



Janie Chroust 2012 – the 4 locations of IDIMT

Welcome to IDIMT 2012!

A hearty welcome to the 20th IDIMT Conference!

It is a heart-warming feeling to be able to welcome you for the 20th time at an IDIMT Conference. Looking into the audience I see many familiar faces of participants loyally coming back year after year. Four of the participants of the 1st IDIMT conference in 1993 are still with us here: Petr Doucek, Antonín Rosický, Vlasta Svatá and me!

And many of this year's participants have a record of having attended ten and more IDIMT conferences! We are a big family!

To me some of the reasons are the friendly atmosphere, staying together in one hotel, having lunch and dinner together, and the provision of ample discussion time during the sessions. Many other conferences unfortunately lack these characteristics.

The overall topic of the IDIMT conferences has not changed: current and future challenges in a world dependent on Information and Communication Technology.

The focus of the discussion has changed gradually: Initially we discussed transitions of economies, technical and managerial concerns, gradually moving into considering the systemic aspects of situations and problems. Sociological and ethical contributions started to increase, as did economic aspects. E-technologies have their fixed place. Security, vulnerability, and disasters find more and more attention.

We stayed in the general area of South Bohemia with its lovely cities and beautiful landscape, full of historical sites and buildings. We are now in the fourth location for the conference (Kubova Hut, Zadov, Ceske Budejovice and Jindrichuv Hradec) and in the fifth hotel, having stayed in two hotels in Jindrichuv Hradec. Each change improved accessibility, quality and suitability of the conference location.

2012 again brought an innovation: In order to honour the 20th anniversary of IDIMT we produced a separate booklet with historical notes in addition to the regular proceedings. It contains two contributions:

- A historical retrospective of IDIMT conferences by Petr Doucek and Gerhard Chroust looking back at the sequence of IDIMT conferences, mentioning the steps of evolution and offering photos of the events.
- Christian Loesch, who presented a technological update since 2000, looks back at these remarkable contributions with the eyes of 2012 – an excellent piece to learn and perceive the evolution of computer technology over the past decade.

In this year's conference we built on the topics of last year, adapting and modifying them according to current trends:

- Impact of ICT on Economy
- Sustainable Economic Growth through Enterprise Networking
- Human Initiatives and Innovations in ICT
- Social Computing for Cooperation
- Realization of Social Responsibility
- Reliance on Cyber-Physical Systems (Systems-of-Systems)
- ICT Support for Disaster Management
- Historical Retrospective on 20 years of IDIMT¹

Based on a double-blind review we were able to accept 39 papers, the authors coming from five different countries. Additionally 7 posters were accepted. Each session was organized by a Sessions Chair. By tradition a session begins with a keynote, the other papers provide additional points of view. The papers are followed by intensive discussions. We believe that these intensive discussions are one of the attractions of the IDIMT-Conferences, due to the interdisciplinary exchange of thoughts.

The preparation and realization of IDIMT 2012 would not have been possible without the support of many organizations and persons. Therefore we would like to thank:

¹ The full papers of this session were published as a separate volume:

20 Years of IDIMT – Looking Back

Editors: Petr Doucek, Gerhard Chroust

University of Economics, Prague, Fac. of Informatics and Statistics

Scientific and Research Paper, Sept 2012

- the Czech Grant Agency for partially sponsoring the conference (GACR Grants P403/11/1899, P403/10/0092), Internal Grant Agency (IGA) Grant 14/2011 (IG409051) and OPVK Programme (Grant CZ.1.07/2.4.00/12.0039),
- the University of Economics Prague and the Johannes Kepler University Linz, which as partner universities provide the organizational infrastructure,
- the Security Research Program KIRAS of the Austrian Federal Ministry for Transport, Innovation and Technology (BMVIT),
- The ÖAD (Österreichischer Austauschdienst, Aktion Österreich - Tschechische Republik) for sponsoring the conference in its first few years and thus making the IDIMT Conferences a reality.

My further thanks go to

- Václav Oškrdal and Antonín Pavlíček 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,
- 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 for improving the papers,
- the Trauner Verlag for acting as the publisher of our conference, and
- all other unnamed persons contributing to the success of this conference.

To a successful conference!

Gerhard Chroust, July 2012

Sponsors of IDIMT 2012





Austrian agency for international mobility and cooperation in education, science and research.

We congratulate you on your ongoing sequence of conferences “IDIMT” that started 20 years ago as a small bilateral project between Czech and Austrian Higher Education Institutions. Started as a small initiative supported by subsidies of the program “Aktion Österreich-Tschechische Republik” the project is a good practice example which has turned out to be a successful model for bilateral project support. The “Aktion” was founded 20 years ago by the two ministries responsible for higher education of the neighboring countries for this exact reason: to help to initiate cooperation projects between Austria and the Czech Republic. In the same year, when you celebrate your 20th conference, the “Aktion Österreich-Tschechische Republik” will also celebrate its 20th anniversary. As the Austrian partner agency of the “Aktion” during those 20 years the OeAD-GmbH (Österreichischer Austauschdienst) Austrian Agency for International Cooperation in Education and Research wishes you all the best for your future cooperation and conferences.

Hubert Dürrstein
OeAD-GmbH, CEO

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ICT SUPPORT FOR DISASTER MANAGEMENT

ICT SUPPORT FOR DISASTER MANAGEMENT

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Keywords

Disaster, Compound Disasters, Intervention, Hazard, First Responder, ICT

Abstract

The appropriate response to disasters can be split into several phases with different objectives. Recent examples show that special attention must be given to the occurrence of multiple disasters. In this paper we discuss compound disasters, their influence on the response phases and the available support by Information and Communication Technologies (ICT).

1. Motivation and Background

When watching TV or reading newspapers one gets the impression that regional disasters (many of them man-made or at least triggered by human activities) have grown in number, in scale, and in destructive power. They usually endanger a growing number of humans and larger areas in more diversified ways. Obviously they have grown with respect to the extent and the intensity of their media coverage. Disasters endanger people, society, environment, infrastructure, and economy in complex, multi-faceted, and interrelated ways.

We observe that our high-technology generates new dangers (atomic plants), amplifies the impact of dangers (global linking of energy supplies), and in itself becomes more vulnerable to natural disasters (the volcanic eruption of Eyjafjallajökull (Iceland 2010) suddenly interrupting air traffic and thus impacting economy). Thus technology is both a victim and a culprit.

Experience tells us that no matter what precautions and safety approaches we take we will always encounter unexpected disasters causing damage.

Society in general aims at mitigating the effects of such possible or actual disasters. Animals and humans have five basic strategies to cope with threats (fig. 1): Flight/run away, Fight/intervene, Freeze, Submit/sustain/endure, Ignore/deny.

Humans individually, as a group, or as a society usually try to fight/intervene in a disaster situation. Meaningful and effective fighting a disaster always means to plan and prepare in advance, even if disasters involve a considerable amount of uncertainty with respect to time of occurrence, specific type of disaster, and strength. To be successful a detailed analysis of disasters and today's possibilities of interaction is highly useful.

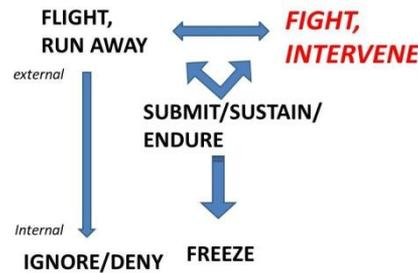


Fig. 1: Fundamental (Re-)Actions

2. Classification of Hazards

2.1. Definitions

We define (Svata, 2012; McEntire, 2007):

a hazard is a physical, technological, or intentional agent such as an earthquake, industrial explosion, or terrorist bombing. ... Hazards are present for many different reasons. Some hazards naturally occur in the environment, whereas others are the result of human activity, mistakes or malicious intent (McEntire, 2007, p.6). A hazard may trigger a disaster, an emergency, or a crisis.

an incident is an occurrence by chance or due to a combination of unforeseen circumstances, which, if not handled in an appropriate manner, can escalate into an emergency, disaster, or crisis (Svata, 2012).

an emergency is a sudden, unexpected event requiring immediate action due to its potential threat to health and safety, the environment, or property.

a disaster is a sudden unplanned event that causes great damage or serious loss to an organization. It results in an organization failing to provide critical ... functions for some predetermined minimum period of time. It is common to distinguish natural, technological and social disasters, or natural and accidental.

a crisis is a critical event that may impact an organization's profitability, reputation, or ability to operate. It need not be time dependent and usually does not deny access to facility and infrastructure.

We distinguish (following (McEntire, 2007)):

- Natural hazards (including biological hazards and environmental hazards)
- Technological hazards (including computer hazards, nuclear hazards and transportation hazards)
- Civil/Conflict hazards (including panics, terrorism and war)

There are several dimensions into which we can classify hazards.

Fig. 2 shows most of the characteristic parameters for a hazard. The originator is the overall cause for the hazard, while the cause is more specific what happens. To each of the causes in combination with the originator one can assign a probability and a risk factor. Another question is how to recognize an insidious disaster caused by a hazard. What are the signals to be observed? This is

strongly linked with the time evolution of disasters, see (Mrotzek and Ossimitz, 2008; Mrotzek, 2009). For planning it is necessary to analyze the different forms and effects a hazard can have: Who is harmed or in danger (number of people, age, able or helpless, local or foreign, etc.)? What is damaged or in danger (amount, type, ...)? How is the environment damaged/in danger? (amount, type, extent). While in the Preparation Phase all data we posses are only planning data, once a hazard has set in, the actual figures will (at least gradually) turn out. The Preparation Phase has to consider (to a certain extent) *all* possibilities. This implies that once a disaster has started/happened, many of the envisioned scenarios are not needed any more.

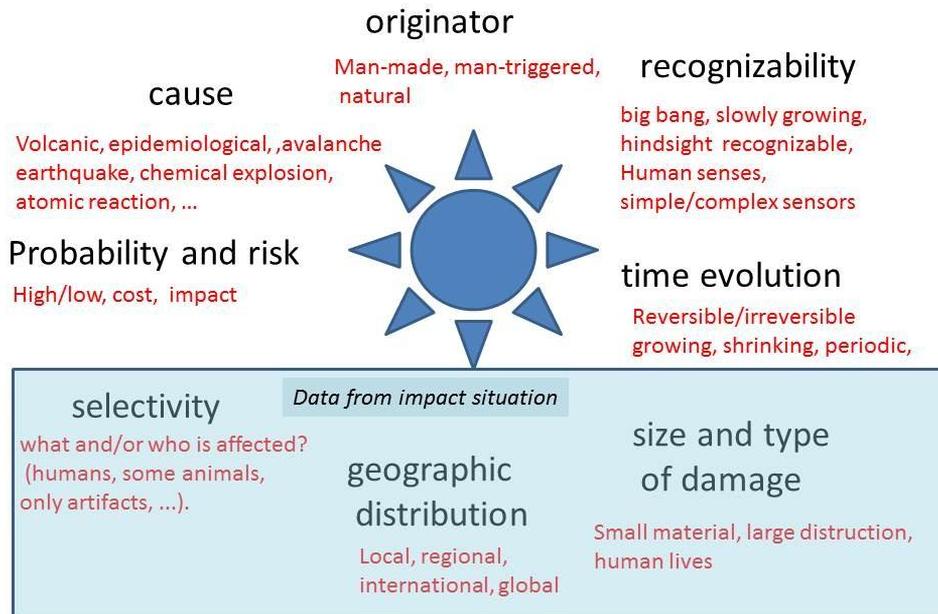


Fig. 2: Classification of individual hazards

2.2. Phases of a Disaster

For every hazard in its own right we can distinguish five phases (Fig. 3) in reacting to a hazard. We have to note that the length of the phases depends on many circumstance, also an overlap between the phases is to be expected. The only certainty is, that when the disaster strikes, it is too late to start preparing.

Despite the fact that disasters are essentially unpredictable, diligent preparations can help to mitigate the consequences (McEntire, 2007).

The key part of a reaction is - and always will be - in the hands (and at the risk) of First Responders (section 3). Modern Information and Communication Technologies provide a multitude of support tools, best practices, gadgets, and support systems which make work for First Responders (section 3) easier, more effective, more predictable, and less dangerous. Technology can be of support in all phases of a disaster situation (see fig. 6).

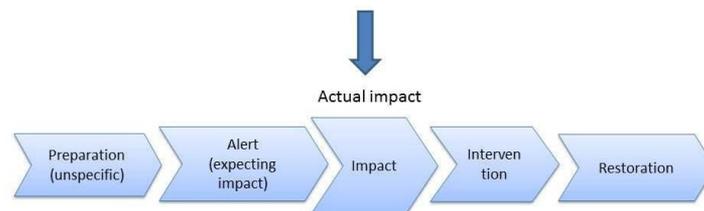


Fig. 3: Phases of a Disaster

Preparation Phase : The Preparation Phase takes place before any actual incident is incipient and considers potential hazards. The necessary data are collected, procedures and strategies are identified, recorded and trained. Necessary materials both for the actual incident and the time thereafter are stored, etc. Organizational questions have to be sorted out (Reissberg, 2010).

Alert Phase : In the Alert Phase one expects specific hazards (perhaps more than one) and starts specific preparatory actions. Still there is no guarantee that the disaster really will happen.

Impact Phase : The Impact Phase can last for a very short time (e.g. an earth quake) to a lengthy period of time (e.g. a long lasting volcanic eruption). It triggers the actual Intervention phase.

Intervention Phase : The impact starts the remedial actions via the intervention. They are performed in order to bring the system into a temporarily acceptable state (Fig. 4). The phase is responsible for quick first responses (e.g. 'First Responders') in order to containing and/or mitigating the damage and give first aid of all victims. It is successful if it manages to bring the damaged system into a temporarily acceptable state, see fig. 4. Time is a critical factor during interventions.

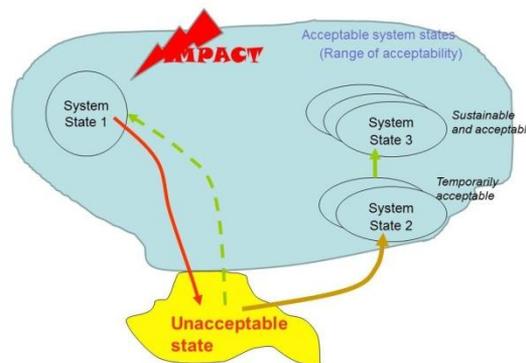


Fig. 4: Acceptable / unacceptable system states and transitions

Restoration Phase:

After a 'settle-down' time the Restoration Phase can start. The Restoration System takes a longer-term view and attempts to restore the damaged system to a state which is more or less acceptable in place of the original system, usually not the same one as before the impact (Fig. 4).

The Restoration System will also try to implement on all necessary levels improvements which will avoid or at least mitigate future damages by the hazard ("feedback and learning to prevent", see fig. 6). Typical examples are legislation on new building codes (safety standards), behavioral rules, improved provisions for information provision, prescription of different materials for objects, improved training of First Responders, etc.

The interplay between Impact, Intervention, and Restoration is shown in fig. 5 where a dependable system is made undependable by an impact. Via Interventions and Restoration finally a another

dependable state is reached. From a systems point of view we split the recovery into an *Intervention System* and a *Restoration System* because the widely different expectations on these two systems (Chroust et al., 2010, 2011).

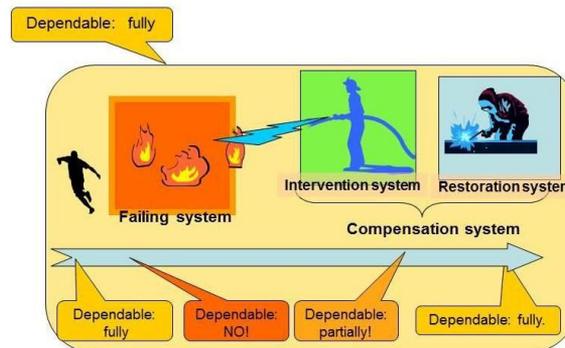


Fig. 5: Intervention and Restoration System

Fig. 6 shows the feedback loops from the Restoration Phase to the Preparation Phase.

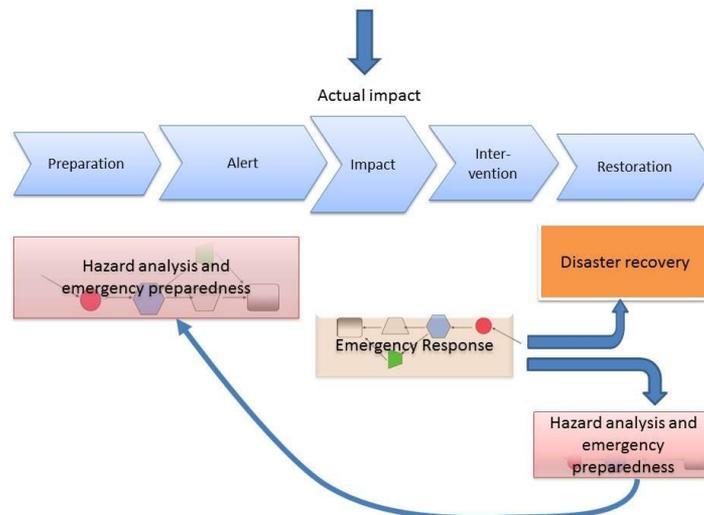


Fig. 6: Disaster Phases and corresponding response processes

Compound Disasters

There exists a proverb "A disaster usually does not come alone".

One often observes that a disaster is connected to several other disasters or even causes them. One of the most recent examples is Fukushima (2011) with the following sequence of hazards:

earthquake in the ocean → Tsunami → damage to atomic plant → radioactive contamination of a large area.

For planning reasons we have to consider the interdependence of the hazards. We distinguish (McEntire, 2007, p.359):

a primary hazard is a natural hazard agent that interacts with vulnerabilities and therefore produces a disaster.

an associated hazard is a natural hazard agent that typically occurs at the same time as the primary hazard (typically hurricanes produce flooding). Since the occurrence of an associated hazard is very likely or even sure, intervention planning must include these in all considerations.

a secondary hazards is a hazard (natural, technological, otherwise) that occurs as a result of the primary hazard (typically in Fukushima an atomic plant was damaged by a tsunami). There can be actually a chain of secondary hazards like dominoes (the damage to the atomic plant causes an electric energy breakdown, causing the death of people in hospitals).

complex or compound disaster involving several individual disasters (e.g. Fukushima)

cascading disaster a series of disasters each one caused by the preceding one.

synergistic disaster where one impact magnifies others (a loss of water supply disables fire brigades to extinguish fires)

natural-tech disaster occurs when a natural hazard interacts with technology to produce or magnify adverse effects.

