge is less deep than consciousness. In fact consciousness changes us, including our actions, while knowledge doesn't. The paper is about the difference between knowledge and consciousness, how they influence, i.e. inform, our perception of VCEN and how they therefore influence our actions. We believe that the current crisis is no VCEN crises, but crises of human poor consciousness and practice of contemporary VCEN. In the paper we put human consciousness firmly next to VCEN, knowledge, information and innovations, as preconditions of success.

1. Introduction

What is the meaning of life? People constantly seek for answers to such and similar questions. Many have asked them-selves: Who am I? What is the meaning of life? Do I realise the meaning of my own life? Not long ago a wise man and Nobel Prize winner Dalaj Lama Tenzin Gyatso from Tibet answered questions about meaning of life during his visit in Slovenia. With his typical good-spirited laughter he answered that happiness is the meaning of life (Gyatso, 2010). According to his words we talk about happiness on two levels: physical and mental. On the physical level people perceive happiness with their five senses; the means for assuring happiness is money. On the other hand on the mental level we can neither perceive happiness with our five senses nor assure it with money. The means for assuring happiness on mental level is, according to Dalaj Lama, ethics. Ethics brings us inner peace that we experience as happiness on a higher level. And Dalaj Lama put happiness on a higher level as the meaning of life and added: „We are all looking for happiness in life and we can only find it in ourselves." He was obviously having in mind ethics of interdependence, mutual respect and honesty, rather than ethics of abuse of the upper-hand position, like Hitler etc.

What we have just pointed out encouraged us to think more about the values, ethics, culture and norms of the modern human. We believe that the crisis of modern time is actually crisis of VCEN. That may be true, but more than VCEN we have to examine more closely our understanding and even more the realisation of VCEN to find the reason for crises. Are we aware of our understanding of VCEN? Are we aware of our realisations of VCEN? We deliberate on that in continuation of this paper.

2. Spirituality or Religion?

The modern human is often convinced that the only tool to perceive the world is reason, with which we try to describe, explain and apologise for what is happening around us. Reasonable thinking prevails next to the hidden awareness that there exists "something more" reaching beyond our reason. Out of fear of the unknown we usually take the stand: What we cannot perceive reasonably just doesn't exist. What we cannot see, hear, smell, taste, and feel, doesn't exist for us. Thus we have dangerously limited our awareness of what is happening around us to perception with five senses, while we consciously push aside the perception of what is going on inside us that is often hidden from our external senses and reason.

Establisher of analytic psychology Carl Gustav Jung touches the hidden happening inside us while comparing life and plants. Jung says (1989, page 16), that life is like a plant, which lives on its rhizome. We cannot see its real life since it is hidden in rhizome. What we can see is that part above the ground, which grows for a year and then it withers away – a passing-by process. According to his words we cannot avoid the impression of total vanity at the constant arising and vanishing of life and civilizations. He says that we may not lose the sense for something that lives and lasts beneath eternal changing. What we see is just a blossom. That eventually withers away. The rhizome stays.

The visible world is one half of the reality, behind which the other half - the invisible world is hiding, says the well known Slovenian psychologist Anton Trstenjak (1994, page 7). According to his words our visual world is our material reality, the invisible world the spiritual reality. He believes that there are many obscurities in perception of spiritual world; that is why the concept of spirituality has a hard time to get established in society. For him merely superficial touching is typical for modern direction to spirituality.

We often connect spirituality with religion. Established Slovenian sociologist Janez Rugelj (2000, page 909) says, that we often mix up the concepts. He believes the religions claim the right to proclaim religiousness as the only form of spirituality. He is convinced that religion is handing us over to the "force", which is above us and thus has "the right" to dispose with us. At the same time he stresses the point that spirituality is looking for the answer to people's question "why" regardless of a "higher force". In continuation Rugelj refers to the known Indian philosopher Shri Aurobindo (Aurobindo in Rugelj, 2000, page 909). Aurobindo stresses that ordinary, religious and spiritual lives are three different topics. He connects ordinary life of people with average human consciousness, led by traditions of reason, life and body, thus with consciousness, which is due to ignorance separated from its true being. He connects religious life with the same ignorance of consciousness, which is turning away from Earth to divine, but without acknowledgement. He is certain that religious life can be the first step to spiritual life, but very often it is just spinning in the circle of rituals, festivities and procedures without visible spiritual progress. According to his words the spiritual life is about changing of consciousness, from ignorant, separated from its true being to a higher consciousness where we find not only our true being, but we also identify with it.

We believe connecting spirituality with religion has deep roots. Dalaj Lama (Gyatso, 2010) reveals the historical point of view, by saying that in the past at first there was no concept of leadership, as we know it today, because the concept of working together and sharing results was prevailing. The need for leadership begins with arising of individual aspirations, where human takes over the leadership due to his/her physical power. With that the concept of hierarchy begins (note: acc. To Schmidt (1993) hierarchy already occurred at building of Egyptian pyramids, in order to enable professionals to quickly provide information to their co-workers – thus it is not about power, which contains the right to privileges and leads all the way to abuse). According to Dalaj Lama (ibid) a continuation of that is occurrence of education systems, which on one hand bring more equality between genders, on the other hand reduces importance of the church. He believes religion has had an important role in society once, mostly in transfer of knowledge and teaching of spiritual values. As the experience of Europe and areas under its influence shows, we establish that the cause for alienation of church from social life is mostly the fact, that every monotheistic church made the same mistake when teaching spiritual values: even though it taught meaningful values it considered itself as the only true one; so it was all about power and authority. Therefore, with the change of authority also the role of church has changed.

Despite all that Dalaj Lama (ibid) warns that education alone is not enough for a happy life nowadays, because it narrowly focuses on development of mental abilities (knowing) and neglects development of inner values (consciousness). To avoid that he stresses the meaning of secular modern ethics (note: secularisation means transfer of something from church authority to civil authority – dictionary of foreign words, Bunc, 1987). He says: for secularity we have to develop compassion and care first as well as honesty and truthfulness, which leads to openness and transparency that is the basis to develop trust and friendship in harmony and cooperation. Dalaj Lama stresses: »We have to develop inner values and in doing so use our hearts«.

3. Ethics of the New Century

Trstenjak (1994, page 7) warns that we often use explanations of eastern spirituality to clarify the concept of spirituality (note: this article also proves that by summarizing deliberations of Dalaj Lama, Mahashwarananda and Shri Aurobida). Trstenjak says that, in doing that, we forget that also the western culture has a rich treasure of spiritual values, even though it is not so old. Proof for that are numerous works of western philosophers on ethic theories. In continuation we will limit our focus to deliberation on ethic theory and ethic of virtues, which was presented by Slovenian scientist Mateja Pevec Rozman (2009, page 45-80). With summarizing of just some findings of her mentioned research we risk an incomplete view of the whole, but allow us to point out just some views which we believe make important contributions to this paper (while we are aware of our imperfection); in doing this consciously we neglect the wholesome presentation of findings, which would be in the given moment useful and necessary, but would step beyond the scope of this article.

According to Pevec Rozman (2009, page 45) there were three main ethic theories in the last two hundred years of western philosophical mind: theory of natural law, Kant's deontological approach, and utilitarianism. The main idea of the natural law was the belief, that each action and each thing have their essence. Theory of natural law is strongly characterised by Aristotle and Thomas of Aquina; for both of them the belief prevails, that God gives all things their essence. In Kant's approach God is replaced by reason, and in utilitarianism by arguments. The last two are based on expected results, which will derive from certain function. Next to the mentioned ethical theories Pevec Rozman (ibid) mentions another pole of ethical thinking. It is the ethic of virtue, which goes back to the time of Aristotle and is linked with the approach defended by natural law. It says that the virtue is here meant as an individual's task to overgrow one's nature and become more and more what one could be; better and better. And that looks like an important starting point to explain the background of spirituality, as seen by western philosophy today. Pevec Rozman (ibid, page 46) finds out that ethics of virtue was for very long time a forgotten project, which bloomed again in the 20th century and is today an independent discipline, not only an extension of natural law.

Pevec Rozman (ibid, page 48) says we have perceived different concepts of understanding virtue in the history of ethics; thus it is impossible to talk only about one unique concept. She believes different philosophers state different, often incompatible virtues and stresses that the conceptions of virtue are not only different throughout the history, but differ also among different cultures. She says the relation between virtues and social orders changes: Aristotle talks about generosity or nobility. Thomas of Aquina adds theological virtues like faith, hope and mercy (love or charity); so virtue is for him some kind of a way to the highest good. For Kant virtue is moral power at accomplishing one's tasks, and he rejects Socrates' intellectualistic ethics, while Hegel sees in intellectualistic ethics an attempt to raise moral question to the level of self-consciousness in form of self-awareness of own deeds in order to enable these deeds to be called moral. With Socrates it becomes apparent that moral consciousness is actually meant as self-consciousness and thus morality is only possible within dimensions of self-consciousness. With Socrates raising the spirituality above physical, he turns around the traditional scale of values and puts people's inner values in the foreground. In her research Pevec Rozman (ibid, page 47) exposes that next to the questions dealt by ethics of virtue also the question of meaning of life arises. In continuation we will limit ourselves to the articles of Socrates and Plato, who have, from our point of view, great capacity to help us understand spirituality as understood by modern society. Their standpoint presents basis for our further deliberation on concept of human knowing and consciousness as well as the difference between them.

Pevec Rozman (ibid, page 57) stresses the fact that Socrates equals the virtue with knowledge. She asks some key questions: How will you know if you do good, if you don't even know anymore what is good? He believes for the virtue one must have sufficient practical knowledge. This is the base of Socrates' definition of evil which says that only those sin who do not know what is good, because if they knew what is good they would do good while acting in their own interest. If knowing is a virtue, it can be learned. If the virtue can be learned, then good people are good due to the findings and not by nature. Socrates believes an individual is aware that he understands the virtues in the way he does just because this is made possible by the community he belongs to. The main question after Socrates becomes the question of relationship between *being a good citizen* and *being a good person.* Socrates hasn't set a boundary between sageness (note: knowing) and wisdom (note: awareness), but he connected both to functioning. He was convinced that the person has sageness and wisdom, who knows beauty and good and knows how to use it, as well as he/she knows the other things and knows how to avoid them. The connection of findings and functioning was also stressed by Plato, Socrates' student, who says that we need to see holiness and justice in order to understand and later on put it into deeds. Aristotle doesn't agree with identification of virtue and knowledge. He defends the thesis that knowledge is not enough for the virtue, but symbioses of theory and praxis is necessary. He believes a virtue is an activity which is according to feeling of pleasure and discomfort oriented towards the best; the malice is oriented in its opposite. Reasons for inclination why we choose something are: beautiful, beneficially and favourably, and to avoid something: ugly, harmful and uncomfortable.

At the end we will present an event from Socrates' life, which is a telling and – for modern time still – interesting example; it touches all important aspects of our current deliberation. The story is about 70-year-old Socrates (Socrates in Pevec Rozman, 2009, page 59), who was accused for not acknowledging Gods and spoiling of youth in the year 399. In his self-defence he said: "I thank you Athens people, and I love you, but I will rather be obedient to God than to you – and as long as I breath and will be able to do so, I will not stop to philosophy and remind anybody I will meet and speak as I am used to: ¨You are the best among men, citizen of Athens, the most important and according to the wisdom and power the most famous polis, and you are not ashamed to deal only with how to gain more wealth, fame and honour, but you do not strive and try to attain reasonableness, truth and to have a better soul?¨ And if one of you will contradict that and say he is trying for that I will not say good-by to him and leave, but I will ask him questions, research and try to dispute with him. And if I don't feel he has virtues, but just declares so, I will tell him that he neglects what is worth the most and appreciates what is not so important. Then, when I walk around, namely I don't do anything else than constantly encourage you, young and old, to strive not so much for bodies and wealth but for (your) soul to be as good as it can be; I am telling you that virtues do not come from wealth, but that wealth and all other goods in private and public life come from virtues."

As a difference to Socrates' society freedom is one of the main values for modern society: freedom to decide for those possibilities, which enable a person to realise him or herself as an individual in his or her individual way. Today the following way of thinking prevails: I wish what I wish, when I wish and the way I wish. People in modern society are so one-sided and partial that they are certain that rules in the form of the prevailing VCEN limit them rather than free them, because they set boundaries to fulfil their individual wishes and wills. Such high demands of modern humans set VCEN under a hard test. In continuation we deliberate weather VCEN is guilty for the crises of modern society or is it the human's (un)consciousness and (un)realisation of VCEN.

4. To Have Knowledge Does Not Mean To Be Conscious

Human's behaviour runs on set patterns, which are hard to change. It is not wrong to behave by the set patterns, if they are according to socially accepted VCEN. Nowadays we often say one thing and do another, while we apologize for our behaviour with excuses that more or less have no solid, requisitely holistic ground. The set VCEN are one thing, but our behaviour is very often something completely different. We can daily see such deviations, in relationship to nature, society and ourselves, but we are only silent witnesses. We see deviations and know about them but we do nothing, because we feel totally powerless to change something. What can cause that? Not knowing the VCEN? Most certainly not. Knowing of VCEN is not necessarily a sufficient condition to fulfil VCEN. We believe we need a higher degree of VCEN-consciousness.

According to words of the Indian philosopher and fighter for peace Paramhans Swami Maheshwarananda, consciousness means to be awake (Maheshwarananda, 2008). He says that people today live consciously only 20 percent of time. Approximately 40 percent of time we sleep, during the rest of our time we act unconsciously, automatic. We sleep automatic, we get up automatic and we wash ourselves automatic. We maybe start eating consciously and then our thoughts drift away. We act most of the time like that. We are conscious only about beginning and the end; many steps in-between are lost.

Based on what we have just said we can state that people are very often unconscious of their behavior. Let's just think about how we drive cars. Drivers know (knowing), that it is necessary to be careful on the road (consciousness). And what do we do? Most of the time, we are not even conscious about the driving. Just think about your driving to work. We drive the same way every day. If we ask you how many road signs are there on your way you would have difficulties and give an answer after a thorough thought. We cannot say that we are asleep while we drive; neither can we say that we are fully aware of the driving. The truth lies somewhere in-between. How would you react to the fact that there is number of other "unconscious" drivers at the same time and on the same place on the road? We can really worry about the situation. But there are no changes to be expected, if we don't change ourselves first, innerly. Indian philosopher and Nobel Prize winner Mahatma Gandhi said (Gandhi, 2009):"Be the change you wish to see". It is a fact: it won't help, if we sit down and wait for the rest of the drivers around us to change. We have no influence on that. We can only influence ourselves and our consciousness. First we change ourselves and then others will change (hopefully). Even if they don't change we have reached our goal, because we succeeded to make our habit conscious and change it. We have made a step from knowing to consciousness. Knowledge doesn't change us, but consciousness does, because it includes internalisation of VCEN and behaviour, and activity.

There are not just drivers on the road who act unconsciously. People behave unconsciously in many areas of our lives. We believe this is what brings us to deviations of our behaviour from the socially accepted VCEN. People usually want to do good, and we believe we can do so, too, in two cases: unless we are not aware of our behaviour (lack of knowing), and of our unconsciousness (lack of consciousness). We see (Jung, 1989, page 147) that the danger doesn't come from nature, but from people, from the soul of an individual and of the mass. According to Jung the soul is more complicated and unapproachable than the body. He says that the soul is so to speak one half of the world; it exists only that much as much we are aware of it. That is why a soul is not only a personal, but a world's problem, believes Jung. Scientists and experts warn that the biggest and the most dangerous pollution is mental pollution of modern society. They stress that a society without VCEN (consciousness) is even more dangerous than the atom bomb (that is its consequence).

The contemporary VCEN are under a lot of pressure. But the VCEN in the future will be put under an even greater pressure: due to globalisation of society they will have to meet different disciplines and different areas of life in a given moment. Every moment the appropriateness of VCEN is revised from different aspects and in different areas. Only VCEN that will pass the difficult test will be accepted in modern society. This puts us, the creators and users of VCEN in front of a difficult and responsible task.

In the modern world the anthropologists find the alienation of people (mind and word) and their products (technical goods, economy etc). The stronger the alienation (Trstenjak, 1994, page 147), the more VCEN are threatened by absurdity, recklessness, and they go towards absurdity. The same way as physics discovered antimatter, which has a 'minus' sign, the anthropologists discover antiintellegence (according to Trstenjak), also with a 'minus' sign. He finds out that intelligence is getting the (quantitative) logic of a machine, but it loses the (qualitative) logic of a person.

Trstenjak (1994, page 146) exposes in his deliberations another test of VCEN: »cultural captivity« of human society. Every culture treats itself unintentionally as "natural", every other culture as despiteful, dangerous and maybe even "wrong", as one that has to be suppressed and destroyed. He warns that wars and natural catastrophes in history of human kind are not the only cause for ruining of a culture or civilization. He believes the challenge of time does not lie only in creation of VCEN, but also in their preservation. Trstenjak sees danger in non-preservation of tradition: what the former generation still could do and knew, the new generation could take over, preserve, and communicate to the next generation. Thus the transfer of knowledge and skills is interrupted and a culture starts to die out. Today we witness vanishing of cultural heritage. Because of the fast technological development the craftsmanship of our great-grandfathers sink into oblivion. If we don't become conscious about that early enough, a culture will vanish and we won't even notice it. Mostly we notice that, when it is already too late to handle. We see a solution in qualitative step from people's knowing to their consciousness, which is also the subject of our deliberation in the continuation of this paper.

5. From Knowledge to Consciousness

The ethics of virtue discusses questions how people shall live, what does it mean to live a good life and what kind of life is worth living. Here we intentionally or unintentionally encounter deliberation on purpose of life; we are looking for answers to three key questions: Who am I? What makes me human? What is the purpose of my life? It is completely logical and natural that we have put observation of ourselves in the centre of quest for these questions. In doing this we have made a big mistake, though. We have put ourselves in the centre but at the same time we haven't focussed our attention to ourselves as it would be expected. So we find ourselves in the centre of processes and we observe the world around us from a higher/superior position. Due to their incapability of a holistic overview and insight people have got the feeling of superiority, which brought us to reasonable misrepresentation of reality. In continuation we will check some fact on that.

The quick technological development provided people the modern way of life, which is based on consumer way of thinking. We live in an era of »use and drop«. Nowadays we excessively exploit natural resources to satisfy more and more needs (rational as well as irrational) and at the same time create mountains of waste. With devastating interference in natural ecosystem, mostly with excessive use of mineral fertilizers in farming, with defecation of animal species and pollution of the atmosphere, the natural resources cannot regenerate themselves anymore. Nature is more and more desolated and destroyed.

According to Nobel Prize winner Kajfež Bogataj (2010) we have developed our consumer way of life in the last 200 years. During this time we have reached 6-times higher population, 17-times bigger wealth (measured with money), 5-times higher energy consumption and we have become 1.000-time more mobile; we emit 4 million tons of $CO2$ in our atmosphere, 1.7 million ton of nitrogen in soil and we cut 1.500 hectares of woods – per one hour. With of the European way of life we use so many natural resources, as if we would live on three planets. Under consideration of the American way of life the number raises to five planets. It cannot go on like that anymore.

To solve the crises we lean on technological achievements of social development, while we feel unable to stand against sociological and ecological challenges of our time; perfectly understandable. Technological development of society is namely connected to reason (knowing), sociological development to VCEN (consciousness) and ecological development to natural and universal laws (natural coexistence). Sociological and ecological development demands from us "something more", something that is beyond our reason.

Even though knowledge was a virtue in Socrates' times, the modern society can also not avoid that. Dalaj Lama (Gyatso, 2010) stresses, that the holistic view is the only way to correct our misrepresentation of reality, for which we need sufficient knowledge (knowing). Knowledge that is requisitely holistic gives us hope that people will overcome the unreasonably created 'reasonable' feeling of own superiority and direct the consciousness from the outer world into the inner world. As Trstenjak says (1994, page 11) we are in a position where we can again connect the outer world with the inner world, e.g. matter (knowing) with spirituality (consciousness).

We are convinced that a global crisis is teaching us the new way of looking at the happenings around us, especially the new way of looking at the happenings inside us. On transition we meet paradoxical need for life on global and local level at the same time. Establisher of dialectical systems theory Matjaž Mulej (Mulej et al., 2008, page 15, and earlier, since 1974) says, that with *globalization* the boarders of economies of different countries in the world are being removed, while *localization* offers us life in home environment, different from town to town. According to his sources and estimations the phenomenon of so called *glocalization* is arising.

The statement of famous astronaut of space craft Apollo that he made after landing on the Moon in 1969, also leads us to think about global and local: „We went to the Moon and we discovered Earth". We are convinced that the process of globalisation will bring us to the point where people will with sufficient (global) knowledge, by a big enough distance of observation, be able to gain a requisitely holistic view on our own individuality, to make a breakthrough from outer world to inner world. It is about qualitative, not only quantitative (e.g. less essential) step of humans from knowledge (reason) to awareness (consciousness). The aim is higher level of consciousness than we have today, e.g. human's self-consciousness.

In continuation we deliberate that higher level of consciousness is necessary to reach harmony of people's behaviour with modern VCEN. Maybe in this way we will be able to defeat our own limitations and current non-holistic perception of meaning of our own existence and life.

6. Behaviour According to Contemporary VCEN Demands a Higher Level of Consciousness, Self-Consciousness

It is not easy to correctly and simply answer the question how to be a good person and behave in the right way. The necessity of this question makes the ethics always interesting in different evolution periods of humans. Pevec Rozman (2009, page 48) says, that we decide how to act differently from case to case, but not only because certain universal principles (general principles) tells us to, but we decide with our own heads (and emotions; note V.K.). She says that acceptance of universal principles doesn't necessary mean to behave according to them. Very import is, she believes, not only knowledge of principles but the answer to the question, what kind of human am I. She says that identification of virtues with knowledge (knowing) does not make us virtuous. Knowledge is a very important aspect though, but not the only one. Essential elements are will and wisdom, knowledge and intuition as well as a clear goal – to do something good. She finds out that next to that, we have to live virtuously, e.g. to live and behave as a wise human would do.

Being wise doesn't necessary mean to have wisdom. Sometimes we are wise also from the broses that we get when we make life experiences. If we don't look at the broses to narrowly, but from a wider aspect, we can say that broses are very precious for us. We constantly learn something new and are richer for an experience. And exactly our own experiences present in our belief the way through testing of VCEN understanding or better said, the way of realisation of VCEN.

Based on experiences, what follows is the changing. Psychologists say that when looking for a solution our mind often misleads us to the area of broader cosmos. In this area we have neither influence nor control as individuals. But this is exactly where we tend to search for possible solutions. Very often we say: In the world we should... or the state should provide etc. Better than to get lost in the area of cosmos, it is more useful to limit ourselves to the area where we have influence and, even better, to limit to the areas of our control. We may have influence in certain cases on society, a group of people and individuals around us, but can not state that we have, next to the influence, also control over them. Each individual represents the area of control himself. On such narrow area, which includes only ourselves, we have total control. And if there are 6.4 billion people in the world then we have together 6.4 billion possibilities for total control, of course each one for him-self. Individuals united like that are not powerless. In the area of control our feeling of having no power changes into feeling of power. Are we as individuals aware of that? You will probably say that you already know that. I agree, most of us know that, the question is are we really aware of that and are we actually living it.

Let's round-off our deliberation with the view of Trstenjak (1994, page 149), who says: »All we have to know about reality changes our image of a human; all we have to know about a human changes our image of the reality". He believes science is relative and will stay relative; he finds out that like physics cannot discover the essence of matter, even though it discovers on and in it constantly new aspects, there were not known before, the anthropology has to be satisfied with only partial discoveries, even though it discovers constantly new sides of a human. Everything that modern specialists and scientists discover is, according to him, only the background of the question: What is a human? He states that the image of a human as discovered by some sciences till now is only undernourished, one-sided human, being showed either by idealists or materialists. He is certain that one and the other are losing themselves in dualism, and are tearing apart the unity of a human with the world and with himself. According to Trstenjak the spiritual world restores this unity of human.

All findings strengthen our belief, that people can direct their attention to themselves from the environment, only if they have sufficient knowledge. With that they will get the opportunity to know themselves while reaching higher and higher levels of consciousness. People will only find the answers to questions: Who am I? What is the meaning of my life? in themselves. The aim is people's self-consciousness, the way leads from broses to wisdom. It gives essential information.

7. Conclusion

People constantly ask questions about the meaning of life. Meaning of life is happiness, says Dalaj Lama. People experience inner peace as happiness of a higher level; means to assure that are the requisitely holistic VCEN. Even though reasonable thinking prevails we know, there is "something more", something beyond our reason. Trstenjak connects the visible world with our material reality, the invisible one with the spiritual reality.

Spirituality is often connected to religion, which has historical background, but is not holistic enough. There are still many obscurities in explaining spirituality. We often use explanations of eastern spirituality. Trstenjak warns that by doing so, we tend to forget that western culture also has a rich treasure of spiritual values. The beginnings reach in the time of the ancient Greek culture, when Socrates raised the spiritual above physical and thus made a transition in traditional scale of values. He has put human's inner values to the foreground. Today we understand spirituality as development of people's inner values and thus changing their consciousness.

People usually want to do good; but is a total different question weather we succeed in it. Very often we say one thing and do another. We find out that knowing VCEN is not necessary enough to actually realise them. We have to be more critical to our understanding of VCEN and even more to realise VCEN. Knowing is less holistic and deep than consciousness. Knowledge is an important aspect, but not the only one. Essential elements are will and wisdom, knowledge and intuition as well as clear goal – to do something good. To live virtuously and behave as a wise man would do.

We are certain that the process of globalisation will bring us to the point where people will be able to observe from a right distance with sufficient (global) knowledge, to requisitely holistically perceive their individuality and thus make a breakthrough from their outer to their inner world. It is a qualitative, i.e. essential leap from knowing (reason) to awareness (consciousness). The goal is people’s self-consciousness and we believe the way leads from broses to wisdom. So in the paper we firmly put people’s consciousness – as essential information - next to VCEN, knowledge, information from others and innovation.

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COMPLEX NATURE OF MAN AND ITS KNOWING

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Keywords

Attitude, culture, human, knowing, information, knowledge, reality

Abstract

The conference topic devoted to values seems to be far from informatics' domain of many specialists interested in successful profession. However it has an essential importance for information management which is oriented rather to meaning of information and appropriate human doing. This paper - arising from systemic positions and advanced cybernetics - points out the real nature of values that is cardinal and prime part of tacit knowledge. To ignore them we clash with *many unsuspected or ignored problems. This article briefly implicates some of them and targets problems of contemporary education and refers to (i) some difficulties of contemporary society and (ii) purport of tacit knowledge incl. values just in informatics.*

That what we have got used to call economics crisis is just another label for moral poverty. Moral poverty is a source, economic decay is the result.

Tomáš Baťa, 1932

1. Topical Outset

The sentences mentioned above of a world-wide-famous Czech entrepreneur are very popular in our population and closely touch the topic of this conferences sessions. Moral indignation seems to be simplified, applies to (analogous to Greece) corrupted politicians and glozes over the moral and/or ethical dimensions of economics. Let us remind several Boulding's articles, namely his *Economics as a Moral Science* (Boulding, 1969) and – within the context of knowledge society – also his paper *The Economics of Knowledge and the Knowledge of Economic* (Boulding, 1966). Both his papers refer to the holistic unity of all concepts (values, culture, ethics and norms) included in the name of the appropriate session. However, they result from culturally shared worldview formed in the past time (in industrial society). To briefly sketch major reasons for such approach we should point to the three foundations, or their inosculations:

a) Positivism - a 'scientific conception' of the man that disregards and denies an intricate human's phenomenon. Its persisting influence is present, especially in the informatics.

b) Utilitarianism restricting moral worth to a utility resulting instantaneously from human doing. Prevailing representation converts utility into notion of '*greatest good'* (for the greatest number of people) generalizes and directs (governs) human doing by the money as symbol of all-purpose contentment (pleasure). However, such concept is far from the *'well being*' (mentioned in keynote speaker's abstract) that is principally subjective and is felt (apprehended) in the long term.

c) An intricate making sense of human cognition including appropriate concepts such as knowledge, information, consciousness language, culture and education. The common understanding of such notions does not do justice to their nature. Let me mention two important mistakes: (i) Substitution of dynamic processes by their static results, and (ii) Neglect of distinction between knowledge and reality.

In similar denotation - as I understand - Mulej and others characterize concisely humans as multilayered entities. However, single layers epitomize only some features regarded from an explicit point of view. The nature of the man emerges from holistic concepts of all layers and its ignoring diverges our thinking of an action from reality. Macmillan Dictionary of Modern Economics offers an illuminating example and defines *Economic man* as *fictitious entity…* (Pearce, 1995, p. 55). Let us remind concept which connects man with rational or intellectual doing or idea of rational expectations. Similar and considerable fallacies as well as problems stem from a disdain of man's nature that is lost in terms such as *human source* (*capital*) *user, employee* and often also *knowledge worker*.

In this paper I will try to point out nature and importance of human values that stay out of our attention and application. Systemic thinking and advanced cybernetics are used as the framework for further cogitation. Such background transcends common and anthropocentric contemplation and stems from the concept of human as a living system (organism) or animal. Also Second-order cybernetics uses similar concept of an observer who is a living system whose behavior depends not only on an external impetus but also on a cognition shaped through its former interactions within environment. The nature of its behavior is not (only) adaptive nevertheless it is proactive and moreover, a goal-seeking behavior is constituted by recent experience. Nevertheless any man as an observer proves important attributes:

- His ability of abstract thinking generates possibilities to distinguish patterns of external objects (entities) and use symbols for their denotation (representation).
- Such symbols (words) are basic elements of human language and their meaning is primarily coupled with internal sensations of the fact that patterns are designated emotions.
- Human communication (of information presented through language) is a special type of an interaction within social environment which shift personal experience towards culturally (socially) formed knowledge.
- Two faces of individual man's cognition (or better knowing) - the first is an externalized knowledge presented (and communicated) through language and the second is associated with values and/or with actual vital emotions.

Both faces of human (tacit) knowledge as well as its roots consisting (i) in real life of an individual and (ii) communication of culturally formed (and shared) beliefs that will be explained later. Consequently also a brief elicitation results in trend towards two domains: Education (and its crisis) in wider context of a human knowledge formation and Informatics and/or information systems, respectively a neglected role of a human in this area.

2. Knowing: Physical and Mental Unity

The nature of the man is covered in cybernetic concept of an observer that is organism - physical entity - existing and interacting within an environment. During this interaction which involves sensual perception the observer constitutes internal knowing of such environment that is thought as reality. Any perceiving organism acquires some degree of awareness and frames reasonable ‘understanding’ of its environment. In this way ‘mental’ activities as well as ‘mental’ entities emerge at large. Man as the mental entity embodies an ability to generalize, to abstract and also to use natural language. As such the man turns into a social entity; its interaction within its social environment obtains new dimension - communicating or better still having conversation with other people. Maturana and Varela muse on observer in this way and characterizes human by the following words (Maturana & Varela, 1980, p 137): *A system that through recursive interactions with its own linguistic states may always linguistically interact with its own states as if with representations of its interactions.*

We commonly underestimate the intrinsic nature of language and/or of meaning (of its words) and associate it only with communication within social systems. We pass over perceptual interaction within physical environment and the responding emergence of personal experiences. Human thinking and also (tacit) knowledge actually *emerges from a long period of personal experiences and interactions and from the self-testing of one's own mental models* (de Grees, 1996, p. 14). Also Maturana (1978) explains the nature of language from ‘biological point of view’ and points out the problems of language and reality in like manner. To support it we can mention two features - langue and parole - of language mentioned by Saussure (in: Bally & Sechehaye, 1983). While the first title (langue, Sprache) conforms to common conception in which language is a system of words (symbols) and rules for their linking (syntax), the second term (parole, Rede) is less known and represents the actual speech. Langue is systematic and homogenous in terms of nominal unity of shared contents of symbols communally shared in a society (nation). But parole is then individual acts - authentic messages with meaning uttered by a single person (observer).

To distinguish between both concepts of language – content and meaning – we focus our attention on semiotics and/or the semiotics theory of information. This notion is related to information presented by symbols[9] [10] and distinguishes its three levels: syntax, semantics and pragmatics. Traditional semantics is concerned with interpretations of meaning as mental activities. However, I would like to point out also the physical nature of information that is associated with the concept of signal. Signals are physical phenomena (physical quantity – for example acoustic signals) and are perceptual stimuli – physical information perceived from one’s material environment. In this way we can distinct four layers of semantic (conceptual) information:

- Physical: selected signals that constitute physical nature of symbols;
- Syntactic: data as structures of symbols (elementary signs) built upon syntax;
- Semantic: messages having content advert to considered reality (actual situation);
- Pragmatic: meaningful information that initiates relationship of observer (receiver) to reality.

[9] To compare human and machine thinking Marvin Minski emphasizes only the meaning of human emotions.

[10] Commonly is semiotics connected with signs, but according to Pierce’s differentiation of signs (icon, index, symbol) I use term symbols that stands with words. Symbols are sequences of elementary signs that form used alphabet.

Let us pay attention to the last two layers: Semantics is concerned with relations of symbols to denoted entity, while pragmatics put man's mind in action about the entity represented by symbols. This fact refers to the fact that human being intentionality originates from self organization of man's nervous system and is interpreted as human's attributes:

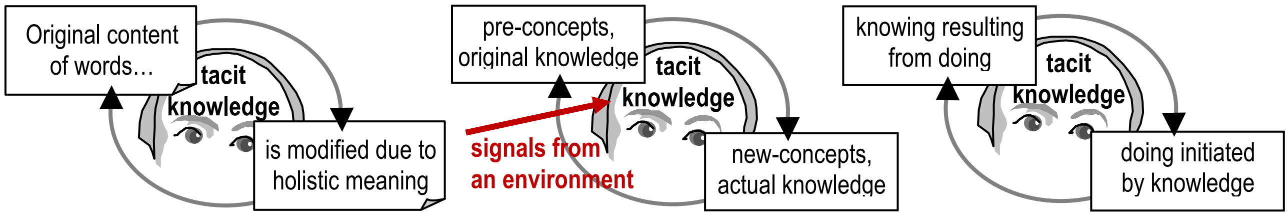
- Directivity of human consciousness (mind, cognition) towards determined entities (objects), and
- Intention as rational (purposefully oriented) contemplation derived from expectations coupled with such entities.

To explain the origin of the qualified entities I would like to use the definition of entity used in information modeling: *Entity is anything in our environment that we consider relevant enough to pay attention to it and entitle it.* Let us advert to two facts (i) entity is not objectively given, but it is *what we consider relevant (in our environment)* and *(ii)* we entitle (entity). In other words: Values and/or value orientation play (i) active and (ii) primary role in human cogitation and action. The latter fact is reflected in word-stock (vocabulary) formed in a given society (nation) all throughout its history. To put it in a better way – it is a way for an emergence of nouns (substantial) that denominate universal (and abstract as such) category of real objects. Using other terminologies[11] we should also distinguish between *type of entity*, *class* and *set* for a description of general group and *entity occurrence, instance* and *element* labeling its individual and particular topic. Then the class partakes of pattern or qualitatively allotted set of elements of a same attributes. Such attributes result from day-to-day experiences of many individuals and also from purposeful observation providing '*scientific knowledge*'.

3. Meaning: Content and Value

Let us return to the concept of man as physical entity and its empirical realization (recognition) giving this day-to-day experience. An appropriate knowing commonly called by perception embodies reacting to the two types of signals (physical information): The first comes from observer's environment and the second takes place in his nervous systems. Just the later signals are outside our attention (due to the positivist world view), although they constitute the human and human cognition to an essential degree. Commonly we associate them with such concepts as feelings, emotions, and/or experience (enjoyment and/or ordeal). Let us recall that these words indicate again rather aware states than processes of real living (living through). Holistic notion of human knowing comprehends and accentuates unity of such emotional and rationale (verbal) faces and points to their circular promotion. Let us point to sensual nature of value and valuation which is derived from sensation of agreeable and unpleasant emotions. Animals incl. man as physical entity, evolve innate behavior from such differentiation and for man as mental entity her behaviors connect such feelings with terms *good* and *wrong*.

[11] See Stonier's and/or Bateson's concepts of information (in: Rosický, 2009).



A *traditional hermeneutics circle (inc. pre-understanding)*

B *circular process re-forming (rather than forming) tacit*

C *enactive notion of knowing unifying mental and physical*

Figure 1 Circular nature of knowing (knowledge) – three various concepts

However, a rather holistic notion comprehends human knowing as unity of such emotional and verbal faces and stresses their circular causation. It is the circular interactions that plays an important role and change many traditional concepts. Figure 1 demonstrates three such substantialities: (A) a traditional hermeneutics circle, well known from philosophy (Gadamer and others), which shows the pre-understanding as general knowledge shared through language, (B) the universal nature of knowledge re-forming which depends not only on external signals but also on original knowledge and (C) Enactive model of knowing that characterizes unity of both cognitive[12] processes - the mental (rational) and physical (emotional) ones.

Osgood with co-authors make a mention of two aspects of meaning in the similar way (Osgood at all, 1967) and they differ *linguistic* and *psychological meaning.* To explain the first of them they refer to Morris and his syntactic and semantics aspects of symbols and/or lingual signs. They connect the other side of meaning with a pragmatic aspect criticizing mentalistic and behavioral conceptions and pointing out patterns of stimulus. Many authors from the area of humanistic psychology (A. Maslow, C. Rodgers, V. Frankl) as well as a contemporary contemplation are enriched with many concepts from systems thinking (Hudlička, 2008). Their conception has a holistic nature and emphasizes real processes - interaction of an observer (organism) within physical environment in which emotions and patterns discerned in an external environment are coupled. However, Ivan Havel (Havel, 2004) elucidates unity of rational and emotional aspects of cognition. He remarks various modalities of the mentioned process (of living through) and their complexity that is appreciable only through lingual unfolding. Though it covers such constituent elements as bodily sensations (*ardent face*), awareness of external environment (*bear going along the bank*). However, 'rationale knowing' - knowledge mediated through language (*danger bounded together with this bear that the individual does not know from self experience*) participates on this process as well.

Many the facts briefly mentioned above form the nature of tacit knowledge in the sense which Polanyi calls *ineffable knowledge* and characterizes in as follows (Polanyi, 1962, p. 90): *The ineffable domain of skillful knowing is continuous in its inarticulateness with the knowledge possessed by animals and infants, who, as we have seen, also possess the capacity for reorganizing their inarticulate knowledge and using it as an interpretative framework.*

These in-articulated and non-considered aspects of (tacit) knowledge affect not only actual human doing, but also forms authentic individual values as well as whole understanding to the world. Such unity of knowing also makes clear (circular) associations of semantic and pragmatics aspects of information and allows pointing out on two concepts of values:

[12] In this prevailing concept the term cognitive connotes rational - value and emotion free – notion. I use it for better understanding, however from holistic and holding view it is not correct.

The first, being typical namely in humanities comprehends value rather than human attitudes to reflected entities. It is affiliated with culturally shared rationale and results rather than from properties attributed to entities from personal viewpoints. The corresponding views are interfered among people as wells as communicated through (mass) media; spontaneously they form (in circular affinities) culture that is shared within a given culture/community currently. The second concept of value is identified with satisfying of human's wants that he or she associates with a chosen entity. It links us to the famous Maslow's hierarchy of needs and is based on individual disposition. The distinction between verbally proclaimed and actually experienced values and attitudes surfaces and this gap also mirrors problem that an increasing number of people lose meaning of life (Frankl, 2006).

4. Crisis of Education

This chapter will link to Frankl who warns us, that we cannot teach 'world' in universities and enunciates that real and effective values - that are inseparably constituent of tacit knowledge - and thus must be experienced. Let us remind further idea of Michael Polanyi previous to the one that we take care of education as an important way of knowledge formation and/or dissemination. Author of the popular concept of tacit knowledge stresses its pivotal role and affirms (Polanyi, 1969, p. 144): *While tacit knowledge can be possessed by itself, explicit knowledge must rely on being tacitly understood and applied. Hence all knowledge is either tacit or rooted in tacit knowledge. A wholly explicit knowledge is unthinkable.*

Polanyi in other words accents the prime position and function of tacit knowledge. To accept substantiality mentioned above we can adjudge tacit knowledge (or better process of knowing) as the only reality while other concepts are metaphors. Speaking about information or knowledge society as well as emphasizing the significance of knowledge we should keep this in mind. However, ignorance of these facts restricts knowledge to external knowledge and a development of society is therefore connected with education and/or with school system. Various people, institutions as well as governments strive for an improvement of current situations and reformations of education system linger. Konrad Liessmann describes real situation concisely in the subtitle of his famous book (Liessmann. 2008) - *Fallacy of knowledge society*. Author forcefully criticizes existing systems and focuses namely on universities. He indicates more lapses as well as their reasons; let us only emphasize two of them:

- Purposes and appropriate content of tuition is aimed rather to an exercise of a profession than actual (holistic) knowledge. Such purposely-built skills rate success in career and existing practice even though they cause problems and crisis.
- Considerably simplified acquaintance (knowledge) substituting insight by description. Liessmann defines the commonness (non-learning) as *'…an equanimity and an absence to understand at all*' (Liesmann, 2008, p. 51).

In accordance with previous conception of knowledge it is fragmented holistic nature and verbal unfolding that faults process of knowing for static (frozen) knowledge. Rather than expression knowledge we should use more apposite term piece of knowledge. Moreover such pieces of knowledge have character that is in the area of artificial intelligence called *declarative knowledge* and *procedural knowledge*. Emergent (simplified human) knowing makes possible to identify a type of problem and occasionally also to select pertinent solution from the *set of 'proof' methods*. Perhaps such assertion seems to be excessive, however that a blind application of *best practices* is still often bad.

Nevertheless true process of knowledge creation, advancement, dissemination and share use is much more complex and we should allow for further matters of fact relate to the mentioned nature of human knowing and/or changing environment. Let us point out three of them:

- The first problem lies in a reduction of various modes of knowledge creation to education, or better to its institutional fixation called educational system. We commonly neglect other ways such as an individual interaction within a physical environment, influence of culture and/or changing form of human communication. Just tutorial programs do not respect the holistic approach to knowledge (and education itself). Moreover presented knowledge is deeply rooted in "scientific (mechanistic) worldview" and don't reflect advanced knowledge incl. true systems approach. Just new background of education involves cardinal failure of contemporary education (next to mentioned by Liessmann).
- Also the second cruces ensue from reduction of holistic learning process to its cognitive[13] aspects, i.e. elimination of learning and its restriction to teaching. Using two words - *upbringing* on one side and *edification* on the other - we can try to explain the pondered distinction. While edification is oriented to fragmented and culturally shared knowledge being relevant to the world (problem), the *upbringing* affects orientation of personal doing. Actually both aspects of education are parts of circular balance as the figure No. 2 shows. This drawing demonstrates both areas of education as well as attributes associated with it including the distinction between real values and considered or spoken attitudes.
- Procedure of teaching as well as schooling cannot constitute real values in the complex process briefly mentioned above. It is possible to discuss them however 'only' an abstract thought or a 'rational calculation' resulting from it. Poverty of emergent morality mentioned in the epigraph of this paper springs from its intangible nature. Moreover, our (Western) predominance based on ideas of individual utility and/or neo-liberal judgment and attitudes has an elusive background.
- Change of thought and knowing emerging from new media. To explain this influence we can remind some of Mc Luhan's ideas, namely his famous sentence '*The medium is the message'* (Mc Luhan, 1991). Let us remind a development of information and communication technology (ICT) and its changing possibilities dealing with information from textual messages through pictures and television up to (computer based) virtual reality. However, ICT is (only) material background of media that denotes wider ways and circumstance of its use. As an example, we can mention such as amount of communicated people, ways of interaction (1:1 - letter, 1:N - TV broadcasting and M:N - internet) as well as freedom (of speech) or/ and commercialization. Postman (2010) recounts appropriate changes associated with telecast and similar analysis referring to internet is absent, even though some authors provide suggestive theories (Meyrowitz, 2006).

[13] I will apply terms class and instance used in object approach and clearly differentiate both phenomena in the future.

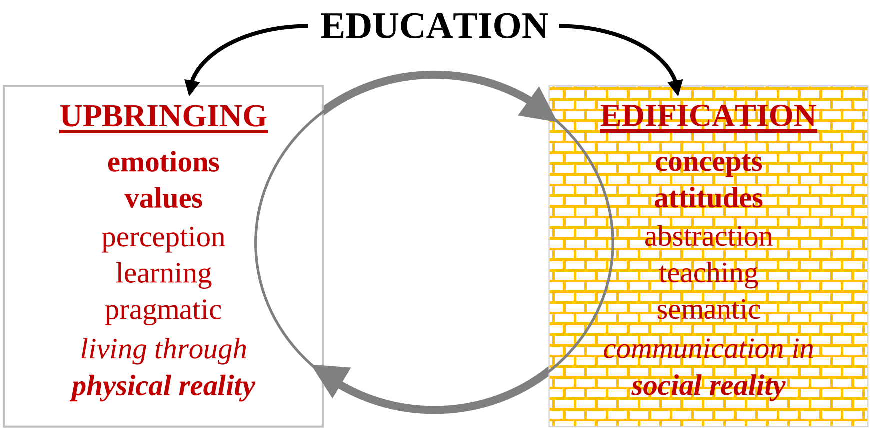


Figure 2 Circular balance of two areas of education

Facts presented above transcend common consideration – individual perception as well as culturally shaped knowledge. Nevertheless, they can advance our common knowledge and practice referring to everyday life and our business. In the first case we should seriously think on crisis of mass culture and associated changes in the society and man itself. Many authors from different areas of science and philosophy call attention to it and often they also admonish (Arendt 1994, Borgman 1999, Hayles 1999, Potsman 2010). This situation relates to more aspects: changes of life style in an easy, artificial environment ensuring basic human needs (Maslow 1993), a shift towards a 'society of enjoyment' (Petrusek 2007, p. 398) etc. However, the evolution emerging from an amended (dealing with) information (Banathy 1996) whose meaning (and human doing) is interpreted by tacit knowledge is also indispensable.

Perhaps the second case seems to be more important for many people and we can point out many ways of our doings that go along with the unthought-of phenomena. For example, we should ponder on a limited benefit of e-learning and on the necessity or possibility to complete them for further doing. Such activities are intuitively connected with an '*experiential education';* however, they (without deeper insight) are often restricted to adventure or similarly pleasurable enjoyment.

5. Conclusion: Knowing and Informatics

The last chapter will be devoted to the human role (that is often denoted as human resources) in the two major positions: (i) user/receiver and (ii) designer/author. Due to our focus on the computers and ICT we more often use the first from both couples of words mentioned in previous sentence. However all people use their individual and tacit knowledge including values: They use it for interpretation of meaningful information in prime case and embed it into designed systems and tools as well as inside of messages in the second case. Problems associated with unequal and also problematic (tacit) knowledge (that is rather belief than true) result from its nature and they catch new dimension just in consequence of some facts indicated above. Still prevailing conception of information based on Shannon's theory in which meaning - and also knowledge - has no significance. Talking about information management – better taking into account purposeful doing emerging from meaningful information than computerized information processing - we cannot ignore it.

Changes of its natural constitution mentioned in the previous text cover some implications associated not only with informatics as a field but also with life in information (informatized) society. To understand this we can point out three aspects of actual knowledge including serious values and problems of their growing poverty:

a) Analytical competency as ability to understand real problems;
b) Creativity coupled with reality as a base for problem solving and
c) Information needs that point to quality of requisite information (not to ways of seeking for it).

The first proposition of systems analysis as well as any other apprehending recognition of actual situation is based on complex knowledge and values. The second arises from real values (not only from attitudes), forms and ability to distinguish relevant from accidental aspects of real problems. In lieu of long explanations we can remember Boom's taxonomy or better its revised version (Anderson & Krathwohl, 2000). Let me accentuate less known existence of three dimensions of knowledge mentioned in both versions:

- Commonly named cognitive component and its higher activities including evaluation;
- Psycho-motor part that covers physical activities with perception and
- Affective that is associated just with human values and also attitudes.

Finally we should refer to one of the most fatal lapse of contemporary culture associated with society information or knowledge society actually. Instead of information literacy we stress and teach computer literacy – i.e. skills to use a computer and ICT for information seeking in given sources. With this approach we ignore well (un)known difference between data and information or better the individual (personal) and tacit knowledge that aims our investigation towards meaningful (relevant) information. The nature of information literacy or better information individual competency is the concept that fades together with bounded knowledge. Information ability accrues from our original knowledge or pre-conception and - better or worse refers to potential information that improves our understanding. The man with reduced individual knowledge including lived-through values has poor or unreal information needs. He must confide in cultural attitudes, general methods (or metrics well known from informatics) and/or universal solutions (called '*best*'). He is helpless coming face to face with actual (namely complex) problems, he prefers efficiency over effectiveness and (mostly) ignores efficacy.

In the preface of his famous book Postman (2010) compares redoubtable (Orwell's) vision of the future with desirable society of welfare with its metaphor in Huxley's book Brave New World. At the same time he alerts to intriguing and disparage danger that becomes actual in many instances today. I mean information overflow and problems to orientate oneself not only in such flux but also in various beliefs and often unreal visions. These common issues make towards well-being that is replaced by bliss and/or savory emotion. Changing knowledge that follows these evolutions brings similar problem. To illustrate it I will use the well-known Turing's test equating human thinking (and problem solving) with computer. Turing speculated about situation in which observer conjectures that he is communicating with a man (being in adjacent room) while a computer is there instead. The result of such faulty judgment is interpreted as oneness of human thinking and computer information processing. It is the promising version - usually associated with completive cofactor such as 'nearly' or 'for the present' - which is unreal and misplaced. Turing and others do not contemplate the second (wrong) verdict that there is a 'man' (while the computer is in adjacent room).

This pessimistic outlook seems to be more real today due to fragmented knowledge that remains on lower steps of Blooms hierarchy. Moreover, it is based on limited individual experience and value - we cannot compare emotions gained from computer games to living through in a natural environment.

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IS BUSINESS ETHICS POSSIBLE?

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Keywords

Business ethics, homo oeconomicus, trust, responsibility, attention

Abstract

In my paper I would like to explore the question how business ethics is possible and whether what business ethicists consider ethics is real ethics in the fundamental sense of the world. For that reason two models of ethics will be developed and their relevance discussed. The reference to some philosophical concepts of ethics will be shown and consequences drawn. At the end a possible relationship between ethics and business sphere will be suggested.

Acknowledgement: This article was prepared with support of the Internal Science Foundation of the University of Economics Prague IGA VŠE IG409040.

1. Introduction

Ethics is an important issue for us because it governs the way in which we relate to one another. St. Thomas tells that "harm should not be given to an other". Kant's Categorical Imperative requires that the moral being should "treat humanity, whether in his/her own person or the person of another, not only as a means but also as an end in itself." Mill's "principle of utility" implies others when he notes that ethics is rooted in the notion of the greatest happiness for the greatest number.

Today ethics is becoming more and more important because the power people have is increasing and the implications of human acts affect a lot of people. Technology is progressing quickly giving people unexpected possibilities. Technology gives us power to influence, but also power to know[14]. Even though the world is getting complicated it is also getting transparent with all consequences it brings.

The popularity of ethics begs the question if businesses were not ethical before. Probably they were to some extent, but they didn't demonstrate that so much. Another question is if business ethics will make businesses more ethical. A possible and not improbable answer may be that the need for business ethics was artificially woken for to be a business ethicist – or any other sort of expert for

[14] An example of such a technology use is "ethical sourcing and trading policy" employed in the nineties in organic food store in California that covers the food chain from original production to sale. The customer uses a hand-held machine in the store to gather social responsibility data, including where the product was sourced, the nutrition content and the background of the product. (Praskey, 2003)

that matter – one must claim (at least) three things. First, that something is needed; second, that you are the kind of person who can do it; third, that you can achieve something with your expertise. So, business ethicists must claim that various customers of their knowledge do not have the resources to deal with moral matters on their own, and hence need guidance from experts. (Jones, 2005)

2. Ethics in the Case of Relationship Marketing

As an example of business area where business ethics is applied I chose the relationship marketing as it was defined by Murphy (2004). It is based on building mutually satisfying long-term relations with key parties – customers, suppliers and distributors in order to earn and retain their businesses. (Murphy, 2004, p. 38). In the relationship marketing the emphasis is also on emotional ties that extend into long term, and so the value of future deliveries will always be greater than the value of existing transactions. As Murphy puts it in the marketing practice the retention and loyalty of existing customer is more important than customer acquisition. In long lasting relationships reciprocity ensures both parties benefits from the relationship. On the other hand long cooperative partnerships lead to increased vulnerability of all parties and so increase the need for ethical behaviour. (Murphy, 2004, p. 41)

Murphy, (2004) envisions virtues of trust, commitment and diligence as the most important in creating relationship marketing based on ethics. Good habits, virtues, focus on the individual and organization rather than on the problem, form the basis for ethical behaviour. These values may prove to be advantageous as they decrease vulnerability of cooperating organisations depending on their partners.

It seems ethics and economy can be combined easily and their application will lead to synergic effects. But it needn’t be the case. The problem is how to combine the homo oeconomicus with the ethical principles which are not accommodated to the self-interested point of view.

Relationship marketing is based on the profitability of the principles and finds in man only the qualities which bring some advantage. The partners must have some qualities which are worth behaving ethically as that behaviour will lead to the highest profit. The vision presented in the relationship marketing is thus too optimistic; the behaviour is not properly ethical. Below I will try to explain why.

3. Is Business Ethics Ethical?

I don’t see much evidence supporting the thesis that ethics makes profit and that trust is good for organisations in long run. It seems to confuse marketing with ethics and selfishness with responsibility. Successful businesses are always sensitive to what their customers want and what other firms are doing. The obsession with trust in business ethics is based on the threat of treason.

In the business sphere different codes and principles are valid than in private affairs. Business is a special kind of community; probably it is not a community at all. People usually don’t care about their work as they would care about their friends or families. The aim of business is to make money and the aim of community is happiness and good life. The aim of friendship is the friendship itself and we wouldn’t say that about business. In order to grasp the behaviour of agents in economic sphere I will use the classical concept homo oeconomicus.

3.1. Homo Oeconomicus

3.1.1. Self-Interest

Homo oeconomicus is a term used by some economic theories to define a self-interested rational agent who acts to maximize his well-being given the constrains he faces. (Kirchgässner, 2008), (Sickert, 2009) Economic agents are understood as indifferent to others. Each maximizes his utility regardless to others.

Economic man is characterized by the desire to posses wealth and by rational method for making choices allowing him to judge the comparative efficacy of means for obtaining his ends. This concept can be found in J.S.Mill's Principles of Political Economy (1848). His homo oeconomicus is characterized by instrumental rationality and material self interest. The term was used by Mill's adversaries and had pejorative meaning. The selfish characteristics of homo oeconomicus are kept in the economic theory until now, they were transformed into axioms only.

For modelling human behaviour the system dynamics model can be used (Mildeová 2006, Brixí and Brixí 2009). Both practical experiments (Forsythe et al. 1994, Fischbacher, Gachter and Fehr 2004, Ostrom et al., 1992) and theory (Collard 1978, Fehr and Schmidt 1999, Bolton and Ockenfels 2000) however show that this model of homo oeconomicus doesn't correspond to the full range of real human behaviour and nature. Human being is more complex and can behave according to different principles than selfish instrumental rationality. Altruistic models of human behaviour are necessary to explain some aspects of human behaviour. In other cases cooperative behaviour or sanctioning uncooperative members may emerge. What kind of behaviour prevails in the economic sphere? I tend to agree with Fukuyama (1995) who puts it like this: "people will act as self-interested individuals often enough for the "laws" of economics to be a useful guide for making predictions and formulating public policy". (Fukuyama, 1995, p. 21). This doesn't mean people are self-interested individuals only. In many spheres of reality people behave ethically to some extent, but that is not economic behaviour as we know it. In economic sphere they tend to follow the pattern of homo oeconomicus. And caring for somebody because he is useful is not ethical, it is calculation. Companies do not care for the other, only for the surface impression he has of them.

It seems business ethics is either a calculated lie or a shop window decorated according to the latest marketing principles. Many businesses speak about business ethics because it is fashionable, but they do not follow its principles in the strict sense of the word. Ethics in its full sense that will be suggested below cannot be subordinated to any other principle, it must govern everything[15]. All human activities must be placed within the realm of ethics. From this perspective every human activity must be explored if it has man as its final purpose in itself. I know that this criterion is quite strict and only a few contemporary human occupations would be able to fulfil it except some charitable pursuits. In case of business ethics I do not doubt that businesses can be founded with ethical principles in mind, but in order to survive they must make compromises. The purely ethical economic behaviour is in our complicated and individually oriented world a utopia. Nonetheless we should strive for it.

In case of business ethics the question is about the principles: are the principles of economy and business running commensurable with ethics? They are not if businesses are based on the behaviour of homo oeconomicus and on profit maximalization. Homo oeconomicus doesn't behave ethically as he doesn't care about other people; they are only instruments for him. If he pretends to respect

[15] The breakup of human activities and separation of ethics from other parts of human life is not a trivial issue. This separation brings with it a lot of new problems which were unknown to the ancient generations.

them, it is only because it repays itself. His selfishness doesn't allow him to see an other. The problem with self-interest is typical for contemporary society. In the individualistic society ethics can only hardly be applied.

3.1.2. Rationality

Another important homo oeconomicus' feature is his rationality. It has this feature in common with the moral philosophy's moral agent who is a rational being capable of neutral descriptions. This agent has his will, independent from reason, and feelings. Moral decisions are rational as the agent is able to evaluate the situation and then choose. What seems not plausible is the fact that morality is a rational sphere. Understanding moral concepts is dependent on the acknowledgement of others as equal human beings.

3.2. Trust, Whistleblowing, Responsibility and Cynicism

In this paragraph I'd like to explain some ethical concept and their use in the sphere of business ethics. Jones' book (2005) will help me.

The stressing of trust seems to be related to the danger of treason. So much talk about trust is the expression of fear from the lack of trust. Launching new ethical programmes and techniques should reconstruct trustful atmosphere. I am a bit suspicious regarding these efforts as people remain homines oeconomici, customers change their minds hesitantly only and people must be responsible for their acts - which include some punishments, possibility for the customer to complain - in order to be trustworthy. One explanation for the popularity of treason may lie in its ecstasy people feel when committing treason. And part of the fascination may be caused by the fact that traitors open doors for influences from other communities.

Whistleblowing means drawing attention to breaking the rules. People are inclined not to do it as they are social beings, parts of the crowd. In this sense people who blow the whistle are traitors. Communities support conform behaviour. Criticising your own organization will damage it. Sharing knowledge and social relations influences in wiki systems were researched by Pavlíček 2009.

Responsibility nowadays very often takes the form of corporate social responsibility. Surprisingly it often takes the form of guidelines or written principles that should be kept. But is this responsibility? Normally responsibility is taken to mean acting independently and taking decisions. Can this be included in a rulebook? I think responsibility is related to the openness to an other which was addressed by Levinas. In the real responsibility there is nothing more than response to the other. Responsibility means welcoming the other and hospitality towards him.

From all this it may naturally follow what reaction people may bear. They all know what marketing is about and what managers do. They don't seem to have enough power to do anything about it, so they are cynical. Cynics know what stands behind marketing and business ethics. But people don't get rid of the ideology. They know it isn't true, but surrender.

4. Two Ethical Models

According to the now quite popular ethical model which I will call "moral agency" morality is accessible to every agent if they share the rationality. Some thinkers (Stocker, Hegeman, Frankfurt, Williams) stress the role played by emotions in moral life. According to this supplemented view emotions are character features and we cannot understand ethics if we do not know what constitutes the agent's reason for action. This reason is in this perspective always internal and constitutes who the agent is. These reasons can also be called dispositions and in this moral agency perspective can be independently grasped. I don't think this is a valid description of ethics.

Wittgenstein has in his Philosophical Investigations an example illustrating his rejection of such an ethics:

"I believe that he is suffering". – Do I also believe that he isn't an automaton?

It would go against the grain to use the word in both connexions. (Or is it like this: I believe that he is suffering but I am certain that he is not an automaton? Nonsense!)

Suppose I say to a friend: "He isn't an automaton". – What information is conveyed by this, and to whom would it be information? To a human being who meets him in ordinary circumstances? What information could it give him? (At the very most that this man always behaves like a human being, and not occasionally like a machine).

"I believe that he is not an automaton", just like that, so far makes no sense.

My attitude towards him is an attitude towards a soul.

The moral agency approach supposed people have character traits which are independently graspable. This idea is based on the supposition that there is an independent human nature from which we could know human desires and our moral task would be to show the means to reach these ends. The alternative approach supposes the notion "believe" is based on an approach or paradigm or Weltanschauung which itself is not a belief. The notion "believe" and the atmosphere in which it can be used and understood as an ethical notion are different and are not based on rationality. "Believe" is an ethical notion and ethics is not the same sphere as rationality. The way I respond to others has nothing to do with knowledge or belief. In the first approach our understanding of the ethical domain is reduced to rational grasping and finding some qualities which call for ethical behaviour if they are found. But ethics is different; it is the whole approach respecting the otherness of the other.

In the above mentioned example with relationship marketing others are taken into account, but not cared for; the basic principle remains the profit (or other benefit) maximization. Most cases of business ethics focus on respect to some features of the other and not on his situation as a member of humanity. For the respect to some features to be ethical it should be based on certain attention to others; in other worlds we must be somehow tuned to the ethical approach in order to be able to understand ethics and act in accordance with its principles.

4.1. Attention to Others

Plot (2009) criticises this moral agency approach as it doesn't allow understanding of what it means to pay attention to others and to care for them. In the first view "morally impossible" is equivalent to psychological incapability. And from the moral agency perspective even business ethics would be ethics. But it is not the case. In the Bible Jesus tells a story of lawyer who asks him how he can inherit eternal life. Jesus answers that he should love God and his neighbour as himself. The lawyer asks who his neighbour is. This question suggests that the layer doesn't have a neighbour and secondly that he believes neighbour can be identified through a set of graspable qualities. Jesus tells the lawyer a story of a wounded man who was lying on the road, people were passing by and nobody helped him. Finally a Samaritan came, felt compassion and took care of him. Jesus told the lawyer: "Go and do likewise." No qualities were stated, just an example.

The problem is not whether others have some qualities which will wake in us ethical feelings, but whether these qualities make en ethical sense for us. People treat slaves differently not because they would lack some qualities, but because they in the case of slaves lack the understanding that would enable them to give the full meaning to the terms when they concerned slaves. The problem is not what qualities we identify in others, but whether we see them as equal to us. Plot (2009) calls such an approach and atmosphere attention. Attention is a kind of limit to our will which makes others have the power to stop our movement and refrain us from doing something just by their presence. (Plot, 2005, 43) It is a special way of seeing others, which allows us to see their feelings and opens the realm of respect and humanity for us.

This way of seeing things is not accessible to homo oeconomicus as it is not based on rationality and advantageousness. It also transcends the inner world of an individual. I would think it would change the economics to such an extent that the economic laws won't be valid any more.

4.1.1. Rousseau's Emil and Gerdil's Antiemil

I think a nice example of the two approaches can be found in the opposition between Rousseau's Emil and Gerdil's Antiemil. Rousseau educates an isolated individual and tries to evolve and develop his skills and abilities as extensively as possible. Social relations are for the student based on some people's traits and can be learnt when the student has achieved some level to understand them; i.e. they are rationally based. Basically social institutions and their rules represent a limit to human development and should be abolished, but Rousseau is aware of the fact that we cannot simply return to the original state. Social institutions have for Rousseau an only instrumental character.