The combination of different hazards cannot be fully predicted in all its combination. Simulation scenarios, what-if-exercises and learning from previous disasters are the only way to improve the situation. For each of these hazards actually the same set of phases occurs, while the Preparation Phases run in parallel. In the Alert-Phase decisions have to be made which secondary disasters could occur (if any).

In the case of compound disasters, especially with respect to secondary disasters, the phases of the reaction process are performed in parallel to the phases of the primary disaster process (fig. 7). Preparation is usually common to all considered disasters.

2.3. Associated and Secondary Disasters

It is known that certain hazards often/always are accompanied by other hazards, the so-called associated hazards (see section 2.3), for example flooding as a consequence of torrential rains. Additionally a disaster might (but not necessarily do) trigger another disaster. Typically an earthquake might destroy electrical supply lines, disabling power supply for the needed intervention machinery. We conclude

- Planning must provide adequate resources for the associated hazard(s). It can be more than one!
- Planning must identify potential secondary hazards and start a separate phase-plan for them, see fig. 7.
- One must also make sure that resources and materials stay useable under the combined influence of all disasters occurring together.

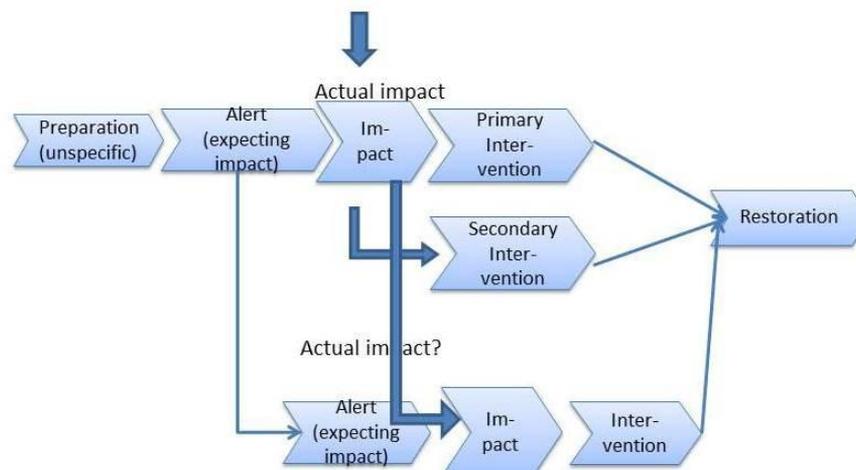


Fig. 7: Phasing for Secondary Disasters

3. First Responders and ICT support

3.1. Resources

Humans (First Responders) are the key to interventions in the case of disaster. Only human bring with them the necessary flexibility and judgement to react to the different forms of disaster which may occur ("Facing the Unexpected", (Tierney et al., 2001)). Following Ross Ashby we can call this the "requisite variety"(Ashby, 1956). Fig. 8 shows the resources usually available for an intervention.

We should not forget, however, that humans also appear in most disasters in the role of victims. Rescuing the life and well-being is one of the top priorities of an Intervention. One of the key requirements (and also success factors) is adequate information and the provision of satisfactory communication.

Interventions need a full range of equipment, starting with protective gear of the First Responders. First Responders cannot rely to have the necessary tools and materials in the location of the disaster. During the Preparation Phase the provision of all these materials must be planned. to be made available during the Intervention Phase. In the Alert Phase the probably needed materials must be identified and prepared for transfer. They might even be already brought to the suspected disaster location. This requires appropriate transport facilities, and - at no surprise - an elaborate and reliable ICT support for identification, selection and distribution.

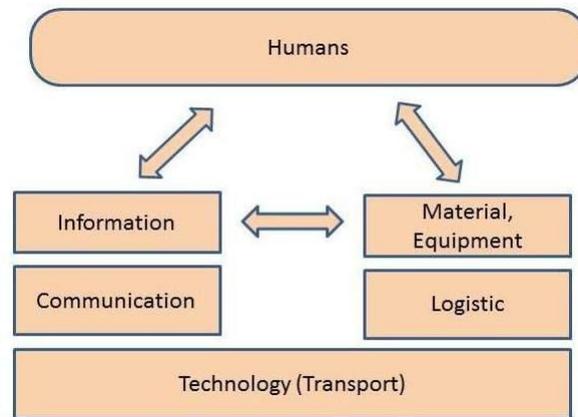


Fig. 8: ICT Resources

3.2. ICT Support

The use of ICT provides several advantages for First Responders by increasing or supplying abilities of humans. ICT is able to augment human senses by additional 'sensors' to detect situations which cannot be detected by the normal human repertoire of senses (e.g. radio-activity).

Modern technology provide numerous means and tools to support and improve the possible reactions to disasters. An essential resource is information. Information should be accumulated in the Preparation Phase when there is time and no pressure to collect it. In the Alert Phase those information items should be put into a prominent position which are related to the expected disaster. Furthermore in the case of a disaster it is necessary to transfer information 'at the right time in the right form to the right person'. This needs planning and training. Essential to a useful information interchange are appropriate, reliable communication means. It is necessary to consider the reliability and availability of information channels even under the damages of a disaster: If there is an electricity break-down television messages would be useless (Skrbek and Kviz, 2010; Skrbek, 2012).

- Questions: For each of the tasks of any phase, what can be done to improve/support/ease it. Examples are: What is the best/safest way to find a radioactive source. How can we locate persons trapped in a building? What information should a Firefighter have before starting to quench a fire in an unknown box? Which areas would an overflowing river inundate to what depth and at what speed?
- Challenge: How could we derive/create the information from the available data? What can be known?
- Technology: Technology will supply both the operational methods e.g. computer programs, checklists, see (Svata, 2012), to acquire the raw data and the means to distill them into meaningful and usable information.

3.3. Phase-oriented ICT Support

For the different phases as shown in fig. 3 different tools apply. The acquisition of data (in the Preparation Phase, the Alert Phase, and the Impact Phase) and the transmission to the First Responders is dependent on communication. Technology is the essential key to good communication. In the case of disaster one has to be prepared for non-availability of some

communication tools. One has to take appropriate evasion procedures. These, too, have to be designed, tested and trained during the Preparation Phase.

Some of the essential ICT tools are discussed below.

3.3.1. Preparation Phase

information, communication : collecting and making accessible historical data, planning of communication networks including backup, identification and evaluation of hazards, risk evaluation, establishing communication rules and organizational procedures (Racek and Ministr, 2012), training of First Responders, simulation of scenarios, identification of material and logistic need.

material equipment, logistic : Acquisition and Storage and preparing of equipment and goods, training of accessibility and distribution training of accessibility and distribution

3.3.2. Alert Phase

information, communication : planning, simulation, communication, warning of persons (Skrbek, 2012), alarming first responders, checking alarm systems (Kubat and Zizka, 2012).

material equipment, logistic : Acquisition and Storage of equipment, checking for accessibility, quality check for time deterioration, date of expiration etc.

3.3.3. Impact Phase

information, communication : prioritization depending on expected disaster, checking work condition of materials, verifying access procedures, preparation of memos to the public, communication, information collection, aggregation and distribution, alarming, visualization, finding victims, logistics of support, damage analysis (Kreiner and Neubauer, 2012), social media.

material equipment, logistic : Transfer necessary material via available routes, considering damaged infrastructure, establish communication, trigger intervention actions.

3.3.4. Intervention Phase

information, communication : information aggregation and assessment, what-if scenarios, information distribution, simulation, visualization, psychological tests, finding victims, logistics of support, communication system, social media.

material equipment, logistic : distribute and use the provided and available materials

3.3.5. Restoration Phase

information, communication : information collection, archival retrieval, what-if scenarios, long-term restoration and improvement planning, considering tradeoffs, simulation of end results, planning for prevention for the next Preparation Phase.

material equipment, logistic : use the materials best fitted for the restoration, utilizing the experience from previous disasters.

3.4. Cross-Phase Issues

3.4.1. Psychological problems

It was already mentioned that humans play a decisive role as First Responders in Interventions. Preserving/restoring their physical safety and health is one of the highest goals. But besides physical restoration it is also necessary to consider their psychological mind frame (Bundesamt f. Bevölkerungsschutz und Katastrophenhilfe, 2011; IASC, 2007). Key problems are psychological problems, fear, stress (Duckworth, 1986), etc. The so-called posttraumatic stress disorder (PTSD) (Norris et al., 2002; van Griensven et al., 2006) affects both victims and First Responders, even years after the actual incident. Little ICT support can be given there, except data collection and tracing of affected people.

3.4.2. Media

The various media play an increasing part in reporting and interpreting media. thanks to ICT one can get the most up-to-date pictures etc. from practically every corner of the world. A media policy must be defined in the Preparation Phase (McEntire, 2007). It is necessary to prepare press-releases and statements, control reports, supply valid information to the media, etc. This information power is a multi-facetted phenomenon, being helpful in reporting back, being embarrassing by delving into human grief and helplessness, by rousing empathy (and donations!) for victims etc.

4. Summary

Disasters will always occur, but with adequate preparation, especially with the help of Information and Communication Technologies the effects of disasters can be reduced, especially by adequate provision of information and pro-active planning.

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SOCIAL MEDIA FOR CRISIS MANAGEMENT: PROBLEMS AND CHALLENGES FROM AN IT- PERSPECTIVE

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Keywords

Social Media, Crisis Management, Crisis Informatics

Abstract

Social media platforms in crisis management such as Twitter and Facebook have gained a lot of interest over the course of the past five years. Emergency agencies have used them for both, as valuable source of information and as platform to rapidly deliver information to persons affected by a natural disaster. However, crisis managers and crisis communicators are not only faced with the problem of adapting existing processes and integrating these platforms into their daily work. The immense amount of data created during disasters requires appropriate tools to support crisis management. In this paper we discuss Twitter, a popular micro-blogging platform and discuss technological challenges and problems when retrieving information during a crisis event. We illustrate these challenges using examples from three datasets: 1) Queensland Flood disaster February 2011, 64,742 messages 2) New Zealand Earthquake Disaster, February 2011, 75,849 messages and 3) Greek street riots in February 2012, 2,112 messages

1. Internet sources during disasters

Even before the rise of platforms such as Twitter and Facebook, internet platforms such as blogs have been used in natural disasters by people providing and seeking information. In 2005 hurricane Katrina, a Category 5 storm, hit New Orleans, leaving the city devastated. Macias (2009) has shown, that blogs – a form of personal journals on the internet – have been used in the aftermath by people mainly to seek people gone missing. Similar findings have been found by Qu (2009) who investigated information use after the earthquake in the Sichuan province, China in 2008. Online discussion boards were used to mainly provide and share information regarding the community and forming a knowledge base for the community.

It has been shown that people being directly affected by a natural disaster, have an increased need for information, which is commonly referred to as *information starvation* in literature. Traditionally, unidirectional means of information flow have been used by emergency agencies to provide the public with updated information during the crisis, meaning crisis managers and crisis communicators collecting information and passing this information on to mass media such as radio, TV or official websites. Such a process was used by officials during the Southern Californian wildfires in 2007, when huge bush fires threatened metropolitan as well as rural areas in California. A study, conducted by Sutton (2008) has shown that information provided by mass media was

perceived as *biased towards metropolitan areas* (and less representative for rural areas), sometimes not timely and sometimes even as not accurate. During the wildfires local community websites and blogs emerged as information hubs during the disaster. These blogs were operated by lay people, therefore it can be concluded, that the Internet in general is taking a more and more vivid role in modern crisis management.

2. The role of Twitter during disasters

Twitter (<http://www.twitter.com>) is a micro-blogging platform, providing registered users with the possibility (promoted by the tagline “What are doing?”) to share 140 characters messages (so-called tweets) with the public. Users can organize themselves in social networks by following each other. Tweets can be forwarded to other people, by a process called “re-tweeting”, thus leading to information reaching a broader audience. Furthermore, content can be organized by tagging it using so-called hash tags, simple words preceded by a hash. (e.g. “#floods”)

Originally Twitter was intended as a SMS service for individuals to share content with a group (Their followers). However, the role of Twitter changed, when an airplane crashed into Hudson River in New York and a Twitter user named Jim Hanrahan (2009) first broke the news by posting “I just watched a plane crash into Hudson rive in manhattan” (sic) on Twitter. Twitter reported on this incident 15 minutes before mass media did as Beaumont (2009) pointed out. In the aftermath of this incident Twitter changed its primary objective by changing their tagline from “What are you doing?” to “What’s happening?” as Dybwad (2009) explained.

Ever since, Twitter is gaining more and more importance during mass emergencies. There is a tendency showing, that the usage of Twitter is getting integrated as standard operating procedures into daily work of emergency agency personnel, as shown by the guidelines of the Queensland government in Australia.

3. Problems and Challenges from an technological perspective

Twitter (<http://www.twitter.com>) has 140 million active users generating 340 million tweets daily as Whittaker Z. (2012) points out. It has been shown, that during a mass emergency millions of tweets are generated, potentially having valuable information for crisis managers and crisis communicators. As a result, it is getting harder and harder to manually monitor the constant flow of information. A report from Bruns (2011) showed that during the floods in Queensland, Australia, which affected an area as big as France and Germany approximately 1,100 tweets per hour have been generated directly related to the floods. Text and data mining technologies can help to automatically process this data. As a rule of thumb, when calling an emergency line, people are pushed to report an incident, following the paradigm, *who, where, what and when*. We therefore identify the key challenges for Twitter from a technological perspective along these lines, mapping these terms to following challenges:

<i>Term</i>	<i>Challenge</i>
Who	Authorship, Identity, Credibility and Reliability of Authors
Where	Situational awareness
What	Identifying important content, while suppressing background noise and commentary
When	Timeliness of information

Table 1: Challenges from an IT perspective

3.1. Who is tweeting? On Identity, Credibility and Reliability

Twitter users can share a public profile with their followers. Profile information includes a 512 characters long description, an image, an optional link to a website and an optional location. Technically, it is easy to fake identity, since Twitter does not require a proof of identity for new users. However, Twitter provides identity certificates² for high-traffic users, e.g. for CNN or well-known persons such as Barack Obama.

3.1.1. Evaluating user profiles

Currently, Twitter stores around 20 attributes describing a user profile. These attributes can be used to categorize users. An evaluation of 9,159 user profiles collected from the New Zealand dataset revealed – using the categories *lay person*, *media* or *official source* – that 91% of all tweets were written by lay persons, followed by media (7%) and official sources. (2%) The evaluation has been made by evaluating the website that is given in the user's profile.

3.1.2. A metric for judging credibility of a twitter account

It can be argued that the classification described above still leaves room for faking identities. In order to judge credibility and reliability further indicators are required. There are two parameters that can measure *popularity* of a given user, namely the number of followers given in the profile and number of so-called re-tweets that are users have made. Klout (2012) is a web service, calculating a so-called influencer score ranging from 0 to 100. This – in conjunction with the classification described above – can be used to measure credibility and reliability of a user account. However, it should be noted, that this can be problematic, since recent history shows that many emergency agencies set up Twitter accounts in the wake of a crisis, meaning that their initial influence (measured by an algorithm) might be low.

3.2. Where is it happening? Increasing situational awareness

Emergency personnel are interested in information, directly related to the location of the crisis. Twitter provides users with the possibility to share geo-enabled Tweets, meaning that each Tweet gets enriched with GPS-coordinates.³ Furthermore, Vieweg (2010) manually investigated references to location in a sample set of tweets during the Oklahoma grass fires between March and April 2009. Based on these finding, Natural language processing techniques can be used to automatically extract location information from the messages itself.

3.2.1. An evaluation of geo-location information on Twitter

Technically, Twitter provides geo-location information for each Tweet. We analyzed 9,159 user profiles taken from 52,602 tweets collected during the New Zealand Earthquake disaster in February 2011. On February 22th, a magnitude 6.3 earthquake hit the city of Christchurch leaving 185 people dead. Out of 52,602 tweets only 62 contained GPS information, showing that geo-enabled profiles are of little use to increase situational awareness for crisis managers. Out of 9,159 user profiles 8,443 (89.6%) contained a textual reference to a location. Figure 1 shows the distribution of references to locations in the New Zealand dataset:

² <http://support.twitter.com/articles/119135-faqs-about-verified-accounts>

³ Users need to activate this feature.

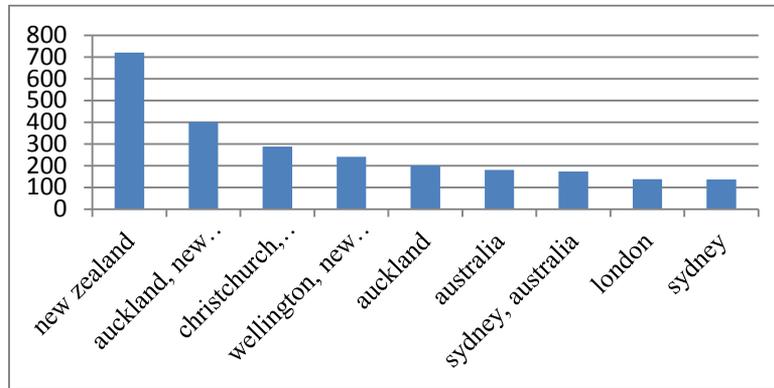


Figure 1: Number of the most frequent references to locations found in user profiles (New Zealand dataset)

It can be seen, that references to locations clearly vary in terms of accuracy with some profiles only including references to countries while others being more specific containing references to cities too.

These results clearly show that a mix of methods, namely investigation of messages itself to find references to locations, evaluation of geo-location information and evaluation of textual references in user profiles are required to increase situational awareness.

3.3. What is happening? Retrieving relevant content

There are three major challenges to retrieving relevant content during a mass emergency content on Twitter. First, data can be automatically extracted through usage of an Application Programming Interface (API). However, access to Twitter’s databases is heavily restricted through this API. Second, people using Twitter are using a specific type of language, which is expressed by heavy use of slang and abbreviations as well as non-standard grammar which makes automatic processing hard. Third, during a crisis situation, hash tags are heavily used to indicate content that is related to the crisis itself. For example, during the Queensland Floods “#qldfloods” was primarily used to indicate flood related-issues. Efforts have been made to standardise the way hashtags are used as Starbird (2010) showed, however adoption rates seem to be low. Furthermore it still remains a challenge, to find appropriate means to prioritize and filter information according to the needs of crisis managers. Current social media mining tools are generally not designed with these needs in mind. It is even more challenging since in many cases content may be multi-lingual as stated in a report by the United Nations Foundation (2011)

3.3.1. A word on language

Due to restriction of message length (140 characters) and the informal nature of the platform itself, language on Twitter is a unique mix of abbreviations and slang which makes it hard for parsers to perform in-depth analysis of content.

Part-of-Speech Taggers (grammatical tagging) are popular tools, which perform word assignment to a specific part of speech. The following example illustrates this process:

Source sentence	Part-Of-Speech Tags
The tree is tall.	The (Article) tree (Noun) is (Verb) tall (Adjective).

Table 2: Part-Of-Speech Tagging

Using part-of-speech (POS) tagging can be used to extract meaning of words in a sentence when using a synonym database like Wordnet (<http://wordnet.org>) for English language or Germanet (<http://www.sfs.uni-tuebingen.de/lsd/>) for German Language. However, popular POS taggers like the Stanford POS tagger as described by Toutanova (2003) have difficulties tagging data on Twitter, since following of grammatical rules largely vary on this platform as following examples (taken from a sample set recorded during the Queensland flood disaster 2011) illustrates:

*“we hve an office desk 4 flood affected family if needed.pls contct me if u no
Any1 who needs.brwn blkc ikea-very minimal style.”*

There are several ways, to address this problem. First, there are a few Twitter POS as described by Gimpel (2011) that were specifically designed to parse Twitter data. Second, message normalization (meaning correcting grammar where necessary) can be performed as Han (2011) describes.

However, Part-Of-Speech tagger and language normalization heavily depend on the language itself, so finding multi-language approaches still remains a challenge.

3.3.2. Using hash tags to pre-filter information

A major challenge consists of finding information that is useful for crisis managers and crisis communicators. As said earlier, in a crisis situation, hash tags are used to pre-filter messages. Twitter API provides access to so-called trending topics (marked by hash tags). Combining trending topics and location-based filtering as mentioned above, can be used to collect a dataset with potentially useful information. However, finding the right hash tags might be hard. The investigation of the Greek dataset revealed, that during the uprising 43 different hash tags had been used. (Some of them not being related to the crisis at all)

Figure 2 shows the most popular hash tags used during the uprising in Athens. The left picture shows the total number of references, while the right picture shows the number of references at given points in time. It can be clearly seen, how hash-tags peak at certain points in time while almost vanishing later on.

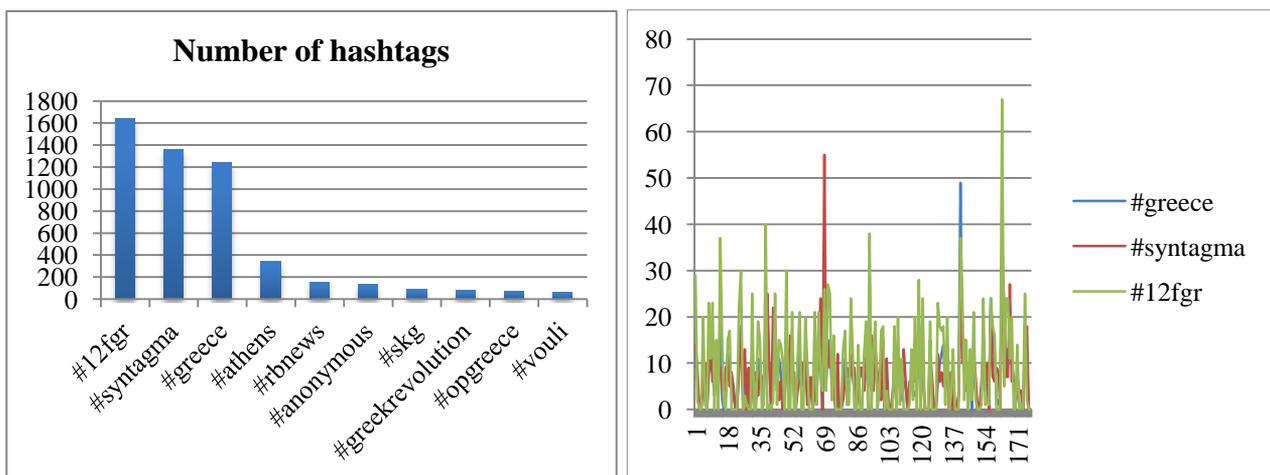


Figure 2: Left: most popular hash tags, right: Development of three hash tags over time (Greek dataset) the x-axis shows minutes since begin of recording

This clearly indicates that intelligent algorithms are needed to identify emerging topics that are directly related to the crisis. As figure 2 suggest, while some hash tags can be clearly associated

with the crisis, others may not be obvious, such as *#syntagma* (the name of the square in front of the Greek parliament) or *#12fgr*.

3.3.3. Using keyword-based filtering vs. advanced language models

Having pre-filtered the datasets using hash tags, keyword-based searches can be used to identify and prioritize relevant content. First of all, we need to define what *relevant* means to different stakeholders in a crisis. Stakeholders in a crisis may include *lay people, crisis communicators (public relations) and crisis managers as well as media*. In this chapter we focus on the need for filtering relevant information from the viewpoint of a crisis manager.

Using keyword-based methods

Keyword-based methods are the easiest way to filter information. However, using the right keywords can be hard, since the choice heavily depends on the nature of the crisis itself. While keywords like *help, shelter* or *need* come naturally, most existing keyword-based methods would not recognize tweets as given in following example:

Anyl with boat in Chelmer nr rosebery tce? dad has been stuck for over 4hrs & we can't get in touch #bnefloods #qldfloods

Using advanced language models

Statistical machine learning and natural language processing techniques can be used to overcome these issues. Caragea (2011) has shown that using language models and Support Vector Machines (and a Bag-Of-Word approach) can easily outperform keyword-based approaches. However these methods are supervised, meaning that a proper classification scheme needs to be set up in advance. Finding a classification scheme which is suitable for different types of a crisis is still a major challenge. Caragea (2011) has used a classification scheme based on a dataset obtained during the Haiti Earthquake. It can be argued, that this classification scheme might not be suitable for different crisis, e.g. the uprising in Athens or even the floods in Queensland.

3.4. When is it happening?

Assessing time of information found on Twitter can be challenging. First, the timestamp of tweets need not necessarily be associated with the incident itself. Second information on time may be embedded into the messages itself or may not even be stored within Twitter itself. (E.g. a tweet might contain a link to a photo hosted outside of the Twitter platform)

4. Discussion and Conclusion

Social Media platforms are heavily used in the event of mass emergencies in some countries. The sheer amount of data requires advanced text and data mining techniques. Technological challenges stem from the fact, that access to data is restricted and current tools are not primarily designed to support crisis managers. Existing tools for social media analytics in the event of a crisis need to take into account the limitations and challenges presented in this paper. New models for content classification are required, existing methods to raise situational awareness need to be incorporated in these tools as following figure illustrates:



Figure 3: Tools enhancement

The challenge for vendors is to provide tools, capable of filtering relevant information, suppressing background noise (e.g. commentary) and delivering prioritized information based on reliability of authors, credibility of content, enriched by information that fosters situational awareness.

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DISTRIBUTING EMERGENCY TRAFFIC INFORMATION

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Abstract

Traffic accidents have unfortunately become part of our everyday lives, bringing considerable material losses and is therefore understandable effort to minimize them. Distribution of information in such situations is now heavily influenced by human factors and leads to considerable delays and inaccuracies. The paper maps service warning systems against traffic accidents in the Czech Republic. It describes the eCall and Radio-HELP systems and outlines solution using these two systems in the event of an accident.

1. Introduction

Traffic accidents and problems accompany us through our everyday life. Timely distribution of relevant information is a key to reducing economic and human losses in such situations.

This paper aims to assess the current situation and to identify weaknesses and influence of planned or proposed solutions. Although there are expected financial savings associated with the implementation of the proposed solution, this paper does not cover this dimension. The financial aspects will be a subject of further research. As a case study model a recent event was used.

On 15th February 2012 around 10 a.m. there were 84 cars involved in a series of mass accidents on the expressway R35 between 290th and 298th kilometre in the direction from Olomouc to Ostrava. The road was jammed even ten hours after the accident. Fortunately nobody was seriously injured. By the afternoon the traffic jams of up to ten kilometres started building up in both directions of R35. (ČTK, 2012)

Two other severe traffic accidents happened at the same day. Let us consider these situations as our case study model and compare their real progress with the one that would have happened if eCall and Radio-Help systems were implemented.

Today the information about a traffic accident is reported verbally to the emergency operations centres via mobile phones, either by those involved in accidents or their witnesses. However, this is associated with problems when attempting to explain the given situation and determining adequate intervention (the exact position and direction of the vehicle, the scope of damage, elimination of repeated reports of the same accident, etc.). Speed of intervention is a key factor for its success, whereby any possible delays influence negatively the outcome of the entire rescue operation.

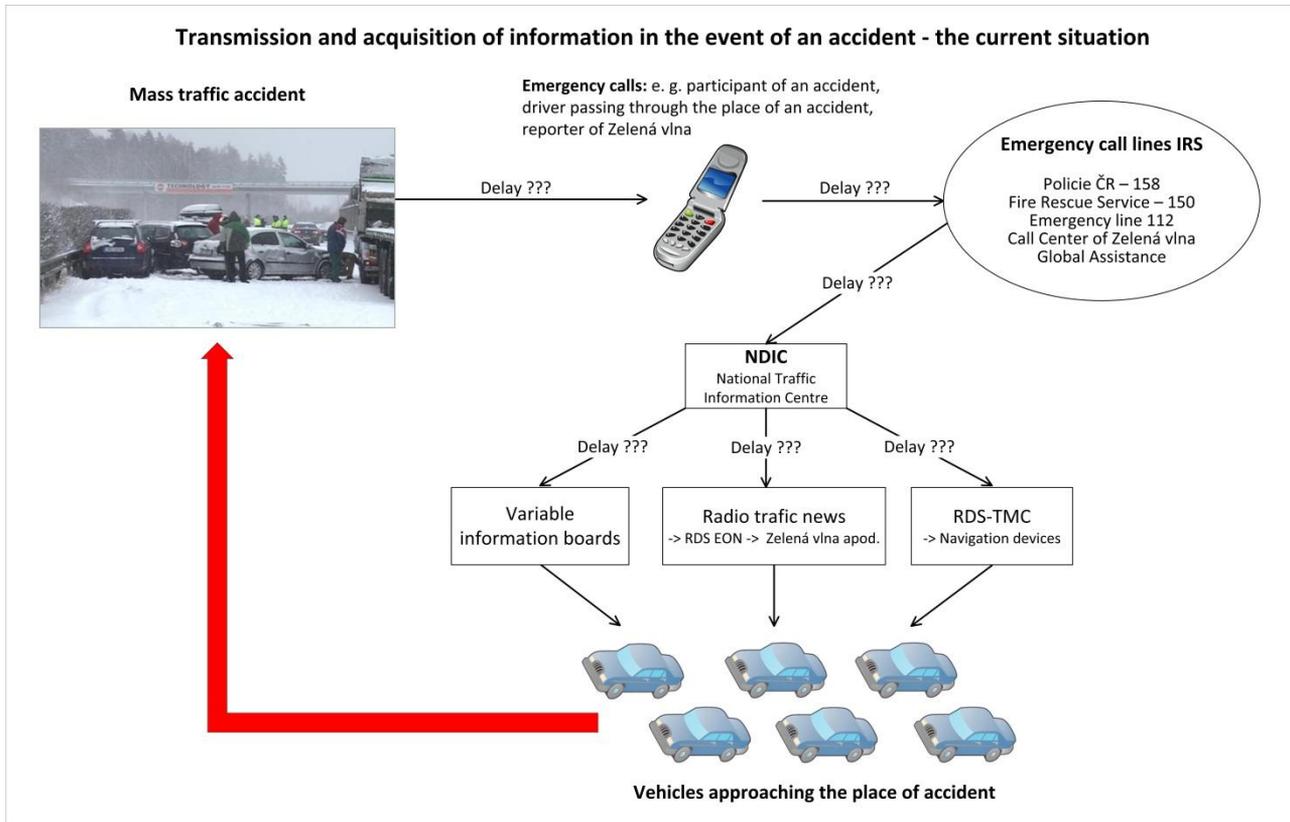


Figure 1: Transmission and acquisition of information in the event of an accident (Authors)

According to a Swedish study which examined the chances of survival in severe traffic accidents, it was found that only 48% of people, who die in connection with a car accident, suffer fatal injuries. From the second group of those severely injured, some 5% die due to late first aid or the difficulty to locate the place of accident. Some 12% of the injured could have survived if they were faster transported to the hospitals. Another 32% could have been saved if they were quickly transported to specialized trauma centres. (SafetyNet, 2009)

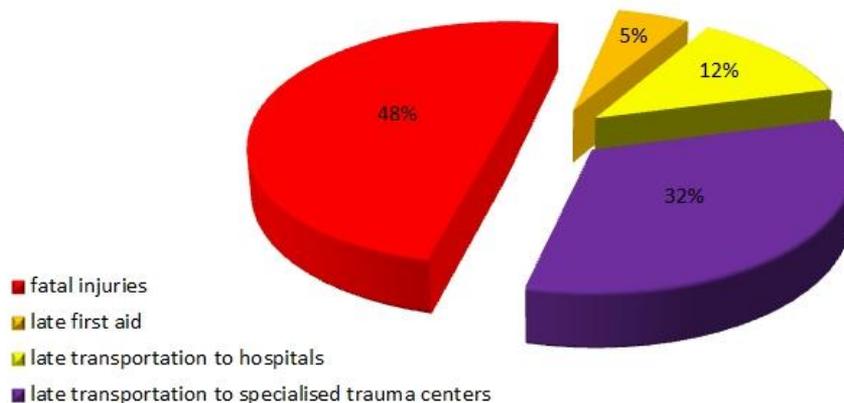


Figure 2: Transmission and acquisition of information in the event of an accident with the use of eCall and Radio Help (Authors)

Currently, there are several projects in various stages of development aiming to solve the current traffic problems in order to reduce damage to property and to protect health and lives of road users.

2. Description of Selected Telematics Systems

2.1. Variable information boards

Information displayed on the boards is received from the unified traffic information system, a joint project of the Ministry of Transport, Directorate of Roads and Highways and several other bodies and organisations.

Currently, there are about one hundred of these variable information boards installed on the motorways and expressways in the Czech Republic, representing coverage of approximately one board per 20 kilometres of highway. (Ředitelství silnic a dálnic ČR, 2012)

For example, in extreme traffic conditions during a normal working day an average number of some 1,400 cars per hour passes the 96 kilometres of the D1 motorway. Delayed distribution of information in a matter of minutes, which is caused by time required for the processing and publishing of this information, brings danger for many motorists who can never receive information about the event in front of them via the variable information boards.

2.2. RDS-TMC

RDS-TMC (Radio Data System - Traffic Message Channel) is a service that provides the drivers with traffic and travel information before and during their journey. This service integrates all relevant information and gives the driver a possibility to optimise the journey. The aim of the RDS-TMC is to provide traffic information within the FM broadcast band using RDS technology. Information is coded using an independent ALERT-C protocol and later on transmitted to the users as a silent part of FM broadcasting and further processed by the navigation device. According to national and international studies the main system benefits encompass significant improvement in traffic continuity and lower environmental impacts.

The disadvantage of this system is that a warning symbol appears in case a traffic problem occurs anywhere on the preselected route. For more information, the driver must manipulate the navigation device, which requires his attention. In addition, if there are further problems occurring on the given route, the warning icon remains unchanged despite the possibility that this newer traffic incident may have occurred in a location which is even closer in route than the originally reported traffic problem.

2.3. eCall (Emergency Call System)

Project co-funded by the European Union aims to create a system that enables automated reporting on accidents to the European-wide emergency line 112, including accurate information about its location. When the eCall device installed in a car detects an accident by means of sensors, it automatically sends a message to the nearest emergency centre, indicating the exact geographical location of the accident as well as other data. This system can be activated either manually by pressing a button on the dashboard by the vehicle passengers or automatically by the vehicle sensors triggered during an accident. After the system is activated, a connection with the nearest emergency call centre (PSAP) is established transmitting both sound and data flows. The sound connection enables vehicle passengers to communicate with professionally trained call operators while at the same time data channels are used to transmit data messages (MSD) to these same operators. Each message contains 43 details about the accident; such as time, exact location, car identification, eCall system status (whether the eCall was activated manually or automatically) and information about possible service providers. Based on this information, the operator will liaise

with the integrated emergency services to direct them to the exact accident location as well as provide them with an exact description of the accident's severity and the number of injured. (Vávra, J., 2010)

Manual use of the system can be useful when we witness a traffic accident (European Commission, 2010). eCall systems should be installed in all new cars, at the latest, by 2015 and possibly also installed in older cars.

Although this system brings a clear improvement of the current situation in terms of saving lives and providing quick health care during accidents, it does not provide a solution for distributing information about the accident to the drivers approaching the place of accident, i.e. who are potentially at danger. When using existing information channels, the acquired accident data could be made available in some 5-10 minutes via motorway information boards, RDS-TMC messaging and radio travel news. However, each of these distribution channels has specific limitations and based on current traffic density the above-mentioned reporting times are clearly insufficient.