Gerdil criticises Rousseau that the result of his theories would be an aversion toward religious and social institutions. He will make bad Christians and bad citizens, says Gerdil. For Gerdil the connection between religion and politics is crucial. He doesn't think rationality is sufficient for forming the habits and convictions of good citizens. Gerdil believes in the irreplaceable role of religion in the formation of ethics. The natural reason is not able to win broad commitment to the personal order of virtue or to the public order of justice. The appeal of abstract reasoning is insufficient for mobilizing the unity of public spirit, constancy in motive, and firmness in conviction necessary to establishing a citizen. (Frank, 2007) Religion doesn't provide only the guarantee for social behaviour of man. It shows respect for something over the individual, which is also critically important for ethics. Intrinsic goodness, benevolence and order are essential for Gerdil because they are spiritual entities irreducible to pleasure and pain. Civic society is without them inconceivable. Their importance is based on social character of man. For homo oeconomicus the fulfilment of his needs and authentic realisation of his potential are most important. The order of the spheres is turned around for him. He behaves ethically, because it repays itself or because somebody woke in him the sympathetic feelings. He is not social as for social beings the primacy of ethics over its interests is clear.

4.1.2. E. Levinas

E. Levinas (1980) gives a description of this attention and respect to others, too. In his view western thought has always denied real otherness and has reduced it into a version of identity. For Levinas only absolute otherness is constitutive for ethics. The essence of ethics is the relation to the other. Ethics involves opening of the subject and willingness to change face to face the other.

Levinas rejects that other people are reducible to any rational categories. It means that people are known before the real encounter, before they express themselves. It is the denial of other's difference, of his otherness and transformation of otherness into sameness. The contact with the other is so broken. Levinas calls it totalization.

The contact with other is not established through reason but through sensitivity. Sensibility, for Levinas, goes back to a point before thought originates. Sensibility is passive, not active as thought, and it is primarily characterized by enjoyment. Man is content with what becomes his part. He is happy, but selfish. This state precedes the rational subjectivity. Sensibility constitutes a place where the other can be met. An other is met not inside the cognitive self, but reaches into the sphere outside the cognitive dimension. Man is originally passive and sensations come to him from outside to be felt.

The other appears at the moment when the egoistic self tries to consume or make part of itself something that it cannot. The other person doesn't allow the self to consume it in its egoism. The other resists. He is not known, he is felt. It is important to note that the encounter with the other is passive, it is not my interest at all. A. Beavers calls it "catching off-guard". The selfish self is caught by the presence of the other completely unprepared and the other seems to be due my concern – not because I chose it, but because it is demanded from me. In this place I'd like to stress two interrelated aspects that come from this: proximity of the other and responsibility for the other that stems from the encounter. The meaning of social subject is to be for the other. Subject actually means subjection to the other. The egoistic self is sacrificed on behalf of the other. The subjection by the other becomes subjection for the other. Levinas wants to say that we all human beings are capable of ethical behaviour and that we are inevitably confronted with the requirements for ethical treatment when we meet an other.

5. How is Business Ethics Possible?

Now the question arises whether businesses can accept and apply such an ethics. I think that if businesses knew what business ethics is in its full meaning they would refuse it. It would be considered impractical, unmarketable and destabilising in the too busy world. Organisations underlie the dictate of mean-end, i.e. they are goal directed. And good is not. The aim of ethics is such to clean the stiff and narrow-minded running of organisations.

Rule following and doing the assigned work is a very important concept in today's society. All formal organisations have formal rules. And people follow rules given by those who have legitimate authority to give them. The human life becomes mechanical and slavish. We have no longer moral language rooted in tradition and solidarity, as shared ideas about good and bad can grow only from shared experience. Because of that our moral world is very narrow and almost one dimensional, like the effective manager following the most effective input/output ratio. The result is, that people feel effective treatment, but miss the ethics. Some philosophers (like Slavoj Žižek) even think that business ethics and people's response to it is a sort of collective play everyman takes part in, even though everybody knows it is a game. Nobody takes it seriously.

However it is good to think about business ethics at least for the possibility to be able to dismiss it. People who don't know what it is cannot refuse it. And people who refuse it must think the way businesses run today is the only possible way.

6. Conclusion

Ethics must be a little bit unrealistic to allow freedom and change. People interested in ethics were always concerned about the world and wanted to change it. So there is certainly a place in the world and in the business world for ethics even though it provokes. But it has always provoked. Nothing has changed, people only mustn't forget.

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THE INFLUENCE OF ENTERPRISE VALUES, CULTURE, ETHICS, AND NORMS ON ITS VISION AND THUS LONG-TERM SURVIVAL

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Keywords

Enterprise values, enterprise culture, enterprise ethics, enterprise norms, enterprise vision.

Abstract

To overcome the crisis the planet Earth faces, enterprises vision should include social responsibility (SR) to motivate enterprise stakeholders toward a modern, requisitely holistic, ethics and behavior, for long-term survival of their enterprises. The information for properly oriented enterprise vision and policy arises from enterprise (stakeholder) values, culture, ethics, and norms (VCEN). We will show the importance of their SR orientation, its influence on enterprise vision, its policy, and thus long term survival. We tried to draft a planning methodology for enterprise vision, in order to direct it towards SR in enterprise behavior. VCEN provide crucial business information.

1. The Selected Problem and Viewpoint

An old saying reads: “Nothing succeeds like success!” An organization succeeds (Stacey, 2007, p. 63) when its people, as individuals, are emotionally engaged, when they believe in what their group and their organization are doing, and when their contribution to this organizational activity brings psychological satisfaction, exceeding the simple basic rewards. Every organization, as an institution of interest linking people and property (Belak, 2002, 2003) defines its basic, general and long-term characteristics in its policy as its important management instrument influencing development and operation. Enterprise policy includes its mission, purpose and basic goals that results from vision – starting point for start-up and developmental enterprise planning – and also incorporates vision; the information for properly oriented enterprise vision and policy arises from enterprise (stakeholder) values, culture, ethics, and norms (VCEN). To overcome the crisis the planet Earth faces, this vision should include SR of behaviour motivating the enterprise stakeholders toward a modern, requisitely holistic, ethics and behaviour, for long-term survival of their enterprises.

2. The Way Out of the Current 2008- Crisis by Innovation of the Enterprise VCEN

The 2008- crisis was not caused in 2008; it only surfaced then, as a consequence of the neo-liberal fictitious rather realistic model of omnipotent market (Mulej et al., 2009d, p. 229), causing also fictitious innovations by banks and finance people and the break of the fictitiously working real estate market in USA. This crisis is obviously much deeper: the market cannot be relied upon, because it does not work as predefined by A. Smith. Neither can governments be reliable, if they are rather biased and one-sided than requisitely or even totally holistic in their approach (Mulej and Kajzer, 1998). The current problems of 2008- crisis crucially depend of VCEN, thus the decisive persons' perception what should be included in the considered cost, effort, benefit, time horizon, tackled circles of persons, etc. If this perception is narrow-minded rather than requisitely holistic, one-sidedness of decisions results and failures of processes outcomes are hardly avoidable. Many researches show (e.g., Kajzer, Potočan, 2004, p. 25) that the most successful enterprises have radically innovated their management processes and style (Collins, 2001; Collins, Porras, 1994; Drucker, 1985; Goerner, 2004; Goerner et al., 2008; Gorenak, 2008; Gregory, Midgley, 2003; Hrast et al., 2006; 2007a; 2007b; 2008; Kanter, 1983; Peters, 1987; Peters, Reimann, 1988; Peters, Watermann, 1982; Štrukelj, Mulej, 2008 etc.). This results from innovation of VCEN and expresses itself as an innovation of enterprise vision and policy; only then they could effectively and efficiently use the top-level informational technology (Zahn, 1989; Zahn, 1990, in ibid), and only then the VCEN will be the information leading to requisite holism/wholeness.

The 2008 saw the start of the worst global recession since the 1930s (if the World War is left aside). Yet, after dealing with the initial shock, companies went to work to prepare for the inevitable recovery. Senior leaders began wondering how the competitive landscape of their markets would change, and which actions would best prepare their organizations to compete in a new and changing world (Chowdhry, 2010, p. 29). For many stakeholders (Mulej et al., 2010, p. 309-310) the Dialectical Systems Theory requires innovation of their VCEN to replace their one-sidedness (Potočan, Mulej, 2007, in ibid) and their un-realistic hope that an 'invisible hand' might solve problems instead of them. But this hand does not exist outside them-selves. Therefore they must innovate them-selves to be able to solve the 2008- crisis (and other crises, too, of course). Humans in influential positions – government, governance, management, other stakeholders, opinion making, teaching, informing through public and inter-personal media, etc. – should innovate their management/influence style (Mulej, 2007a, b, in ibid) to save humankind by leading humans out from the 2008- crises. Authors recommend five interdependent sets of attributes that are more efficient in practice of enterprise development and performance aspiration than bosses' issuing orders without listening and making synergetic syntheses. They include attributes of humans' personal VCEN to be attained and to include also personal and personality's development of influential individuals toward personal requisite holism, innovativeness, SR, and well-being, emotional stability, and self-realization (ibid, p. 310). Many influential persons (Mulej et al., 2009f, p. 11) made history by making their individual values a culture, shared by a group of their followers who then diffused this culture to make it a socially acceptable ethic, resulting in the social norms, and influential over individual values of others who had a dilemma to face: accept the novelty and be acceptable in the society or refuse it and be outlaws. See Table 1.

Individual values (interdependent with knowledge)	↔	Culture = values shared by many, habits making them a rounded-off social group
↕	╬	↕
Norms = prescribed values on right and wrong in a social group	↔	Ethics = prevailing values about right and wrong in a social group

Table 1: Interdependence of values, culture, ethics, and norms (Mulej et al., 2009f, p. 11)

Along this basic thought as the background of interdependence of the current crisis and enterprise VCEN's innovation, it is worth thinking about the enterprise vision and resulting policy.

3. Enterprise Vision

According to Zimmerer and Scarborough (2005, p. 71) the greatest political and business leaders have been visionaries. Empirically, Collins (2001) and Collins and Porras (1994) found the same. The purpose is the same: to focus everyone's attention to the same target and to inspire them to reach it as a long-term sense-making goal. The vision touches all enterprise stakeholders – employees, investors, lenders, customers, and the community. It expresses what the owners stand for and believe in. Highly successful entrepreneurs are able to communicate their vision and their enthusiasm about that vision to those around them.

An organizational vision (Coulter, 2005, p. 47) is a broad comprehensive picture of what a leader wants an organization to become. It's a statement of what the organization stands for, what it believes in, and why it exists. The vision provides a vibrant and compelling picture of the future. It presents a view beyond what the organization "is" to what the organization "could be" (Marino, 1999, p. 20; Silvers, 1994-1995, p. 10-14 in Coulter, 2005, p. 47).

Enterprises strive to achieve their (basic) vision in the long term. Wheelen and Hunger (2006, p. 13; see also 2009a, 2009b, and 2010) see a vision statement describing what the organization wants to become: a strategic vision (ibid, p. 49) is a description of what the company is able to become. According to Stacey (2007, p. 63) the word "vision" is usually taken to mean a picture of a future state for an organization, a mental image of a possible and desirable future that is realistic, credible and attractive. According to Hinterhuber (1992, p. 43 in Belak, 2002, p. 74; see also Hinterhuber, 2004) three factors of the vision are reality feeling, openness and spontaneity. Filion distinguishes the beginning, central, and secondary visions (1993, p. 51 in Belak, 2002, p. 73); the central vision should express realistic, credible, and possible view on the products' market position, desired by the entrepreneur, and on the type of an organization he/she has to develop to reach that position.

A vision is a picture of the better world (Wickham, 2004, p. 225) the entrepreneur wishes to create. It inspires the entrepreneur and gives him/her direction. The shared vision communicates the organization's necessary direction. If the people who make up the organization see the vision and accept what it can offer, the organization as a whole will gain its sense of direction. However, a vision only specifies an end, not the means. It indicates where the organization can go, not the path it must take. It leaves open the potential for a wide range of possibilities and courses of action. Different courses must be judged in terms of how effective they will be in leading the organization towards the vision. Key ideas about vision summarised by Wickham (2004, p. 275) include:

- A vision is a picture of the new and better world that the entrepreneur wishes to create;
- Vision can be refined and articulated as a management tool;
- Vision can be used as the basis of a powerful leadership strategy;
- Visionary leadership demands communication of the vision in a way, which draws stakeholders towards the venture and motivates them to work for its success.

Strategic vision (Huff et al., 2009, p. 7) provides a compelling image of what the company wants to become or do… It sets direction, but does not give employees and others very detailed information about what should be done, by whom, how, when, with what cost and consequences, for whom, or why. Strategic vision of an altered future (ibid, p. 367) can be the glue that holds an organization together. The vision should describe what members of the organization are trying to do and provide an overview of how they are going about it. To the extent that employees share this vision, it provides a general framework that guides decision making. It also gives the organizations a yardstick against which they can measure their present performance. On the said empirical and theoretical basis we believe that efficiency, effectiveness and ethical behaviour (SR) influence enterprise performance and long-term survival. The latter must be included into an enterprise vision.

4. Enterprise Vision and Policy Innovation toward SR for its Long-Term Survival

The innovation of planning and management criteria must be oriented toward more SR and requisite holism (Mulej et al., 2009a, 2009b). A new benefit for the current and coming generations should be provided through innovations (see Mulej et al., 2009c). Our economies need radical changes to get out of the current 2008- (VCEN) crisis, also through the governance and management process innovation (see Štrukelj, Mulej, 2009) and requisitely holistic ethics planning as pre-condition for enterprise ethical behaviour (Belak et al., 2010). In the concept of SR (Wheelen, Hunger, 2006, p. 56) a private corporation has responsibilities to society beyond making its profit. Strategic decisions often affect more than just the corporation. Managers (see ibid, p. 57) must be able to ethically deal with many conflicting interests to formulate a viable strategic plan (originating in the enterprise vision, N. B. author). Among many world-wide acknowledged models of integral management that stress the governance and management process let us expose authors considering the above systems connection, e.g. Bleicher (2004), David (2008), Hinterhuber (2004), Kajzer, Duh, Belak (2008), and Wheelen and Hunger (2010). But we must be aware (see Štrukelj, Mulej, 2008, p. 178-179) that also all these models presented only a partial (although rather integrative) view of organizational development and business, depending on subjective viewpoints of cooperating authors and schools. Thus, models are only frameworks for precise organizational investigation. Theoretical approaches to schools of thought in strategic management from the integrated strategic management perspective were briefly explained by Criado, Galván-Sánchez and Suárez-Ortega (2010, p. 109-112); for brief introductions to schools of strategic thought see for example (Grant, 2007, p. 14-22, Stegmann, 2007 and Matthews, 2005). About the need for SR of enterprise governance and management (process innovation) read (Štrukelj, Mulej, 2008, 2009, Štrukelj et al., 2010). For enterprise to attain its long-term survival the principles of stakeholder interests, enterprise developmental, economic and social (SIEDES) responsible (enterprise) policy should be followed (see: Bleicher, 1995, p. 100-120; 2004; adapted) (Table 2).

1. To reach business excellence and hence to find their way out from the crisis, responsible enterprise policy should stress the regular innovating.
2. Arising from VCEN innovations, expressed as persons interests, the enterprise's general definitions of its policy depend on interests of its important stake-holders.
3. All of them should once again rethink their long-term interests (benefits), and
4.Their consequences, and
5. Their willingness/ability to innovate them toward their responsible, requisitely holistic behavior concerning all other humans (families, co-workers, other citizens and planet Earth residents – with predominating of long-term interests concerning all of them).
6. Enterprise's developmental orientation (e.g. exploitation of opportunities of its environmental development),
7. Their economic orientation (with striving for politics of economic responsibility toward all inhabitants of the world), and
8. Their social orientation (toward ecological and socially responsible goals and social desire consideration) should also be innovated all the time.

Table 2: The principles of stakeholder interests, enterprise developmental, economic and social (SIEDES) responsible (enterprise) policy

Many entrepreneurs practice the modern VCEN with clear business benefits; their criteria of benefit are often not short-term and narrow-minded (Mulej et al., 2009d, p. 240). Organizational vision provides an overall picture of where the organization would like to be in the future… It should also reflect the organization's commitment to SR and ethical decision making (Coulter, 2005, p. 48). The lack of suitable VCEN, based on SR seemed to be one of important (economic) factors that caused the (economic, social, environmental, financial) global crises of 2008-. And just now, if not earlier, the necessity of enterprise's SR is hence more urgent and needed than otherwise. This need has to be included into the enterprise vision.

A case: a number of highly visible global economic problems and environmental disasters (Coulter, 2005, p. 49) caused a new awareness and spirit of environmentalism of strategic decision makers, who increasingly began to face questions of the natural environment and its impact on organizations. This recognition of the close link between an organization's decisions and actions and its impact on the natural environment is referred to as the greening of management. As organizations become "greener", we find more and more of them issuing detailed reports on their environmental performance. The Global Reporting Initiative (GRI) (www.globalreporting.org) was launched in 1997 as a joint initiative of the Coalition for Environmentally Responsible Economies (CERES) and the United Nations Environment Program. It is aimed at enhancing the quality, rigor, and utility of sustainability reporting. To that end, GRI created its Sustainability Reporting Guidelines. Using the guidelines, hundreds of companies around the globe report their efforts in promoting environmental sustainability. Still, not all of them do it, which may mean that many do not really behave with SR in their vision and practice. This may be a crucial cause of the 2008-crisis, including the dangerous data saying that the world-wide humankind now emits – every hour – four million tons of carbon dioxide in our atmosphere, cuts 1.500 hectares of woods, and puts 1.7 million tons of nitrites in our soil (see: Kajfež Bogataj, 2009). This is a very dangerous lack of requisite holism in practice.

This is a very good reason for SR to be included into an enterprise vision. We took this into consideration in our second vision development planning methodology attempt; for the first version see (Štrukelj, Mulej, 2010 at IRDO).

5. Our Second Attempt of Enterprise Vision Development Planning Methodology

Vision (David, 2005, p. 55; 2008) is “a possible and desirable future state of an organization” that includes specific goals. Many organizations today (ibid, p. 9) develop a vision statement to answers the question: “What do we want to become?” Developing a vision statement is often considered the first step in strategic planning (enterprise development planning, N. B. author).

A clearly defined vision helps a company in three ways (Zimmerer, Scarborough, 2005, p. 71):

1. *Vision provides direction*. Entrepreneurs who spell out the vision for their company focus everyone’s attention on the future and determine the path to attain it.
2. *Vision determines decisions*. It influences decisions, be them big or small, that owners, managers, and employees make every day in a business. This influence can be either positive or negative, depending on how well, i.e. requisitely holistically, defined is the vision (in contrary we believe that an enterprise purpose statement is such an important part of the business policy that it should be written in an independent note, separated from vision, N.B. author).
3. *Vision motivates people*. A clear vision excites and ignites people to action. People want to work for a company that sets its sights high.

Four components matter for organizational vision (Silvers, 1994-1995 in Coulter, 2005, p. 47-48).

1. First (ibid, p. 47), the vision should *be built on a foundation of the organization’s core values and beliefs*. These values and beliefs address what is fundamentally important to the organization, whether it’s conducting business with requisite holism, i.e. ethically and responsibly, satisfying the customer, emphasizing quality and all aspects, or being a leader in technology. And, the vision should stress whatever those core values might be.
2. Second, the vision should *elaborate a purpose for the organization*. Every organization – profit or not-for-profit, large or small, local or global – has a purpose, and that purpose should be specified in organization’s vision. In that way, all organizational stakeholders are explicitly aware of why this organization exists.
3. The third component of organizational vision is that it should *include a brief summary of what the organization does*. While the vision shouldn’t provide explicit details of what the organization does…, it should explain what it’s doing to fulfil its purpose.
4. The last component of organizational vision (ibid, p. 48) is that it should specify broad goals to provide a target for all organizational members to work toward and to unify organizational members toward a common end. An organization’s vision can and should be a guiding force in every decision (we agree, but would like to stress that also the enterprise basic goals, like its purpose, should be written separately as a part of an enterprise policy statement, N.B. author).

Many vision statements include a single sentence. Even a longer vision statement should motivate all enterprise stakeholders. An excellent vision statement should contain answers to the following questions we prepared to answer “what do we want to become” (Table 3).

• Why does this organization exist, what are its major products or services (which needs do we satisfy with them; quality/price/newness/customer satisfaction potential)? • Which is our desired product market position (where – on which markets – does the enterprise compete; who are its customers; how to improve this position)? • What are the basic/core values, beliefs, enterprise culture, ethical (socially responsible) priorities, and norms of the enterprise? • What type of the enterprise do we have to develop to reach the defined attributes (this answer should indicate the importance of creative individuals/teams and declare the importance of all viewpoints of innovation)?

Table 3: Guidelines for developing an excellent vision statement

All of these questions should be included; but in the vision they should not be recognised as a question-answer path. All of them must be realistic, feasible, requisitely open, credible, attractive, and include spontaneity. Enterprises can attain such a vision. "Concrete picture of the future, near enough for involved persons to see its realisation and at the same time so much far away that it awakes enthusiasm for included novelties in the organization" (Boston Consulting Group, 1979).

David (2005, p. 50) argues that as many managers as possible should contribute to developing the vision statement. If employees and managers together shape the vision statement for their enterprise (ibid, p. 54), it can reflect their personal visions about their own futures. A shared vision creates a commonality of interests that can lift workers out of the monotony of the daily work and put them into a new world of opportunity and challenge. We agree, and believe, that this is possible only when owners'/shareholders'/stakeholders' interests coincide with such a way and make a synergy of interest requisitely holistic and clear.

6. Concluding Remarks

Businesses need new bases and methods (Mulej et al., 2009d, 235) taking in account new VCEN of humans, including their personal and personality's development, leading both humans and businesses to their own requisite holism. This covers also enterprise governance and management and their predisposition to (responsible) enterprise vision (and policy) we studied, because they are able to show the way out from the current crisis. So "the best prepared" enterprises will survive the current crisis: creative, able to learn, innovate, and prepared to change them-selves in many respects if necessary (Štrukelj, Mulej, 2009, 2010, Mulej et al., 2009c, Mulej et al., 2010). Informal systemic thinking/behaviour (Potočan, Mulej, 2009, p. 219) has been applied for millennia by successful persons attaining requisite holism/wholeness without existence of systems theory. Narrow specialists tend to neglect it rather than to practice interdisciplinary creative cooperation to attain it. The current crisis results from it and from the related lack of requisite wholeness of information as a basis of behaviour. Prevention of errors in information systems is therefore crucial. (Corporate) SR that requires honest behaviour of influential people and organizations toward their co-workers, other business partners, broader community/society, and natural preconditions of survival of the current civilization of humankind, can support information processes to attain requisite holism/wholeness. It can also receive support from them. This possibility originates in VCEN of influential people affecting their enterprise vision and (SR of) policy.

Despite the facts that we are researching the formation and development of visions the period and wholeness of which are relative, in our discussion we originated in different definitions of vision. We tried to draft a planning methodology for vision, in order to direct vision towards SR in enterprise behaviour. If an organization fails to develop a vision statement and a comprehensive and inspiring mission statement (David, 2005, p. 57), it loses the opportunity to present itself favourably to its existing and potential stakeholders. All organizations need customers, employees, and managers, and most firms need creditors, suppliers, and distributors. The vision and mission statements are effective vehicles for communicating and reaching agreement with important internal and external stakeholders. If organizational leaders articulate a distinct vision, their co-workers may be more motivated to contribute more effort (Larwood et al., 1995; Oswald et al., 1994, in Coulter, 2005, p. 47). Hence, an enterprise vision must be transmitted throughout that enterprise.

Vision is based on the entrepreneur’s values (Zimmerer, Scarborough, 2005, p. 71). They reflect in organizational culture, ethics, and norms (Potočan, Mulej, 2007). When they are oriented toward enterprise’s SR, enterprises (and humans) have more possibilities for their long-term survival. Vision, when properly used (Wickham, 2004, p. 555-556), is a powerful driving force for the entrepreneurial venture. However, there can only be one vision, which dominates within the venture. There is no room for an alternative. Two or more visions offering different directions within the same organization will inevitably come into conflict. An important, perhaps the most important, element in the power base of the entrepreneur is hence his or her ability to compose, articulate and control the vision that shapes and drives the venture as a whole. Wickham also argues (ibid, p. 556) that an effective entrepreneur wants to lead the enterprise in a way that offers success to all its stakeholders; that is, in the long run, the only way in which his or her power can be sustained.

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THE ROLE OF CRITICAL THINKING FOR WELL-BEING OF INDIVIDUAL AND SOCIETY

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Keywords

Critical thinking, well-being, information literacy, health

Abstract

Well-being is one of the strongest engines driving the society. A desire for better life and higher satisfaction of one's needs always led the mankind ahead. The today's still broadening gap between rich and poor countries along with the exploitation of natural resources gives the introduced issue new contours. In order to improve the well-being of society, it is therefore not enough to increase the GDP per capita but there is a need to improve well-being of individuals. Concerning the fact that subjective well-being is to a substantial extent influenced by stable psychological resources of individual, one of the best ways how to improve well-being of individual is the education of critical thinking. Critical thinking enables the individual to work with information more efficiently which in contemporary society seems to be crucial for success in one's both professional and personal life. Critical thinkers are much more successful and therefore subsequently improve not only their well-being, but also the well-being of society as a whole. Moreover, the society that efficiently uses such a critical thinking is able to better implement the principles of sustainable development that are essential for its future.

1. Well-being and the Society

Human society has always been driven by unceasing effort to improve its well-being. It was in fact the effort of the individuals themselves that resulted in development of the society and led to the well-being improvement. Regardless which theory is used for explanation, there is no doubt that everyone wants to be happier and at least to some extent also prefers a higher level of happiness for the other members of the society as well. Concerning this issue, it is necessary to keep in mind that the ideal way of living leading to well-being can be viewed and explained as a never-ending process more than a matter of state. Because, inevitably, ones a person gets close to the accomplishment of its aim, always a new desire occurs, e.g. a desire for even greater amount of such goods, for even higher level of quality or for getting a greater credit in the society.

Well-being can be defined as “a positive physical, social and mental state; it is not just the absence of pain, discomfort and incapacity. It requires that basic needs are met, that individuals have a sense of purpose that they feel able to achieve important personal goals and participate in society. It is enhanced by conditions that include supportive personal relationships, strong and inclusive communities, good health, financial and personal security, rewarding employment, and a healthy and attractive environment." (DEFRA, 2007, p. 111)

In theory there are different approaches in dividing the well-being into diverse categories. Figure 1 provides an explanation of the relationship between human well-being, economic well-being and the GDP. As can be seen from the diagram, the core of human well-being is represented by the GDP and other linked indicators such as financial flows towards education, health service, police etc. A part of GDP designated as "social regrettables" represents the costs that are essential for the state but that are not reflected in well-being itself. On the other hand, economic well-being broadens benefits for individuals resulting from GDP by involving non-market activities that either directly increase individuals' income or at least cut their cost of living. These activities can be imagined for instance as domestic work, care for ill members of family or growing of one's own crop. In addition, human well-being involves also components that are not economically expressible, e.g. satisfaction resulting from work, social status obtained etc.

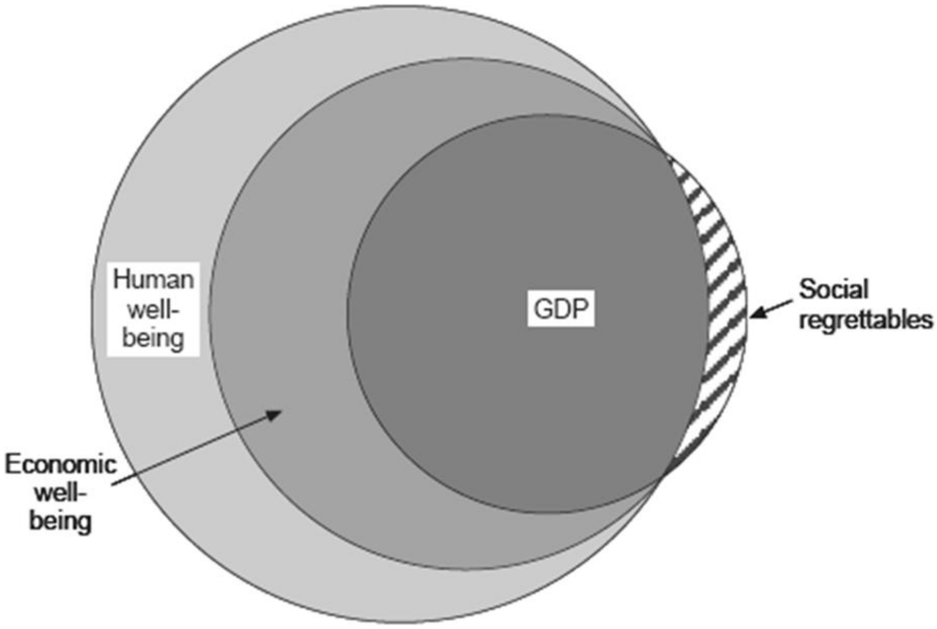

Figure 1: Relationship between human well-being, economic well-being and GDP (Healy, Côté, 2001, p. 10)

In the following text we will distinguish between well-being of individual and well-being of society. The latter term can be additionally divided into many other sub-categories such as community well-being, well-being of mankind or well-being of state.

1.1. Well-being of Individual

The concept of individual well-being is tightly inter-connected with the individual itself depending on its mental equipment, stress resistance, and many other psychological preconditions. Concerning all the above mentioned characteristics, however, the core of individual well-being resides in the soundness of its physical health that can be understood as a base not only for all its feelings and sensations but also resulting in diverse needs for creature comforts. In this context, it is useful to keep in mind the difference between highly developed and developing countries and realise that in the latter case even minor disease can be life-threatening. There are, however, also many other factors influencing the well-being of individuals such as sex, age, education, mental abilities, occupation, family, income, ethnic group, religion, having children, marriage, social contact and social activities. Despite the fact that well-being of individual is in its core meaning highly subjective, on the example of well-known Maslow's pyramid of need not only subjective but also objective aspects could be easily demonstrated. Using the essential idea of Maslow's hierarchy, these objective aspects can be classified into home, health, nourishing, salary and many others. Subjective aspects, on the other hand, can be imagined as such as job satisfaction, love, self-satisfaction and other highly personal feelings. The intricacy of the objective aspects can be seen in the fact that what can be viewed as a satisfactory salary to one person, does not necessarily have to be satisfactory to the other.

In addition, the Maslow's attitude can be used to illustrate the positive relation between well-being of individual and its income. The higher the income, the better ability of satisfaction of essential needs of the particular individual and the higher possibility of reaching the upper floors in the hierarchy by the fact that such a person has enough sources for its self-improving through diverse courses and workshops and which as a consequence also results in the improvement in its self-perception.

The relatively broad issue of psychological well-being is illustratively described in Figure 2.

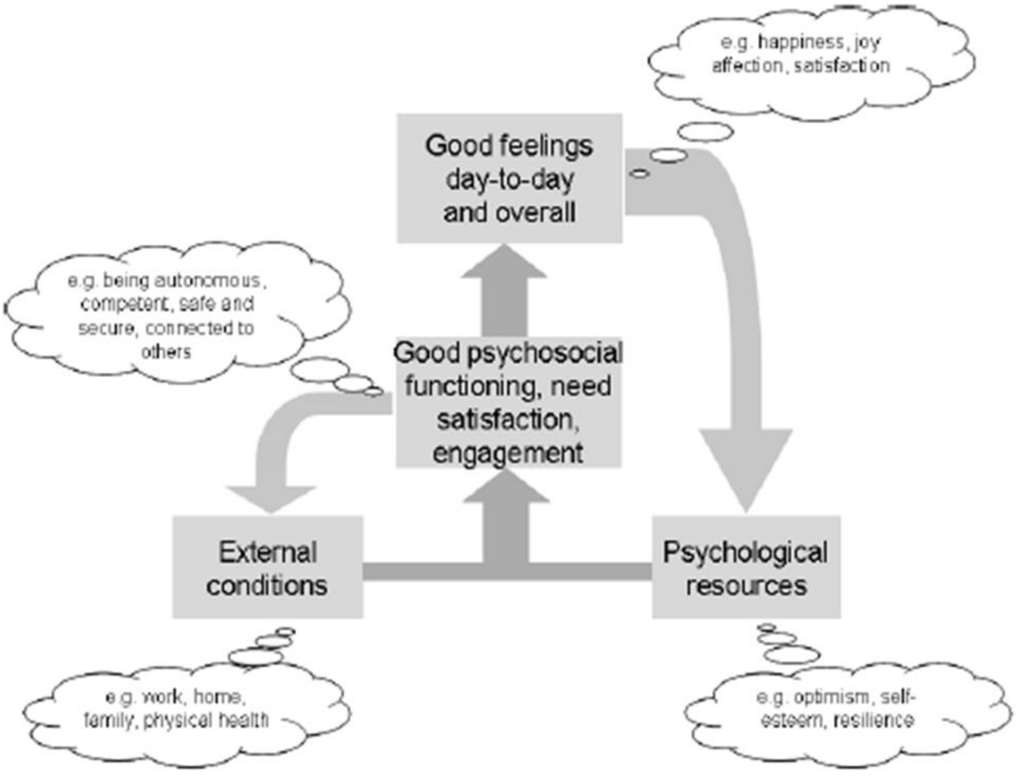

Figure 2: A dynamic model of psychological well-being (Thompson, Marks, 2008, p. 12)

Personality of an individual is here described as a combination of psychological resources along with external conditions. These determinants in particular form the way how such a person act within the society and influence its feelings. Good psychosocial functioning in return influences external conditions of living, because a self-confident person is more successful in both professional and personal life. A positive acceptance of a person by the society strengthens its day-to-day good feelings and these feelings are in return able to partly influence its otherwise stable psychological resources.