2.4. Smart Road Restraint Systems

The project aims - in addition to addressing timely reporting of accidents – on eliminating of loss of life and property through timely preventive distribution of warning information. The proposed system obtains information about the current situation using existing visual and sensory infrastructures (highway camera system, radar system and weather condition monitors) and distribute such information to drivers. It also seeks to find opportunities for new materials to decrease safety hazards (such as better energy absorption through deformation zones of transport). This project is one of three priorities of the EU on the issue of transport in 2020 and is also co-financed from EU funds. (SMART Road Restraint Systems, 2010)

2.5. System for Automated Forewarning of Vehicle Crashes

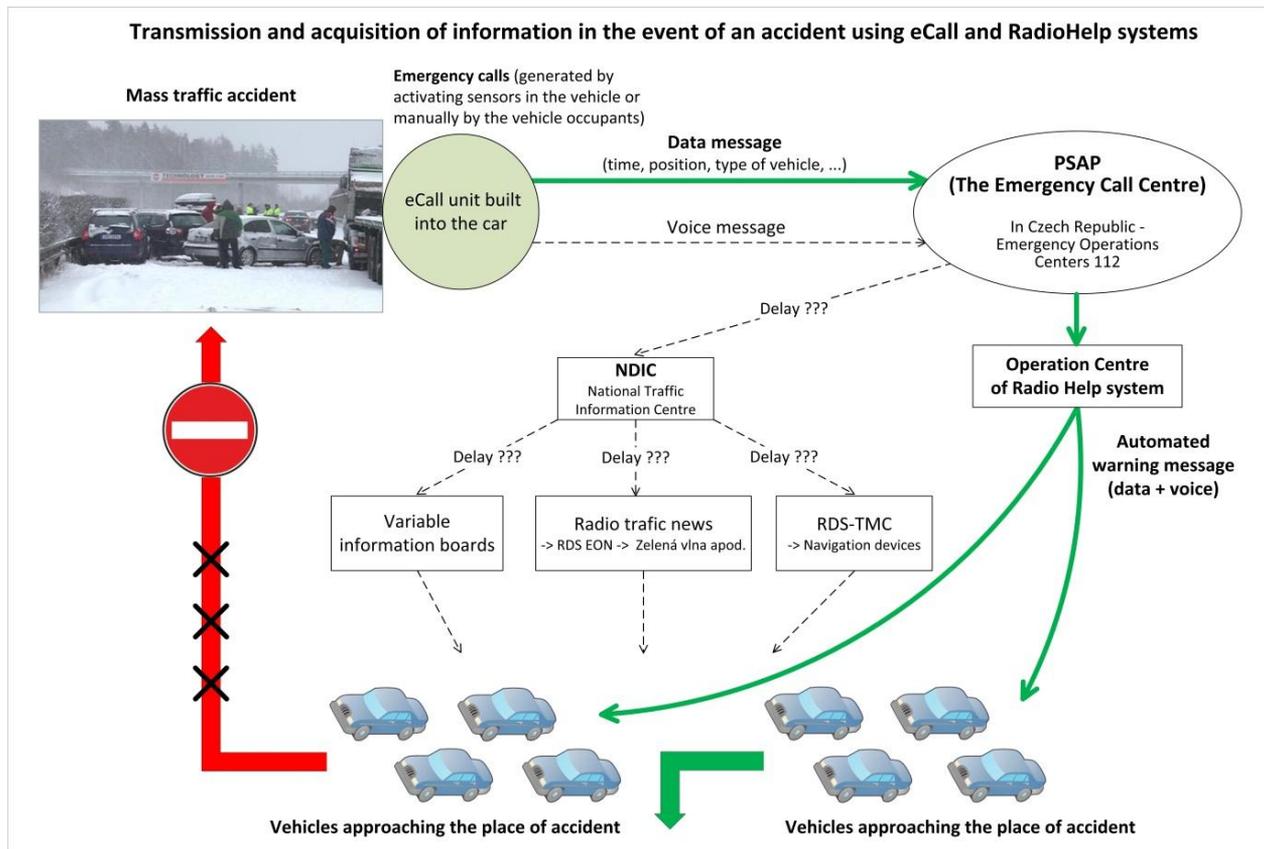


Figure 3: Transmission and acquisition of information in the event of an accident with the use of eCall and Radio Help (Authors)

For better and particularly early distribution of warning information could help a system called System for Automated Forewarning of Vehicle Crashes (the System), which has a data connection to the receiver systems-vehicle emergency call (e.g. eCall). The principle consists of full automation of generation and transmission of all relevant information about the accident to vehicles moving in its vicinity. The process of warning is initiated by the crashed vehicle, which will send information about the accident using eCall immediately after the collision happens together with the exact location of the accident. Information is received by the central office of the System which immediately generates data and / or voice information about the incident, including the positional code of the accident. Data will be sent via radio session and to car receivers as well. (Brunclík, 2010)

System receivers (mobile phones, navigation devices) must be equipped with a positional code comparator of an accident positional data generated by the positioning system receiver. If the comparator evaluates that the position code of an accident coincides with position code of the receiver and vehicle movement will be evaluated as being directed to the scene of the accident, it will be forced to activate the data reception and / or voice session. In practice, we may be able to automatically inform road users according to their current position and direction of the danger which is coming, almost immediately.

The System uses HD radio broadcast technology or digital radio broadcasting system, supplemented by determining the position through GPS. If we consider data acquisition for warning from eCall, in the event of a major expansion could be a very effective addressable warning system

that would significantly limit the creation of public transport accidents. Transfer of information in the case of using "System for Automated Forewarning of Vehicle Crashes" is shown in Figure 1, where solid lines show the flow of information the driver will receive with minimal delay.

Detailed principle of radio broadcasts warning information is described in detail in under the working title RADIO-H (Radio Help) (Skrbek, 2010, p. 138). It is based on simultaneous application of analogue receiver technology with digital content (HD RADIO and DRM) or all-digital broadcasts with the possibility of defining the positional coordinates via GPS (Skrbek, 2009). HD Radio technology company iBiquity Digital Corporation has been selected in 2002 in the U.S. as a key technology for the digitization of radio broadcasting. Currently, this technology carries a large percentage of U.S. radio stations. HD Radio technology uses the principle of superposition of the digital signal to analogue signal.

The transmitted relation of Radio-Help uses positional codes for identifying areas of compulsory income, i.e. where the broadcast is directed. The receiver in the area is maintained in standby mode and capture broadcast on fixed rate compares its position according to GPS coordinates with areas included in the broadcast. If there is an agreement it activates forced broadcast reception session. After the broadcasting code ends receiver goes into standby mode again. Subscribers of Radio-Help that are outside the defined zone will not be disturbed by warning broadcast sessions.

By this principle implies that it is possible to simultaneously transmit separate sessions to more areas. For the broadcast could be used longwave radio transmitters, which are currently in transition to shortwave broadcasts gradually lose its utility. In this case, would suffice to cover the whole CR only one central longwave transmitter.

Due to the development of technologies where circuits for terrestrial broadcasting and positioning GPS are now equipped with most new mobile phones, it should not be technically demanding to use it for these purposes. Also, upgrading of domestic appliances (radio, TV, ...) with the reception of Radio-Help would not be a major problem. In this case, since it is a stationary device, would be sufficient to initialize the device to enter the current value of the GPS coordinates, for example, according to available maps or other GPS device. They also maintain such equipment in standby mode should not be energy-intensive.

This solution also has a distinct advantage when total power failure, a risk which we are often confronted with. Using this technology offers the possibility of permanent informing the population about the current situation. The system also provides direction to a particular broadcast receiver, which could also be a specific distribution of information to specific groups of people such as representatives of municipalities or other groups of civil servants.

3. Summary

While the RDS-TMC has long been in operation and eCall should be installed in new cars from 2015, a project of Smart Road Restraint Systems is still under development. Similarly, an automated system warning of critical accident site, which uses almost functional eCall, but its other aspects are under investigation.

Automatic emergency call system eCall is designed especially for accelerating action of rescuers and other components of IRS (Integrated Rescue System). Availability of accurate information about the accident, particularly the place of an accident, type of car or extent of the damage, without any significant delays will undoubtedly be very beneficial. It follows that the introduction of eCall may help reduce human losses and reduce the consequences of accidents by early intervention emergency services.

At least equivalent effect may be the prevention of subsequent accidents. If the data from eCall is also used for early warning of other potential participants in an accident, it can lead to significant lowering of human and economic losses that could follow in the event of traffic accidents occur. Combining from eCall together with the use of System for Automated Forewarning of Vehicle Crashes can ensure distribution warning messages to drivers coming to the accident. Drivers should have relevant information in time in case of the approaching the accident so they could timely respond. The described combination can provide direct transfer of relevant information with minimum delay. In addition, information is sent only to specifically defined geographical area - for example, only to drivers of vehicles that are far from the accident less than 15 km and also go towards this accident.

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ICT SUPPORT FOR EMERGENCY MANAGEMENT

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Geodata, Process Analysis, Visualization of Geodata, Emergency Management

Abstract

This paper deals of the data analyze, process modeling and knowledge representation in context of emergency management. In area of emergency management it is possible to define several scenarios in which geographic information supports decision making. User and situation are the most important aspects determining role of geodata and thus its visualization. The illustrated case describes the traffic accident and transportation of dangerous substances.

1. Introduction

Many approaches to develop a geoinformation driven system for disasters have concentrated primarily on dealing with the immediate aftermath of an emergency including the mobilization of relief agencies, the delivery of aid and the provision of medical care (Wang, Y. et al., 2001). In the Czech Republic there exists the common will for the development of an effective information support at all levels of emergency management. Geoinformation and process support in tactical level and direct visualization and update of geoinformation in the field could simplify the decision making process of intervention commander and raise the quality of work of Integrated Rescue System. Presented use case is based on the scenario "Transportation of dangerous chemical substances" proposed in 2006 (Talhofer, V. et al., 2007) which was focused on verification of the dynamic geovisualisation procedures and proving of functionality of the communication and information systems designed as the emergency system components. The presented contribution further develops the proposed system by integrating three interdisciplinary fields: emergency management, process modeling, and adaptive cartographic visualization.

2. Characteristics of Integrated Rescue System in Czech Republic

Civil Protection is a complex of the prepared measures that are practically realized during Extraordinary Events and Crisis Situations. These measures are executed by components of the Integrated Rescue System which is legally specified as open system of coordination, cooperation and modeled cooperation procedures. In case the Extraordinary Event the Integrated Rescue System components realises Rescue and Liquidation Works, resp. Civil Protection. These activities are required to have Forces and Means, e.g. sources of manpower, tools, technical equipment, and powers (competence), i.e. qualification for various activities within Rescue and Liquidation Works given by law. The basic aim of the Integrated Rescue System is to integrate possibilities of all, who should participate in the Rescue and Liquidation Works.

Basic Integrated Rescue System components are responsible for all-time readiness for emergency phone calls (numbers 150, 155, 158, 112), evaluation of the event and the immediate intervention. These components include

- Fire Rescue Corps of Czech Republic
- Fire Prevention Units
- Police of the Czech Republic
- Medical Rescue Service

Other Integrated Rescue System components are used when the basic components of Integrated Rescue System are not sufficient for Rescue and Liquidation Works. The other Integrated Rescue System include

- Army of the Czech Republic
- Armed security corps (except the Police of Czech Republic)
- Other rescue corps (except the Fire Rescue Corps of Czech republic)
- Public health authorities
- Emergency, professional and other services
- Civil Protection facilities
- Non-profit organizations and civil associations, etc.

All of the Integrated Rescue System components are registered and their cooperation is set by the Integrated Rescue System Alert Plan.

Coordination of activities within integrated rescue system is done on three levels - strategic, operational and tactical (Conception of civil protection 2008, 2008), and is corresponding with the generic conclusion defined by (ORCHESTRA 2009, 2009).

- Strategic level of the Rescue and Liquidation Works management is realized by standing or temporary coordinating authorities of the administration, region commissioners and Ministry of Interior - General Management of the Czech Republic Fire Rescue Corps.
- Operational level permanently provides the coordination and cooperation between individual Integrated Rescue System components (operational centers of the basic components, dispatching centers, standing services, oversight centers of distributive and emergency services). Operational and Informational Centre manages cooperation within

the Rescue and Liquidation Works with using Integrated Rescue System documentation (e.g. Alert Plan, Emergency plan of the region, Water sources survey, Model Action Activity of the IRS Components at the Common Intervention). The responsibility of Operational and Informational Centre includes securing activities of intervention commander, coordination of higher level activities, citizens' warning, exchange of information, etc.

- Tactical level includes activity coordination at the place of intervention and cooperation of Integrated Rescue System components. Intervention commander proclaims corresponding Level of Alert, which predetermines needs of the Forces and Means for Rescue and Liquidation Works.
 - In simple cases, the intervention commander coordinates the Forces and Means alone.
 - In cases requiring time consuming and complex cooperation, staff of intervention commander is established (leaders of Integrated Rescue System component, event. experts or assistants of cooperation units).
 - In the case of too complex or large-scale intervention, individual sectors are set and the sector commanders are nominated. The intervention commander organizes the Rescue and Liquidation Works based on the consultation with Integrated Rescue System component leaders and follows document "Model Action Activities of the Integrated Rescue System Components at the Common Intervention".

Modern and efficient information support to the Integrated Rescue System provides ICT, especially Adaptive mapping. Adaptation of geographic information can be seen as an optimization process that enables the provision of objects of high utility that satisfy a user's current situational context; can be carried out at different levels - data level, communications level, task specific level and others. Geographic information is produced and used by people to support better informed and faster decision making. However, this potential can only be exploited adequately if the purpose (tasks) for which the user needs the data is taken as an important factor for the optimization process (Tvrdíková, M., Koubek, O. 2011). Adaptive maps have become one of vital approaches for modern cartography in general and map use in particular (Erharuyi, N., Fairbairn, D., 2005). The principles of adaptation deal with the theory of description of so-called "context". This context is set of determinants identifying particular cartographic representation. If something happens around map device, its context is changed and appropriate visual representation is selected. Basic idea of adaptable maps follows practice of map use. There we can distinguish many attributes of map context and their impacts. Selection of that attributes is strongly related to the overall purpose of map representation. For context identification is crucial detailed analysis of solved task. But generic description of the goal and necessary information is not enough. We need to know how acting subjects perceive the reality. The same phenomenon in reality has different meaning for specialist who observes them and different meaning for people that are influenced (Doucek, P., 2010). To handle such issues we need detailed description views of specialists which create supporting data (Hančlová, J., 2006), views of crisis management actors and to create the necessary translation between these models. We believe there is a need to refocus geographic information adaptation from a strictly technological to more problem based process, asking questions such as:

- What are the activities we use it for?
- What are the tasks that constitute an activity or phase in emergency management?
- What actions do we need to perform within a task?

Geographic information is produced and used by people to support information richer and faster decision making, but this potential can only be exploited fully if it accommodates user expectations.

3. Case study with using of adaptive visualization and process modeling

Geovisualization can be used as a tool to support cooperation both on tactical and operational levels with support of a cross connection of adaptive visualization and process modeling on the domain of emergency management. Next described case study is focuses on tactical level of cooperation, i.e. activity of intervention commander and decision making support during organization of intervention in situation “Accident of vehicle transporting dangerous substance”. Aim of described solution is control of the activity intervention commander which is responsible for settlement of accident of vehicle with dangerous substance and providing of information necessary for decision making. The authors are aware of other attitudes proposed and often used in this area like semantics driven or ontology development (Klien, E., Lutz, M., Kuhn, W., 2005), (Tanasescu, V. et al., 2007). However, this research aims in building the support in a different manner starting with a simple use case, identifying main obstacles and possible bottle necks for a more extensive implementation. The whole system is built on the principles of architecture based on the workflow reference model. The base part is composed of two separate software components. The first component is the Process Definition Tools (PDT), where processes are modeled. As a modeling language is used BPMN and then is created a process definition in XML format. The PDT also includes tools for simulation and performance measurement processes. The second component represents a workflow machine itself, based on events and stimuli from the external environment create and manage instances of processes. Also takes care of communication with administrative tools, other workflow machines, through the user interface communicates with the user and automatically triggered applications. Compared to the standard workflow user interfaces is in this solution significantly stronger support for work with maps.

3.1. Processing of user requirements and Analysis of Integrated Rescue System activities

Users’ requirements have been conducted on three different levels of detail – on EU level several international projects (OASIS, 2009), (ORCHESTRA, 2009) and studies (Diehl, S. et al., 2006) dealing with the emergency management and geoinformation have been analyzed and their results synthesized into the generic requirements level. Directed interview with a complex questionnaire has been realized within the public administration bodies in the Czech Republic defining the current state of the art and main demands on geoinformation support in Emergency Management (Foltýnová, D., Stachoň, Z., 2008). High level system demands and services were further developed on the level of individual crises scenarios. Activities of intervention commander were analyzed with using document “Model Action Activities of the Integrated Rescue System Components at the Common Intervention” that models activity of the Integrated Rescue System component at Rescue and Liquidation Works with regard to the character of Extraordinary Events. It defines responsibility and activity of involved units in 9 different emergency situations - e.g. utilization of radiology weapon, aircraft accident. To analyze the activity of the intervention commander by an accident of a vehicle with dangerous substance, model situation finding item with suspicion of presence B-agens or toxins (Figure 1) were used and modified for case of vehicle accident by analyzing other Integrated Rescue System documents and based on discussion with experts. A few observations on Operational and Informational Centre were undertaken to get deep knowledge about cooperation and coordination both on tactical and operational levels.

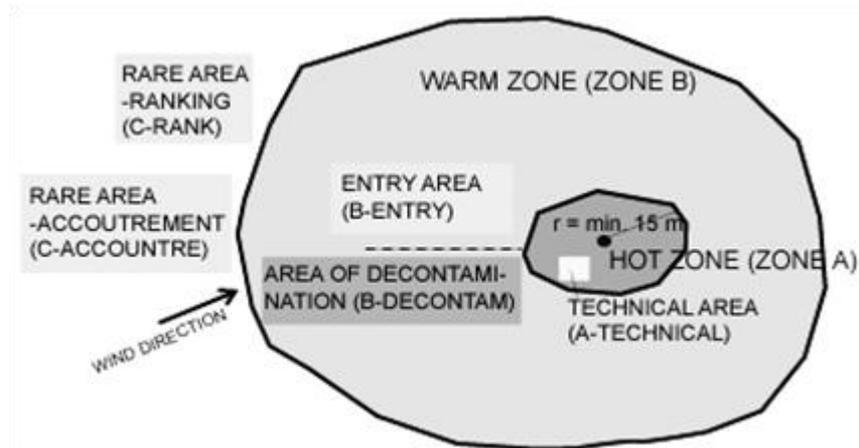


Fig. 1. Place of Extraordinary Event and its zoning by common intervention of Integrated Rescue System in situation finding item with suspicion of presence B-agens or toxins dapted from (Catalogue set 2006).

In brackets names of map features defined for the use case.

3.2. Process and Geovisualization support

Event “Accident of vehicle transporting dangerous substance” can be seen in complex view and represented by the UML (Unified Modeling Language) use case diagram. The main purpose of the use case diagram is to find and document the modeled system requirements (Ludík, T., Ráček, J., 2008). Border of the modeled system is defined by the Czech Fire and Rescue Act. Everything else is considered to be surroundings of the system. By analyzing the activities within the event, an actor list is created containing different roles which are assigned to persons or subjects that use the modeled system. Addressed questions are: “Who or what uses the system?” and “Who or what communicates with the system?” Having understood the roles of the individual actors, it is possible to start creation of use cases. A use case is perceived as specification of the sequence of activities that the system or subsystem can execute through interaction with external actors. Each use case can be then specified by process maps (Ministr, J., Števkó, M., Fiala, J., 2009) incorporating and defining the activity sequences in the particular directives. A process is a set of activities arranged in parts which creates in a repeatable way a required output on the base of one or more inputs. (Hollingswort, D., 1999). To illustrate a process map the use case called “Organization of intervention” is processed. This directive controlled by Intervention commander consists of ten activities illustrated in process map on Figure 2.

In this way the process map of organization of intervention is created. All modelled processes (process maps) are transformed to XPD L (XML Process Definition Language) format (Hollingswort, D. 1999) where the individual process activities are assigned to the required geoinformation. The example of resultant relationship between geoinformation and process activities is shown by CRUD matrix on Figure 3.

Map features listed in crude matrix (Figure 3) pose so-called context specific map content that is visualized on the background of topographic base. This BASETOPO is a set of topographic features that can be as a whole reused in other contexts. BASETOPO is defined in a few scale ranges - in the case study, use of BASETOPO in large-to-middle scales is expected. An example of visualization is given in Figure 4.