In theory, life satisfaction as a concept can be divided into many categories selected according to diverse criteria. One of the most persuasive approaches by Ryff (1989) distinguishes six categories of life satisfaction, in particular (i) self-acceptance, (ii) positive relations with others, (iii) autonomy, (iv) environmental mastery, (v) propose in life, (vi) personal growth.

1.2. Well-being of Society

Well-being of society is not given by a simple sum of well-being of its individuals. As in case of other concepts concerning the human community, also here a synergy effect can be observed. The term well-being of society is also linked to the concept of human capital defined according to OECD as „the knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being." (Healy, Côté, 2001, p. 18) In the report it is additionally stated that „sustaining well-being requires adequate investments in human and social capital since change in both the social and natural environments operate on long-term time scales." (Healy, Côté, 2001, p. 14)

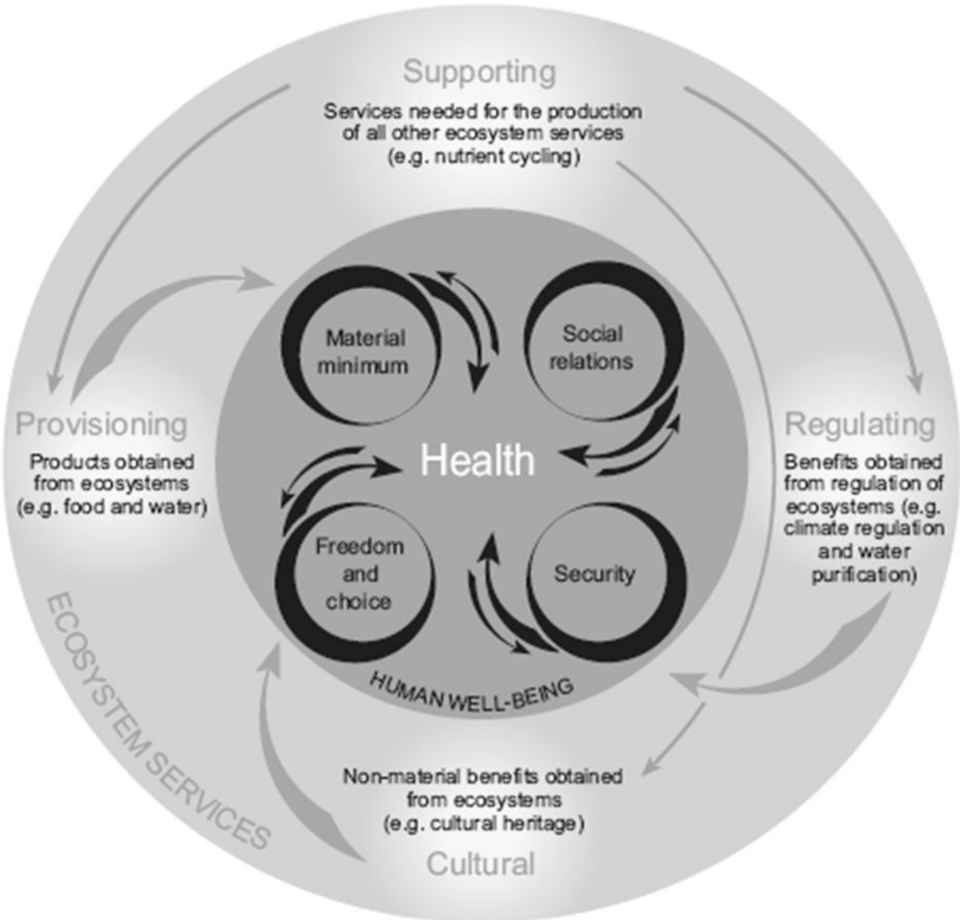

Figure 3: Associations between health, other aspects of human well-being and ecosystem services

(Corvalan, Hales, McMichael, 2005, p. 14)

While well-being of society is often interchanged with economic development of a country, it is in fact tightly linked with eco-system, i.e. environment and its impact on people's health. As can be seen from Figure 3, health that is considered to be a core component of well-being is in this approach influenced not only by the other aspects of well-being but also by the ecosystem, in particular by the four in the diagram presented ecosystem services. Without full balance of the particular indicated linkages, it is neither possible to arrange the people's health nor the well-being of society as a whole.

As dependence of mankind on the environment is an essential issue, requirements of sustainable energy and water and nutrition supplies are often highly emphasised. But on the other hand, knowledge acquired from the field of ecology must be evaluated thoroughly according to the rules of critical thinking. This is the only way how to avoid inefficient and sometimes entirely wrong solutions that are regularly put as suggestions by diverse interest groups. As a shining example of such a conduct, can be given the case of adding of rape as a bio component to petrol enforced by the EU, although energy requirements for processing this farming product are much higher than in the case of other farming products already used in petrochemical industry.

In order to improve the well-being of society as mankind, it is necessary to arrange an equitable distribution of welfare in the world. Also here the well-known 20/80 rule can be applied, i.e. that 20% of the richest countries in the world consume 80% of the world income. Grün and Klasen (2003) additionally state that „global inequality is thus not just a political, economic, and social problem, it is a welfare problem as it reduces aggregate global well-being considerably.“ (p. 644)

These circumstances could result in a huge problem in the future, since great differences in economic situation of families and so the whole society will lead to substantial differences in access to education that further deepen the gap between rich and educated and poor and uneducated people.

Many researches and comparisons of well-beings confirm the linkage between well-being and the GDP, in particular GDP per capita. Subsequently, many other indicators are linked to this relationship, e.g. employment rate, equity measured by using the Gini coefficient, health (the amount of money involved in health service) and social cohesion. Sometimes also more personal issues concerning the family, job satisfaction, living and others are implemented.

The positive relationship between life satisfaction and GDP per capita is presented in Figure 4.

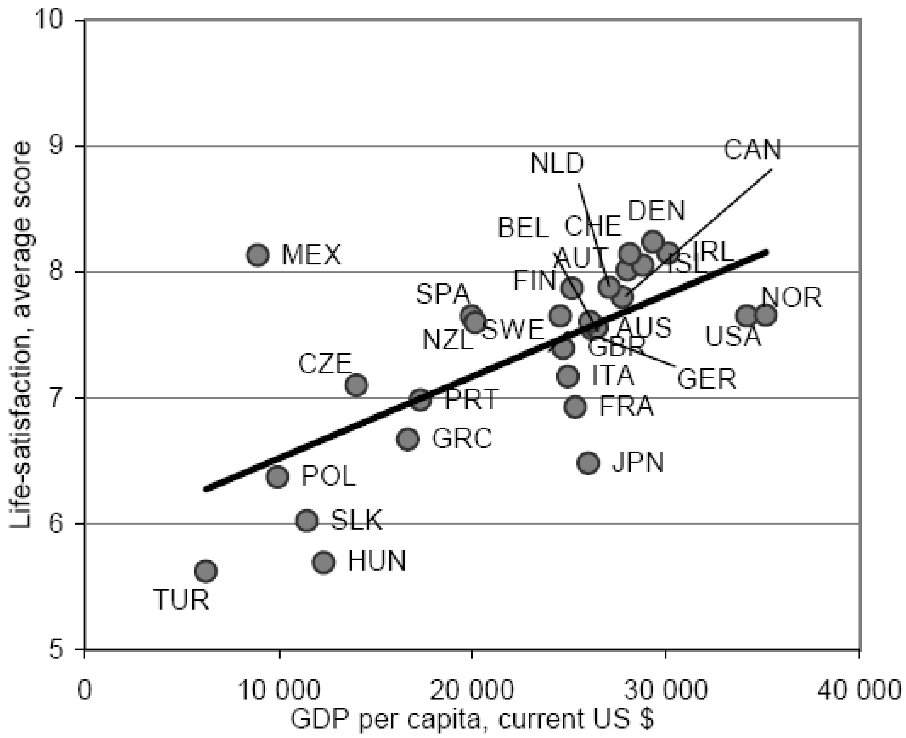

Figure 4: Cross-country relation between average life-satisfaction and GDP per capita in OECD countries, 2000 (Boarini, Johansson, d'Ercole, 2006, p. 34)

The diagram, however, also shows that life satisfaction could vary substantially in diverse countries, even though the GDP per capita is being approximately the same, e.g. the case of Mexico compared to Poland for lower level of GDP per capita, or the case of Belgium compared to Japan for higher level of GDP per capita. These differences could for instance result from political situation, religion or the "nature" of nation.

2. Critical Thinking

2.1. Information Literacy

If we consider an individual as an entity with several different groups of needs, the already complex issue of well-being becomes even more complicated. These needs in fact involve among others (i) physical comfort, (ii) psychical comfort, (iii) social comfort, and (iv) economical comfort. The most important of the above mentioned needs that influences almost all the others is the so-called information need, i.e. the need of relevant, valid, up-to-date and credible information. Evaluation of quality of information is usually linked with highly developed countries. However, right adaptation to surrounding conditions that is based on the highest-quality information is crucial for life and survival even in still developing countries.

Essential importance of these four aspects of the information quality improves hand in hand with the increasing amount of information we need to cope with. After a boom in using of the Internet, information seems to be at least at the first sight very easily and almost cost-free accessible, but with increasing amount of information obtainable, the overall length of evaluating process of such information increases rapidly as well. Facing the problem of web anonymity, and as a consequence even more significant difficulty with determination of the level of information quality, the issue of evaluating information becomes more and more in the concern of many teachers, researches and other professionals as well as general public.

Evaluating of the quality of information can be nowadays seen as one of the key abilities that are needed in today's world and information itself is considered the core element of creating knowledge. And it is the information and knowledge that are necessary in the business process for further innovations that are considered as the only way of sustainable development of the Earth as a whole.

The key role in effective and efficient coping with information can be found in education. The whole-life education needs to focus on information literacy as a part of critical thinking in the sense of Paul and Elder (2007). The whole-life principle seems to be essential as IS/ICT develops rapidly and this development strongly influences not only the access to information but also the way of processing and consequential action.

There is a need to emphasize that information literacy is far more global than the narrower concept of computer literacy, as these terms are often incorrectly confused. Computer literacy contains the ability to work effectively with current IS/ICT, more concretely to work with common PC and the most common software and web-based products such as Microsoft Office, web browsers, e-mail, ICQ and recently also Skype or Facebook, Twitter and other social networks.

Information literacy is a concept of abilities to work with information in all the following aspects: (i) searching, (ii) evaluating in sense of validity, relevance, accuracy, credibility, etc. (iii) using, (iv) learning. Each of these mentioned aspects can be a matter of teaching as well as learning process. There are many books, brochures and other materials that are helpful, but the first essential step towards a desirable change is to recognise one's own imperfection in working with information.

2.2. Critical Thinking

The ideal way of working with information is by means of critical thinking. For the purposes of this paper, the definition by Paul and Elder (2007) seems to be the most suitable: "Critical thinking is the process of analyzing and assessing thinking with a view to improving it. Critical thinking presupposes knowledge of the most basic structures in thinking (the elements of thought) and the most basic intellectual standards for thinking (universal intellectual standards). The key to the creative side of critical thinking (the actual improving of thought) is in restructuring thinking as a result of analyzing and effectively assessing it." (p. 7)

In addition, many other definitions of critical thinking exist. One of the most interesting point of view is offered by Cohen, Salas and Riedel (2002) shown in Figure 5.

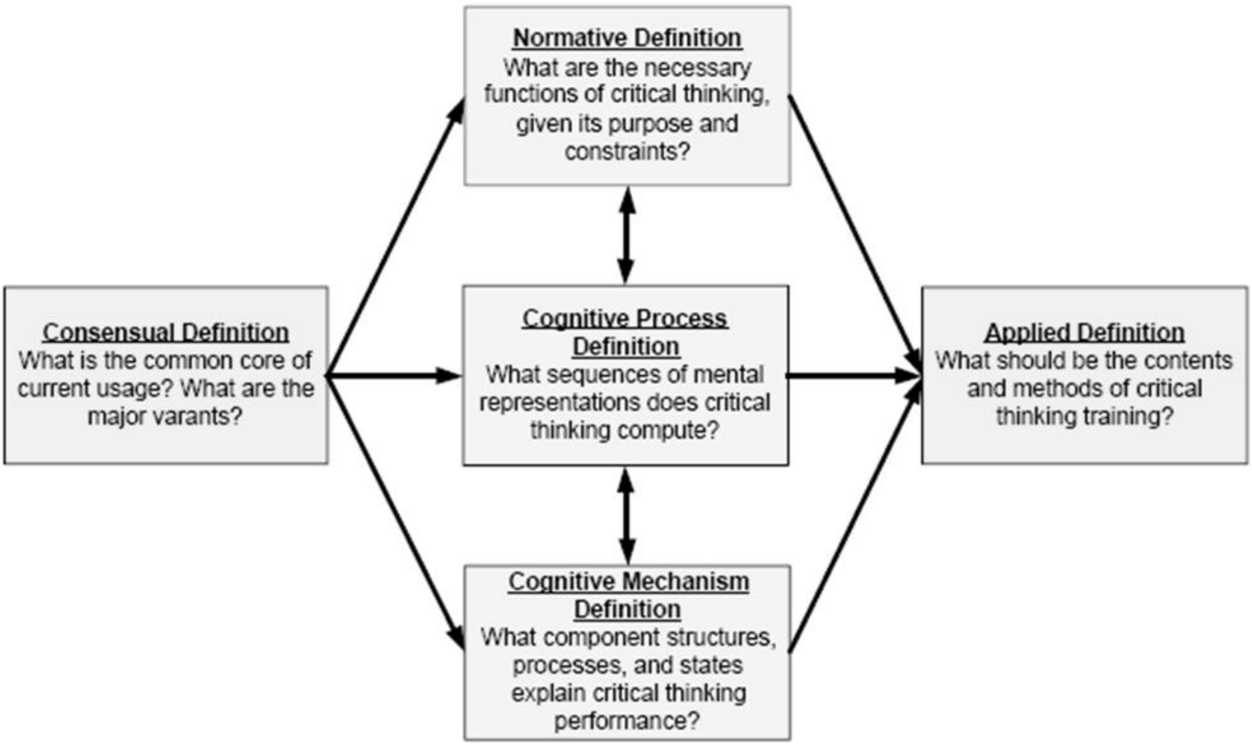

Figure 5: Five strategies for defining critical thinking (Cohen, Salas, Riedel, 2002, p. 18)

On the way towards critical thinking, learning is a crucial point of potential success. The relationship between critical thinking and learning could be described as follows: "The only capacity we can use to learn is human thinking. If we think well while learning, we learn well. If we think poorly while learning, we learn poorly." (Paul, Elder, 2007, p. 10) It is therefore necessary to start with education of critical thinking already in the children's age. An important role in this issue plays not only the educational system but also the family.

Undoubtedly there is a strong correlation between critical thinking and success, in personal life as well as in professional career. Carroll (2004) points out that "When we're thinking critically, we're using our knowledge and intelligence effectively to arrive at the most reasonable and justifiable position possible. When we're thinking uncritically — no matter how intelligent or knowledgeable we are — we'll make unreasonable decisions and arrive at unreasonable beliefs or take unjustifiable actions, unless we are lucky and end up making the right choice for the wrong reasons!" (p. 2)

Critical thinking is much more demanding mental activity than common thinking. Monitoring of all possibilities in a broad context, verifying the sources and critical evaluating of obtained information is not an easy issue. However, by day-to-day application of the rules of critical thinking everyone quickly becomes an efficient critical thinker able to accomplish better results in its both professional and personal life and to become more successful and also happier. As a consequence, hand in hand with improvement of a subjective well-being of a particular individual, also the well-being of society as a whole increases.

The goal of critical thinking pointed out by Carroll (2004) is: "What a critical thinker hopes for is to become free from the tyranny of those who would rather see obedient servants than thoughtful, independent thinkers. We should also hope to become free from our own tyranny — the tyranny of self-deception and wishful thinking. Only by becoming free from these tyrannies can we hope to think clearly and accurately so that we might judge fairly what we ought to believe and do." (p. 23) We cannot avoid making mistakes though. These mistakes should, however, be smaller than and not as frequent as they used to be before the change of the way of our thinking. Hirschman (1989) much earlier stated that "holding many strong opinions is an ambiguous indicator of well-being: it may or may not lastingly fulfil the promise of endowing the holders with true identity and rich personality". (p. 78)

However, critical thinking itself does not necessarily have to help the society as a whole. The highest level of critical thinking shifts toward to ethical reasoning. The meaning of ethical reasoning described Paul and Elder (2005) as follows: "The proper role of ethical reasoning is to highlight acts of two kinds: those which enhance the well-being of others — that warrant our praise — and those that harm or diminish the well-being of others — and thus warrant our criticism. Developing one's ethical reasoning abilities is crucial because there is in human nature a strong tendency toward egotism, prejudice, self-justification, and self-deception. These tendencies are exacerbated by powerful socio-centric cultural influences that shape our lives — not least of which is the mass media." (p. 2)

3. Conclusion

Well-being is an issue that directly concerns this society and subsequently also all the generations in future. Therefore, the aim of our generation should not be only to sustain and possibly improve the level of well-being of our society but additionally arrange such conditions that would enable its future further improvement. Besides a "simple" increasing of GDP per capita and mutual help and co-operation between rich and poor countries, as one of the possible ways we should consider the critical thinking. Compared to contemporary common way of thinking, thanks to its higher efficiency, the critical thinking improves both satisfaction and well-being of individuals as well as the whole society. In order to acquire the knowledge of this kind of thinking there is, however, a need to learn and include critical thinking in our day-to-day lives. Although this great shift towards the society of critical thinking can be expected to take some time, it can be concluded that such a huge change would result in gains not only in the form of overall well-being improvement of the society but also in the improvement in the level of people's health. And these are obviously values really worth of long-life process of critical thinking.

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THE IMPACT OF STRESS ON WELL-BEING OF EMPLOYEES IN ORGANIZATIONS

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Keywords

Well-being, stress, personnel management

Abstract

In the paper the authors at first define the term stress and well-being of employees as well as examine the connection between them. Then they present the strategies for managing factors that cause stress with employees and for assuring their well-being in organizations. Stress is hence important information for owners and managers to consider seriously. In the paper the impact of stress in work environment on well-being of employees as well as some strategies for managing stress and assuring well-being of employees will be considered.

This contribution is based on research project supported by the Public Agency for Research, Republic of Slovenia; contract number: 1000 – 09 – 212173.

1. Introduction

Stress at work is common throughout all organizations in Europe. In surveys carried out every five years by the European Foundation for the Improvement of Living and Working Conditions, respondents name it as the second most common threat posed by the working environment. According to the fourth European Survey of Working Conditions, carried out in 2005 in all Member States, stress was experienced by, on average, 22% of working Europeans. Slovenia has the second highest level of stress (38%) after Greece (55%). Stress is hence important information, i.e. influential data, for owners and managers to consider seriously. It causes loss of health and bad work, therefore poor well-being and economic results.

Loss of health due to stress constitutes neither the biggest nor the only cost in the organizations. Mistakes and/or false decisions, which employees make under the effect of stress, cost even more than loss of their health. Therefore, it is necessary to think carefully what to do to prevent stress in employees. In order to solve this problem, various strategies for stress management can be developed in the organizations. As stress has a great impact on well-being of employees, the related strategies also contribute to improvement of their well-being. Well-being is much more complex than welfare in only economic terms.

2. Stress and Well-being of Employees

The word stress comes from the Anglosaxon world and was first applied in physics for designating the mechanical force. It denotes the exterior pressure, tension, load upon an object (Newhouse, 2000). The term stress was first introduced into medicine by Hans Selye in 1949 (1976). According to his definition stress is a way of physical adaptation to new circumstances, a reply to irritations that disturbe the individual balance (Luban, Pozza, 1994). Ivanchevich and Matteson (1993) define stress simply as “an interaction of the individual to his or her environment”. They also define this term in detail as: “adopted response of a person as a reflection of their diversity and/or psychological processes to activities, states, or events in the environment creating exaggerated psychological and physical needs.” Greenberg and Baron (2000) define stress as “a complex pattern of emotional states, physiological reactions and related thoughts in response to external demands”. They refer to the demands emanating from the environment as stressors. Examples of stressors are: the demands of work assignments, interpersonal relations between co-workers, one's relations with one's spouse and children, and social obligations. The third term, strain connected to stress and stressors, according to these authors, refers to the accumulated effects of stress expressed as deviations from normal patterns of behaviour or activity and thus constituting a consequence to the exposure to stressful events.

Subjective well-being is the main subject in the context of positive psychology (Musek and Avsec, 2006) and has an important place within well-being. It is defined as a person's cognitive and affective evaluations of his or her life, which include emotional reactions to events as well as cognitive judgement of satisfaction and fulfilment (Diener et al., 2002). Diener and Seligman (2004) define the subjective well-being or welfare as the evaluation of an individual’s life taking into account his or her positive emotions, work, life satisfaction and meaning. For Musek and Avsec (2002) the subjective well-being is the main notion, which combines a series of evaluations, which refer to the individual’s life, cognitive and emotional, general and more specific. Subjective well-being is a measure of a person's well-being that incorporates all life events, aspirations, achievements, failures, emotions and relations of human beings, as well as their neighbouring cultural and moral environment (Rojas, 2004). Diener and Biswas-Diener (2000; summarized after Musek 2005, 179) claim, that the dimensions of optimism and the feeling of fulfillment should also be considered as a part of the concept of well-being. Therefore we can speak about the emotional components of the subjective well-being, which are composed of positive and negative effects, and cognitive components, which are composed of, for instance, life satisfaction. Although the mentioned components correlate, they do not have the same meaning (Diener and Biswas-Diener, 2000; summarized after Musek in Avsec 2002, 12).

3. The Connection between Stress and Well-being of Employees

People experience stress when they perceive that there is an imbalance between the demands imposed on them and the resources they have available to cope with those demands (Treven, Mulej, 2005). Although the experience of stress is psychological, stress can also affects people’s physical health. The sources of stress may appear in the work environment as well as in the private life of people. Some jobs and organizations expose individuals to high levels of stress, whereas others involve much less stress. In work settings various factors may cause stress with employees, such as job insecurity, type of job or occupation, quantitative work demands, role conflict, conflict between work and private life, role ambiguity, low job control, physical work conditions, harassment, physical violence and others (Treven et al, 2010). Stress in work environment is strongly but negatively connected with well-being of employees. Hence, some strategies for managing stress and assuring well-being of employees will be considered in the following section.

4. Strategies and Interventions for Managing Stress and Assuring Well-being of Employees

The purpose of strategies for managing factors that cause stress with employees in organizations is the reduction or total elimination of stress with their work as well as assurance of their well-being. Those strategies may be: creating favorable organizational climate, job enrichment, reducing conflict, precise role definition, career planning and developing, effective leadership, communication capabilities development, motivating of employees, job satisfaction and interpersonal relationships (Treven et al, 2010).

Creating favorable organizational climate. In many organizations they have unfavorable, inflexible and impersonal climate. It emanates to a large extent from the strictly formalized levels and relations between employees. Such climate creates stress in work settings and reduces effectiveness of employees. In those organizations they should accept a strategy reducing stress with employees; it would tackle designing of a more decentralized and employee-friendly structure, participative business-decision making as well as communication flow from lower to upper decision making levels (Treven, Potočan, 2005; Treven, 2005b).

Job enrichment. Work assignments in organizations are often designed without considering the motivation aspect and job satisfaction of employees. Such state in structure and job content may cause stress with employees. Therefore, bosses should also consider job enrichment when designing a particular job. This dimension refers to a great extent to improvement of job content and its characteristics. The content factors include e.g. responsibility, independence, recognition, possibility of success, promotion, and growth. The basic job characteristics include skill variety, task identity, task significance, autonomy, and feedback (Treven et al, 2010).

Reducing conflict and precise role definition. Role conflict in work settings and personal role of an employee are two of important stress factors. To what extent do those two factors cause stress with employees, depends primarily upon managers – their capability of a precise delimitation of roles of their subordinates. For each job it should be determined what the expectations are regarding its implementation and what information as well as other resources the employees need to carry out their work efficiently (Treven, 2005a).

Career planning and development. Strategy of career planning and development is also one of the strategies for reducing stress with employees in organizations. Managers usually do not show a lot of interest in their subordinates' careers and, hence, leave them alone in deciding about their careers. Such a situation can be compared with the state of students at a large university that may use only a computer, if they want to obtain a special advice about their courses. A possible consequence of such a state may cause some doubt and stress in students (Byars, Rue, 2003; Treven, Potočan, 2005).

Effective leadership. Nowadays efficiency of organizations depends to a large extent on bosses' capability to organize and lead their employees. Modern organizations require a modern style of leadership in management, i.e. one that allows for and even encourages a creative and innovative work by co-operative managerial style and managers' role model of creativity and innovation processes (Treven, 2005b; Mulej, Ženko, 2004). People are no longer satisfied, if treated as machines. They are better educated and more ambitious, so their wishes, insights, and views must be considered. This causes changes. Organizational culture is getting more human and humane.

Developing communication capabilities. Well-developed communication improves work productivity, increases the sense of affiliation, and makes employees aware of their superiors appreciating their opinions. Workers need precise and accurate information in order to perform their work well. A close cooperation between coworkers depends primarily on first class information. The worker who is not acquainted with novelties in his fields will feel lonely and unconfident. Therefore, he will not be able to evaluate the work process or his own work properly. Feedback on the implemented work may also constitute a strong motivator (Hellriegel, Slocum, 2004).

Motivating of employees. Work motivation can be defined as a force influencing the behavior of employees in organizations (Treven et al, 2010). Sense-making work is the strongest motive to drive the employees, hence organizations must stir up their interest in it. Managers must show the employees that they are important and respected, and appreciate their work. They also have to indicate that it is in their mutual interest to learn, grow and develop their abilities. That is the best motivation the organizations can give (Robbins, Judge, 2010).

Job satisfaction. We do not speak about job satisfaction merely when employees earn good salaries or have opportunities for promotion. It can also be influenced by internal factors like: work achievement, appreciation of work done, responsibility, good working conditions, as well as external factors, such as: appropriate policy and management in the organization, adequate leadership, and good mutual relations (Možina et al, 2002). Factors that may increase one's job satisfaction and reduce stress include: challenge, success, appreciation, rewards, appropriate level of responsibility, control over one's own work, work with pleasant people, loyalty to organization, and clearly determined roles, aims and priorities (Treven, Potočan, 2006).

Interpersonal relationships. Mutual relations between coworkers and work groups are dimensions of our personal experiencing of the organization (Maslach, Leiter, 2002). Good work relations reduce the impact of stress, diminish tension and assure well-being of employees. The social support by co-workers, mentors, clients and subordinates that the employees feel is also important in buffering the effects of stress.

Physical qualities. There are multiple ways to deal with the physical environment stressors encountered. Strategies may involve protecting people from the stressors (for example, with redesigning access into building of the organization, such as screening of entrants for weapons, installing gates and cameras, and adopting extra security measures) and a safer physical environment (improved lighting, changing the layout to reduce isolation). They may also be oriented to altering the environment in order to deal with the stressors (for example, decrease the noise level) (Treven et al, 2010).

Interventions to raise subjective well-being. Besides the strategies for eliminating stress in organizations, the interventions to increase subjective well-being are important as well. Fordyce (1977; summarized after Diener et al., 2002) published several studies in which he evaluated a program designed to boost people's happiness. This program was based on the idea that people's subjective well-being can be increased, if they learn to imitate the traits of happy people, characteristics such as being organized, keeping busy, spending more time socializing, developing a positive outlook, and working on a healthy personality. »Fordyce found that the program produced increases in happiness compared with a placebo control, as well as compared with participants in conditions receiving only partial information. In a follow-up 9 to 28 months after the study, Fordyce found that there were lasting effects of his intervention (Diener et al., 2002). Pavot and Diener (2004) suggested the following examples of interventions, which might increase subjective well-being: day-care programs, other forms of respite care, increased opportunities for physical exercise, and opportunities for older adults to maintain involvement and engagement in the life of the organization, work with the local community and the media to promote awareness of the impact of stress on teaching quality and the health of workers, and encourage positive, supportive behaviour. Hence, we can suggest the applications of such interventions in organizations, too.

Care for healthy natural environment. Health, as a component of well-being and absence of the destructive stress, is also a component of managerial actions against stress (Šarotar Žižek, Potočnik, Mulej, 2010; Hrast et al., ed., 2009, etc.).

Total responsibility management. All mentioned and similar managerial interventions are as easier to attain as much more the managerial style is able to be the total responsibility management (Gorenak, Mulej, 2010). It can receive a crucial support from requisitely holistic ethics planning as pre-condition for enterprise ethical behavior (Belak et al, 2010), including innovation of managers' attributes (Mulej et al., 2010a) and of habits towards social responsibility (Mulej et al, 2010b). To make it happen, managers can benefit from using vision as an instrument for becoming a socially responsible enterprise (Štrukelj, Mulej, 2010) and of the entrepreneurial rationality for enterprise's long-term survival and development (Štrukelj et al., 2010). Managers can also receive support from fostering innovation in their organizations (Globocnik, Celec, 2010) and innovation-oriented relations between employees (Auer, Antončič, 2010) and other ways of establishment of innovation-supporting culture (e.g. Bučar et al., 2010; Buljubašić, 2010; Burger et al., 2010; Fallast et al., 2010; Ionita, Gaidargi, 2010; Kociper et al., 2010; Casio et al., 2010; Mele, Kozoderc, 2010; Nagy et al, 2010; etc., all in: In: Rebernik et al, ed.). Creation of preconditions for requisite holism of information bases for the invention-innovation process management is also a crucial precondition to be met (Mulej et al, 2010c). See also Trappl, ed. (2010), contributions in symposium on management and innovation, and www.exinnovate.com, etc.

5. Conclusion

Stress is a naturally occurring experience of every person as an individual and an employee in organization. Stress may have beneficial or destructive consequences. The beneficial ones stimulate. The destructive consequences of a stressful experience are not inevitable. They only result from ineffective management of stress and stressful events. The thesis of this paper is that the destructive consequences of stress in organizations have a great impact on well-being of employees as well as that they may be avoided through the appropriate strategies and interventions for stress prevention in work settings. Consequently, much more well-being of employees is assured in such organizations. This paper provides for a number of messages able to become information supportive of well-being and resulting success of work and life.

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Computer Support of Cooperative Work

COMPUTER-SUPPORTED COOPERATIVE WORK IN VIRTUAL ORGANISATIONS

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Keywords

Cooperation, CSCW, virtual organization

Abstract

Computer-Supported Cooperative Work has become a well-established research field with a broad range of cooperative systems used in various organizations and organization types. These cooperative systems provide support for social interaction: coexistence, communication, consensus, coordination, and collaboration. The orchestration of this support highly depends on the respective organization type. In this paper we provide an overview of cooperative systems, and we report on a case study of the particular organization type virtual organization with its specific requirements for cooperation support and an advanced instant messaging system meeting these requirements.

We thank all members of the Cooperative Media Lab; part of the work has been funded by the Federal Ministry of Transport, Building, and Urban Affairs and by the Project Management Juelich (FKZ 03WWTH018).