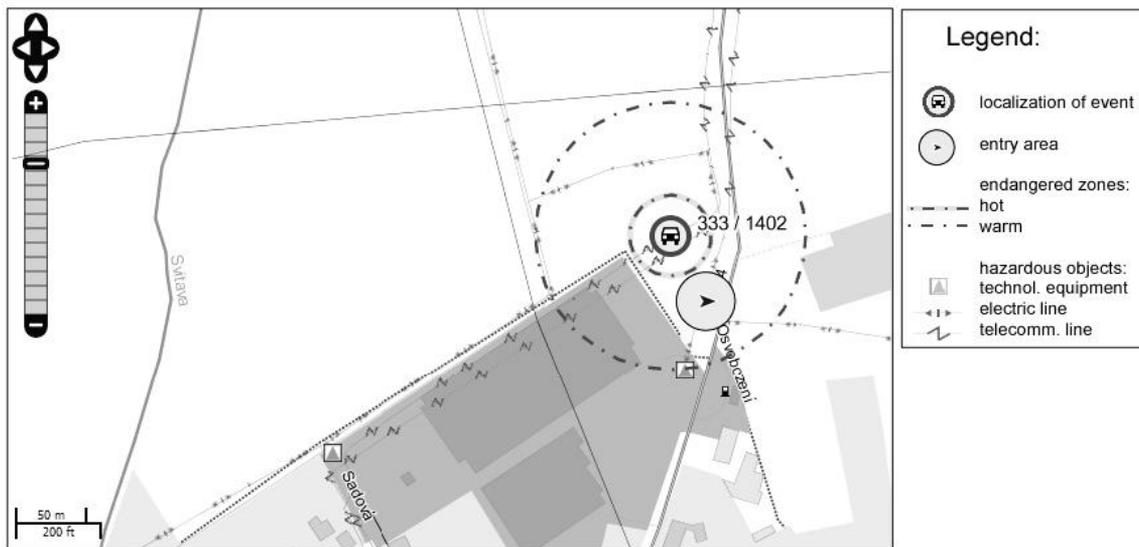


Fig. 4. Map content and its visualization within activity “Determination of entry area”. During this activity user create object “entry area”. In the background, BASETOPO in the large scale.

Contextual map service is based on Open Geospatial Consortium standards. Transactional Web Feature Service (WFS-T) is used for bi-directional transfer of data and on the fly update of central database. Service is in detail described in (Kozel, J., Štampach, R. 2009).

4. Conclusion

Contextual web service based on previous process analysis and mapping has been tested in the field experiment during which accident of vehicle transporting dangerous substance was simulated and geoinformation support of intervention commander tested. Nowadays there is no direct automatic connection between both attitudes and process analysis outputs have been used as “better and more reliable” inputs for contextual service. However the fusion of both methods has helped to optimise the geodata visualisation rules and the amount of transferred information.

Future development will consider the crude matrix as a direct driver for contextual service automation and further development of other emergency management use cases.

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NOTIFICATION OF CIVILIANS IN REGIONAL EMERGENCIES, DISASTERS, CRISES AND UNEXPECTED SITUATIONS – AN AGILE APPROACH

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Keywords

Communication; Agility; Emergency; Crisis; Information; Notification; Radio-Help; Katwarn,

Abstract

To distribute a position-based warning information - in cases like tsunami, floods, extensive fires, nature disasters, terrorist attacks, black-outs of energy etc.- is strongly limited. Limits are given not only through available technologies (with respect to responsive approaches to collection, selection and distribution of information), but also by possibilities and abilities of people to receive, understand and appropriately use delivered information. This contribution, related papers (Skrbek, 2009), (Skrbek & Kvíz, 2010) and (Skrbek, 2011-3) of previous IGIP conferences, describes some wider views on this topic and selected technology with the intention of notifying civilians in unexpected situations. It critically evaluates created systems of notification like Katwarn (introduced in Germany), Czech Danger Alert Communication System based on the SIPP technology and Radio-Help system.

1. Introduction

On January 27, 2011, Egypt turned off the Internet. There was no giant switch or big red button involved, but in reality it was almost as easy: the Egyptian government simply issued an order for ISPs (Internet Service Providers) to shut down service⁴. "The authorities have the right to issue such an order and we are obliged to comply with it," Vodafone Egypt explained in a statement shortly afterwards. One of the high-tech communication channels can not only be decommissioned by black-out of electricity but also by decisions of governmental authorities. The general principle of Law on Cyber Security was published for discussion in the Czech Republic in February 2012. On the basis of this law, the government would have the opportunity and right to switch-off the Internet in cases such as terrorist-attacks, cyber-attacks or information attacks on key enterprises.⁵

⁴<http://gizmodo.com/5746121/how-egypt-turned-off-the-internet>, cit. 5.5.2012

⁵<http://www.parlamentnilisty.cz/arena/monitor/Podle-pripravovaneho-zakona-bude-mit-stat-moznost-vypnout-internet-224077>, cit. 28.4.2012

Previously, only the police and army of the Czech Republic had a right to interfere with radio communications or mobile networks. The police turn off the mobile phone network several times a year. So far it has only been applied locally, e.g. if was essential to avoid potential detonation of explosives by mobile phones.⁶ In such situations mobile networks are rendered useless for notification of people in affected areas. It is apparent that, currently, the integrity of our structures is affected more easily by disasters and we are not well prepared for the accumulation of multiple-source risks (Chroust et al, 2011, p.1). Our present-day communication media are unable, in some specific cases, (such as tsunami, floods, extensive fires, nature disasters, terrorist attacks, black-outs of energy etc.) to guarantee provision of critical information to the right people in the right place.

2. Notification as a tool of emergency management

Currently, society is facing more and more new and unexpected situations and it is necessary to react in new and innovative ways. Disaster researchers have been describing and documenting the nonstructural factors such as improvisation, adaptability and creativity that are critical to coordination, collaboration and communication and to successful problem solving. Many well known cases such as e.g. Hurricane Katrina (2005), tsunami in Thailand (2004), earthquake and tsunami in Japan (2011) illustrate that current disaster and rescue services failed or were ineffective at critical moments. The designers of really effective systems for emergency response must facilitate not only the disciplines of structure, doctrine and processes of disasters management but also disciplines that need agile approaches like creativity, improvisation and adaptability (Harrald, 2006).

Agility dominates the approaches to crisis management, if we see crisis as "the perception of an unpredictable event that threatens important expectancies of stakeholders and can seriously impact an organization's performance and generate negative outcomes" (Coombs, 2012). In the following paragraphs we will generally not distinguish between crises and other unexpected situations mentioned above. Crisis management including notification and communication is more than reaction; it can be prevention and preparation too.

Crisis communication can be defined broadly as the collection, processing, and dissemination of information required addressing a crisis situation. In pre-crisis, crisis communication revolves around collecting information about crisis risks, making decisions about how to manage potential crises, and training people who will be involved in the crisis management process (Coombs & Holaday, 2010). Haddow (Haddow, Bullock, Coppola, 2010) defines four phases for effective communications strategy in the frame of crisis management for providing timely and accurate information to the public in affected areas:

1. Mitigation - to promote implementation of strategies, technologies, and actions that will reduce the loss of lives and property in future disasters.
2. Preparedness - to communicate preparedness messages that encourages and educate the public in anticipation of disaster events.
3. Response - to provide to the public notification, warning, evacuation, and situation reports about an ongoing disaster.

⁶ <http://www.techzon.cz/armada-bude-mit-mozna-moznost-rusit-mobilni-a-datove-site/>, cit. 28.4.2012

4. Recovery - to provide individuals and communities affected by a disaster with information on how to register for and receive disaster relief.

It is evident that the needs and demand for distribution of information are different in any of these phases. The role of information and notification is also very different as well as the requirements for reliable, safe and trustful communication channels. It is especially important for preparedness and responsiveness phases – when the availability of communication channels could be very limited and the demand for position-based and immediate information from trustworthy sources is extremely high. Timely distribution of information could often save both material values and also human lives. (Skrbek, 2009).

As described in (Chroust & Ossimitz, 2011), it is necessary to respect the psychological and physiological aspects of received information in stress situations. “Being a First Responder is a stressful experience for many reasons.” Shared responsibility by the majority of people in affected areas is desirable. The only way is to remove information barriers, in order to share important information. Adequate school & life-long learning training and education is crucial in utilizing all relevant technological, organizational and rescue options in accurate information interpretation, Doucek (2011) also finds a lack in the current education system of the Czech Republic.

The provision of timely and accurate information directly to the public is critical to the success of any response and recovery effort. This contributes to the well-being of the community following a disaster by ensuring dissemination of information that (1) is timely, accurate, consistent, and easy to understand and (2) explains what people can expect from their government.



Figure 1. Model for situational crisis communication – inspired by (Coombs, 2012), p.40

The crisis response phase is the most heavily researched aspect of crisis communication. How and what an organization communicates during a crisis has a significant effect on the outcomes of the crisis, including the number of injuries and the amount of reputational damage sustained by the organization. Principles of relations among stakeholders of crises are indicated in Fig. 1.

The principle and technologies of crisis communication also takes place in non-disaster situations such as the distribution of faulty goods etc.

3. Technology for crisis communication

The technological options available for crisis communication have expanded considerably in the last decade. Both state and rescue organizations are using television, establishing phone lines to respond to questions, but lately they also need to consider Internet resources. Organizational websites offer a highly accessible resource that provides various stakeholders with crisis information. Increasingly, social networking tools are also used to communicate and establish dialogues with stakeholders. Whether using weblogs, Twitter, podcasts, YouTube, and e-mail messages, now there are so many new media options that are defined as crisis communication tools. As was mentioned above and described in (Skrbek, 2010), (Skrbek 2011-2), in many situations the availability of new media are very limited. The following paragraphs describe three technologies with the purpose of defining standards of emergency notification.

3.1. KATWARN

KATWARN (Catastrophe Warning) - is aimed at creating affordable and comprehensive warning systems. It was designed in the Fraunhofer Institute for Software and Systems Engineering. The project, financed by public insurance companies of Germany, started in 2009 and was widely published at the beginning of 2011. The core idea of KATWARN is that people can only be protected from dangerous situations “if they are alerted at the right time at the right place”. The designers argue that using separate warning systems for each case and situation is too expensive.⁷ KATWARN is aimed at creating affordable and comprehensive warning systems. The role of it is to modify and broaden possibilities and efficiency of warning systems (Skrbek, 2011-3).

KATWARN employs a variety of warning channels in order to reach people affected by disasters. In addition to the conventional interaction channels of phone or radio, different warning technologies like SMS and e-mail are being evaluated (Skrbek 2011-2). Up until last IDIMT 2011, KATWARN had been tested and implemented in different parts of Germany. One of the major pilot implementations until August 2011 (with limited functionalities) is in Hamburg. The geographical positioning of the SMS transmission is based on postal codes of Hamburg residents. Additionally, as an option, the warning information would also be distributed by e-mail. From August 2011 until May 2012 KATWARN has been used for 16 notification warnings. The representatives of Hamburg are sure that the new system is incomparably better than older one that were based on siren warning signals. They also consider that KATWARN eliminates the potential misinterpretation of prevention alarms that could lead to misbehaviour or - in the worst case - even to panic⁸. Disaster warnings by sirens often do not reach many people: The reason is soundproof windows, areas with insufficient or no siren signal or the loud sound of television sets. Even if people hear the sirens, many often do not know what signals mean. In a real emergency it could be fatal.

Other implementations of KATWARN were realized during the past year in Frankfurt am Main, Bad Homburg, Schwalm-Eder-Kreis, Emden and in counties Aurich, Leer and Wittmund. Citizens from these regions can easily sign up by SMS or e-mail. The public insurances provide the system and the technical infrastructure for free⁹. KATWARN is foreseen to be developed in future to full

⁷ <http://www.fraunhofer.de/en/research-topics/safety-security/disaster-crisis-management.html>, cit. 15.4.2012

⁸ <http://www.w.idw-online.de/en/attachmentdata10536.pdf>, cit. 18.8.2011

⁹ <http://www.voev.de/web/html/start/verband/engagement/schadenverhuetung/katwarn/index.html>, cit. 5.5.2012

functionalities, as was described in (Skrbek 2011-3). Technologies such as integrated fire alarm devices and automatic building controls should be soon tested and integrated in KATWARN.

As was previously published (Skrbek, 2009), regardless of the technological solution the system of notification and information services in crisis, disasters and emergencies has to fulfil the following requirements:

- the system must be available to everyone (citizens, visitors, strangers etc.),
- the system must be available everywhere and anytime,
- the system must be independent of the operation of mobile networks and internet,
- the system must be independent of the operation of the electric power network.

Based on publicly available information, it is apparent that KATWARN still does not fully respect three of these four points. However, it is one of the few realized solutions which seeks to eliminate the weaknesses of existing early warning and notification systems.

Regardless of the lack of detailed information (technical, organizational, finance) the KATWARN system represents a solution that is in many cases able to effectively transmit the necessary information to the majority of required recipients.

3.2. Danger Alert Communication System

Advanced ICT technologies are the basis for alternative systems designed to alert populations to dangerous situations. The system, presented by (Vozňák, Řezáč, Zdrálek 2010) in 2010, is based on using a SIP call generator to generate and distribute voice messages directly to the end device (IPhone, cellphone, fixed line, etc.). The benefit of such communication compared to the others is the fact that it uses a phone call and therefore is possible to get feedback who received the message. The whole system would be based in the data centre of a telecommunications operator and would be accessible to the crisis centre's staff. A staff member is able to load the pre-recorded alert. The outputs of the application are SIPp voice messages which are sent into a communication server. The end user obtains the phone call with sufficient voice information to solve the situation. If the end user does not receive the call (missed call, phone switched off etc.), the system arranges to re-send the message and re-initiate the call with the end user.

In theory, there is cooperation with mobile operators who are able to deliver the list of numbers located in the target area. The warning messages are entered into the system in voice format. Actual voice messages would be sent out to all end users and played once if the phone call is accepted. The call is not regarded as executed unless the end user accepts the call.

The factor of maximum load of the SIPp application can affect the number of system-generated calls at a particular moment. In tests it was found that the open-source tool SIPp can generate a maximum of 700 SIP requests at a particular moment without a fault. This factor limits the maximum number of calls generated at a particular moment to 500. In order to distribute even to sets of end users exceeding 500, it is necessary to divide the total amount of requested calls into subsets of 500 requests. Additionally, the system can effectively generate 500 calls every 60 seconds (Vozňák, Řezáč, Zdrálek 2010).

Such a number of potential customers of phone based voice-alert system could be adequate in small villages and/or outside larger cities. This also depends on of the features of phone networks (mobile as well as fixed phone network).

3.3. Radio-Help

The current early warning systems in the Czech Republic are designed to work independently of electric power in defined mode for 72 hours. Defined mode means function ability for 10 minutes... What will happen after this time?

As was published in (Skrbek, 2009), the core task of the Radio-Help project was to find an appropriate technology for targeted one-way communication. In other words – it was necessary to define two main components of a radio-broadcasting system, sender and receiver, based on current transmitting protocols and technologies.

Position based distribution of information uses the synergy of widely applied technologies in different devices for reaching new quality. The technology of Radio-Help system is in detail described in (Skrbek 2011-1) and (Skrbek 2011-2). In principle the solution of targeted broadcast for a geographically defined area consists in a superposition of digital positional data to the transmitted information. The receiver of such a signal is equipped with a positioning system (GPS and/or Galileo). Broadcast targeting is performed by comparing the positional coordinates of the receiver (in the form of satellite positioning system) with the codes that are a part of the trigger partition in the beginning of each broadcasting session. When an external position code, which is transmitted by an authorized transmitter, conforms to an internal position code of the receiver, the forced listening broadcast session is activated (i.e. the session targeted for listening in the defined area). More detailed information about the locally targetted distribution of information is listed in the authors' patent applications (Brunclík, Skrbek 2008-1), (Brunclík, Skrbek 2008-2).

The Radio-Help broadcasting will cover not only holders of special Personal Communication Terminals (PCT's), but also the receiver of Radio-Help can be integrated into any audio and audio/video devices. It is especially important for elderly people. Radio-Help system gives them the opportunity to get necessary information through their radio or TV set. For stationary A/V devices (radio, TV, etc.) it would be possible to set up a fixed positional code, based on the postal address of their users.

At a practical level, it is possible, in a similar way, to immediately use all current voice sirens and public information systems (e.g. in supermarkets, shopping centers, schools, factories etc.). Such systems just need the position code to be setup once (e.g. by initially switching them on). Wide areas of applications bring the integration of Radio-Help receiver into sound systems in cars and navigation systems. (Skrbek, 2011-2). System of Radio-Help is stable and workable in such situations like black-out of electricity, mobile phones, Internet and public broadcasting.

A reliable means of communication to enable appropriate community (re)action is one of the main cornerstones of the Radio-Help system. Crisis communication would be mediated - morally and professionally competent, well known individuals with an ability to lead citizens to self-help rescue of lives, health, assets and elimination of panic. The responsibility to oversee the management of this activity would typically fall to state-owned radio-stations such as BBC Czech Radio etc. Organisation of Radio-Help broadcasting supports, extends and improves the current Early Warning System of central Rescue Services, as described in (Skrbek, 2011-1).

Over time other system options were elaborated and developed, mainly encoding broadcasts based on geographic position of receiver. This Radio-Help system is also the basis for a large number of useful applications. The representative of them is e.g. "System for automated forewarning of vehicle crashes" as is mentioned e.g. in (Skrbek & Kvíz 2010). Also the favourite broadcasting standard of Radio-Help system – HD Radio - in recent years, has been vastly expanded not only in the USA but also in other countries around the world.

4. Conclusion

Radical change in the system for informing the population in crisis is not a question of discussion in terms of whether to carry it out, but only a question of how and when to decide on its implementation and where to allocate the necessary resources. Unfortunately the current period of economic and social crisis does not favour introduction of new communication systems for crises and disasters. It is our opinion that the reason why the responsible institution in the Czech Republic (like Czech Radio, Fire and Rescue Services et.) despite of declared interest do not possess any own initiative or activity. According to available information, nobody has properly studied the impact of crises and of its macroeconomic and microeconomic aspects, from the perspective of prevention of losses, due to full accessibility of all relevant information.

Experts say that, in the near future, due to a variety of reasons, civilization will be more regularly faced with such problems like black-outs of electricity lasting several days, local floods, heavy snow falls, terrorist attacks etc. Responsive approaches are the only solution for management of similar situations. All these situations, although very different in nature, have one common issue: - how to ensure real-time dissemination of relevant information to the affected areas.

The Radio-Help might, in principle, fully meet the requirements of adequate, locally defined information spreading in all the above-mentioned situations. Despite the potential benefits of Radio-Help systems and its applications (practical content of broadcasting) and principled shortcomings of KATWARN solution it is true, that currently the only emergency notification solution implemented, within the EU is the KATWARN system.

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METHODOLOGICAL SUPPORT OF IT LOSS EVENT MANAGEMENT

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Keywords

Event Management, Risk Management, Incident, Emergency, Disaster, Crisis, Check-List Based Approach, Incident-Based Approach, Asset-Based Approach, Process-Based Approach, COBIT5, Goals Based Procedure, Pain Point-Based Procedure, Risk Scenarios-Based Procedure

Abstract

Information technology plays an important role in modern disaster management mechanisms, helping organizations identify and prevent loss event risks in operating activities. Owing to the fact, that there exist so many different types of disasters and other incidents each of which differ in the risk value and ways of protection against them, the goal of this article is to provide the global framework for IT event management and then focus on one part of it – methodological support of loss event management at the enterprise level.

1. Risk and Disaster Management Approaches

The common driver for each security management activity (disaster management included) is risk management. Risk management is the identification, assessment, and prioritization of risks followed by coordinated and economical application of resources to minimize, monitor, and control the probability and/or impact of unfortunate events or to maximize the realization of opportunities. Risks can come from uncertainty in financial markets, project failures (at any phase in design, development, production, or sustainment life-cycles), legal liabilities, credit risk, accidents, natural causes and disasters as well as deliberate attack from an adversary, or events of uncertain or unpredictable root-cause. A number of accounting, credit and debt crisis together with rising occurrence of disasters resulted in the concept of governance, risk and compliance (GRC). The main aim of the GRC concept is setting the sound corporate governance principles and in the area of Enterprise Governance of IT, which is the inherent part of GRC, to improve the mutual cooperation and understanding between the business view and IT view over the IT value delivery. One of the important parts of GRC concept is risk management and disaster management, so in the next text the problem is narrowed down to this area.

Typical risk and disaster management implementation approaches include (ISACA Journal, 2010, p.1):

- Checklist-based approach– organizations provide risk and disaster management as a reporting exercise. Implementers and auditors adopt the check-list approach for testing the

compliance to a list of requirements (e.g. ISACA: Business Continuity Management Audit/Assurance Program). This approach is environment-specific and seems to be too often weak. But it is popular for its simplicity. The core steps of checklist-based approach are

- problem area (subject, process) scoping (e.g. continuity management within specific organization)
 - checklist design or identification of the existing checklist¹⁰
 - filling in templates, tables,
 - result analysis and recommendations.
- Incident-based approach – looks at the past deviations, using incident reports, error reports, system failure reports, etc. Example of such an approach is Basel II, which recommends collecting loss-event data as a measure of operational risk exposure. The main weakness of this approach is assumption that if there is a problem in the system, it would be visible in some of its effects. But it is not always true. Incidents provide traces to the level of the exposure and allow organizations to recalibrate their business processes to meet the new exposure levels. But in the case the incident turns catastrophic, it is too late for any remedial action. Next are the main steps of incident-based approach:
 - definition of the desired (expected, normal) flow of activities
 - identification of the incidents (errors, failures, deviations, etc.)
 - choosing the tool for incident monitoring
 - analyzing the incident reports and providing feedback.
 - Asset-based approach – in this method, assets and their vulnerabilities are identified together with their threats that could compromise security of these assets. In case of information assets mainly confidentiality, integrity and availability can be compromised. Based on the probability of threats exploiting these vulnerabilities and the consequential impact, the risk exposure is computed. Risk mitigation measures are suggested for vulnerabilities with risk exposure higher than the risk tolerance limit. The typical representative of the asset-based method is ISO 27005 or OCTAVE¹¹. This approach is more rigorous and comprehensive than the previous ones. The idea behind is that risk is looked upon as a threat to an asset and the remedial measures are incorporated in the business and IT processes. The problem is, that there exist so many different types of assets within an organization (processes included), that it is often very complex and inefficient to map all of them, provide their prioritization, identify their threats, vulnerabilities, etc. It is resource consuming and usually it is not possible to realize without any specialized risk management software support (e.g. CRAMM). Asset-based approach includes next steps in short:
 - identifying and valuing assets,
 - identifying threats and vulnerabilities, calculating risks,
 - identifying and prioritizing countermeasures.

¹⁰ A checklist is a type of explicit knowledge in form of template which can help us to provide assurance for complex problem while compensating the potential limits of human knowledge, memory or attention.

¹¹ OCTAVE is The Operationally Critical Threat, Asset, and Vulnerability Evaluation method developed by the Software Engineering institute (SEI)

- Process-based – approach is based on premise that incidents or threats to assets are due mainly to process vulnerabilities. Therefore a fundamental approach to risk and disaster analysis should start with process analysis. So the core parts of this approach is to provide
 - a hierarchical map of processes (products, services – related processes – sub processes and activities) and
 - process description which besides the traditional information (roles responsible for activities, involved entities, inputs, outputs, supporting application programs, etc.) includes information about the controls and practices build into the process and risks associated with sub process/activity.

2. Types of Loss Events

The most general term for the “activity” which activates unusual operations and can compromise the different values of an organization is event. But in the same time we often use terms like emergency, incident, disaster or crisis interchangeably in many occasion. But in fact they have different meaning BCM (2012) recognises next types of events.

Types of loss events	Level of awareness	IT Support	
		Methodological	Technical
Incident	Enterprise (internal)	Check list-based Incident-based Asset-based Process based	<ul style="list-style-type: none"> • Traditional file-based backup and restore • Image based backup and restore • Bare metal backup and restore • Point in time snapshots • Data replication • Continuous Data Protection (CDP) • Local high availability (HA) configurations • Remote business continuity (hot standby) • Hosted or cloud based backup • Recovery to hosted/cloud based services • Managed DR services • Virtualisation enabled recovery
Emergency	Enterprise (internal) together with national or international (external)		

Disaster		Integrated protection system Crisis management	<ul style="list-style-type: none"> • GIS and remote sensing <ul style="list-style-type: none"> ○ Drought ○ Earthquake ○ Flood ○ Landslides ○ Search and rescue • Internet • Forecasting systems (flood, cyclone, stock exchange...)
Crisis	National international (external) or	Early warning systems support Legal	

Figure 1: The relationship between the types of harmful activity, level of awareness and IT support.

An **incident** is an occurrence by chance or due to a combination of unforeseen circumstances, which, if not handled in an appropriate manner, can escalate into an emergency or disaster or crisis.

An **emergency** is a sudden, unexpected event requiring immediate action due to its potential threat to health and safety, the environment, or property. When we have an emergency, it can be an incident however, the characteristics of this incident requires an immediate response as the situation do not permit the responder any time to wait.

A **disaster** is a sudden unplanned event that causes great damage or serious loss to an organization. It results in an organization failing to provide critical business functions for some predetermined minimum period of time. It is common to distinguish natural, technological and social disasters, or natural and accidental.

A **crisis** is a critical event that may impact not only profitability, reputation, or ability to operate of many organizations, but it negatively implies the lives of many people. It may not be time dependent and usually does not deny access to facility and infrastructure.

Looking on the table mapping all the important areas of different types of loss events, it is not possible to encompass all these areas within this article. Therefore the next chapter focuses on the methodological part of IT support at the enterprise-wide level (relevant for incident, emergency and partly for disaster management).

3. IT Process Based Approach to Incident and Emergency Management Based on COBIT5

There exist many different guidelines, best practices and other standards aiming to help organizations to implement, test and maintain loss event controls¹². Owing to the fact that recently the COBIT5 has been released to public, let me present after the short introduction to COBIT5 some procedures helping organization to provide IT processes scoping for event management at the enterprise level of awareness.

¹² Examples are: ISO22301 , ANZ505 , ASIS, BS25999, MS1970, NFPA1600, SS540, ENISA, ITIL

3.1 Brief introduction to COBIT 5

The COBIT 5 framework provides the basis for governing and managing enterprise IT, and includes a number of products:

- COBIT 5 (the framework—now available)
- COBIT 5 Enabler Guides, where governance and management enablers are discussed in more detail. These include:
 - COBIT 5: Enabling Processes (now available)
 - COBIT 5: Enabling Information (in development)
 - Other enabler guides (more details on the COBIT pages on the ISACA web site)
- COBIT 5 Professional Guides, which include:
 - COBIT 5 Implementation (now available)
 - COBIT 5 for Information Security (mid-2012)
 - COBIT 5 for Assurance (2013)
 - COBIT 5 for Risk (2013)
- COBIT Online, a collaborative environment to support the use of COBIT 5.

The three publications released in April are COBIT 5: Framework, COBIT 5: Enabling Processes and COBIT 5 Implementation.

COBIT 5 is based on a revised process reference model with a new governance domain and several new and modified processes that cover enterprise activities end-to-end, i.e., business and IT function areas. It consolidates COBIT 4.1, Val IT and Risk IT into one framework, and has been updated to align with current best practices, e.g., ITIL, TOGAF.

COBIT 5 divides the governance and management processes of an enterprise IT into the two domains – governance and management:

- The governance domain contains five governance processes EDM131 – EDM5
- The four management domains provide end-to-end coverage of IT:
 - Align, Plan and Organise domain contains twelve processes (APO 1 – APO12)
 - Build, Acquire and Implement domain contains eight processes (BAI1 – BAI8)
 - Deliver, Service and Support domain contains eight processes (DSS1 – DSS8)
 - Monitor, Evaluate and Assess domain contains three processes (MEA1 – MEA3).

In case, that our main problem is to improve the loss events management by the help of improving the relevant IT processes, we are facing the problem which processes from those, covered by Cobit 5 should be on the top of our attention. In this case Cobit 5 offers us basically three different procedures which can help us to choose the most relevant IT processes:

1. goals-based procedure
2. pain points-based procedure

¹³ EDM – Evaluate, Direct and Monitor

3. risk scenarios-based procedure.

3.2 Goals-based procedure

The first procedure is based on detailed mapping of the enterprise goals, IT goals and processes. The document Cobit 5 Enabling Processes, Appendix B (p. 225) presents 17 generic enterprise goals and 17 IT-related goals grouped by BSC dimensions. The table shows mapping of how each enterprise goal is supported by IT-related goals. Consequently Appendix C (p. 227) provides detailed mapping of IT related goals to IT related processes. The mapping in the both of appendixes uses the scale “P” - stands for primary and “S” - stands for secondary relationships.

Figure 2 shows the chosen enterprise goals (3 Manage business risk and 7 Business service continuity and availability) which seems to be the most relevant for our problem of loss event management. Next columns declare how these enterprise risks are mapped to IT goals and processes.

Enterprise goals	IT goals	Cobit 5 processes
3 Manage business risk (safeguarding of assets)	04 Managed IT related business risk	EDM03 Ensure risk optimization APO10 Manage suppliers APO12 Manage risk APO13 Manage security
	10 Security of information, processing infrastructure and applications	EDM03 Ensure risk optimization APO12 Manage risk APO13 Manage security
	16 Competent and motivated business and IT personnel	EDM04 Ensure resource optimization APO01 Manage the IT management framework APO07 Manage human resources
7 Business service continuity and availability	04 Managed IT related business risk	EDM03 Ensure risk optimization APO10 Manage suppliers APO12 Manage risk APO13 Manage security
	10 Security of information, processing infrastructure and applications	EDM03 – Ensure risk optimization APO12 Manage risk APO13 Manage security
	14 Availability of reliable and useful information for decision making	APO09 Manage service agreements APO13 Manage security

Figure 2: Enterprise goals and their cascading to IT goals and Cobit 5 processes

3.3 Pain points-based procedure

Many factors may indicate a need for new or revised GEIT (Governance of Enterprise IT) practices. By using pain points or trigger events as the launching point for GEIT initiatives, the business case for improvement will be related to issues being experienced, which will improve GEIT. Cobit 5 offers in its document Cobit 5 Implementation Appendix A – Mapping pain points to Cobit 5 processes (p. 62) several pain points which are mapped to Cobit 5 processes. The most relevant pain point for our problem is “Significant incidents related to IT-related business risk such as data loss or project failure”. This pain point is mapped to processes EDM03, APO09, APO12, and all the processes in DSS domain.

Pain point	Cobit 5 processes
Significant incidents related to IT-related business risk such as data loss or project failure	EDM03 Ensure risk optimization APO09 Manage service agreements APO12 Manage risk DSS1 Manage operations DSS2 Manage service requests and incidents DSS3 Manage problems DSS4 Manage continuity DSS5 Manage security services DSS6 Manage business process controls

Figure 3: Pain point mapped to Cobit 5 processes

3.4 Risk scenarios-based procedure

Next way how to provide scoping of Cobit 5 processes is based on risk scenarios. One of the challenges for IT risk management is to identify the relevant risks amongst all that can go wrong. A technique to overcome this challenge is the development and use of risk scenarios. Once these scenarios are developed, they are used during the risk analysis, in which the frequency of the scenarios occurring and the business impacts are estimated. In the top-down approach one starts from the overall business objectives and performs an analysis of the most relevant and probable IT risk scenarios that are impacting the business objectives. Document Cobit 5 Implementation Appendix C – Mapping example risk scenarios to Cobit 5 processes contains 36 generic risk scenarios. The most relevant for our problem together with recommended Cobit 5 processes are shown in Figure 4.

Risk scenarios	Cobit 5 processes
Destruction of infrastructure	DSS01 Manage operations DSS05 Manage security services
Environmental	APO03 Incorporation of environmentally friendly principles in enterprise architecture BAI03 Selection of solutions and procurement policies DSS01 Manage operations

Malware	APO01 Manage the IT management framework DSS05 Manage security services
Logical attacks	APO01 Manage the IT management framework BAI03 Selection of solutions and procurement policies DSS05 Manage security services
Infrastructure theft	APO01 Manage the IT management framework APO07 Staff training BAI03 Selection of solutions and procurement policies DSS05 Manage security services
Operational IT errors	APO07 Staff training DSS01 Manage operations DSS06 Manage business process controls
Industrial actions , e.g. strikes	APO07 Staff training BAI08 Managing staff knowledge
Acts of nature	DSS01 Manage operations DSS04 Manage continuity DSS05 Manage security services

Figure 4: Risk scenarios mapped to Cobit 5 processes

4. Conclusion

Three different procedures resulted in the three different sets of Cobit 5 processes that could have potential to improve loss event management within the enterprise management of IT. In the next step we can provide process frequency analysis which can help us to understand the priority of the Cobit 5 processes (see Figure 5). The process with the highest priority is from the management domain DSS05 Manage security services. The process EDM03 Ensure risk optimization is the most important process from the governance domain. Other important processes from management domain are APO12 Manage risk, APO13 Manage security, and DSS01 Manage operations. Surprisingly the process DSS04 Manage continuity does not belong to the most important processes. The analysis results show that Cobit 5 like other best practices or guidelines can provide only a basic orientation to solve the problems that must be corrected and supplemented by the specific environment characteristics and the attained level of knowledge.

After such a process refinement Cobit 5 can help us to implement chosen processes describing the processes from different aspects:

- Process goals and metrics
- RACI chart (includes key management practices and responsibilities of different roles for them)
- Process management practices inputs, outputs and activities.

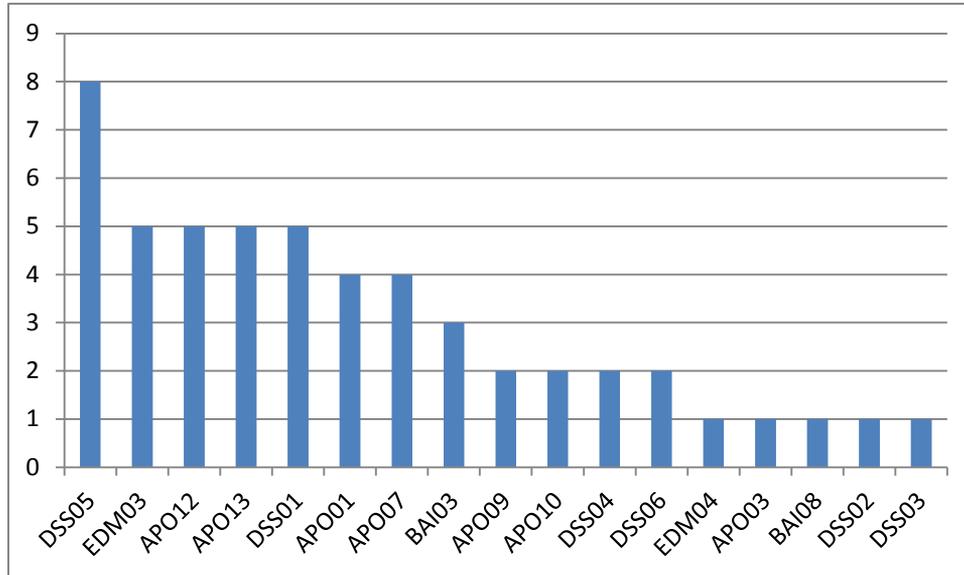


Figure 5: Overall Cobit 5 processes frequency in the scoping procedures

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**RELIANCE ON CYBER-PHYSICAL SYSTEMS:
„SYSTEMS-OF-SYSTEMS“ CHALLENGES**

CYBER-PHYSICAL SYSTEMS (CPS) - WHAT CAN WE LEARN FROM DISASTERS WITH RESPECT TO ASSESSMENT, EVALUATION AND CERTIFICATION/QUALIFICATION OF “SYSTEMS-OF- SYSTEMS”?

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Abstract

Our society and our lives are “embedded” in a set of “systems of systems”, so called “cyber-physical systems”. The increasing complexity and the increasing (inter) dependencies lead to many unforeseen effects (“emergent behaviour”). Since regional disasters are normally not caused by a single event but are becoming disastrous only because of a combination of several causes, mitigation concepts and emergency measures are depending on a far more holistic view with respect to the preceding hazard and risk analysis. Examples from previous years are shortly discussed, including some where emergency measures and mitigation measures were not successful for quite different reasons.

The key message is, that engineers tend to look in most cases on the technical point of view, thus ignoring the “systems-of-systems” view point. The “systems” include not only the technical component or device and its immediate environment and reasonably expectable behaviour, but also all systems around which may have some impact under certain circumstances. Risks originating in inappropriate human actions, non-performance of people, of emergency services and of the responsible companies (manufacturer, operators, service providers etc.), may it be because of negligence or just for short-term profit, can counteract the best safety measures. If we assess the risks of large scale deployment of critical systems to the public in the large we have even to take into account that either required safety measures or proposed mitigation measures are neither sufficiently implemented nor sufficiently managed and maintained.