1. Introduction

Computer-supported cooperative work (CSCW) is a research field with a short history, but a great variety of focus issues. It can be described as a design-oriented academic field bringing together different sciences such as social psychologists, sociologists, computer scientists, and economists. This diversity underlines the importance for a commonly agreed definition on what CSCW exactly is. In 1984 Irene Greif and Paul M. Cashman coined this term, by expressing their concerns about supporting multiple individuals working together with computer systems. Research started as an effort by technologists to learn from economists, social psychologists, anthropologists, organizational theorists, educators, and anyone else who can shed light on group activity (Grudin, 1994). By now more than 20 years of intensive CSCW research in a broad range delivered important insights on how smaller and larger groups can and should be supported in their work through cooperative systems, no matter where and when they work together. However, CSCW researchers still need to improve on bridging the gaps between the technical and the social sub-communities in the field (Jacovi, 2006). Hence, a thoughtful recapitulation of the targets, their interrelation, and the environment is needed.

Looking at the lexical denotation of cooperative work on Merriam-Webster Online, this process involves an activity in which one exerts strength or faculties to do or perform something, and is marked by a willingness and ability to work with others. In the social sciences cooperative work is a term with a long history (Bannon) and research results have therefore been a fruitful input to the CSCW area. For the boundaries of CSCW research it is surely sufficient to assume that cooperative work is the ‘general and neutral designation of multiple persons working together to produce a product or service’ (Bannon, p. 362). Though, a closer look at the underlying characteristics of social interaction does certainly amplify the scope of science.

Computer-support defines the fact that computer-based systems are involved in providing assistance. Concerning this matter, researchers are interested in technological concepts, systems, and prototypes supporting social interaction (Gross, 2009).

Putting it together, the main goals of CSCW research are for one part to understand groups of users, their social interaction, and their interaction with technology (Gross, 2009). Another part is to discover ways of using computer technology to further enhance social interaction through developing, designing, and evaluating supporting systems. Subsequently the changes in cooperative work brought up by introducing technology into a certain environment need to be surveyed.

So far we have looked at CSCW in a non-systemic way. However, group work does not take place in an isolated environment and it is rather important to take into account the organizational embedding, because groups are a major mechanism that organizations use to get work accomplished (Kraut, 1996). The knowledge about the potential of cooperative systems has arrived in different organizations and within different organization types, but the success of their application has often fallen short of the ambitious expectations. Knowing the type of an organization helps understanding its structure, its social interaction, its interdependencies and how work can be supported with cooperative systems, since ‘organization structure is more than boxes on a chart; it is a pattern of interactions and coordination that links the technology, tasks and human components of the organization to ensure that the organization accomplishes its purpose (Duncan, 1979, p. 59). This issue has become even more important in relation to two organizational trends: spatial and temporal distribution of organizations and disaggregation of organizations at many levels (Kraut, 1996). Also, organizational work styles have changed from a hierarchical, monolithic, and rigid form of cooperation to flatter organizations and increased division of labour within and between companies. The division of labour within but also between different companies, global markets, and globally acting enterprises increasingly requires remote collaboration (Gross, 2009). So, the type of an organization is highly correlated to an enlarged spectrum of requests for cooperative systems.

In the following sections we give an overview of cooperative systems, report on a case study for one specific type of organization in a precise context, and finish off with a conclusion.

2. Cooperative Systems Supporting Social Interaction

As stated above one essential contribution to supporting cooperative work is a thorough understanding of social interaction. There are different types of social interaction, and depending on task, group, and organizational structure more than one type of social interaction should be supported in cooperative systems. We look at cooperative systems from a technological perspective and distinguish between three categories. Classical groupware is defined as ‘computer based systems that support groups of people engaged in a common task (or goal) and that provide an interface to a shared environment’ (Elis, 1996, p. 40). This class of systems includes desktop applications. The difference of social software and web 2.0 is the exclusiveness of web-based supply of services and functions for a common interaction to reach a specific goal using an installed browser. We define ubiquitous systems as ‘accumulation of hardware and software that forms a framework of tools to support users with a specific task, embedded in daily activities and objects and so remaining widely invisible to the users' (Gross, 2009, p. 697). In the following we outline types of social interaction and how cooperative systems support them.

2.1. Coexistence

Coexistence means that information about one's presence and the presence of others is exchanged. It makes users aware of others and 'allows for social encounters and for spontaneous contacts' (Gross, 2009, p. 694). It is a prerequisite for other types of social interaction. Awareness information should be visible or retrievable to each user at any place since physical presence does not necessarily implicate being at the same location.

Systems supporting coexistence serve the modeling and mapping of social relationships between users. They offer substantial information sources for follow-up communication, coordination, and cooperation. Sources of information can be permanently refreshed awareness information, like availability, social awareness, group membership, or working status. Other sources contain personal presentation of users as well as contact details. In addition to traditional groupware systems supporting coexistence (e.g. media spaces), social software and web 2.0 systems provide enhanced possibilities for awareness support. Using social networking sites, web logs or micro-blogging people can create personal profiles and connections to other users as well as disclose personal information about their current status. Ubiquitous systems show current locations of users based on the position of their mobile systems (e.g., cell phone, PDA). They allow specifying a notification with additional information, like preferred way of contacting.

2.2. Communication

Communication is based on the exchange of information between people. Thereby information is not restricted to explicit symbolic messages. They can also be implicit as system generated notifications and propagate users' changes to the environment or system to other users (Gross, 2009). Communication is important to make arrangements, to exchange ideas, and to transmit knowledge.

Systems supporting communication feature secure transmission of information, permanent access to the operations of transmission. They differ in the number of contacts, storage, the medium of the message, the degree of popularity of users, speed of delivery. Classical groupware supports communication synchronously (e.g., instant text messaging, instant video messaging) or asynchronously (e.g., email, short message service). Systems of social software and web 2.0 integrate multiple services for communication. They provide a convergence of text, audio, video, and other media sources beneath a homogenous web surface. Ubiquitous systems adopt the existing concepts and adjust them to mobile devices. They use sensors and actuators to allow for changes of location and availability and hence propose an appropriate device and moment for communication.

2.3. Coordination

Coordination is the management of interdependencies of activities, actors, or resources. Activities can have procedural constraints and need to run in a specific sequence; actors can have interpersonal or intrapersonal conflicts in their roles; and resources need to be used or shared by multiple parties (Malone, 1992).

Systems supporting coordination display goals and current working status. Systems also contain components like task coordination, including assignments and control features as well as a blocking function. Such systems can serve the coordination of projects, resources, or documents. An important characteristic is common scheduling for all users. As classical groupware workflow management systems allow users to create and share workflows, customize forms, and manage processes. Such systems enhance reporting and working with structured tasks and processes. Social software and web 2.0 take on these functions and provide web-based shared calendars with task lists, checks of obligations as well as the current stage of work, and they eventually send out notifications via email or instant text messaging. Ubiquitous systems maintain a shared, temporal, spatial, and peripheral awareness of the unfolding of work. They consist of a number of services and clients running on large interactive displays. Temporal coordination is supported through continuous scheduling and re-scheduling. An example of an application context is the support of staff in hospitals (e.g., doing surgery).

2.4. Consensus

Consensus refers to decision making in social settings (Gross, 2009). In the process of decision making, typically issues, positions, and arguments are collected and structured, evaluated, and votes are taken (Eliss, 1991). Its goal is to reach an agreement between the parties involved.

Systems supporting consensus prepare voting and decision-making processes, accompany them, and document them for follow-up decision analysis. They collect information and visualize ideas, opinions, and facts for the decision-making process. They also allow for generating ideas within and beyond the decision process. There are two kinds of classical groupware to support consensus. Systems that prepare and document decision-making processes with the collection of information and systems collecting questions and corresponding positions with the issue-based information system method. The latter visualize opinions in form of decision trees. Systems of web-based social software and web 2.0 can also be viewed in two kinds: some systems collect arguments of single users and just visualize them, others recommend a transparent and aggregated decision based on the arguments and opinions of users. Single users or groups of users receive recommendations according to the knowledge about the users and the present information sources. Extended to ubiquitous systems, consensus can be supported through a system that is accessible for all devices to articulate opinions and turn in votes as a concluding element (e.g. social television).

2.5. Collaboration

Collaboration describes the process of close cooperation and includes sharing and manipulating data together (Gross, 2009). It often contains quite an effort for communication and coordination. For successful cooperation it is important to structure the involved parties and the group process adequately.

Systems supporting collaboration allow a shared and effective editing of documents, whether active or passive, and across temporal and spatial distances. Passive groupware supports the distribution and administration of information, documents, contacts, and calendars between single users and groups. They store working results in one specific and shared location, where all members have access to project based information. Active systems allow for synchronous editing of documents, highlighting of contributions of users and rights distribution. In systems of social software and web 2.0 the concept of sharing is also a characteristic element. It describes the process of having data ready for common editing in a web-browser. Those systems also allow for selective disclosure of documents or workspaces. In ubiquitous systems the concept of sharing becomes an even wider importance. They aim for sharing and co-editing information out of different information sources across different devices. For example interactive workrooms contain different interaction elements, which can be shared and used through each device.

3. Case Study on Virtual Organisations

This section presents a case study, which aims at transferring appropriate organization types and cooperative systems to enterprises in the context of the children's media sector of Thuringia, Germany. Since it is a regional and context specific case, sometimes literature is only available in German language and will be cited as references. In the described context economic advantages and an improved market position can especially be reached by acting as a virtual organization. This type of organization in turn leads to specific requirements for cooperation support. We first characterize the studied enterprises and their requirements for computer-based cooperation support, and then present an example of a system, which accounts for this specific type of organization and context.

3.1. Virtual Organizations and Their Requirements for Cooperation Support

The target group consists of enterprises in the children's media sector. They produce media content exclusively for children aged between 3 and 13 (Will, 2006). For the most part these micro enterprises have less than 10 employees. Their economic environment is highly dynamic based on the fast social and technical changes as well as on the high competition between the enterprises.

The involved enterprises are characterized by a small staff, loose division of labour, little management hierarchy, informal communication, and with power focused on the chief executive (Mintzberg, 1979). Benefits of this structure are a personal relationship between employer and employees caused by a manageable number of co-workers. It enables short and direct information paths. The enterprises act flexible and are formalized to a lower degree than large-scale enterprises. (Levi, 1998) Their corporate culture is reliable accompanied by a strong identification of management and staff. This in turn ensures high working engagement (de Vries, 1993). On the other hand this structure comes with a few disadvantages. The complex conditions and the sparse differentiation of labour go along with an accumulation of functions and can cause work overload, since there are restricted human resources. The lack of time impedes a sufficient documentation of work. Since most of these enterprises are owner-managed their market position mainly depends on the foresight and business acumen of the management (Carson, 2003). A lack of financial resources is common.

This sector's growing globalization leads to new demands to the enterprises, which can only be mastered insufficiently with classical concepts of organization types. It permanently faces new concepts, different operating fields of activity and new technologies (Münchhausen). It is mainly characterized by project organization, where details are not predictable and agreements are secured on a low level. To overcome these shortcomings and to use economic changes each enterprise needs to concentrate on its core competencies. The consolidation of enterprises into cooperative and dynamic organization types helps to adjust to the global market and ensures existence within the process of globalization (Heinze, 2007). Accounting for the dynamic changes and the lack of resources of the enterprises, a virtual organization is promising to overcome the difficulties.

Virtual organization refers to a concept 'comprising a set of (legally) independent organizations that share resources and skills to achieve its mission/goal, but not only limited to an alliance of for profit enterprises' (Camarinha-Matos, 2004, p.9). The main goal is an increase in flexibility and innovation accompanied by a minimization of cost and organization effort (Mowshowitz, 2002). A virtual organization helps to manage complex, highly variable tasks or to master new tasks in an instable environment (Dess, 1995). It is a temporary alliance of at least two partners, which join based on a contract or project.

Considering the peculiarity of the enterprises in the children's media sector synergetic effects are the highest in a virtual organization, characterized by a heterogeneous range of services with low competition. The partners should support each other qualitatively and complementary through concentrating on their specific core competencies. Cooperative work in such a virtual organization enlarges the access to new resources, markets, and special knowledge on one side and distributes the risk to different partners on the other site. The deployment of modern information and communication technology speeds up exchange processes and expands the access to information (Malone, 1991). Comprehensive knowledge management allows for procurement of experiences of finished projects and use of insights for future work (Radding, 1998). Towards a customer only one enterprise serves as contact person, allowing for a consistent market presence. This in turn leads to the perception of a very individualized product out of the customer's perspective. Besides these benefits mastering different challenges determines the success of such a virtual organization (cf. Figure 1).

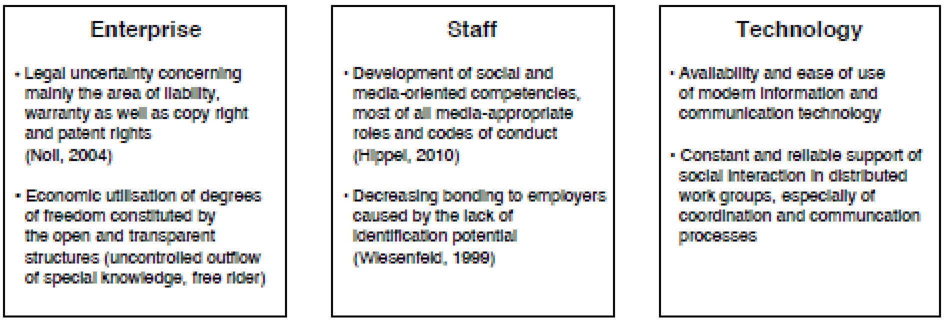

Figure 1. Factors influencing the success of virtual organizations.

Being a member of a virtual organization comes along with continuous social interaction across time and space. This in turn requires modern technologies supporting cooperation. At the same time a harmonization between internal and external systems is crucial for success. Here we describe requirements for cooperation support in a virtual organization, derived from qualitative interviews with representatives of the involved enterprises.

As stated above a virtual organization is an innovative concept for enterprises in the children's media sector. This kind of cooperation widely goes without setting up central management functions controlling and coordinating incidents within the network. It is generally based on trust and depends on the quality and duration of the relationships between the involved parties. Trust within social interaction helps to maintain coherence and is dynamic—it changes according to the length of relationships and can be easily unsettled. Formation of trust is a basic requisite to be promoted especially for partners without previous contact. Therefore, technology should take into account different kinds of relationships between the enterprises and towards customers as well as provide adjustment to individual needs. Recommendations can substitute the functions of control and central coordination. Based on already existing projects they can give orientation and serve as a reference for future contracts.

Supporting the development of trust is strongly associated with a high level of transparency. This criterion is important to bring together the involved parties, different projects, and to enhance the high demand for coordination. Transparency means to continuously provide cooperative partners with up-to-date information about contact details, range of service, working conditions, and responsibilities. It helps to be aware of the cooperative partners in the virtual organization and to know who is engaged in what kind of work within a project. This in turn prevents from interferences. However, care should be exercised in offering too much transparency in order to avoid the outflow of specialized knowledge.

This challenge leads to the requirement of selectively disclosing information. It cannot be assumed that each enterprise wants to share information in an equal degree of detail and liberality with all partners. Also information is handled differently within and outside of the enterprise boundaries as well as within and outside the virtual organization. Changing partners and customers goes along with a need to disclose information and to manage self-presentation selectively. Hence, systems should support selective information disclosure and individual adjustment to particular addressees. Amongst others this encompasses contact details, project status, availability, or market presence.

When information is transferred within systems security is essential. Though information can vary in its level of sensitivity secure transmission and storage is required. This includes the protection of unauthorized access to sensitive information. Therefore, users sometimes do not trust systems of commercial providers. In addition a system must prevent loss of data and contain security mechanisms (e.g., backup).

The secure storage off data leads to another requirement related to the temporary limitation of project teams. They constitute only for a certain time and are marked by changing members. Permanent availability is not necessary and might cause unwanted disruptions. Thus, cooperative systems need to support an individual status of availability according to current projects and depending on contacts. Grouping mechanisms help users to easily organize their contacts according to current needs and allow that each group can be assigned an individual state of availability.

None of these requirements—trust, transparency, information disclosure, sense of security, and availability—should be treated as separate factors. They are highly connected and affect each other. Moreover, not all requirements can equally be supported in different technologies.

3.2. Advanced Instant Messaging for Virtual Organizations

Based on the requirements for cooperative work in virtual organizations described above, we developed a prototype of an instant messaging (IM) system to enhance coexistence and communication, as two basic types of social interaction. One of the requirements is selective disclose information towards different contacts. In our IM system this is implemented via faces. A face represents a part of the user's digital identity and provides specific information to selected recipients (e.g., customers, virtual organization partner, and third party). People construct their social identities by means of faces in accordance with their audience, and through revealing certain individual characteristics and information, and hiding others. Users can control what source of information is disclosed to whom with what kind of persistence, and according to their enterprise. Aface is a container formed by information sources and contacts. Information sources are standard information types and user-defined custom information types. Contacts are recipients of the information. Users can create any number of faces. Any number of contacts can be assigned to each face and each contact can be assigned to multiple faces. Each face has an internal and an external name visible for others (e.g., internal = virtual organization partner; external = J.Smith.Enterprise). Users can select specific online states for each face.

Static information contains all information that is manually entered by the user, and not changed or adapted by the system (whereas dynamic information is captured and adapted by system sensors). Users configure their faces through a matrix-organized panel (cf. Figure 2). It contains a standard set of information types and can be extended as well as customized. Information types can be classified as personal data (e.g., given name, nickname, birthday), phone information (e.g., fixed number, mobile number), address information (e.g., street, country), messenger (e.g., ICQ, MSN), and email (email address). Users have one initial instance of each information type, and can add any number of additional information types (e.g., second address, second given name). In order to protect users' privacy, per default no information is disclosed. If users want to share information with everybody, they can declare them as global (persistent), which make them visible to any contact at any time, independent of the users' online state. If users want to share information selectively, they can add them to any number of faces, which makes them visible only for the respective contacts and only while the users' online state is available in the specific faces. Overall, users decide what kind of information they want to share and to what extent.

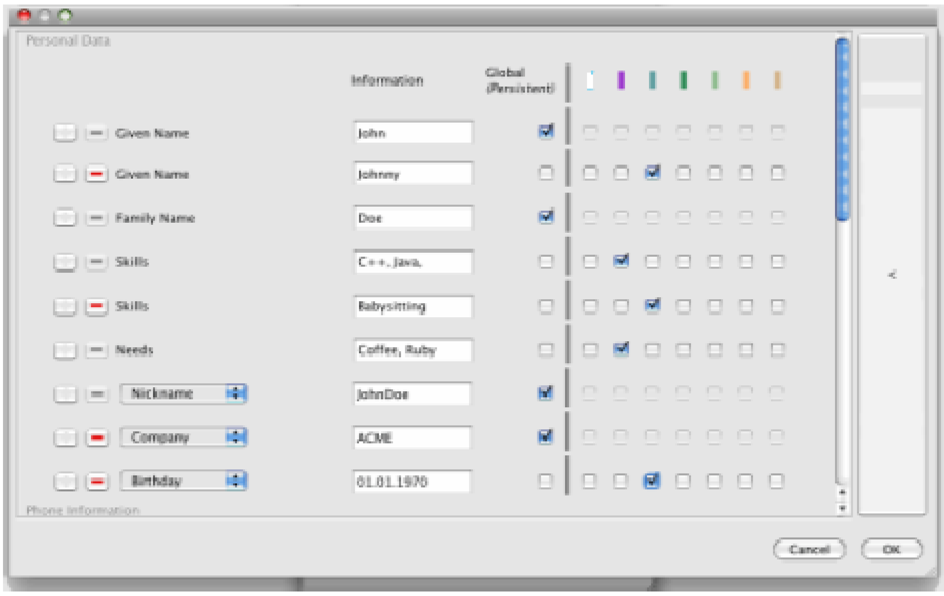

Figure 2. Configuration panel for selective information disclosure.

To check whether the expected benefits could be realized, we conducted a first proof-of-concept study to see how actual users perceive the system. We introduced the system to a restricted group of users and let them work with it over a short period of time. A working situation with distributed work groups was simulated, in which the IM system was the only means of communication. Each group consisted of six users and was structured as a virtual organization consisting of three independent enterprises. Two participants acted as co-workers of the same enterprise and had specific task-related information, which the respective other participants needed to complete their primary task. The participants' mission was to create a corporate customer presentation (primary task) for which they needed to exchange information (secondary task). During the one-hour session the users' selective information disclosure behavior was captured and logged. Afterwards personal data was captured in a short questionnaire. Further, two open-ended questions gave participants the chance to document positive and negative aspects using the IM system.

The logged data and qualitative responses provide useful acknowledgements on how to improve the system. Logging data confirmed that sensitivity of information plays an important role when disclosing information in IM. Whereas most users disclosed standard information types persistently, they assigned additional and customized information types to individual faces. In most cases users disclosed information only in one face. Changes of availabilities were observed very rarely and users did not use the full spectrum of different online states. The open-ended questions about positive and negative aspects using the IM were clustered into categories. Most users perceived concept and design as strengths. They emphasized the usefulness of selective information disclosure of personal information by means of faces. They mentioned an intuitive and simple configuration and a clear arrangement of the configuration panel. Other positive comments involved individual status settings for groups of contacts, the labeling of faces with an internal and an external name, the clear overview of the online contacts, and the detailed specification of information types. Users reported weaknesses about disruptions within the communication process due to some instability of the system. Few users noted not being convinced by the underlying concept of selective information disclosure; another was confused about appearing on multiple faces of contacts.

Overall, individually disclosing information by creating and managing faces, and by customizing information types seem to have value for users of IM systems in virtual organizations.

4. Conclusion

Research in the field of CSCW encompasses a broad range of academic disciplines trying to bring together their special knowledge. So far many cooperative systems have been developed and designed, but in many cases the systems have fallen behind their anticipated benefits when introduced to their target groups in a certain type of organization. For successful cooperation support the system by itself cannot be viewed in isolation. The type of organization bears important insights on requirements considering the type and essence of social interaction and the people engaged in cooperative work. In addition the respective industry sector forms the context for the use of cooperative systems. We studied the organization type virtual organization in the specific context of the children's media sector. Future work needs to enlarge this spectrum to more organization types and to different contexts. Research should also concentrate on other basic types of social interaction.

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COMPUTER - SUPPORT OF COOPERATIVE WORK IN HOSPITALS

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Keywords

Computer support of cooperative work, healthcare, knowledge management, knowledge sharing, internal audit

Abstract

Structural changes and increasing market dynamics in the health care sector intensify the need for cost-saving and process optimization. How to improve the quality of patient care and how to reduce the costs in hospitals? This paper is aimed to find the answers of these above mentioned questions. In the Czech hospitals the internal audits are now quite often executed and therefore we have focused our research on the ways how to use the information and communication technologies (ICT) tools during these internal audit processes. Because all processes in hospitals need data, information and knowledge which have to be gathered, analyzed, shared and managed. In this article we provide the results of the research realized in Czech Republic hospitals. Research results indicate low percentage of ICT using during internal audit and during necessary communication supporting audits in hospitals. For the effective using of ICT during collaboration we suggest to create knowledge network for all involved user, in this knowledge network all the processes should be matured according the Capability Maturity Model.

1. Introduction

The need for knowledge and its importance for the organization is not a new requirement, but current development of information technology contributes to its greater use. Peter Drucker (2005) described the current century as the century of knowledge-based society. Furthermore, many other authors as Nonaka (1995) refer to knowledge being one of the key sources of sustainable competitive advantage. This article aims to highlight the challenge of bigger use of information and communication technology (ICT) for knowledge sharing in the healthcare field where the application of ICT and knowledge sharing does not yet reach the same extent as in the industrial or service sectors. In addition, the article aims to outline the path how healthcare facilities could improve their situation. Researchers in medical informatics as Reddy (2008) and Sauer (1999) who verified the organizational and social issues, show a large percentage of the shortcomings in this area.

The issue of knowledge sharing and the use of ICT as a support of cooperative work seem to be insufficient in healthcare services. Management of medical services is currently associated with a challenge to lead an institution with a relatively large number of employees, complying with the statutory requirements of the Health Ministry and of insurance companies. Management also has to deal with significant quantities of various medical equipment, is influenced by the ethical requirements and very limited financial resources. Furthermore there are a number of other requirements and restrictions that must be observed. Therefore the hospital management depends on good information systems and information technology.

The basic modules of information systems (IS) needed for health care industry are almost the same as in other business areas. They include all economic modules necessary for the operation of hospitals and therefore enable consistent economic data entry without a need to duplicate the inputs. More sophisticated information systems have advanced modules for the needs of healthcare facilities that are required for system integration and operation of medical departments. Such modules have options for editing and reading data (medical card), maintenance of medical devices, and fault reporting requirements, registration of medical devices, property records and reading bar code on drugs. Using of more sophisticated information systems enables to implement systemic approach to management in healthcare facilities. Nowadays, majority of hospitals implement ISO 9001 for quality and reliability management. ISO certification is also connected with a procedural method to manage individual departments and to implement internal audit as a tool for controlling the medical and support processes.

2. Research Model

Implementation of internal audit requires cooperation among all involved parts and also information and knowledge sharing. In this cooperative work model we can identify the three key areas. These areas consist of:

- Incentive Structures: How can we create appropriate systems and organizational structures to motivate users to properly use the technology?
- Workflow: How does the technology fit into the work process of its users? The workflow reflects processes that an organization has created to coordinate the activities of different individuals, to ensure successful completion of the work, and to improve the overall efficiency of workers. Key features of workflow, such as standardized operating procedures and forms, influence the character of coordinated activity. Standardized procedures play the prominent role in coordinating of individual activities make the concept of workflow to organizations and to systems designers.
- Awareness: What techniques can be used to help people be aware of and coordinate their work with others? Investigations of work show that collaboration improves when people can actively produce and maintain an idea of what is going on around them. Maintaining awareness of ongoing action helps ensure that people's actions are coordinated.

This cooperative work model is corresponding with similar approach used in Knowledge Network Reference model according Prof. Back (2005) from St. Gallen University in Switzerland. This Knowledge Network (figure number 1) consists of people, organization resources and relationships among them, who are assembled in order to accumulated and use knowledge primarily by means of knowledge creation and transfer processes, for the purpose of creating value.

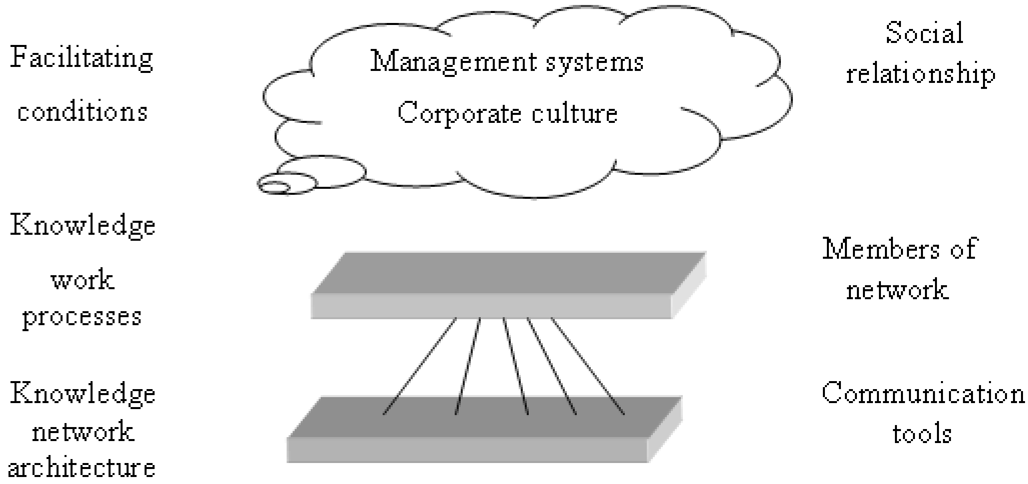

Figure 1 Knowledge Network according Prof. Back (2005, p.15)

In knowledge work processes (according to above mentioned model) we would like to apply the concept of process maturity. This concept was created in the Total Quality Management movement, where the application of statistical process control techniques showed that improvement in the maturity of any technical process leads to two things: a reduction in the variability inherent in the process, and an improvement in the mean performance of the process. Maturity is the quality or state of being mature. If we apply the concept to an organization it might refer to a state where the organization is in a perfect condition to achieve its objectives. Project maturity would then mean that the organization is perfectly conditioned to deal with its projects. In the real world we will not find a fully matured organization. No one has reached the stage of maximum development. Therefore it makes sense to talk about a certain degree of maturity and make an effort to measure or characterize the maturity.

Through the widely adopted "Capability Maturity Model" (CMM) for software organizations, developed by the Software Engineering Institute of Carnegie-Mellon University between 1986 and 1993, this concept of process maturity migrated to a measure of organizational process maturity. This model follows the five evolutionary maturity levels. It is also possible to examine the maturity development across nine knowledge areas in the Project Management Institute's (PMI) A Guide to the Project Management Body of Knowledge (PMBOK Guide). The five project management maturity levels are defined as follows:

- Level 1 - Initial Process: Processes are ad hoc. Management is aware of project management, but hasn't yet taken steps to formalize it.
- Level 2 - Structured Process and Standards: Basic processes are defined, but not used on all projects. Management supports the use of project management processes.
- Level 3 - Organizational Standards and Institutionalized Process: The processes are repeatable and standard for projects.
- Level 4 - Managed Process: Project management processes have become integrated with corporate processes. Management mandates the use of the project management processes.
- Level 5 - Optimizing Process: The focus now is on continuous improvement of the processes.

These five maturity levels define an ordinal scale for measuring the maturity of project processes. The levels also help project managers to prioritize the improvement efforts.

3. Actual Situation and Future Look in the Czech Republic Hospitals

Health care industry should be one of the most information intensive and technologically advanced in our society. Thus, the information has to be accessible easily, timely, complete, accurate, reliable and relevant. The medical informatics is the integration of data, information, knowledge, and tools necessary to apply that data and knowledge in the decision-making process associated with patient care. The focus on the structures and algorithms is necessary to manipulate the information separated medical informatics from other medical disciplines.

To be more precise, the entire hospital system that is being practiced with the manual system has to be completely transformed into electronic by using the latest information technology for example: IS which contains the domain functionality, flowcharts, screens, database that are developed, tested and produced as application software for implementation in order to convert a hospital into a computerized format. This is the most important part of domain functionality IS which can be use in whole Health centers and hospitals:

- The application layer to include: Patient management, Medical care, Nursing, Technical support and Medical support, Administrative, Ancillary services, Controlling.
- The middleware layer should include: Authorization component, Patient component, Activity component, Resource component, and Healthcare record and Knowledge component.
- The persistent layer related to Images, Bio-signals, alphanumeric data, Web pages. While developing the electronic hospital information system, in order to achieve inter-operability, portability and data exchange health care information system must apply standards.

The Computerized physician order entry (CPOE) or eHealth systems helps in improving the quality of patient care and reducing the costs. Studies have shown that CPOE system lead to better accuracy and completeness of medical orders, which in turn lead to reduced lengths of stay and costs and allow fast transmission of orders, legibility, and on-line tracking of the life cycle of an order.

The Internet is a tool to improve health and health care delivery. An increasing proportion of the public is using the Internet for health information. The advantages of the Internet as a source of health information include convenient access to a massive volume of information, ease of updating information, and the potential for interactive formats that promote understanding and retention of information. Health information on the Internet may make patients better informed, leading to better health outcomes, more appropriate use of health service resources, and a stronger physician patient relationship.

More-informed patients often have a more favorable prognosis, and doctors can help make patients better informed by supplying reliable Internet sites. In conclusion, the Internet and Web have had important impact in the practice of medicine. Physicians need to know the importance of this media and how to use it in a pragmatic and efficient way. They can have easy access to clinical guidelines, journal contents, and reference textbooks and even provide patients with educational materials. Physicians will be able to obtain information on state-of-the-art conferences and have direct communication with other physicians and specialists or practice telemedicine, thereby expanding the depth and extent of medical knowledge and providing better diagnosis and patient care.

Also the processes of internal audits in health care centers and hospitals it is necessary to select, gather, analyze, manage and improve data, information, and knowledge according to Health Care

Criteria (2004). The Health Care Criteria are designed to help organizations use an integrated approach to organizational performance management that results in:

- delivery of ever-improving value to patients and other customers, contributing to improved health care quality,
- improvement of overall organizational effectiveness and capabilities as a health care provider,
- organizational and personal learning.