1. Introduction: Cyber-physical Systems (CPS)

Computers are everywhere – may they be visible or integrated into every day equipment, devices, and environment, outside and inside of us, mobile or fixed, smart, interconnected and communicating. Comfort, health, services, safety and security of people depend more and more on these “cyber-physical systems”. This is not just a new term for “Embedded Systems”, which have already similar properties – “cyber-physical” implies more, it implies the embedded systems’

aggregation and combination on a higher, “systems-of-systems” level. They combine software, sensors and physics, acting independently, co-operative or as “systems-of-systems” composed of interconnected autonomous systems originally independently developed to fulfil dedicated tasks and strongly interacting with humans. The impact on society as a whole is tremendous – positive as well as (potentially) negative.

Thus dependability (safety, security, reliability, adaptability, maintenance, sustainability, resilience) (Avizienis, 2001) in a holistic manner becomes an important issue (Schoitsch, 2008), exacerbated by emergent behaviours and interdependencies. Co-operative, distributed networked systems and resilient systems (adaptive systems maintaining dependability even in changing environments) and their interconnection, integration and interoperation providing completely new functionality add another dimension of complexity (Lee, 2008; Chroust, 2008).

The ubiquitous deployment of such software-based systems requires to take into account the complex interplay of software, hardware, networks, environment and humans actors in different roles, including unexpected and unpredictable, emergent system behavior (especially in case of interlinked “systems of systems”, composed of (legacy) systems originally designed as autonomous systems), and this particularly with its physical world environment (and humans, of course). The design, operation, and protection, but also risk assessment, validation, verification and certification, maintenance and modification through the life cycle of these systems (Schoitsch, 1997) have to take into account unexpected behavior or threats experienced from the real-world environment and the other interconnected systems. The interplay between humans, environment and systems must be considered in a holistic, interdisciplinary view for the distribution of tasks, including mutual overriding mechanisms for automated and human decisions, for performing interventions at system failures, etc. (Parasuraman, 2000). 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.

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. They are not “subsystems” which would have been normally designed as parts of the overall system together with it.

This definitely demonstrates that it cannot be sufficient that a technical subsystem, part or component adheres to (is compliant with) some e.g. functional safety or security standard, or is certified (qualified) according to certain requirements, laws or regulations, because these requirements or rules have in most cases a far too narrow view and imply the so-called “emergent behavior”. Therefore, an increased burden of responsibility is with the experts and authorities who finally have to assess, evaluate and approve the systems which become part of these extended forms of “systems-of-systems”, which would require holistic-thinking systems engineers! The following examples will show how difficult this can be, because we have to manage contradicting requirements and to define acceptable priorities and counter measures – and we have to learn more from incidents before they become disastrous!

2. How risks emerge – simple assumptions and simple examples

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 (nanotechnology, 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 (ARTEMIS SRA, 2011)(EPoSS SRA, 2009). Much effort is put into safety functions, but even more in comfort functions – often contradicting the safety goals under realistic circumstances, particularly if they are hidden and their interdependencies not well understood.

2.1. Hacker disables more than 100 Cars remotely

(see <http://www.wired.com/threatlevel/2010/03/hacker-bricks-cars/>)

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 (see Fig. 1).

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.”



Fig. 1: 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 financiers extend credit to consumers who might otherwise be ineligible for an auto loan.

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. 1). Fortunately, it was not safety critical since it seems to have been a "no-start" condition and not a "stop"-condition, but one could imagine road traffic situations when the impossibility to start a car immediately may be safety critical.

This is a comfort function – not for the citizen, but for the business!

2.2. Armored SUV car does not protect U.S. agents in Mexico drugs war

A hidden (or forgotten) comfort function for hurried commuters or comfortable family vacation trips "kills" U.S. special agent Jaime Zapata and his partner in Mexico (Miroff, ACM SIGSOFT SW Engineering Notes 2012).

When he was killed by drug cartel gunmen in Mexico, Zapata was driving a heavily armored SUV, being able to defeat intense machine gun fire, fragmentation grenades and land mines. His car was forced off the road in a well co-ordinated ambush and rolled to a stop. Then a quiet click – the door locks popped open! The whole protective measures became worthless – because of a comfort function for hurried commuters and families, still implemented and active! A really unwanted "emergent" behavior!

However, this does not only apply to this case: Risk assessment is based on hazards to be considered, and real world environments are not easily predictable, so overrides and work arounds become important, but should not increase risk beyond acceptable levels, and basic settings have to be adapted to the expected use and hazards.

Some examples from the same source (ACM 2012) as contributions to the discussion of this issue:

Take care of initial factory settings: defaults are often insecure, e.g. wireless routers shipped with security switched off, firewalls configured to allow all traffic etc.

Car door lock:

Defaulting locked without manual override can be dangerous in case of fire or loss of power;

Some cars lock in case the motor is running – but beware to leave the car with running motor just to adjust the right rear mirror from outside – the car remains locked, no re-entry!

Elevator defaults in case of alarm:

Down to bottom by balanced gravity – bad in case of water floods

First floor (main lobby) – bad in case of front-door armed building take-over

Top of building – bad in case of fire.

Security doors and fire alarm (own scenario):

Priority is to let people out (doors default open) – in case of false fire alarm, which might be deliberately set by a potential intruder, security breach achieved! (Schoitsch, 2005).

2.3. Car to Car Communication, remote car software maintenance: What risks next?

Car to Car (or V2V – Vehicle-to-Vehicle) Communication is a promising approach to make future road traffic much more efficient, and many (research) projects, prototypes and evolving communication standards are engaged in this direction, with the final goal of truly autonomous driving; the first step would be platooning of “car trains” on high ways, i.e. a bunch of vehicles following a lead vehicle autonomously, controlled by information via V2V communication, and supported by a number of sensors controlling near distance behavior and safety.

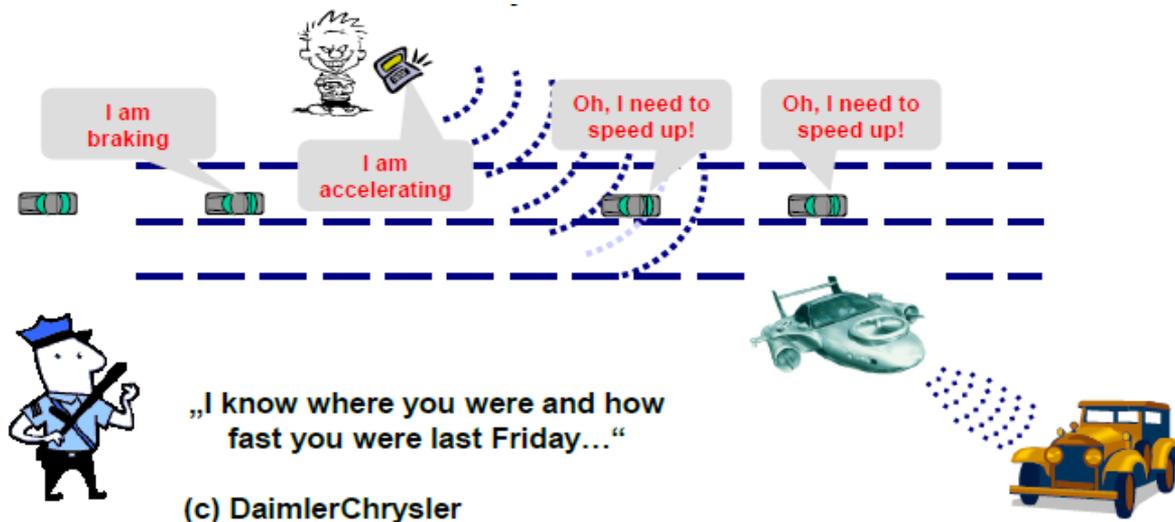


Fig.2: Platooning road traffic: safety, security and privacy issues

This concept implies a number of safety, security and privacy issue (see Fig. 2) – and the liability issue is far from being resolved legally (who is responsible in case of an accident? The first driver? How strong is the individual driver control, how can alertness be guaranteed? There are many scenarios possible for technical and legal implementation). An additional problem is the long-term guarantee of security, keys can be broken, electronics can wear out partially, there must be alternatives in case a car is used ten years or longer, with the same devices inside or not, etc.).

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

One of possible solutions is the “Public Key Management Block Approach”:

- All devices have the same set of public keys
- Each device has an unique subset of corresponding private keys
- If a device is compromised, the leaked private keys are banned by authority, devices use other keys

The following requirements are met by this approach:

- Trust: is provided via verification of the signature with a known and trusted public key
- Anonymity: each key is shared among many vehicles, but it is obviously not perfect
- Resiliency: the system can tolerate a limited number of compromises by revoking the leaked key set(s)
- Efficiency: requirement is met, perhaps with the exception of key revocation

Remote automotive software update in the field:

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!

This idea is driven by the concept of remote maintenance of in-car software (updates, error corrections). It works (sometimes) with space vehicles and satellites – why not in the field for cars? (see Fig. 3).

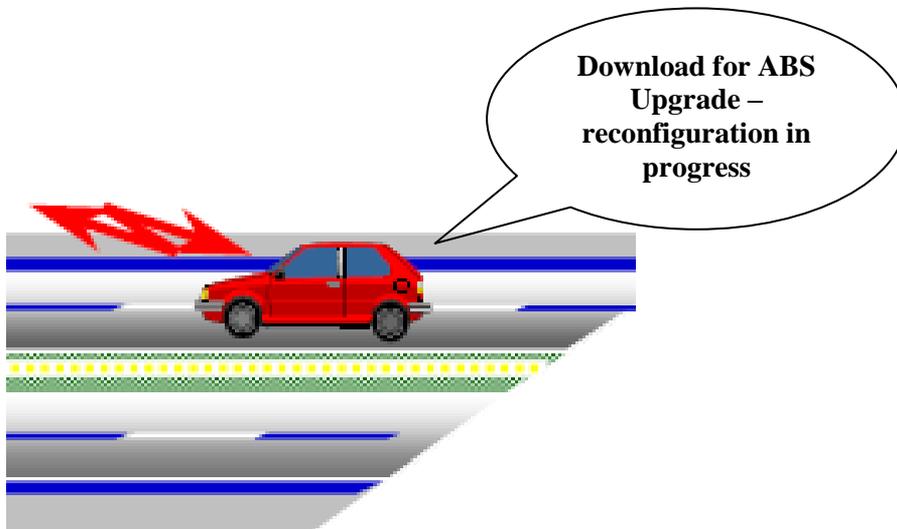


Fig. 3: Software download in the field?

Here again, the hazards and risks need very thorough analysis – it has to be guaranteed that only in safe situations and in a secure manner downloads of proven updates for the actual configuration of software in the individual car are possible, taking into account many complex scenarios – just to download when the car is not moving is for sure not sufficient, since many scenarios can be imagined where cars stop, but have to restart immediately if required by the traffic situation.

At the moment, this is only possible via diagnostic interfaces in a qualified maintenance station, but what made the author feel uneasy was the fact that he has read in an automotive magazine an enthusiastic article written by a journalist just talking about the benefits in an uncritical manner, not even mentioning safety and security issues that should be tackled.

Related massive deployed systems applications of high potential for safety, security and privacy risks:

The same or similar risks will arise in context of

- The grid control approaching private homes: smart grids for efficient power distribution, but our civilisation is very sensitive on loss of power because of almost all services and protective measures depend on appropriate power availability – on the other hand a lot of data on individual behaviour, habits, information on presence and absence etc. become available, endangering privacy,
- highly automated process industry plants, power plants and manufacturing plants, even with remote “control via internet”,
- in building automation and control (heat, cooling, elevators, fire alarm and fire fighting, doors/entrance and rescue), at least with remote maintenance access,
- 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.

3. Disasters: Different reasons, but always a combination of effects

3.1. Dependability as a holistic issue - the humans included

Dependability is a holistic issue – it has to take into account hardware, software, communication, networking, interfaces, environment and humans (behaviour and different mind models, human mistakes, (Parasuraman, 2000)), 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!! (Avizienis, 2001; Tiako, 2009).

Examples are: safer cars imply more aggressive driving behaviour 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 (Schoitsch, 2005; Pfitzmann, 2004). Not only after 9/11 we have 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” (PCSRF, 2003).

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”. With ubiquitous computing, seamless connectivity, massively deployed networked embedded systems, 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 behaviour to the advanced abilities of such systems to prevent loss of live 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, and car navigation devices let people become unable to read maps or to orientate themselves in a foreign environment or even in their known environment if some road works require them to find alternate routes themselves).

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 implied by changes in human behaviour and perception.

3.2. ICE train disaster near Eschede, Germany, June 3, 1998



Fig. 4: Eschede train disaster, June 3, 1998, Germany

In the Eschede train disaster on June 3, 1998, close to the railway station Eschede on the ICE line Hannover – Hamburg, died 101 persons (of 287) (including two workers with a car who were at the bridge when it collapsed because of the derailed train). It was the biggest train disaster in Germany ever, and the biggest one hitting a high-speed train world-wide.

Although this disaster is not linked to software or electronics (embedded systems) it is mentioned here because it demonstrates that the catastrophic result is not only based on derailing a train at 200 km/h because the rim of a wheel was destroyed and a switch changed by it. It became such a catastrophe only because at the point of the incident a road bridge was spanning the tracks having pillars close to the tracks (which is normally not the case at newly built high speed lines), and coach

3 hit one pillar when its rear was thrown out of the track by the changed switch. Because of the high speed, even coach 4 was able to pass the collapsing bridge.

The second fact was the ultimate reason that it was as disastrous as reported. The first part of the train (front engine and three coaches) passed the bridge before it collapsed, 106 persons in this part survived without severe damage, the rear of coach 5 was damaged, coach 6 buried under the bridge. The rest of the train was compressed in zig-zag mode at full speed similar as to running against a wall at the speed of about 170 km/h. On the other hand, the train ICE 787 running the opposite direction has already passed one minute earlier as planned and ICE 884 was one minute late, so the other train passed two minutes before the crash – image what could have happened otherwise ...

Fortunately, the emergency services could approach the location easily and work efficiently.

An additional note: The new road bridge spans the entire track area without pillars...

3.3. The Kaprun cable car disaster, Nov. 11, 2000

The fire in the Kaprun cable car 2 railway killed 155 persons, including 2 persons in the downhill wagon (relative movements of such cable cars are bounded since they are connected by the cable and crossing in the middle of the line where two switches enable a passing by) and three persons in the station on the top end of the line, including the operator in his cabin which was damaged by the extremely fast, poisonous smoke and gas which moved upwards like a storm. Fortunately, most people in the mountain station could escape the building. 162 people were in the coach, 12 could escape by running downhill, the others who tried to run upwards had no chance to escape the smoke and firestorm. It was the biggest disaster in Austria since the Second World War.

According to reports, the fire started by ignition through a (defect) heater not designed for use in vehicles, inflaming the hydraulic oil (18l, high pressure 190 bar) in the rear cabin. The “driver” was in the upper cabin and did not see what happened in time. Again, several causes contributed to the incident to become such a big disaster:

1. There was no connection between the passenger cabins and the driver to inform him about the fire on the downhill side of the coach or to ask for advice
2. The doors were blocked and could not be opened by the passengers, there were no emergency exits
3. The burning plastic material and oil produced poisonous hot gas
4. The tunnel was like a chimney, the gas and smoke reached the other wagon and the mountain station (the persons in the downhill wagon had no chance)
5. There was no emergency training (for the “driver”) or advice not to run upwards (since the fire broke out in the downhill drivers cabin, most people fled in the opposite direction – upwards, only a small group destroyed in an early phase of the fire the windows at the lower end and escaped downwards).

On the other hand, the railway regulator and authorization everything was ok, the burnt down rest of the wagon was still standing at the position where it stopped, the brakes worked. But I’m afraid there was no assessment of accompanying risks besides the railway regulations, particularly for the situation of burning plastic producing poisonous gas (in that case plastic material should not be allowed I would say) and the strong chimney effect. This is an example that the holistic view is missing – there are several approvals necessary, but independently, concerns are too separated.

(pictures from focus online, 8.5.2011)



Fig. 5: Smoke and gas at top station (mountainside)



Figure 1: Burnt down wagon in the tunnel

3.4. Nuclear disasters: Fukushima, March 11, 2011

The most recent nuclear disaster was puzzling the world: even in a high-tech country such disasters can happen, and the information policy and emergency measure are insufficiently managed. Of course, a sea earth quake is not foreseeable, and a Tsunami cannot be controlled by men – but when establishing such a high risk plant as a nuclear power station in an earth quake zone requires much more carefulness than in other regions not so endangered. According to the information that became available over time, the following seems to hold:

The reactor shut down started properly

The Tsunami risk was not taken into account properly: the flood protection covered only 7m, but in Japan 1896 happened a Tsunami of more than 30 m! Was there an insufficient Preliminary Hazard Analysis? “Tsunami” is a Japanese word!

The equipment providing and controlling the cooling supplies was at sea level, insufficient protected, and no redundancy available (in a “diverse” location)

Requirements for sustaining earth quakes and lateral movements of the ground have been increased, but the upgrading seems not to have been implemented for years

Information policy was insufficient, foreign help (e.g. the French offer of robots for work in highly radiated areas) was rejected.

Here again, the holistic view was missing with respect to external systems influences and potential impact from the outside, so, although the technical shut down worked properly, environmental influence, human negligence and may be for cost (profit) reasons new requirements not implemented make standard safety measures obsolete.



Fig. 6: Fukushima from the sea – March 11, 2011



Fig. 7: Fukushima, March 20, 2011

Looking at past nuclear disasters, emergency services and rescue measures failed – but for different reasons:

- Hiroshima/Nagasaki: from the Japanese point of view: emergency services could not be appropriate because the risks were absolutely unknown (and could not be known at this time)
- Tschernobil: risks were known in principle, negligence of operators, and consequences deliberately concealed for a time too long
- Fukushima: Astonishingly even in a well prepared high-tech country and society risks have not been fully assessed in a holistic manner, mitigation measures have not set up properly

4. Conclusions

It has been demonstrated, that big disasters normally do not have just one reason – there are always a combination of events and circumstances which lead from an incident to a disaster. These risks are not automatically mitigated by implementing software-intensive embedded (cyber-physical) systems on top of existing systems – it may even lead to an increase of risk. 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.