For comparison this is the several measuring and correlation procedures which are used by health care institution in other countries:

- Build medical-records coding and data, billing, materials management, cost accounting, satisfaction surveys, and human resources data so effectively and reliably that they are taken as a given. Use internal audit function to ensure the accuracy of critical nonfinancial measures (Griffith and White 2003).
- Benchmark and compare to best practice. No goal is set without benchmarking because "external visits are keys to the benchmarking process". The best way for this is guide book on intranet that describes sources and uses of benchmarks.
- Provide internal consultants to help analyze the relationships between measures, identify trends, and prepare forecasts. Improvement proposals are expected to provide quantitative forecasts of all relevant measures, and accepted proposals are expected to achieve the forecasts.

4. Data Collection, Methodology and Results

Our research was focused on a narrow group of information systems, designed for the use in medical facilities. These systems are used by the management and medical staff as a sophisticated auxiliary tool. The research aims to identify the satisfaction with the currently used information systems, about the use of management information systems, internal cooperation and knowledge sharing in various medical facilities throughout the Czech Republic. Preliminary results indicate that 85% of healthcare facilities use some form of information systems. Data were collected through a structured questionnaire in 40 hospitals. One of the most important questions in the questionnaire was about type develop of IS. *Is your IS commercial or was specifically developed for you?* This question is mainly associated with the individual need of hospitals to determine the mode of communication within the facility. Development issues its own information system is possible also to compare with many industrial enterprises before implementation of information system. Especially in health care there is a problem with the need to implement many of the specific information system modules and processes. As shown in Chart number 1, the ratio between hospitals using commercial information system, commercially delivered system and specially developed IS is nearly balanced.

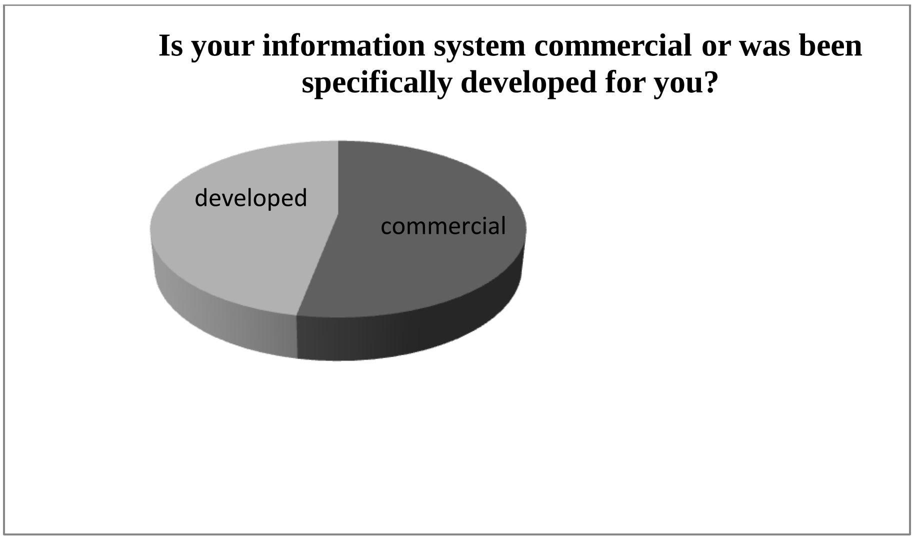

Chart 1 Is your information system commercial or was been specifically developed for you?

The completed survey concludes that the healthcare companies also would like to innovate their present information systems and they would like to integrate the internal audits to there IS portfolio. However, the medical segment distinguishes number of obstacles that complicate the implementation of standard information systems modules.

Another question of our survey was related with the satisfaction of implemented IS. The Chart number 2 displays the degree of satisfaction of individual healthcare facilities with their implemented information system.

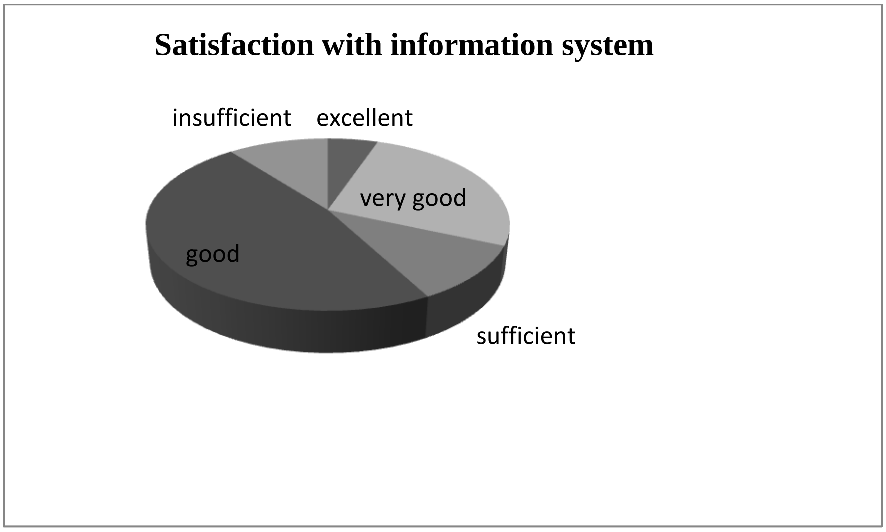

Chart 2 Satisfaction with implemented information system

Part of the survey was also question about the disposition of suitable modules to cooperate during internal audits in the healthcare facilities. The results of this survey show a clear lack of the necessary modules for internal audit in an environment of healthcare. Chart number 3 explains number of hospitals owning some kind of information system supporting the realization of internal audits.

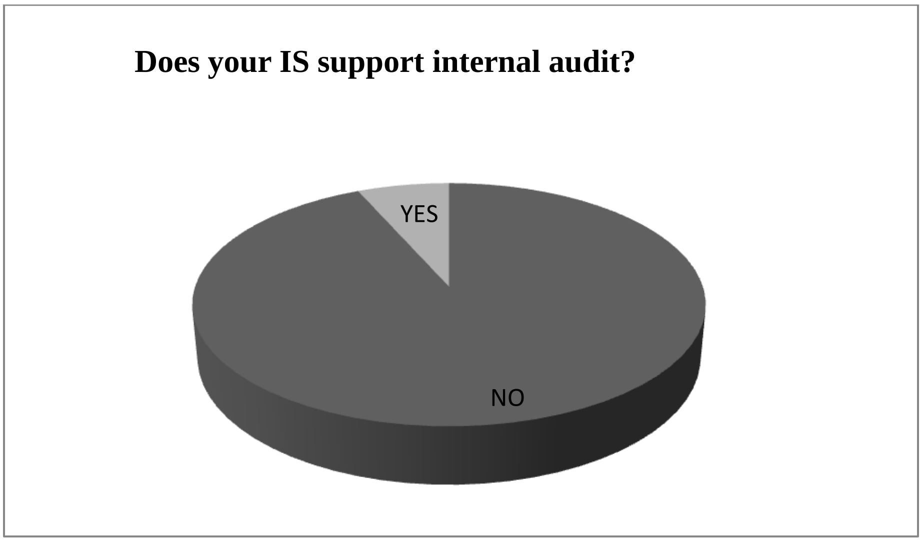

Chart 3 Internal audits supporting information systems

Absence of modules supporting internal audit is caused by the specific requirements of the medical industry. There is a need to coordinate the legal standards, EU regulations and requirements of confidential data maintenance and also the needs of connections with the necessary metrics to meet ISO standards implemented in healthcare facilities.

Other issues included the possibility of extending the information system of another modular unit, which would expand the use of existing functions. This extension enhances the possibility of using new methods, procedures and relevant test process management in organization. In this regard, the vast majority of organizations that own information system said that there is no simple possibility to extend their system. This result is shown in Chart number 4.

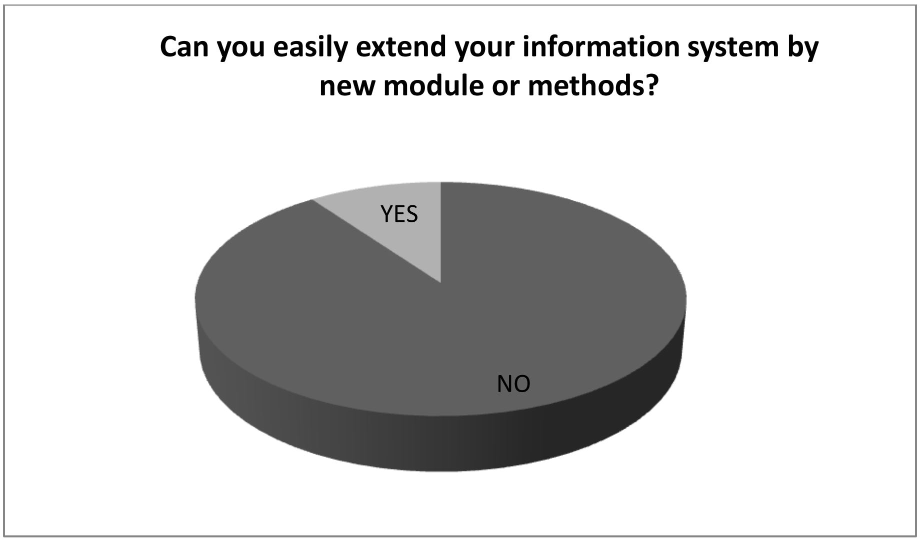

Chart 4 **Can you easily extend your information system by new module or methods?**

The survey also shows that ICT solutions supporting internal audit process are individually solved (in-house). However, some extremes also occur in the form of the ongoing communication via e-mail or corporate mailboxes, which cannot be considered completely effective and there is a real possibility of information loss or delay in information flow.

The requirements of hospitals show that for the actual needs of internal audit it would be appropriate to own a specific module, which could arrange records enabling to plan and evaluate the audits, monitor disagreements and coordinate them with a corrective and preventive action. In practice it should primarily include:

- Audit plan

This means an overview of all internal audits with the necessary metadata, such as status, date of occurrence, auditors, etc. Audits can be internal and external. Audits may be accompanied by given tasks to other employees.

- Incidents

In case an incident (disagreement) is found, it will be recorded to a list. An integral part of the list is a field which to determines which audit the occurred incident belongs. So there are the relations visible.

- Precautions

If an incident is detected, an appropriate precaution needs to be created (so-called Corrective Precautions). Furthermore, there are preventive precautions that are not allocated to any error. However, the link between an incident and the resulting precaution is needed for clarity of the system.

5. Conclusion

The findings of this article identified a lack of support for the modular components of commercial IT systems suitable for healthcare industry. If a medical facility has information system, it usually does not have all the necessary modules suitable for cooperation in the field of internal audits. Only a small percentage of the respondents possess this module. These facilities own a module which was created specifically for their needs and belongs to the information system developed also specifically for these medical facilities.

The survey, representing a part of ongoing research activity of the Faculty of Economics in Liberec, examines the improvement of the current system management support in the Czech healthcare industry. We suggest creating knowledge network according to above mentioned model during realization of internal audits in hospitals. In the knowledge work processes we apply the concept of maturity model. As a communication tool could be used the intranet or some types of wiki systems for instance as in Pavlíček (2009).

In the near future we plan that the results of the survey will be correlated with the data obtained in foreign medical facilities in EU. Next step will be developing of a methodology which will help to implement the specific knowledge network in the healthcare areas.

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COOPERATION SUPPORT: A MULTIDISCIPLINARY CHALLENGE IN A DIFFICULT WORLD

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Keywords

Cooperation support, CSCW, web 2.0

Abstract

Cooperation is an interdisciplinary multilevel issue reaching from technical to organizational to human aspects. It combines concepts from Computer Supported Cooperative Work (CSCW), Human-Centred Computing, and Ubiquitous Computing. Changes in our industrial environment request new IT solutions for collaborative task management in distributed teams wherein team members are essentially involved in the process management and responsible for its progress. This paper discusses some cooperation support aspects of CSCW and related requirements.

1. Some Basics of Cooperation Support

Globalisation and increasing competition force enterprises to decentralize the development of products by participating international suppliers in the engineering processes. This trend is especially due to the quantity of components used up in a product and its variety. More and more the development of software components plays a decisive role in engineering processes. Therefore enterprises build distributed teams of members with various expertise and technical background to handle complex engineering processes. The production processes in the automotive industry are a typical example for this. But the decentralization of the enterprise's knowledge and business processes over organizational and institutional boundaries raise new problems. How can team members reach a common understanding of the process tasks, identify dependencies between tasks, stay informed of the current process status and results, coordinate appointments and agreements, and collaboratively develop the requested results. Our goal is to combine methods and results from the workflow management and the CSCW research area with methods to enhance and coordinate distributed engineering processes. Today, the coordination support for distributed engineering processes focuses on the administration of artefacts like source code, object code and executables, but mechanisms to plan and process system development in distributed teams are missing or only rudimentarily supported. Traditional workflow management systems support structured processes at top-level, but they are too rigid and inflexible for development processes in self-organized distributed teams. CSCW systems provide flexible tools, but the coordination and monitoring effort is left to the users themselves. Our intention is to join software engineering methods with workflow management and CSCW approaches to achieve innovative solutions for distributed software engineering in organizations and over organizational boundaries.

Let us take a closer look at various aspects of software systems, tools and techniques for CSCW. This kind of technology raises new questions about the role and power of computers in daily life. CSCW is more about people than about computers, and applies a truly user-centred approach to the design of CSCW systems. Technology already plays an important aspect in our everyday lives. From the advent of the first telephone, to the current usage of email and cellular phones, humans continue to be social creatures, who aim to keep in touch, whenever and wherever. In fact, emails and cellular phones are tools of CSCW, but there could be much more – and there is.

Computer Supported Cooperative Work is concerned with investigating how people cooperate to solve problems and how that cooperation can be automatically supported. It is an interdisciplinary activity and the research group works closely with sociologists who carry out studies into the cooperative nature of work. New buzzwords have become part of our daily lexicon: Web 2.0, Social Software and Social Web are often used as synonyms. These concepts focus on new or existing software systems, which are influenced by human communication and collaboration (Jahnke, 2009). Thus, Web 2.0 is heavily reliant on social interaction, and so, social web-based applications generate and require a human-centred design approach. Furthermore, this kind of new media influences the people. A new generation of the "digital natives" are arriving (Prensky, 2001).

The number of users of Web 2.0 applications in private settings (e.g., leisure) is very high. However, in organizations and enterprises Web 2.0 concepts or such combined applications are still at an early stage. There are some Web 2.0 tools in universities, in particular wikis and blogs (e.g., (Hookway, 2008)) but the usage of these tools and other Web 2.0 scenarios for supporting teaching, learning or research is not yet fully developed. So, the question how the Web 2.0 can support community-based daily life or research processes is not yet satisfactorily answered.

In face to face shared activity, workspace awareness is a natural, constant, and even unconscious part of people's interaction. From a technical angle, the provision of awareness information comprises three separate yet co-dependent steps. First, the information is gathered, then distributed, and finally communicated (Suchman, 1989).

What are the support achievements of the last years:

- empirical studies of work that contribute to the design space of CSCW,
- novel techniques and technologies relevant to CSCW,
- enhancement of the conceptual foundations of CSCW.

In particular, those achievements are:

- Comparative analyses of empirical investigations that contribute to a deeper understanding of single application domains of CSCW or aspects of CSCW, which cross different domains
- New computer-enabled forms of organisation
- Collaboratories and distributed scientific work, including reflections on CSCW aspects of e-science
- The conception, construction and use of CSCW technologies in complex and demanding settings, like manufacturing, healthcare, security, control systems, etc.
- The implications of new interaction technologies (pervasive, ubiquitous, handheld ...) for CSCW: empirical research of use, studies of integration with other CSCW technologies and applications

- The integration of CSCW technologies with other technologies used to support organisations, such as information systems, production systems, decision support systems, knowledge management systems, etc.
- The conception, construction and use of innovative interaction modes for CSCW applications, e.g. interfaces and supportive functionalities, including diverse users, such as impaired users
- Architectures supporting CSCW technologies with quality requirements, such as flexibility, tailorability, adaptability, etc.

2. Some Critical Remarks

As terms like “Ubiquitous Computing” or “Seamless Interaction” promise the computer application chances are unlimited and access to computer based services for users have no barriers any more. But perhaps there should be some limitations regarding freedom in design of such applications? The Open Source movement has founded the free exchange of software and free of charge online systems established the success of Web 2.0. But should designers and developers line out all their competence and their creativity in every project? How do we achieve a balance between the observance of conventions and standards and innovative solutions? The question of “unlimited freedom” has to be discussed among computer scientists, psychologists, work scientists, designers and engineers together with users of interactive computer systems in a free interchange of cognition, belief and experiences. Categories of this discussion are:

- interface design: new paradigms like Web 2.0 and Semantic Web, embedded and ambient systems, speech based systems, mixed and enhanced realities, tangible media, avatars, 3D worlds, brain-computer interfaces;
- usability-engineering: processes, methods and tools for a systematic, economic, task and user-oriented system design; return on investment (ROI) for systems utilizable systems;
- applications & case studies: innovative applications systems based n novel methods, techniques and processes; mission critical man-computer-systems; multiple identities and protection of private life.

3. Some Indispensable Goals and Requirements for CSCW in our Real World

CSCW systems have mostly been built using an ad hoc approach to information storage and management. As these systems mature, a more systematic approach will be required and it is already clear that existing database management systems lack a number of required facilities to support effective cooperative work. The CSCW technology has the potential to enable a flexible design of an organisation, as it can be used for making communication more flexible than before. However, we still lack methods for the design process of CSCW systems. The use of CSCW technology has the potential to facilitate the design of an organisation, as it allows for a flexible structure of communication within the organisation. However, we still lack methods and experience when it comes to the design process of such systems. We need methods that facilitate the design of different work organisation alternatives within the CSCW system.

CSCW is a research domain, which examines ways of designing systems – people and computer systems – that can have significant implications for the way in which people work together. Although the domain initially emerged from the discipline of computer science it can be argued that the CSCW research domain differs from traditional computer science in that it draws on the contributions of various disciplines, all of which support the aim of developing computer systems on the basis of people and their working relationships. It is a research area that examines issues relating to the design of computer systems to support people working together. This seemingly all-encompassing definition is in part a reaction to what has been seen as a set of implicit design assumptions in many computer applications - that they are intended to support users do their work on their own. In cases where a scarce resource has to be shared; systems designers have minimised the effects of this shared activity and tried to create the illusion of the case of exclusive access to resources. This assumptions hold in discussion of digital libraries as a way of offering access to resources without the need to compete with other library users.

In other words, CSCW aims to support the overhead that arises when work is conducted among distributed, independent agents. Articulation work includes two important threads: construction and management of a common, shared information space and workflow management. In the past, designers of workflow systems automated written procedures as maintained by each target organization, which in all cases turned out to be a fictional, idealized version of the real work process.

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GROUP-ADAPTIVE PERSONAL LEARNING HISTORY

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Keywords

Group adaptivity, learning history, e-learning

Abstract

Documenting collaboration is an important prerequisite for its improvement or reflection on it. But learning platforms usually support logging individual actions only, falling short in two aspects. Typically not the small actions (like individual mouse clicks) but larger activities (working through a chapter) are of interest, and regarding collaboration the individual contribution (a message sent) is important, buts its context, the group setting (frequent collaboration with a certain group of other students) should be included as well. A group-adaptive personal learning history is described as a solution for these problems. Individual actions are aggregated to larger activities and these are then used to generate individualized log entries to a personal history log. An exemplary implementation for two tools is presented to show the viability of this approach.

This publication results from the research project "ASCOLLA – Adaptive Support for Collaborative E-Learning", funded by the Austrian Science Fund (FWF; P20260-N15).

1. Introduction

Cooperation between learners is a necessity in most pedagogical approaches, although currently comparatively less supported in E-Learning from the didactic point of view. Technologically all manners of communication are supported, but their embedding into the concept of a course as well as the support for cooperation (based on, but different from communication!) is lacking (Paramythis/Mühlbacher 2008). Also, unlike individual activities the steering and documentation of communication - and especially collaboration - is more difficult. This is true for humans, where e.g. assigning a mark to each student based on their group's joint result is more difficult than if each learner's work can be assessed separately. In E-Learning this is more complex as it must be done not only automatically but often also for asynchronous activities, where even identifying the "group" can be difficult. It is therefore desirable to create a "log" of collaborative activities (which need not necessarily have been performed at a single point in time or simultaneously) as a first step towards documenting and assessing them and for later improvement. It must be noted that such collaborative activities, although based on individual learner's actions, should not remain on the single person level but include the actions of others, i.e. encompass larger units (like discussing a certain topic with a list of persons) instead of individual events (for instance posting a message in a forum); see Figure 1 for a graphical description. These activities can then serve as the basis for improvement or enlargement of the learning cycle: if the current state or quality is unknown, changes cannot be based on evidence and verification of new approaches is very hard. Additionally, introspection and reflection as an individual learner as well as within a larger group become possible.

One preliminary step for documenting group activities is identifying which learners constitute a “group” working on a single “product” (Figure 1: actions from which learners should be integrated; ❶). This can be quite trivial if explicitly represented groups working on a shared result exist: A group receives a separate workspace, its members are assigned rights on it in the learning platform, and all of them edit one document at some time during a defined period. But in more unstructured and ad-hoc cooperation, like chats or forum discussions, this becomes much more difficult.

Another issue is integrating the activities of several persons into a single “documentation unit”, typically a single section of text summarizing this shared or common activity (Figure 1: how to produce the content of the learning history entries from the collaborative activity; ❷). For this cooperation is split in two aspects: What each student performs as a person, and what the group does as a whole. For example, in a chat or a Wiki the former are the messages or modifications a person authors and the latter is the chat as a whole or the resulting webpage. While the former can be documented quite easily and in many learning platforms already is (tools like “recent activities” or “new pages”), the latter is our prime target here. Individual actions or activities will still be logged for each person separately, however they should at least integrate the actions/activities of other group members as well. In this way the individual learning history is enriched by group activities. Collaborative actions as such are however identical for each member of the group and therefore exist only once and are shared between the personal logs of all members (Figure 1: Group learning history entry).

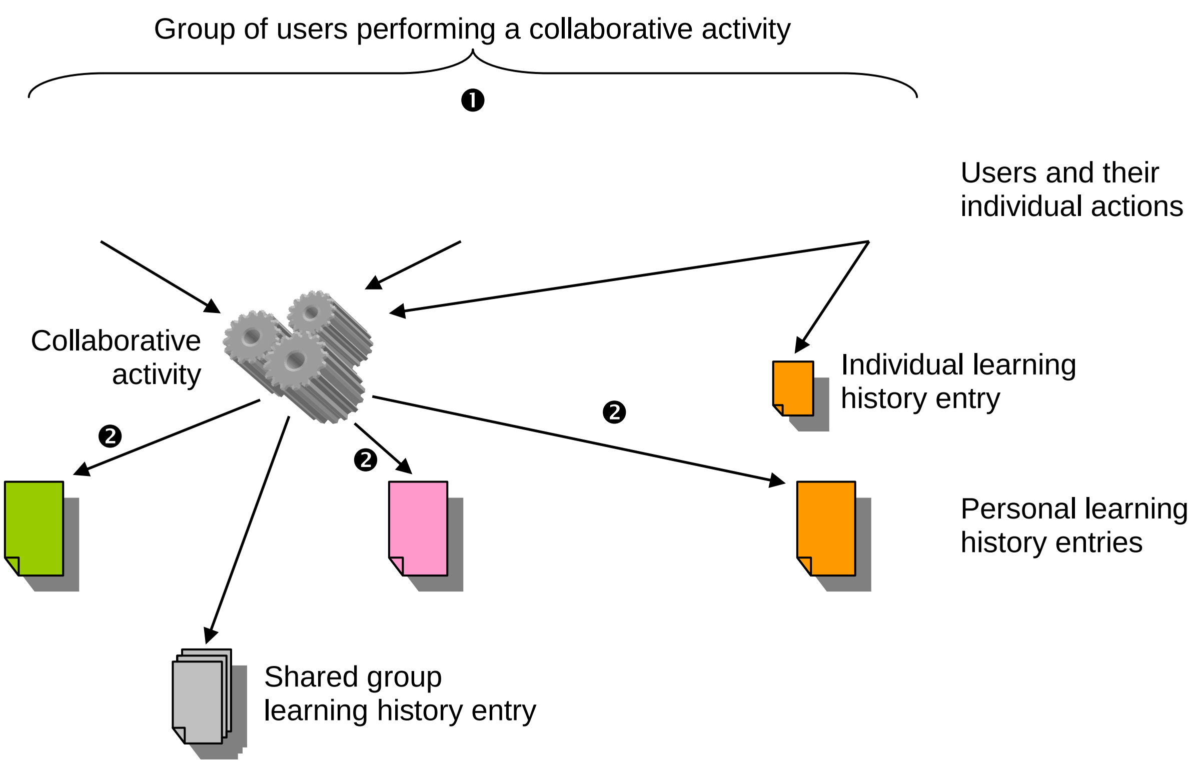

Figure 1: From actions over activities to personal learning history entries

1.1. Personal Learning History

A “personal learning history” (PLH) is a log describing activities, achievements, problems, or experiences over a longer time for later reference and reflection. In this way it becomes easier to identify problematic areas in learning style (not necessarily regarding specific learning materials) or detect areas for future focusing: how to improve the learning path (→ teachers) or better learning methods (→ learner). Such a history can be generated manually or to some degree also automatically. Examples for the latter are reminders/notes when a report has to be - respectively had been - submitted. Notes taken during an online or offline course or during studying learning materials are examples of the former.

Personal learning histories aim at providing an opportunity to improve learning from past experience. They foster life-long learning and may be used as the basis for ePortfolios. With them learners can “go back in time” and review their progress. Depending on the educational model such a history might be part of the marking by teachers as well: assessing not only the absolute level achieved but also the progress made. In a variety perhaps more acceptable to learners such a history can be used to improve guidance by coaches. They do not need to elicit the current problems of the individual learner but can obtain an overview on these by inspecting the personal learning history.

As a PLH is a condensed report on past steps in the learning cycle focused at being helpful in the future, it should be created with two aspects in mind: documenting the past and improving reflection in the future. While the former is quite easy, it is partly at odds with the latter. Although documentation is trivially possible automatically e.g. by recording every single mouse move, key press, or action in a learning environment, such detailed recording will be useless for (and in) the future as too much information is stored which is typically of no interest at a later point in time. On the other hand, what is important in the future is mostly unclear at the moment a log entry is created. Therefore some aggregation is necessary to keep the PLH brief, yet retain all necessary information for possible future uses. Entries to the history should therefore not merely describe what occurred, but also incorporate some background information, like intentions for these activities, the procedure how it came to be, reasons for the results, or references to activities of other learners or other groups. Such cross-connections allow comparisons and can enhance future use through diversity, as not every participant of a discussion will create an identical summary (or receive an identical automatically generated one) for their PLH, so reading several or all of them together enhances the overall picture, and the differences provide incentives to look as the other group member’s logs.

1.2. “Group Adaptivity” and Its Subdivision

Adaptivity (Kareal/Klema, 2006) means in this paper’s context to modify the learning environment to the properties of the individual learner. This can be performed in various ways, e.g. using a different display (larger font/no images/… for people with disabilities; e.g. AHA by De Bra et al. 1999), showing other content (depending on the individual learning style, pre-knowledge etc.; e.g. ELM-Art; Brusilovski et al. 1996 and Weber/Brusilovsky 2001), or providing guidance through content (adaptive navigation; e.g. InterBook, Brusilovski et al. 1998). However, such adaptivity is not inherently restricted to an individual person but can be applied to groups as the target as well in two different ways: individual adaptation based on group information, or adaptation not for an individual but for larger groups. The latter can be exemplified through providing specific additional learning materials to all students who graduated from a general school alike, which is omitted for those from technical ones. An obvious prerequisite is that this group’s properties must be known instead of merely data on individuals, which can be implemented e.g. through explicit questioning or observation of individual’s behaviour + integration/generalization. The second approach is adaptive elements for individuals based on other's activities. E.g. individualized learning examples are presented to each user separately, but their generation/selection is not based solely on his/her results but also on that of a larger group, e.g. taking into account general (as opposed to individual) difficulties in understanding as well. In short, group adaptivity can be based on adapting something for a single person based on information on a larger group (group-information based adaptivity), or adapting for groups as a whole (adaptivity for groups). In this paper we focus on the first, although PLH is possible for the second equally.

2. Group Adaptivity in Personal Learning Histories

Integrating group adaptivity into PLH is based on one of the two group adaptivity possibilities. An individual learning history for a single person is created – although perhaps visible to others as well (see below) – which takes into account activities by other "nearby" or "similar" learners, i.e. a group. In the current implementation each log entry is tailored to the associated person, although it is based on a shared basis (which itself might be used for a group learning history). The aim of integrating group adaptivity in PLH is therefore to provide an "abstract" of the *aggregated individual learning history as embedded within a larger group* for later use, with a special focus on activities related to cooperation.

Based on the amount of influence on the entry, group adaptivity in PLH can be subdivided into the following finer variations:

1. Individual actions: This is actually neither group adaptivity nor PLH, as only individual elements and solely actions are logged for each person separately. However, it can be used as a fallback and as the basis for the improved approaches below. Examples for this are the upload of a finished assignment or notes taken during a lecture or while working through learning materials. The exemplary implementation does not create such entries.
2. Individual activities with possible relations to other users: While still only pertaining to a single individual, cross-connections to other students are made, e.g. whom to ask for advice to this specific problem by taking into account the activities of a larger group (see 3.2). Another example is helping group formation through suggesting possible persons for cooperation or collaboration.
3. Individual activities enriched by information from a group: The data logged to the learning history includes information on other members of a group. This group might be the same for all entries or could be different for each category or even each log entry. Examples are progress within the learning material as compared to the whole class (could be a static or a dynamic comparison, i.e. compared at the time of log creation or at the time of viewing) or a summary of a chat with statistics on how frequently/verbosely oneself or the other participants said something (see 3.1).
4. Group activities: These refer to activities where individual actions still exist but can be distinguished only with difficulty or make little sense on their own, so only the collective activity is logged any more. An example for this is a Wiki, where individual modifications might be very small (adding a few words here, inserting an arrow and a textbox there …) and only the overall progress is useful to retain for future review in a separate entry (see also 2.2).

In the following subsections three important aspects of group-adaptivity in PLH are discussed: Group visibility as a bridge between individual and pure group entries, how to aggregate simple actions into larger activities (to then log them), and how to create a useful documentation of a real group activity (paragraph 4 above), based on a Wiki as an example.

2.1. Aggregating Actions into Activities

A difficulty of group adaptive PLH is how to define the "group" for an activity. Approaches for identifying a group can be based for instance on an existing explicit representation, e.g. the organizational structure (all learners in a course, all participants in the learning platform with certain rights on an element, …), or comparing the individual actions to identify common "signatures" and assembling a group based on "similar" action/activities (e.g. all persons participating in a chat or reading the same section in learning materials).

Actions are often not monitored directly but rather through events, i.e. each subsystem of a learning environment, such as a chat/forum module, exercise generation tool, or a quiz, defines what itself sees as an important and potentially interesting event and distributes this to all interested parties, perhaps through a central event bus of the platform. Such events are typically, but not necessarily, the direct and immediate results of an individual user's action (examples: chatroom created/deleted, chat message posted, exercise generated/started/finished/marked, quiz created/filled in, Wiki page modification, …). By comparing these events common signatures can be identified in certain cases automatically. If they differ only in a single element, e.g. the user who caused it to be fired, then some "common" activity took place, like in our examples two persons sent a message in the same chatroom simultaneously. Obviously, this doesn't work correct in all circumstances, as for instance the time will usually be a differentiating factor as well, resulting in already two differences. If the events occur within a short time span, they are probably related (two messages within a few seconds in the same chatroom by two different persons will have something to do with each other – at least the other participant has read it). But if a longer pause exists they could be completely unrelated as well. For instance two separate subgroups of a course use the same chatroom on different occasions or exercises from a generator have no overlapping common ground. This is complicated by the fact that no general rule is possible when two events are related, as e.g. the time difference is of little importance in a Wiki as opposed to a chatroom, but there the spatial difference (which page within the Wiki has been changed) is important (which doesn't even exist within a chatroom). Therefore generic aggregation of individual actions can only serve as a first approximation.

An improved approach must therefore rely on hints for (or by) each event source or type what can be considered as "related events". This may include differences solely over time, i.e. where the same person causes an event to be fired repeatedly. This is important for a group adaptive PLH too, even though it applies to a single person only, as an improved information source on a group member enhances the group assessment as well. An example is, that repeated "successful" events (e.g. for a quiz) can be integrated into an "expert status" to be used for the adaptivity categories 2 and 3 (possible relations and enrichment) described above. Obviously this requires event history storage so that previous events can be compared to or integrated with new ones, in addition to merely acting on events the moment they occur.

2.2. Group Visibility

An important decision for a group-adaptive PLH history is the amount of privacy. Who may view the individual log entries: only the learner or also the other members of the group on who's input it is based as well? As it is a "personal" learning history the restricted visibility seems to be more natural. However, this visibility should match the sources used for its generation because of equality. For an individual learning history these are solely the actions of this person, resulting in a private log entry. For a single entry for all group members (=group learning history) the actions of all group members are used, so every member should be able to see and perhaps modify it (equality of all persons regarding access rights). For a personal learning history influenced by other group members, but with individualized entries based on a single person, this person should have more rights (e.g. modifying it) than the others, but the group members should not be completely excluded (e.g. just read access). Opening up the accessibility of individual entries to the group is therefore a middle ground between the two extremes of a single identical entry for the whole group and a purely personal log.

Obviously this is a potential privacy issue, as some data of such entries pertains to the person alone and is not a completely shared one. So the option to either turn off this feature or allow changing individual entries to private ones should be offered. Still, as only members of the group can see these entries there exists at least some connection between them – they are not complete strangers. Consider for instance chat messages. If the group is defined as "has participated in the chat" everyone has already seen the messages so any summary or statistics is nothing new to them. If someone joins the chatroom later, they typically have access to all the history, so even if they have not read it, they at least had the opportunity to do so. Especially in this exemplary case group visibility can be useful, as instead of having to re-read all that has gone on before they joined, a look at the history of the other participants informs late comers roughly about previous developments.

An additional consequence of group visibility is that comments by these other group members are possible. If the learning history is available just to the individual, only manual additions or modifications, or comments to automatically generated entries are possible. But if others have access to these entries they can comment on them too, introducing an additional starting point for collaboration and providing perhaps a new point of view on a topic, or starting or improving reflection.

2.3. Group Activities: Wiki as an Example

Another issue of group adaptive PLH is, what log entry to produce for group activities, where the individual actions are difficult to interpret or unimportant, i.e. how to summarize them, ideally in addition with a focus on the aggregated contributions of a single individual. An example for this problem is a Wiki. Learners might work together in a group to create a shared page on a specific topic, each reading and improving the contribution of the others. Typically the work is split into subparts and every member of the groups writes her/his section. At this point the individual part can still be identified easily and addition to a PLH is simple. But if actual collaboration after this cooperation phase occurs, which is commonly the pedagogical intent, everyone enhances the products of the others with their own knowledge, discuss it, and improve their own part based on feedback received. I.e., a self-contained and coherent contribution of a single person is practically non-existent any more. Still there are some approaches, how such an activity could be represented in an automatically generated personal learning history. This can be done either according to the process (who did when what) or the result (representation in final outcome, resulting product).

Regarding the process one option is to produce statistics, for instance the frequency and amount of data contributed, the part of it which was (not) modified by others, e.g. measured in sentences or paragraphs, the extent of modifications to other person's contributions etc. To some degree it is also possible to identify the type of modification, e.g. through the size: was it only a typo correction or was something important changed, e.g. through inserting a negation? Through calculating the frequency of changes to other person's parts a very rough measure of the "amount of collaboration" is possible. If a person only changes its own sections, cooperation is probably low (but not necessarily, as the modification might be based on a discussion with others), but if significant alterations to “foreign” sections occur repeatedly, a lot of interaction and mutual influence takes place.

Taking into account the resulting product only, automatic summarization can server as a replacement if a summary is not part of the resulting product. Also, those elements changed most often can be cited in the log entry, as these are probably important or useful for later reflection (why were they changed so often, who modified them in which direction etc.). Similarly interesting are sections which have been reverted to a previous state often. Regarding the aim of documentation it might be more useful to link to the Wiki itself, perhaps specifically to sections changed often, than trying to reduce/summarize the history – which is especially difficult for the document as a whole.

Another approach is integrating external activities, like chats/forums connected with this page or E-Mails. These elements might be explicitly associated with the work product or could perhaps be related to it through their content (e.g. copied text, citations) or links.

3. Exemplary Implementation

A personal learning history has been implemented in the learning platform Sakai (2010). It is based on a blog tool, as this resembles a learning history best: several independent entries after each other, which can be commented upon or modified by the creator or others, are associated with access rights etc. In this way also a user interface is available automatically, which had only to be adapted for the additional functionality, e.g. the group visibility.

Manual entries can be added to the PLH as well (based on the normal blog), or the automatically generated ones modified. In additional to these main entries comments are possible. Regarding the access rights, everyone who can see an entry can also comment on it by default (can be changed manually if desired), but only the owner of the PLH can change the main entry. Visibility is by default to all group members, but can be changed manually to fully public or private. As groups vary from entry to entry, no “canonical” form exists save the one for the person it mainly belongs to, its owner, who can see all entries.

Which persons are considered as a “group” is not defined in the general implementation: Each tool (i.e. chat, exercise generator, wiki, …) can and must define this on its own (see section 2.1). Therefore the PLH consists of elements originating from various tools, each possessing a different concept of “group”. This might be confusing but is unavoidable, as a learner can for instance be member of two differently composed groups in two courses attended during the same semester, which must be mirrored not only in the content, but also the access rights. Other group members from one course should not be able to see or modify the entries belonging to the other course, unless they are in the same group there as well. At the moment the logic for defining these adaptivity elements (which persons constitute a group, what to log exactly etc.) are hardcoded, but a promising approach is employing a modelling language for easier modifications or perhaps even meta-adaptivity (Paramythis/Cristea 2008).

Two tools have been enhanced to contribute to a PLH at the moment: The chat room and a generator for exercises, which creates new cases in a special field of law for learners to solve. Other tools like poll, forum and wiki will be extended in the future to provide a fuller view and as examples for different kinds of cooperation and allow better verification of the usefulness of this approach.

3.1. Chat Learning History

For chats each chat room is considered a separate entity and therefore receives its own entry in the PLH, as conversations in separate rooms (which are in Sakai quite static and often created per course/group and not ad-hoc for a single session) typically have little in common. An entry provides statistics on the learner's participation (message and character count, i.e. how often and how "extensive" he/she participated) and who sent the last message. These are recalculated whenever the learner leaves the chat room. The "group" for this tool is defined as all persons who participated in this chat. Therefore every learner sees their own statistics in their PLH, allowing a quick assessment of the involvement and (hopefully) the topic through the chat room title.

A shortcoming of this approach is, that although chat rooms can be freely created by participants for separate tasks, often an existing and free one will be "reused". This is not detected at the moment, as even old conversations might be "restarted" after a longer interval (=same discussion), but when everyone leaves the chat room and immediately after another groups reuses it, these are different discussions. Which of the both cases occurred is very hard to determine. Session gaps, i.e. periods with no persons within the chat room can detect the second scenario, but will fail in the first. Still, it is probably better to generate a separate PLH entry for a different session with the same topic, than merging two completely different discussions.

A possible extension is automatic text summarization, which could be used to provide a better assessment of what went on in this chat or at least its main topic.

3.2. Exercise Generator Learning History

This is a generator for legal cases (Sonntag, 2009), which students solve autonomously and which can then be corrected with the help of an exemplary solution generated as well, similar to an intelligent tutoring system (Murray, 1999). Each case consists of several independent legal problems assembled into a single textual description. The entry into the PLH provides brief information on the current state of the case (not its content – could be possible through automatic summarization if such a service were available) and on the result of the assessment, if it has been completed.

As the main focus of the PLH is on integrating several events over time (to avoid listing only small actions, which are not interesting), the entries are here dynamic. This means, depending on later events previous log entries are modified. Here each case receives only a single log message. Whenever its state changes (generated → solved → assessed), the associated PLH entry changes as well to incorporate the new development. In a second way it is even more dynamic, as the entry lists other users which might be of help regarding the actual problems selected for this case, as they encountered this or a closely related problem in the past. These students are considered a "group" for this tool, as each learner receives individual cases for solving alone, and their only common aspect are the potentially identical/similar problems in their examples. This list is created at the moment a user looks at the PLH entry and is not stored at all, i.e. it is completely dynamic and therefore potentially changes every time the entry is viewed. An extension of the entries to not only list such possible advisors but also contact them directly (e.g. showing them differently if currently online and opening a direct chat for them if accepted by the other learner) is planned for a future extension.

4. Conclusions

Adding collaboration-related data to a personal learning history serves not only to document group work (for the learners themselves as well as thirds, e.g. coaches), but also as a source for reflection. The important aspect for this is to not stop at recording individual actions, but integrating them into larger activities, and then combine those of several persons together. Unfortunately this is not possible on the detail level, i.e. for individual entries, in a generic way but must be tailored to each source. Only on a very high level ("persons most often collaborated with") this could be possible. The viability of this approach has been shown through the completed parts of an ongoing project.

For the future an extension to polls and the wiki is planned. For the former a group can be identified as all persons who gave similar answers and the PLH can include statistics as a comparison how similar the own answers were to those of the group ("mainstream" member of group or on its border) as well as to all participants. Regarding the Wiki statistics on own overwrites of other people's parts (and vice versa: parts of the learner overwritten by others), the share of the final result, frequency and size of own contributions ad well as the most actively worked on pages are planned. A group can there be derived from who worked on the same parts extensively as well (obviously interested in the same topic) and from the overwriting/being overwritten statistics.

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IMPLEMENTATION OF BUSINESS INTELLIGENCE AS THE „SOFTWARE AS A SERVICE“ - THE OPPORTUNITY FOR SMALL AND MEDIUM-SIZED COMPANIES

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Keywords

Business intelligence, small and medium-sized companies, software as a service

Abstract

Issues of using business intelligence tools as the "Software as a service" in small and medium-sized companies are discussed. The emphasis is put to the largest possible range of functions offered and the effectiveness of the acquisition, regardless of the hardware facilities of the company. Use of the "Software as a service" offer is recommended. Business intelligence tools are the necessary condition for success of development of a company in a rapidly changing economic environment. They make possible to change data into information and information into knowledge.

1. Introduction

Possess sufficient amount of information has nowadays become a key success factor in all fields of human activity. However, it is not enough to merely gather information as such – information must fulfil certain criteria. Valuable information is such, which is provided at the right moment, at the right place, is relevant, correct and complete, to mention at least some of the important attributes.

It is not simple to extract such information from available data. Integrated information systems allow anyone who is entitled, to receive (more or less simply and quickly) any sort of information from any place, time and process. However, to obtain the information that we really want or need?

2. BI Applications

Executive Information Systems (EIS), Customer relationship management (CRM) and Corporate Performance Management (CPM) belong among basic BI applications. The applications make use of multidimensional data store, based on multidimensional table (data cube) enabling to change quickly and flexibly individual dimensions, thus changing user's view of economic reality being modelled. Multidimensional data saving is mostly carried out on metadata superstructure basis over the relational tables. Metadata assign lines and columns of relational databases to individual dimensions and cells in n-dimensional table. Metadata also include rules of data aggregation on individual levels of defined dimensions. This is the principle of OLAP data saving technology or on-line analytic data processing.

They are capable of transporting considerable volumes of primary data, generated by basic company processes, into logic structures which represent the managing and decision-making processes in company.

Basic Executive Information Systems - *EIS* application characteristics are multidimensional concept and data handling, possibility to obtain data from heterogeneous data sources, menu of own databases for OLAP and direct access to external data and support of advanced analytical accesses.

Special features of EIS application consists of effective processing of thin matrices, processing of non-standardized data and distinguishing missing and zero value, generic dimensionality and flexible reporting.

EIS multidimensionality enables to create quickly and simply new views of data, place them in new relations, search for regularities (trend characteristics), indicate key indicators deviations from planned values, work with history and anticipate future development.

According to Maoz (2005), Customer relationship management - *CRM* can be considered as a way of company's manners towards its customers, it is a strategy aimed to satisfaction of customer needs. CRM exploits the information contained in company information systems and processes it with the respect to customer characteristics. CRM effectiveness depends on the ability to gather data from different customer channels evaluate these data and modify them into new business processes influencing interaction with customer. CRM systems are usually structured into operational and analytic parts. Analytic part of CRM represents the analytical processing including the data from data warehouses. According to the result, business operations are optimized and a new strategy of the company is proposed. Operational part of CRM executes predefined business operations.

Corporate Performance Management - *CPM* is based on the idea of BI tools integration into the support of company planning. All the methodologies, methods and information tools needed to monitoring and managing the performance of company or an institution are parts of CPM, say Rayner, Buytendijk and Geishecker (2005).

2.1. Data Retrieving, Transformation, Cleaning and Loading Applications

Data warehouse is a prerequisite for BI tools to work. It is an integrated database optimised for data retrieving and analysis accompanied by tools which allow queries, analyses and high quality output presentation. Data from either internal or external sources are integrated and stored in a data warehouse.

Data Warehouses operate on principle of three steps, which are together designated under abbreviation ETL – Extraction, Transformation and Load. ETL execution signifies mainly programmed implementation of data pumps, testing of their time requirements and setting of operation parameters. ETL tools parameters – supported platforms and their connectivity, metadata administration support, multiphase pump usage based on set timing, workflow support levels, data pump protocol levels, real time data processing support. The trend in the field of ETL tools is towards is their consolidation with metadata administration tools and data quality securing tools, as well as towards delivery with standard database machines.

Data quality is one of basic prerequisites of effective use of BI applications. It is essential for BI application to work with correct data, reflecting real situation in a company or institution.

Data quality can be defined in several ways, for our purposes we will use simple definition – quality data (first-rate data) correspond with reality, they are complete and consistent.

Ciarciello (2006) found that data quality issues grew in importance at the time of data warehouses formation when it became obvious that data processed from varied sources do not correspond, in greater or lesser extent, to reality or contain conflicting values.

First-rate data represent essential part of any modern information system. Another indispensable part is a quality description of its content, way in which the content was created and also of way it is used – that is *metadata*.

Importance of metadata as a main means of description of information system content and situation has grown considerably in recent time. Primary reason for metadata (defined as data about data) existence is that they provide context to otherwise haphazard accumulation of information fragments. Main advantage of metadata existence is that they make possible to easily understand principles, functionality and content of individual information systems.

Metadata can be divided to two main groups - technical metadata and attributive metadata. Provide satisfactory data quality and description, it is a task not only for information systems (mainly for data warehouse, as it was originally understood at birth of those solutions), but also in great deal task of its users, says Tvrdíková (2006). Main reason for gradual shift of responsibility for data quality provision and description of individual data element is the fact that users who use data long term know them best.

3. Characteristics and Needs of Small Businesses

SME is defined in the legislation of the Czech Republic and the European Union for its support. In the Czech Republic, this definition in the Act on Support of Small and Medium Enterprises No. 47/2002 Coll., as amended. From 1.1.2005 is also a new definition of small and medium enterprises for the purpose of grant of public funds in the environment of the European Union, which is listed in the table. No. 1 made by Štverková (2007).

Business categories	Number of employees (less than)	Turnover	Balance sheet (assets)
Medium	< 250	≤ 50 mil. EUR	≤ 43 mil. EUR
Small	< 50	≤ 10 mil. EUR	≤ 10 mil. EUR
Tiny (mikro)	< 10	≤ 2 mil. EUR	≤ 2 mil. EUR

Table 1: Definition of SMEs - Source: Štverková (2007)

As medium-sized companies the EU considers companies employing fewer than 250 people and a turnover of less than 50 million euro. And a small company then, those firms with fewer than 50 employees and whose annual turnover is less than 10 million euro.

In the Czech Republic, there are currently a number of very successful small and medium sized companies from various sectors. The primary challenge of medium and small companies is now not secure their existence. More and more often happen the consolidations and buying small companies by large ones. It is obvious that in these companies if they want to succeed in the current conditions, management must decide intelligently, which means reasonably, properly and sufficient quantity of quality information.

The situation in small and medium enterprises improved recently particularly in the promotion of basic business processes and adopting common business standards. It improves the view entrepreneurship - the company seeking to develop new processes and business activities and then to develop their IT support, says Tvrdíková (2006).

Management of any company desiring prosperity must ask questions like:

- Is there always the right information?
- Do we have a quick and convenient information access?
- Can we formulate the necessary questions and get them quickly and easily appropriate response?

In today's information technology market is a wide range of software solutions that support corporate governance, according to knowledge, many suppliers of these technologies already offer a solution for midsize businesses. The problem is the price of these solutions versus the financial capabilities of many small and medium sized companies. The need for quality information system is also its integration. Only truly integrated IS can provide company executives the necessary background information. It is not only the integration of internal processes within the organization and integration of information system functions and the processes. For the smooth running of the company or institution is very important also external integration, it comes integration of the information system of the firm with its environment (business partners, suppliers, links to the required services, banks, insurance companies, etc.). Increasingly, the importance of information system which connecting the company to its customers shoot up. Very important is the integration of data - creating a single repository of data whose quality is guaranteed, and where can the veracity and completeness of the data needed to control intervals. Solving the problems and requirements is offering the use of SaaS (Software as a Service), which already offer some of the software companies.

4. Software as a Service (SaaS)

Software as a Service (or simply Saas) is a quite new technique in the world of IT which allows you to hire a software application only when there is a requirement of such utility. The main reasons for its popularity are high services, low costs and less maintenance.

In the software as a service model, the application, or service, is deployed from a centralized data center across a network - Internet, Intranet, LAN, or VPN - providing access and use on a recurring fee basis. Users "rent," "subscribe to," “are assigned”, or "are granted access to" the applications from a central provider. Business models vary according to the level to which the software is streamlined, to lower price and increase efficiency, or value-added through customization to further improve digitized business processes according to the Software & Information Industry Association (2001).

This kind of on-demand service also saves the complex hardware requirements, once the use of the software is over. The SaaS enables a centralized control of the business by the service provider. In other words, the network of action is distributed amongst many users from a single server.

But there is not only Software as a Service term. You can meet many of the "aaS" acronyms and the most important ones are described below:

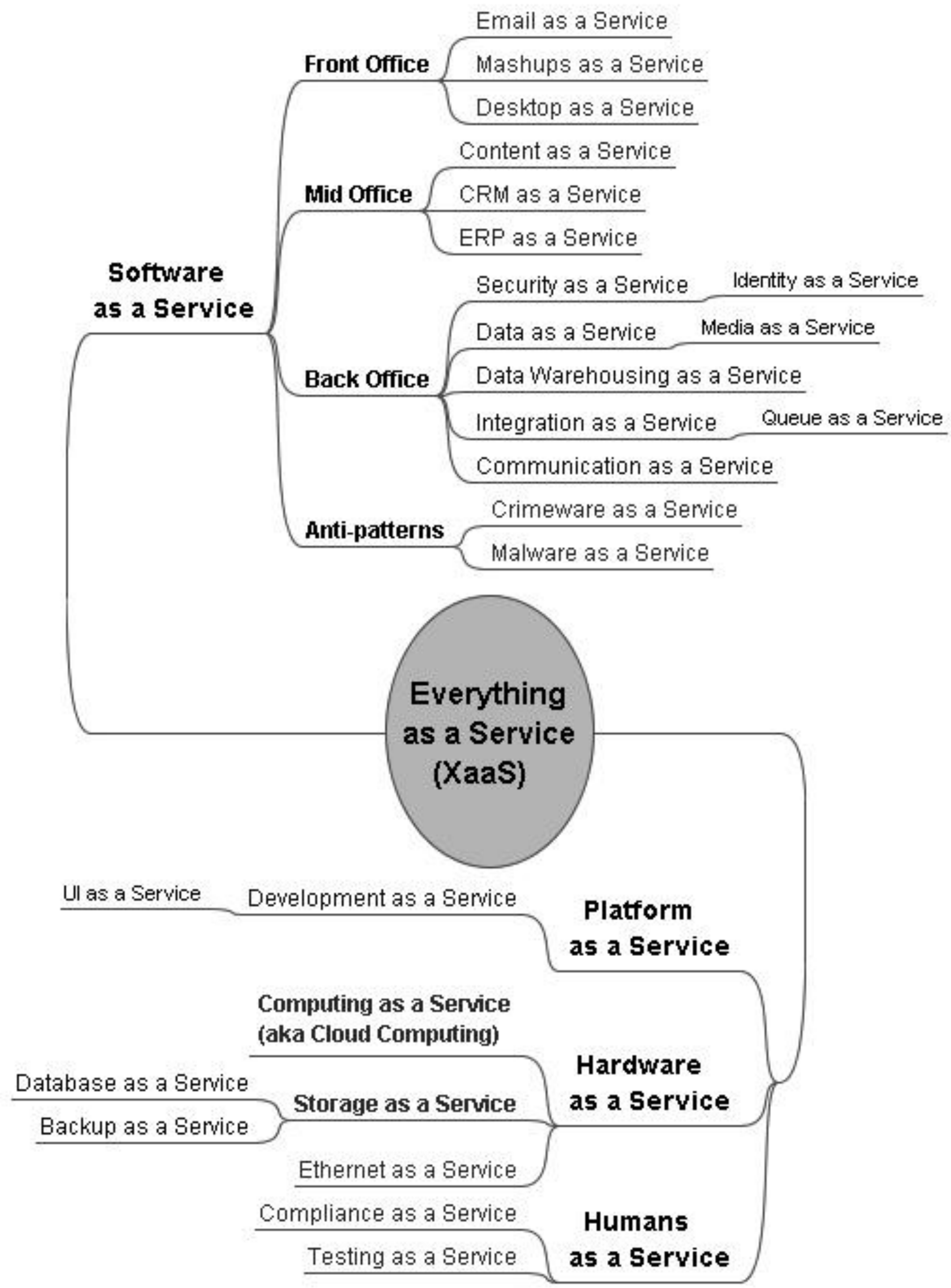

Figure 1: "aaS" acronyms - Source: Laird (2008)

In its most generic form, SaaS is any software offered remotely as a service. Since this definition includes the entire World Wide Web, there are generally agreed on criteria for SaaS products to narrow the scope:

- Primarily business software
- Usage based pricing (pay as you go) with no long term contracts
- Delivered over the internet, primarily via a browser

- Managed by the ISV (Independent software vendor) that developed the application (as opposed to the former ASP model)

Software & Information Industry Association (2001) and http://www.whatissaas.net/ website say that the short history of SaaS term started in 1999. It was then that Bennett et al came up with the term as the “beginning for gaining acceptance in marketplace” during December, 2000. Although the phrase ‘software as a service’ soon came in to common use - the “SaaS” (Title Case acronym) was not widely accepted until 2000-2001 in the white paper, which was known as the “Strategic Backgrounder: Software as a Service”. In February 2001, this paper was published by e-Business division of “Software & Information Industry”, even though the content was actually written during the 2000 fall.

4.1. Characteristics of the SaaS

The motive behind designing SaaS applications is to make the software applications easy in use and more web-oriented. The architecture of the SaaS model is so designed that it enables many users to access the same application through a single license. With simple design, it also reduces complex procedure needed to stand the application in use. These features are some characteristics that separate this technique from other applications like ASP (Application Service Provider).

Software as a Service (SaaS) also known as software in demand implies differently to different people. The important characteristics of SaaS by the http://www.whatissaas.net/ website are:

- It enables both network and web based access to commercial available software computing services, the work or processing related to is done not at the location of customer, rather it is done on a third-party server.
- The application delivery is multi tenant based including partnering, architecture, pricing, and management features.
- The end users do not have to download the upgrades and patches for the software, as it has the feature of centralized updating.
- The SaaS software is mainly required in a bigger system of communicating software. It is used either as the part of the mash up or as a plug-in to the platform (as the service). Traditional software models are quite simpler than the Service oriented architecture.
- SaaS application price is totally based on the user. It is small for a less count of users, which may rise, if the user demands for the extra storage and bandwidth. SaaS revenue stream is lower as compared to the conventional application license fees at the initial stage, but it may change at the later stage.

4.2. Key Benefits

Software as a Service (SaaS) is a great way to have professional system for small and medium sized companies. Here are some key benefits than SaaS brings:

- Save money by not having to purchase servers or other software to support use, everything runs from the browser
- Focus Budgets on competitive advantage rather than infrastructure
- Monthly obligation rather than up front capital cost

- Reduced need to predict scale of demand and infrastructure investment up front as available capacity matches demand
- Multi-Tenant efficiency
- Flexibility and scalability
- Easy to use

4.3. Limiting Factors of Saas

SaaS was initially considered as a prospective security & operational risk. Along with so many advantages, it has disadvantages also. It is a desire of many businesses to keep information technology operations under the control of internet. However, professional, who work on SaaS opposes it and they say that the security & redundancy tools, which are available to them, are much better and hence, you can conclude with it that such professionals are having excellent level of service. Those businesses, which require extensive customization, only in those cases SaaS face some troubles.

However, if you will analyze all these things properly, you will see that have succeeded a lot both in terms of customization and advertisements when it is compared in reference with their programming interfaces. However, at this time of recession, you can have your own software application, by combining inexpensive hardware, low cost bandwidth and open source applications. These help in convincing economic reasons of businesses to build their own software product.

The data transfer takes place in SaaS with the help of internet. Sometimes, it becomes very expensive and you will feel that it is very difficult to maintain it. If it would have been at Ethernet speed, then it would sound much better. In such cases, you may face some problem with the back end system like firewall might not be able to permit integration with the same. When you will initiate an application, it will not be very easy to understand and handle the same. Such problems get solved by hybrid SaaS model.

SaaS is implemented at a wide range and then it needs well-defined service for describing and promoting it. Economy of the scale and ability to balance the sale and demand is required in such cases. It is then only you will need IT areas that are everywhere and article of trade like. Thus, it shows that you cannot use SaaS for pioneering of extremely specific functional systems.

The http://www.whatissaas.net/ website also says: If you are user of SaaS, then a strong confidence is an essential thing for your success. You should build strong confidence in yourself. A balanced service agreement is very helpful in enhancing your confidence because it offers opportunities to make your issues right. However, it should be done in the limit, which will be suitable for the client. The provider, who is providing you with this opportunity, should be believed with both the purpose and the capability to protect the information.

5. Case – BellaDati:

Author of the BellaDati application is the Trgiman Software Solutions which is a Czech software company founded in 2006, which specializes in development of the innovative web portal and business intelligence solutions. With its headquarters in Prague, the Trgiman Software Solutions company has 25 IT experts. Currently, the applications of this company use significant international and Czech organizations. The main areas of specialization are:

- E-government applications in education and management systems

- Software as a Service provided by telco operators
- Business Intelligence
- Identity Management
- Integration of third party systems
- Middleware Development and Integration
- Outsourcing and hosting solutions

The most important Trgiman Software Solutions customers are Prague City Hall, Telefonica O2, GE Money Bank, Sun Microsystems.

5.1. BellaDati

BellaDati is a business intelligence software product that the Trgiman company offers to small businesses and teams as a Web service. This software allows user to retrieve data from its agenda, several databases or SAP and Excel to the user friendly environment. It includes processes for sharing, distribution and analysis of data between the working groups or the whole company. The user always works with data in the required depth on the interactive dashboards. BellaDati allows management to monitor actual performance of the business in a Web browser window, share report files, analyze them and make their presentation. Above mentioned features make consequential benefits for managers as they list them at the company website (2010):

- Analyses and reports in real time
- Presentations to management available online with the option to save PowerPoint or PDF
- The results of the department no longer need the exchange of hundreds of Excel files via e-mail
- Each bar applications with all necessary features, no long-tracing reports and analysis
- It is not necessary to know the technical terms of IT or wait for the specialist to program the report
- Notification of important changes goes via e-mail

Likewise, there are features that facilitate the work to analysts:

- Analyses are shared online with all team members
- Data from tables can be clearly visualized by using various types of graphs
- Data from several sources can be analyzed in one place
- analysis can be used off-line and stored on a laptop thanks to exports and imports to Excel and CSV format
- Preview the upcoming report is displayed continuously thanks WYSIWYG
- A predefined set of performance indicators, setting up the new manager with KPI
- The system itself formats the appearance of presentations and reports.

BellaDati is a web application accessible via a web browser. A smaller team can choose the hosting at belladati.com and start using the BellaDati service immediately without worrying about hardware and installation.

- All functions available via the web
- Connection to existing user accounts
- Import data from Excel and CSV files
- Own data warehouse

BellaDati use outside of one department can take place without creating separate islands of data that would need to be connected later. In the core of BellaDati is built direct support for the structure of the company, which can be modified without programming. Web services of the system include functions for extracting, transforming, and loading of data from existing enterprise data warehouses. Because of technology that allows users to work with data directly in BellaDati, all queries run quickly and source databases are not burdened. All data are synchronized back with the data in the source database to maintain a single version of truth. The system includes, for example:

- SAP connectors for selected SAP modules
- Database Connectors to Oracle, MySQL, Postqres
- Connection to Enterprise Identity Management
- Services for integration with existing portal solutions

6. Conclusion

Capable and well-educated managers need adequate tools for their important activities. Business intelligence tools represent exactly such tools, which allow, in conjunction with organisation measures and specific project solutions, management by knowledge. Data quality in company information systems can be influenced mainly by BI components, the growing importance of which we see only in the recent past.

Primary purpose of business intelligence tools is to support managerial decision making and learning about organisation, its working processes and interaction with external environment. Secondary purpose is to secure fast access to information and capacity to warn managers about dangers in specific fields of company functions or specific field of business issues. One can say that BI application integrate information and business strategy and allow a company or an institution to survive in the turbulent environment of the present day.

The Software as a Service technology is a very good opportunity to implement BI tools, while maintaining low cost. Despite the described shortcomings the SaaS is still a great business opportunity especially for small businesses.

Realizing the importance of SaaS services can be illustrated by the fact that in a "Digital way to prosperity" (developed VŠE, ČSSI and ICT Union under the auspices of former Prime Minister of the Czech Republic Jan Fischer) is also this service among the proposed measures to promote competitiveness in the ICT sector. There is a recommended support of the SaaS services in ICT projects, particularly in public administration. The aim is to increase the functionality of public administration and extension of the development of ICT sector in the horizon of 1-3 years according to Novotný and Voříšek (2010).

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MACHINE TRANSLATION: CAN IT BE A WAY OF COMMUNICATION IN A WORKGROUP?

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Keywords

Machine translation, communication, post-editing, edit distance

Abstract

This paper focuses on the quality of machine translation and post-editing. Machine translation and post-editing proved to be useful in an enterprise environment as a fast and inexpensive way of translation.

A software tool has been made to detect the edit distance between an orginal, raw machine translated text and its post-edited version. After detecting the edit operations (insertion, deletion, substitution and move) the editions have been (and will be further) analyzed to attempt to scale these editions according to frequency and gravity, so that later these results can be used for a tool for semi- or completely automatic post-editing.

1. Introduction

Although machine translation (MT) does not strictly belong to the research field of "Computer Support of Cooperative Work", and conventionally it is not meant to be a special technology for workgroups, it could greatly help communication in a multilingual working environment.

Machine translation has nowadays become a rather fashionable topic even among "laypeople", as it has appeared in the form of "web translation" on many websites, powered by several companies. This phenomenon – namely MT's appearance on the web – suggests that there *is* a need for MT. People have a very easy access to information in several languages through the web, and obviously they would like to use the benefits of this easy access, and understand the available information. Machine translation is a fast and (so far) cheap way to achieve this.

But there is a 'slight' problem: the quality of machine translation is not perfect, moreover, it is very far from being perfect, and it has not yet reached the level of being even acceptable (Varga, 2006).

From the point of view of its quality, machine translation has to fulfil the following criteria: accuracy, understandability, acceptability, and readability. At this moment if machine translated texts meet these criteria, they will be able to be used for obtaining the necessary information from foreign language texts. If MT reaches a level where it has an acceptable quality, and it becomes reliable, it can be used for much more than only web translation. It could greatly help cooperation in multilingual working environments, lower the cost of translation, and fasten the process of communication where obstacles caused by language differences arise.

2. Communication in a Multilingual Environment

In a multilingual enterprise environment there is a need for third-party translation in the communication process if the sender and the recipient do not have a common language they know sufficiently well. Machine translation can be a fast solution, if its quality is acceptable. But as it already has been mentioned that this is not the case yet, thus ways of improvement have to be examined.

Machine translation can be especially efficient, if the documents to be translated can be easily found, accessed and are well managed, like in an enterprise wiki solution. (Pavlicek, 2008, p. 405)

3. Methods of Improvement

The ways of improving MT can be categorized according to when they happen during the translation process. Before translation the text can be pre-edited. “During” translation we can either improve the system or the user can use interactive translation. After translation the text can be corrected, i.e. post-edited.

As in the case of interactive translation the task of correction belongs to the user, further on only pre- and post-editing will be dealt with.

3.1. Pre-editing

Pre-editing is the task of “correcting” the text before translation. The resulting text is in a language called controlled language, or if the text has domain-specific features, it is in a sublanguage.

3.2. Post-editing

Post-editing (PE) is defined by Senez as "the term used for the correction of machine translation output by human linguists/editors". (Allen, 2001, p. 26) This is most commonly a manual job for a human post-editor.

But as MT has started to be more and more widespread, more and more attempts have been made towards automatic post-editing. Guzmán recommends the use of regular expressions to partly automate PE (Guzmán, 2008). Allen gives a report about a tool that still requires PE by hand, but which considerably reduces the time spent on the whole translation process. (Allen, 2001) However, these methods are still not completely automatic.

Another main line of automatic PE is the statistical method. Dugast et al. try to combine the Systran rule-based machine translation software with a statistical module that is trained with the source language text and its raw machine translation (Dugast et. al., 2009). Allen and Hogan write about an experimental system that learns from the source language text, its raw machine translation and the post-edited text (Allen and Hogan, 2000). Simard et. al. in Canada report about a system that uses statistical MT software to translate the raw MT to its post-edited version (Simard et. al., 2007).

4. Quality of Machine Translated Texts

The quality of machine translation has to be viewed and measured according to completely different criteria than human translation. Several sources list several criteria, but understandability, accuracy and acceptability are emphasized as the most important ones. (Boitet, 1998, p. Arnold et.

al., 1994, pp. 158-160) Understandability and accuracy are self-evident, but I need to point out how important acceptability is. These machine translated texts in Hungarian are quite funny-sounding, they have very unusual structure and wording. But after some practice they become much more understandable. Thus attitude towards machine translation is very important, and attitude depends on acceptability and vice versa.

4.1. Translation versus Post Editing

The quality of completely automatic machine translation is so poor so far that the question arises: why don't we just humans translate the texts? But it has been shown that post-editing requires less effort than complete translation (O'Brien, 2007), moreover, considering cost and time 2/3 of the participants in a research chose post-edited MT as the most appropriate translation in an enterprise environment (instead of raw MT and complete human translation) (Bowker and Ehgoetz, 2005)

5. Post-editing Hungarian Texts

Taking international research as an example, post-editing methods can be developed also for Hungarian machine translated texts. The situation is very much different from the case of English, as Hungarian is a highly inflective language (i.e. cases are expressed with affixes). Therefore probably completely different results will be received regarding the possibility of automatic post-editing.

6. Method of Analysis

An automatic tool is being made to detect differences of raw MT texts and their post-edited versions. The software lists insertions, deletions and moves, and also word corrections and substitutions. From this list some grammatical categories can be automatically filtered, others have to be manually analysed, so that a model can be created to correct the most commonly occurring errors of the translated text.

6.1. Comparison: Levenshtein Distance

The basis of the analysis is a modified Levenshtein distance measuring algorithm. The Levenshtein distance (Navarro, 2001, p. 17), or edit distance is the cost of changing a string (eg. a word) into another one by counting the deletion, insertion and substitution operations of single characters. The algorithm to detect these operations in sentences was modified and is described in (Kis, 2009, pp. 78-81).

The main outline of the algorithm is the following:

There is an original sentence in the original text and an edited sentence (or also called a segment). The tokens (words, punctuation marks, etc) in the original segment are compared in each position with their pair in the corresponding position in the edited segment. This way a matrix is made where partial and complete matches are marked. The rows of the matrix are labelled with the original tokens, and the columns are labelled with the edited tokens.

The operations are detected using this matrix. The algorithm searches for matches first column by column. In the first row where a match was found all the columns before the first match will be the tokens that were inserted in the edited segment.

All the rows before the row of the first match are the tokens that were deleted from the original segment.

This procedure has to be repeated from the cell one to the right and one below the match, thus all insertions and deletions are found.

Moves can also be found in the matrix: during the previous linear search all the “submatrices” have to be marked. Submatrices are the small matrices first starting from the top left corner, and ending at the cell one to the left and one above the next match. (This is marked grey on the matrix.) The next submatrix starts one right and one below this match, and so on. All the matches that are outside of this marked area are the tokens that were moved (in italic). This means that the first matching tokens in the two segments are considered fix, i.e. not moved, and the same is the case with the matching tokens in the submatrices, even if their positions are not the same in the two segments. Those tokens are considered moved whose position has changed *relatively* to these fixed.

Substitutions can be detected by examining the insertions and deletions already found: where the position of the deleted and inserted token is the same, and they have not been moved, this means these tokens were substituted for each other.

		1	2	3	4	5	6	7	8
		We	whip	hard	foam	from	the	whites	.
1	From	**I**	**I**	**I**	**I**	**1**			
2	the						**1**		
3	protein							**D**	
4	we	**1**						**D**	
5	whip		**1**					**D**	
6	hard			**1**				**D**	
7	cream							**D**	
8	.								**1**

Table 1. A matrix to illustrate the algorithm

The two sentences were taken from the example texts below. The column numbers (positions) of the cells with the letter I have to be stored, and these will be the positions where a token was inserted. The row numbers (positions) with the letter D also have to be stored, and they will be the positions from where a token was deleted.

The algorithm was worked out by Balázs Kis (Kis, 2009) and it was presented in his PhD dissertation, but it has not been implemented before, and it has not been tested.

6.2. Implementation

A software implementing this modified Levenshtein algorithm has been implemented.

The software takes two texts as input: the two texts need to be aligned (i.e. each segment in the first text has a corresponding, marked segment pair in the second one), and need to be in .tmx format.

Alignment is a process of matching the segments of two texts. It is predefined what a segment is: in this case (like most of the times) it is basically a sentence. Alignment was made with the help of translation environment software called MemoQ, which is able to create translation memories in tmx format.

The tmx format is a standardized format for translation memories, the Translation Memory eXchange format, and it is an XML document. In this format each segment and its pair is marked by the markup language (Savourel, 2004).

The input segments can be in any language, but for the present goal only segments for the same language are suitable, and the user has to give the language pair at the beginning.

The program reads out a segment pair, breaks it down into tokens, and examines the matches. It creates the matrix, detects the operations, and saves all segment pairs, the operations and the matrices in a database. SQL queries have been made to select and view the operations. The decision for the database was that later it can be queried easily from various aspects and in a flexible way.

Matches are marked in the following way: a complete match is marked by 1. Partial matches are matches where at least 3 characters and 50% of the characters are matching in the token. If the token is shorter than 3 characters then a perfect match is required. In Hungarian there are 2 kinds of definite articles (similarly to the English indefinite article a/an), they are always considered a partial match. The difference between the lengths of the two tokens cannot be more than five. In the matrix the number of matching characters is stored for partial matches. In a row where several matches are found the largest one is kept, or in the case of equality the one closest to the diagonal.

The program does not examine edit distance between tokens; this will be implemented in the future.

Queries have been made to select token-pairs next to each other, to list all deletions, insertions and substitutions. There are also queries to see the environment of inserted/deleted tokens. Results of queries can be exported to spreadsheets or other formats, where they can be manually processed.

7. Comparing Texts

7.1. The Corpus

The texts in the research are Hungarian machine translated texts translated with MorphoLogic's webtranslator (http://www.webforditas.hu), and their edited versions. The editions were made manually by volunteers. The volunteers were unfortunately inexperienced and without any linguistic background. They come from various fields of study, and all with BA/BSc/MA/MSc degrees. They were asked to do *the least* corrections on the texts that would make them understandable and readable.

The corpus at present is very small, it is only suitable for a small research, or rather experiment, but it is still growing at present.

The original texts themselves are online newspaper articles from British sites in various topics. It has to be said about these articles that their language is rather difficult, they use unusual vocabulary and complex syntactic structures, which makes the quality of the translations worse, and the editing job harder.

The original English texts are available to help the editors, and in most of the cases the editor needs to turn for help to this original.

8. Results

8.1. Example Texts

For the sake of illustration an example has been created in English (from a Hungarian-English machine translation).

The original Hungarian text:

Banános csokitorta

Előmelegítjük a sütőt 175 fokra. A csokoládét a vajjal gőz felett olvasszuk fel. Tegyük félre, hogy langyosra hűljön. A tojásokat válasszuk szét, a sárgájához adjuk hozzá 15 dkg cukrot, és keverjük habosra. A fehérjéből kemény habot verünk. Adjuk a cukros tojássárgájához az olvasztott csokoládét, és keverjük egyneművé.

Raw machine translation

[1]Banana *brownie*

[2]Warm the oven onto 175 degrees. [3]Let us melt the chocolate above steam with the butter. [4]Let us put it aside, *that onto lukewarm one* let him be getting cool. [5]Let us separate the eggs, the *sárgájához* we add *it to it* 15 dkg of sugar, and we whip it. [6]From the *protein* we whip hard *cream*. [7]We add the melted chocolate to *his* sugary yolk, and we stir it homogeneous *one*.

The edited English text

[1]Banana *chocolate cake*

[2]Warm the oven onto 175 degrees *Celsius*. [3]Let us melt the chocolate above steam with the butter. [4]Let us put it aside, let it be getting cool. [5]Let us separate the eggs, *to* the *yolks* we add 15 dkg of sugar, and we whip it. [6]We whip hard *foam* from the *whites*. [7]We add the melted chocolate to *the* sugary yolk, and we stir it *until* homogeneous.

(the parts affected by the edition are italics in both texts)

Let us see the results from the queries concerning the operations:

Moves			
Segment	**From**	**To**	**Token**
5	12	7	to
5	13	20	it
5	14	12	15
5	15	13	dkg
5	16	14	of
5	17	15	sugar
5	18	16	,
5	19	17	and
5	20	18	we
5	21	19	whip

5	22	20	it
6	4	1	we
6	5	2	whip
6	6	3	hard
Substitutions			
Segment	**Position**	**Original**	**Edited**
1	2	brownie	chocolate
4	8	onto	it
6	7	cream	whites
7	7	his	the
Deletions			
Segment	**Position**	**Token**	
4	7	that	
4	9	lukewarm	
4	10	one	
4	12	him	
5	8	sárgájához	
5	13	it	
6	3	protein	
7	16	one	
Insertions			
Segment	**Position**	**Token**	
1	3	cake	
2	7	Celsius	
5	9	yolks	
6	4	foam	
7	15	until	

Table 2. Operations on the texts

A problem arises, when a word (token) is moved and also changed to another word (substituted). In this case the algorithm does not detect the match, and the operations get lost, and most of the times become other operation. For example in this case *"protein"* is substituted for *"whites",* but the algorithm found that *"protein"* was deleted from position 3, and nothing was inserted into its place (since *"whites"* is in position 7). The algorithm finds it correctly, that *"whites"* was substituted, but the original is not *"protein"*, but *"cream",* which is on the same position (7) in the original sentence, and which was deleted.

8.2. Operations on the Hungarian Texts

The final goal of the research is not to calculate edit distance between segments, but to discover the exact correction operations, to analyze them and scale them according to frequency and gravity. Nevertheless, it is interesting to see the proportion of different operations.

	Insertions	Deletions	Ins only	Del only	Move	Substitutions
Number of op. for 100 tokens	28.57	33.04	13.66	15.63	27.78	14.16
Percentage of operations of all operations	32%	39%	15%	18%	29%	17%

Table 3. Rate of operations in Hungarian texts

The first row of the table shows how many operations were made on 100 tokens on average. Insertions and deletions also include those tokens that have been substituted with another token (rewriting). In the *Insertion only* and *Deletion only* columns the numbers mean those "clean" operations where the tokens do not have a corresponding pair, i.e. they were completely deleted or inserted (eg. *it to it* and *Celsius* in the English examples).

It can be seen that the proportion of editions is quite large, if we add moves and the average[16] of insertions/deletions almost 2/3 of the tokens are in some way modified, and almost 1/3 of the tokens are moved to a different positions. From the query results it can also be seen that move operations affect whole phrases in almost all cases.

9. Summary

Taking the size of the corpus and the stage of the research into consideration general conclusion cannot be drawn. The tool for the research has been created, and it can be very well used for collecting data. The algorithm detects and enumerates edit operations, however, moves and substitutions still have to be worked on.

So far the method of the research has been presented, and some tendencies can be observed and the basis and starting point of linguistic analysis has been created.

9.1. Future Plans for Father Research

After having finished collecting and analyzing the data about post-editing operations, according to the results new texts can be corrected. The quality (acceptability) of these texts can be measured with the previously made tool (Varga, 2007), and compared with the quality of the original texts.

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Technological Outlook: The Future of Information Technology

SOME ECO-TECHNOLOGICAL ASPECTS OF THE FUTURE OF INFORMATION TECHNOLOGY

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Keywords

Information technology, economics, business models, improvements.

Abstract

The financial crisis is shifting the centre of attention from technological and scientific brilliance of IT- and especially semiconductor industry's developments also to its economic feasibility and business strategies to cope with the approaching scaling limits of Si-technology.

First we will peruse the economic–technological scenario, its structural dynamics, emerging business models, future development of the technological platform and the strategies for continuing improvement of the cost per function subsequent to the scaling with and beyond Moore's law.

Second we will endeavour to look ahead and discuss some of the emerging technological options ranging from New Materials and Devices, Nanotechnology & Nanoscience, Molecular electronics, Spintronics, Optoelectronics, Photonics and Quantum Computing.

In spite of its speculative character will we attempt to gain an overview of the fascinating plethora of future options for Information Technology arising over the horizon.

1. The Economic-Technological Scenario

The normal way to look at the future of information technology is to present status and extrapolate future developments.

We would like to compliment this by including the economic perspective which is not only determining the financial feasibility and its strategic direction and thus the direction of investment into R&D, marketing and manufacturing.

Let us first recap how the semiconductor industry faired during the crisis of the recent months and years and review some of the major trends shaping the industry.

The semiconductor industry has not only been much less impacted by the recent economic recession than by the recession of 2001 and additionally the speed of recovery has been significantly faster than in the previous recession.

Nevertheless the recent economic development impacted the business thinking of the industry and triggered major restructuring and productivity enhancements and significant headcount reductions made by many companies.

The structural dynamics of the industry continued further but was showing some restraint in investment for hardware while the service industry continued its booming. During the recession worldwide hardware industry continued to grow by 1,6 % while the service sector even continued to grow by six percent.

The first quarter results of 2010 confirm not only these developments but exceed these developments by far (AMD, 2010a), (AMD, 2010b), (Hiramoto, 2004), (IBM, 2010a), (IBM, 2010b), (IBM, 2010c), (Intel, 2010a), (Intel, 2010b), (ITRS, 2009), (Samsung, 2010a), (Samsung, 2010b).

	1Q10 REV(Bio $)		1Q10 Net Earnings (Bio $)	
AMD	1,6	+30%	0,26 (0,33)	
IBM	22,9	+5%	2,6	+13 %
HP	31,2	+8%	2,6	+8,3%
INTEL	10,3	+44%	2,4	+400%
SAMSUNG	31,2	+21%	3,6	+600%

In parallel the restructuring of the industry progressed further, companies like IBM attribute only few percent of its revenue to hardware. The use of products has been continuously shifting to consumer electronics, wireless communications, mobility, sensors and related applications. The emphasis shifted to enhancing the present technological level.

During “CRISIS”:

- HW restraint WW: HW 332 B$ +1,6%
- SVC cont´d SVC 842 B$ +6,0%

The worldwide semiconductor market is expected to grow by 27 percent according to an estimate of the market research company Gartner.

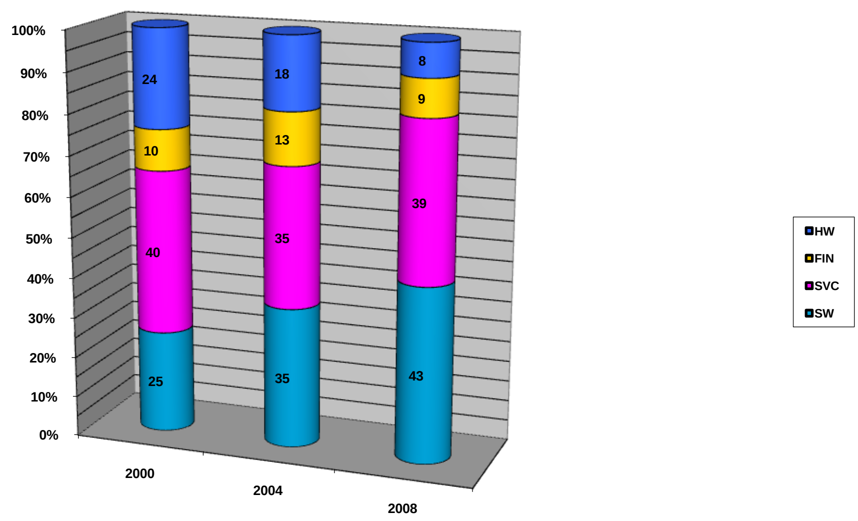

Figure 1: Structural Dynamics (example IBM) (IBM, 2010c)

Structural dynamics is also the continuous shift to software and service and enlarging the scope of business.

Another phenomenon is the continuing tendency of the big companies to acquire smaller complimentary companies that is expanding into software, service and application oriented fields rather by purchase as shown below.

- IBM bought UNICA 480M$, Coremetrics, Sterling (SW) 1,4B$, ….., SPSS 1,2 B$ in ´99, PWC 3,5 B$ ´02 … bis ´15 20 B$
- HP bought 3Com (Cisco Competitor in CN, server market) 2,7B$, PALM in 2010, EDS 18 B$ ´08, 3PAR (Storage specialist 2,4 B$) ´10
- ORACLE 4,2 B$ for 60 companies e.g. SUN 7,4 B$
- INTEL Consumer electronics from TI, McAffee 8 B$ 2010, Windriver (OS emb. proc)
- SAP Sybase 5,8B$
- DELL Perot 4 B$ 2009

IBM bought 75 smaller companies in recent years, and during the recent weeks e.g. Coremetrics, Storwise, BigFix and Cast Iron Systems.

This while investment in research and development has remained flat which means in inflation adjusted terms a reduction, but continues at a level unimaginable for many industries.

Additionally we see a continuous high level of patents registrations which also illustrate the shift to SW and Services.

The reasons for this development are shifting market opportunities, the trend to areas of higher profitability and the rising CAPEX challenge. The increasing size of capital investment needed for next generation manufacturing capacities led to the restructuring of the production: the foundry model, light-out manufacturing facilities, fabless companies, EDA´s, pre-competitive cooperation aso.

As shown below Asian companies have taken the lead, but recently IBM, SAMSUNG, Toshiba, NEC, Infineon, ST etc. established a company called Global Foundries to participate in the above development (Wikipedia, 2010).

Rank	Company	Country	Revenue (million $)		
			2008	2007	2006
1	TSMC	Taiwan	10,556	9,813	9,748
2	UMC	Taiwan	3,400	3,755	3,670
3	Chartered	Singapore	1,743	1,458	1,527
4	SMIC	China	1,354	1,550	1,465
5	Vanguard	Taiwan	511	486	398
6	Dongbu	South Korea	490	510	456
7	X-Fab	Germany	400	410	290
8	HHNEC	China	350	335	315
9	He Jian	China	345	330	290
10	SSMC	Singapore	340	350	325

Having reviewed some aspects of the economic scenario, let us turn to some of the arising technological challenges ranging from lithography, interconnections, new materials, power dissipation, to cost of manufacturing, design and verification.

We are right now witnessing the successful extention of the present technologies through improvements ranging from power reduction to performance enhancing measures, multi-core processors, further integration, optical connections, 3D Chips and new materials (High-k, HfO2, TiN, TaN), thus extending the present technological platform.

These trends affect both hard- and software as the shift of software engineers to parallel programming tasks demonstrates.

2. The Roadmap for Semiconductors

The ITRS (international technology roadmap for semiconductors) a prestigious organization assessing present and future developments forecasts an optimistic picture for that coming decade and beyond.

Key messages of the ITRS ROADMAP 2009 forecasts are for

- MPU until 2013 2 years cycle, from 2014 3 years cycle
- DRAM 6F2 design -> 4F2 design
- WAFER 2014-2016 the transition to 450 mm.

Looking at the longer term future means looking beyond silicon technology. The Post-Silicon area holds a fascinating plethora for of options. New materials are improving and extending the present technology and offer options for an evolutionary improvement of Si technology and are complimenting and substituting Si for special applications.

Considering key properties as e-mobility we see a theoretical improvement potential through III – V materials as GaAs of 600% or InSb of 5000% or energy consumption improvement of 1000% by use of InSb at 0,5V. But at present the costs of these technologies preclude their use at present except for special applications.

Due to the strategic importance and the fact that the US is importing 90% of its rare earth requirements a critical view on the global supply situation should speak for itself.

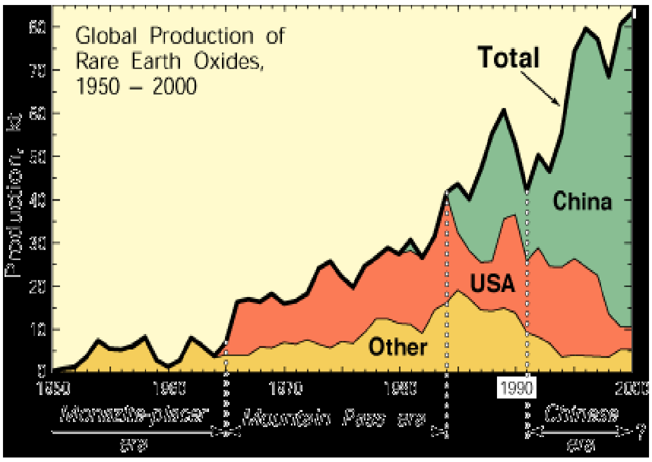

Figure 2: Oxides production, source: (Wikipedia, 2010)

3. Emerging Research Devices

But nothing should obscure the view on ultimate physical limits we are approaching as the wavelength of the electron 10nm, direct tunnelling limit in SiO2 of 3nm or the distance between Si-atoms of 0,3nm.

These are not a pie in the sky speculations but potential studies based on systematic analysis as prerequisite for R&D investments into ERD (Emerging Research Devices) as

- Atomic switches
- Spin transistors
- NEMS devices
- Pseudospintronic devices
- Molecular switches
- Spin wave devices
- Nanomagnetic Devices
- Moving wall devices ASO.

The potential is not judged by its intellectual attraction, but each single field of ERD is evaluated against a series of criteria:

Criteria for long term potential of devices:

- Performance
- Energy efficency
- On/off ratio
- Operational reliability
- Operational temperature
- Cmos technology compatibility
- Cmos architecture compatibility
- Scalability

Each criteria is assessed for its potential and rated from one to three indicating:

1. Substantially inferior to the ultimately scaled technology
2. Comparable to the ultimately scaled technology
3. Substantially exceeding the ultimately scaled technology

As an example of emerging research device studies Moving Domain Wall devices are shown selected out of more than a dozen different studies

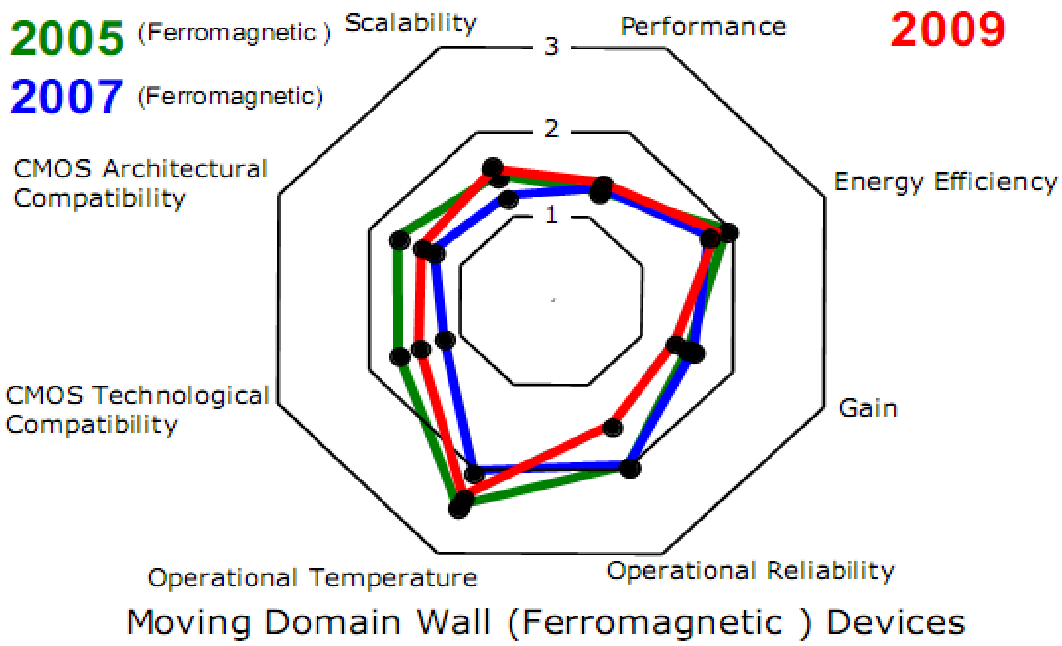

Figure 3: Devices, source: (ITRS, 2009)

4. Beyond Silicon

The table below shows some of the potential research and development areas both in near/medium and long-term as (Loesch, 2009):

- Molecular (nano) electronics
- Optoelectronics
- Spintronics

Long term:

- Quantum computing
- Organic computing
- (DNA, Proteins)

5. Molecular electronics

The outstanding properties of some the nanoelectronic devices make nanotechnology extremely attractive, a fact which we have already covered in previous IDIMT sessions.

Turning to Molecular Electronics we see a series of outstanding properties of potential molecular electronic devices as low power consumption, high storage density (105 times), potentially cheap (manufacturing by self organization) and long term stability.

Molecular Computing holds the promise of being fast in spite of low e-mobility (the electron being a part of the orbit of a molecular chain). But massively parallel operations could easily counterbalance this and enable theoretically 1023ops/s vs. today's supercomputers 1017ops/s. But

Cost of Mfg & Assembly, (defect correction), Interconnection & logic remain problems to be solved. (HP, 2010)

6. Optoelectronics

Here we are not at the beginning we are already in the middle of an exciting development.

Photonics and especially glass fibre connections have enabled the exponential development of communication, the Internet, wide area networks and locate area networks etc., but short distance connections are hampered by the fact that it takes more energy to send a signal over short distances then with current technologies and the conversion of optical to electrical signals is expensive. Nevertheless research is ongoing to empower rack-rack card to card and even on-card optical connections. The drive to convert from electrons to photons as close as possible to the source of the signal is continuing.

Photonics is another promising field.

What makes photonics attractive? It holds the potential of being smaller, cooler, faster (up to 1000 times!) and may be even cheaper in addition to be cross-talk free and without skew For the problem of storage encouraging experiments are showing up with as echo chamber storage in an Yttriumvanate orthosilicate crystal and praseodymium ions to trap photons.

The all optical computer remains far away in the future but optical components and interconnections are continuing to penetrate the computer. Optical computing and processing has still to move out of the lab.

7. Spintronics

Turning to spintronics means turning to a different kind of physics, we are not anymore looking at streams of electrons but at the physics of individual electrons.

Instead of looking at the mass and charge we are looking at the spin, the angular momentum of an electron.

What are the promises of spintronics, they are significant improvement in data storage, something we are already enjoying based on that GMR effect, non-volatile memory chips, instant-on capabilities and generally speaking higher speed at less energy.

But there is also another facet of quantum physics.

8. Quantum Physics and the Quantum Computer, the IT of the 21st century?

Quantum physics is already around since the past century and we use it since more than half a century. Its phenomena as superposition or entanglement as are still hardly comprehensible and compatible with our daily experience, but Quantum Physics is proven and has not failed a single test in these hundred years.

- 1900 Plank
- 1913 Bohr
- 1926 Schrödinger

- 1935 „Cat“ and EPR
- 1982 QC
- 1994 Shor

QC (quantum computing) represents a totally different approach, a paradigm change and it is no Turing machine anymore.

Since we have covered the principles of QC in previous IDIMTs, let us in brief discuss where QC stands today and what are the achievements needed for the timeframe of the next 5 -10 years are (Zoller, 2010):

- Cryptography available with restrictions
- Qubits today tens, needed 1000-10000
- Gates today tens, needed > 100000
- Applications (with few Qubits)
- Many-qubits specialized applications.
- Quantum interface
- Quantum repeaters.
- Quantum error correction & purification.
- Multi-particle entanglement & applications.
- Larger quantum memory
- Quantum algorithm with up to 50 qubits
- Longer distance quantum cryptography and Satellite quantum communication
- Multi-node quantum networks

There is still a long way to go to the quantum computer; it is a tremendous challenge but also there is no fundamental roadblock in sight.

We should not review far-out technologies without devote some words to organic computing

9. Organic Computing (DNA)

Even far out, the prospect of integrating the fascinating properties of DNA, make it so appealing both for computing and storage:

- Slow but fast by parallel 1014 ops/sec
- Energy effizient 109
- Enormous quantities i.e. memory capacity
- Durability
- Dense 108 x Si + 3D
- Cheap?

Organic computing represents again a totally different approach. Hardware and software are mixed in a solution, an unprecedented density of data storage – in 1 m3 of water with the addition of 0,5 kg of DNA all data in all computers worldwide could be stored. Again, as in the case of Quantum Computers, Organic Computers may be programmable but not universally.

10. Organic Computing (Proteins)

Protein-based Organic Computing would mean additional fascinating new paradigms and features as (Ramakrishnan):

- Dynamically reprogrammable

  (Nervous system, genome)
- Senses state and responds appropriately
- Network can be „rewired“
- Bistability and apoptosis
- Memory
- Oscillations
- Pattern selection (preferences, tuned responses)

It might appear as pie in the sky research projects but it is theoretically feasible and may have an impact far beyond IT.

11. Summary

Forecasts indicate an evolutionary development, a continuation of Moore's law for the next decennium and beyond with impressive cost/benefit achievements, attractive both by its scientific and even more by its economic aspect with the inherent shift to higher profitability areas as software and services.

All this should be observed in front of the CAPEX perspective, taking into consideration, that the necessary CAPEX for a plant in 2020 may reach 1 T$. Such an investment can only be afforded if supporting volumes can be reached. This explains the drive for horizontal expansion and use of all evolutionary approaches to prolong the lifetime of the prevailing Si-technologies before entering new endeavours. It will ensure that the industry will not leave silicon until the last drop of performance is squeezed out it.

"The race goes on", this excellent outlook combines with a plethora of options on the horizon, an outlook that only few fields of science and industry can match, with the caveat that extrapolations are to some extend predictable while paradigm shift and revolutionary developments remain unknowable.

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PROCEEDINGS CORRECTIONS AND UPDATES

2nd version (v2), 17. 9. 2010 – updated proceedings published via IDIMT website www.idimt.org

- p. 1: added v2 reference to header
- p. 283: corrected author affiliation (replaced “University of Maribor” with “DOBA”)
- p. 397-408: added section “Technological Outlook: The Future of Information Technology” and paper “Some Eco-Technological Aspects of The Future of Information Technology”
- p. 409: Christian W. Loesch added to list of authors
- p. 410: proceedings corrections and updates page added

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ISBN 978-3-85499-760-3
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