Besides technical issues, we have to look in addition at:

- Risks originating in inappropriate human actions/behaviour (it would be naive to ignore these human factors!)
- Risks because of non-performance of people and services
- Risks because of non-performance of responsible organizations and companies (negligence, ignorance, cost reduction vs. social responsibility and society) (it would be naive to ignore these risks)
- Risks because of insufficient hazard and risk analysis, not taking into account the overall system (and „system-of-systems“) aspects beyond the „Equipment under control“ and the „safety system“ (terms from functional safety standards (IEC 61508, 2010; ISO 26262, 2011/12))

Because of our social responsibility for the life and health of millions (billions) of people, we as scientists and engineers well advised not to believe that all technical safety measures as derived from e.g. functional safety standards, directives and law, are implemented in an appropriate manner, nor that defined system boundaries are sufficiently chosen in the analysis. When estimating the risk for the public (population as a whole) we have to consider not only the technical risks and safety measures but also the potential risk of

- stakeholders NOT fulfilling completely the requirements or legal precautions, or
- the possibility of neglected interdependencies, or
- Malicious actions (from outside AND inside)

As a final remark, I want to conclude with Kevin Driscoll’s key note statement at SAFECOMP 2010 in Vienna: “Murphy was an optimist”: “Not only does happen what can happen, even worse: All that cannot happen happens!” (Driscoll, 2010)

This should change considerably the approach to safety of large, complex systems.

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MANAGEMENT AND CONTROL OF USER DEVICES AND SERVERS IN THE CONTEXT OF INFORMATION SECURITY

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Complex System Security, Information Security, Server, Computer

Abstract

Securing systems of user devices and servers requires a complex approach which includes not only the configuration of the device itself but also many other factors. The goal of this paper is to present principles of new guideline aimed at security and management of systems consisting of user devices and servers in the context of information security. In its first part paper analyses existing industry standards and frameworks from the perspective of information security. In the second part the user-devices and servers security framework DEVSEC is briefly described with accent given to security requirements, security measures processes and resources and security of the system as a whole.

1. Introduction

Information security has been in focus in many corporations in recent decade through implementing principles of process management and various control mechanisms into enterprise management frameworks. An increased interest in information security also elevates general requirements on security of interconnected user devices and servers.

A loss of information often represents a significant financial hardship. Experts calculated that the global average cost of a loss of personal data is 142 USD per record (Ponemon Institute, 2010). The cost of a loss of personal data in the USA is even higher estimated at 204 USD. If we look at some prime examples of direct costs associated with data losses, for example the Zurich insurance company has been penalized with a fine of 2,3 mil GBP for loosing their clients' data (Fortado, 2010), and the HSBC bank has been fined with a 3 mil GBP penalty (BBC, 2009). Loosing confidential or other way restricted data can be very expensive.

A loss of information is often caused by a failure of human factor. The reason for loosing data is often the environment which allows this type of failure to happen. Some studies claim that up to 85% of computer fraud and attacks are caused by internal employees (Ernst & Young, 2003). Another study (Cappelli, 2007) presents results of a research in which 59% of internal attacks and computer fraud is caused by former employees.

A loss of information is often caused by data being in places or accessible through venues where they shall not be available. Today's mobile phones and tablets are powerful devices whose capabilities often surpass office desktops. Mobile phones can function as payment terminals, or tablets in doctors' hands can provide access to patients' personal data in hospitals. Smart mobile devices are used at 78% of workplaces, 81% of users of smart mobile devices have access to corporate email from their devices, and 58% users use their devices without any access restrictions (Jech, 2012).

An increased usage of smart mobile devices together with the fact that most cases of loss of information are caused by a failure of human factor combined with the fact that a loss of data can be very expensive would make one think that corporations employ some standards in their security management processes of interconnected devices and servers. To better assess this area, we have conducted a research on the availability of security standards.

This article presents results of a research on security standards and consequentially also introduces a new model for user-devices and servers security audit and management.

2. Problem Definition

When we say "server security" or "device security", their operating system configuration is the first thing that comes up to people's mind. Unfortunately, the configuration of the operating system alone, which can be checked using various automated tools such as a vulnerability scanner or penetration testing tools, is not the only and final factor that makes a device or a server secure or insecure. Security of a device or server can be seen as a mosaic composed of many domains such as encryption, data loss prevention, patch management, disaster recovery, asset management, life cycle management, incident management, authentication, monitoring, a mix of preventive, detective and corrective measures, documentation, and many other areas. Even a corporate culture which determines the relationship between security, costs, and usability can play a role here. Looking at this collection of security factors can be challenging for an auditor or security manager trying to assess or improve security of corporate infrastructure. They need to assess the device or a server among other things also in the context of the interconnected system, corporation, their usage, security requirements and corporate risk profile. Some measures can impact security indirectly.

Expertise in conducting an infrastructure assessment can be acquired by the auditor or security manager either through their long-term work and education, or it might be available through a security standard or some other collection of best practices or expert recommendations. From the initial review, quite a few standards are available in the area of IT security, but it seems that neither of them really provides a complex approach to user-device and server security, especially in respect to current boom in smart phones and other mobile devices and virtualization. For this reason we have researched standards that relate to IT security with the goal of finding a security standard that would be suitable for user-devices and servers' security audit and management.

For the purpose of this research, we have asked the following question: *"Is there a generally accepted standard, guideline, model, or a collection of knowledge that would be suitable for managing and auditing security of user-devices and servers?"*

3. Methods

3.1. Data Collection

Collecting information for this research was conducted throughout the year 2011. Data collection was not geographically restricted; information was obtained from both Czech and foreign literature and other sources.

3.2. Analysis

To assess evaluated standards, we have reviewed them from several perspectives. Reviewing them from various perspectives helped us to better determine their fitness for our purpose. First, we have categorized evaluated standards into a matrix by their scope and by their focus. Second, we have categorized them by their focus on complex server and user-device security. Third, we confronted their adherence to the research question. When learning about standards, we have drawn from standards documentation, and also from other publicly available sources such as articles, press releases, books, guidelines, and also from personal experience.

4. Research on Approaches to IT Security Management and Control

Our research of user-devices and server security know-how was focused on industry standards and frameworks (herefrom called together “standards”) as well as expert literature.

First, we had to define the term “*suitable*” that we used in our research question. Suitable in our view means a standard which satisfies the following conditions:

- Used primarily in the field of IT
- Specialized, focused standard (not a broad, general standard)
- A combination of being both process and technology oriented (processes related to specifically servers and user devices; not only process-oriented, but working also with technology concepts)
- Relating security measures to information security requirements
- Relating security to costs
- Open (the user shall be able to expand the standard based on his environment)
- Simple and short (maximum of 50 pages; comprehensible without years of studying)
- Including the principle of continuous improvement
- Including a maturity model
- Flexible (able to respond to current trends, e.g. virtualization, smart mobile devices)

Having the definition of suitability, we were able to start the research.

COBIT, ITIL, ISO/IEC 20000, and ISO/IEC 27000 are the most commonly known standards in the area of IT management and control (ITGI, 2008). In addition to these major standards, other less known but often more narrowly focused are Val IT, INTOSAI, PRINCE 2, and PM-BOK. Some common standards such as the Sarbanes-Oxley (SOX), Six Sigma, COSO, Balanced Scorecard, CMMI were originally not intended for use in IT management. These standards were originally

intended for management and control of performance, risks, or processes but given that IT is today often tightly interlinked with the core business, even these standards often affect IT management today, even though they are adopted at the general corporate-management level. It is important to remember that IT is affected also by various legal standards, such as the Personal Information Security Act, the Electronic Signature Act, some paragraphs from the Penal Code in the Czech Republic, or for example the Patriot Act or HIPAA in the United States.

There are many standards that affect IT management. The standards differentiate in their scope, i.e. whether the standard is a generic one just providing basic principles, or whether the standard is focused on operational details. Another viewpoint is their object or focus, i.e. whether the standard is implemented at the general business-management level and propagates into IT from top, or whether the standard is primarily intended for IT management. We have analyzed standards using these two points of view and came up with a categorization as depicted in Figure 1.

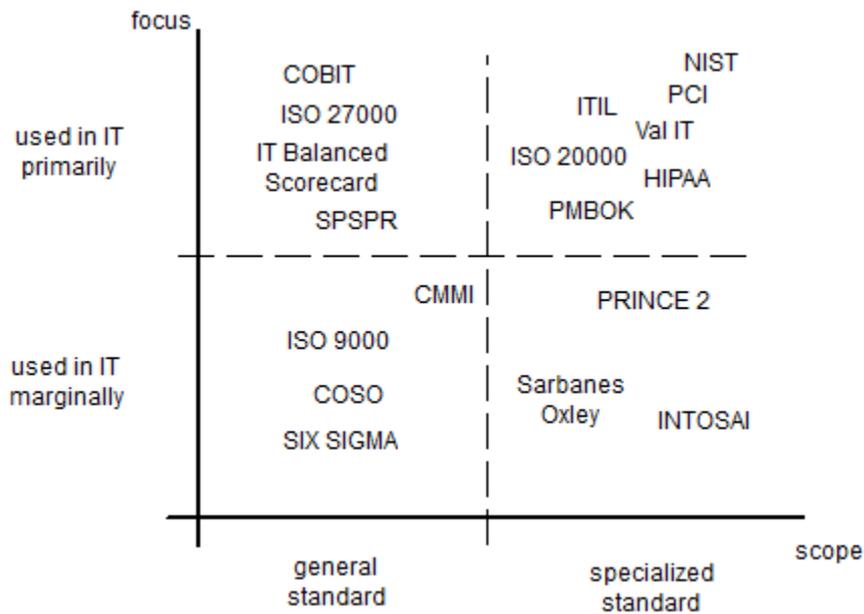


Figure 1. Categorization of standards by their scope and by their focus

Looking at the details of evaluated standards, we have also tried to determine whether they deal with security of servers and user devices in any way, and we came with a chart as depicted in Figure 2 and explained further in the text.

Deals with servers and user devices' security?	IT Balanced Scorecard																	
	IT Balanced Scorecard	CMMI	COBIT	COSO	HIPAA	INTOSAI	ISO 27000	ISO 9000	ISO20000	ITIL	NIST	PCI	PMBOK	PRINCE 2	Sarbanes Oxley	SIX SIGMA	SPSPR	Val IT
YES			x								x	x						
NO	x	x		x	x	x	x	x	x	x			x	x	x	x	x	x

Figure 2. Focus of standards on server and user device security

Starting with the commonly known standards in IT management, the ISO/IES 27000 standard is used in areas where it is necessary to improve security of information, or in other words, to

implement a system for the management of information security. This standard is often used by companies needing to assure to business partners, regulatory bodies, and to other entities that information they store and process is safe and secure. This standard is too broad for our purposes.

Another standard often used in IT is the ITIL. The ITIL standard focuses on services providing and delivery. In case we need to manage delivery of software, project management, client center, help desk, this standard or its ISO counterpart ISO/IEC 20000 would be a good choice. Managing a sophisticated client center (call center) involving processes for incident management or project management is easier with the help of these standards. Even though a client center involves servers and user devices, neither of these standards sufficiently address their security.

Other standards such as the IT Balanced Scorecard, COSO, INTOSAI, SPSR, HIPAA, PMBOOK, and PRINCE are often used in IT, but they focus on different areas than server and user-devices security. They are also too general to be used in this area. Standards such as SEA, GLBA, Basel, SOX and others indirectly require that information security is addressed in the corporate management and controls scheme (for example, the SOX act imposes hefty fines for a breach in information security which negatively affects corporate financial data), but they do not deal with the details of servers and user devices and their processes.

A good candidate for managing security of servers and user devices is the COBIT standard; however, not even COBIT perfectly suits our needs. COBIT is a process-oriented standard which puts together IT processes, resources, and information criteria across various domains. COBIT is today one of the most widespread standards in this area (ITGI, 2008), and its complexity is given by the fact that it, simply said, attempts to manage everything that relates to IT in any way. Topics presented in COBIT range from definitions of internet banking risks, change management controls to for example human resources controls. It is a framework which uses controls as a tool for managing IT. Although COBIT is the primer for many auditors, it cannot be considered a simple guide for this area. COBIT requires many years of experience and also knowledge of COBIT-supplemental documents “IT Assurance Guide“ (ITGI, 2008, b) and „IS Standards, Guidelines and Procedures for Auditing and Control Professionals“ (ISACA, 2009) which is all together some 900 pages of expert reading material – not a guideline for an average business auditor.

PCI and NIST standards are probably closest to our area of interest. The PCI Data Security standard focuses on data security, specifically in the payment cards industry. Although PCI deals with data security through focusing on topics such as network security, access control, security policy and other related areas, it does not deal directly with servers and user-devices security with all their complexities. On the other hand, the NIST General Server Security standard provides in-depth knowledge for securing servers. The drawback of this standard is that it does not put suggested measures in context with information security requirements (some servers need to be more secure than others) and costs, and it also does not employ a maturity model. This standard also does not reflect virtualization concepts and does not address security of user devices.

In addition to industry standards, security of servers and user devices is discussed in literature. We can find a more complex approach to security for example in (Liu, 2001). Authors of this article list a number of security domains but without providing further details. The author in (Lampson, 2004) discusses the concepts of security and focuses mostly on access management. The author in (Carrow, 2007) criticizes the classical approach to security and discusses user devices security requirements in the context of service oriented architecture.

Finally, after browsing through researched standards, we also confronted them against our definition of suitability as set in the beginning of this chapter. This is shown in the Figure 3.

Criteria	IT Balanced Scorecard	CMMI	COBIT	COSO	HIPAA	INTOSAI	ISO 27000	ISO 9000	ISO 20000	ITIL	NIST	PCI	PMBOK	PRINCE 2	Sarbanes Oxley	SIX SIGMA	SPSPR	Val IT
Used primarily in IT	x		x		x		x		x	x	x	x	x				x	x
Specialized					x	x			x	x	x	x	x	x	x			x
A combination of process / technology oriented											x							
Relating security measures to requirements																		
Relating security to costs																		
Open																		
Simple and short											x	x						
Including continuous improvement			x	x			x	x	x	x								
Including a maturity model		x	x							x								
Flexible																		

Figure 3. Adherence of standards to author’s definition of suitability

We can see in Figure 3 that neither of evaluated standards fully satisfies our definition of suitability. Concluding our research, we have not found a suitable standard for user devices and servers security that would meet our definition of suitability. This means that neither standard meets our research question. This lead us to proposing a new model as discussed in the following chapter.

5. User-devices and servers security in DEVSEC

As we already mentioned earlier, management and control of security of servers and user devices shall not focus solely on the operating system configuration, but it shall consider a wider system context. The security of servers and user devices shall include

- technical configurations (measures),
- resources,
- processes,
- information security requirements (security level, risk profile),
- maturity model,
- continuous improvement.

Through our research we came to a conclusion that neither of evaluated standards satisfies our definition of suitability as stated in previous chapter. Seeing a gap in currently available security standards, the author has developed a model focused on *security of servers and user devices* which puts all these dimensions together, as illustrated in Figure 4. We call this model the DEVSEC model (Device Security).

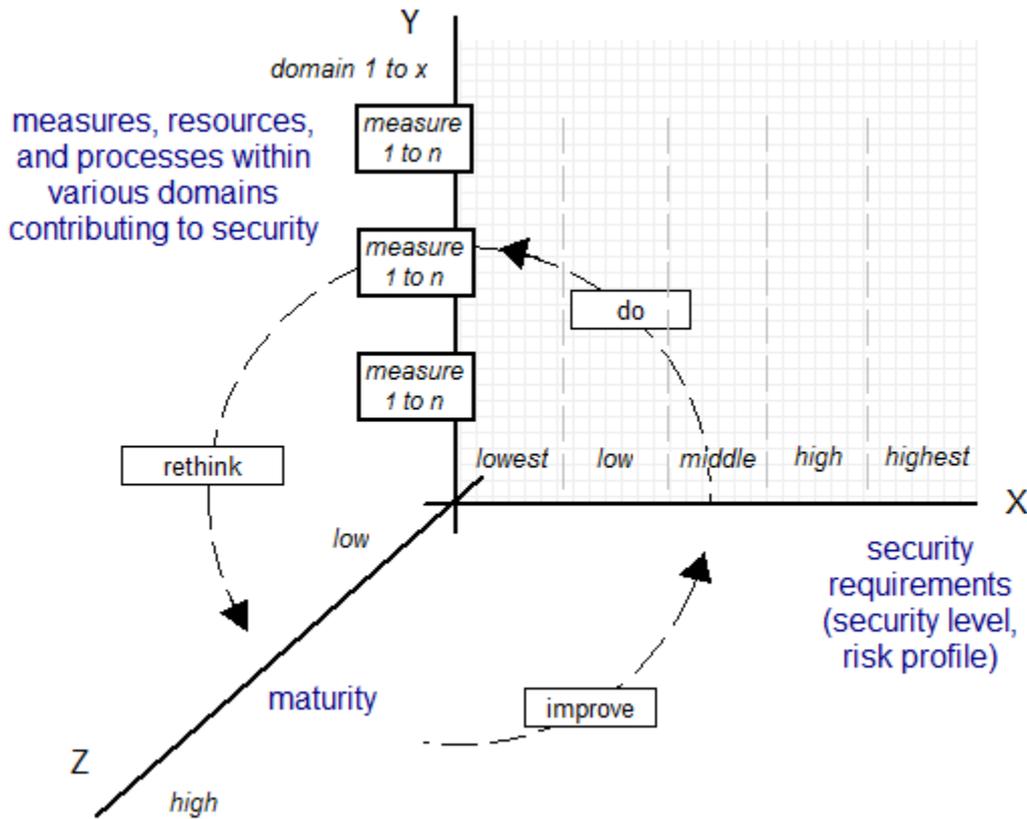


Figure 4. DEVSEC model (server and user devices security)

The model views security as a continuous process in the context of information security from three perspectives. First, on axis X, we set security requirements which are given by the risk profile of a server or user device and determine the desired security level. Second, on axis Y, we implement measures, processes, and resources from given domains which are necessary to achieve desired security level. Third, on axis Z, the combination of various measures, processes, and resources (or their effectiveness) determines the maturity of the whole interconnected system. Completing the cycle brings us back to the beginning where we might want to rethink what we do. The model has been designed to include a perpetual improvement cycle. Following a cycle which goes through security requirements setting, measures implementation, and evaluation shall hopefully lead to a continually maturing information system.

5.1. Axis X: Security requirements

Prior to taking actions to improve security of servers and user devices, it is necessary to establish security requirements which are given by the risk profile of a server or user device in focus. Security requirements differentiate among companies, industries, but even within a single business. For example, financial and health-care industries are known for very stringent security requirements. A waste disposal company will likely have lower security requirements than a local hospital. A laptop used by a financial director is most likely more important for corporate wellbeing than a warehouse desktop computer.

The question is how to set and formulate the security requirement, or how to tell whether a computer needs to be well secured or just minimally secured. This distinction is an important one because implementing and maintaining security measures can be very expensive. There is no need to invest in protection of a server that is not important. Categorization of security requirements is

influenced by numerous factors. The industry (a bank vs. local bakery) or the computer importance for corporate operations (a server running production line vs. market research PC) are examples of these factors. Other factors include the importance of data stored or processed by the computer (business intelligence data vs. cafeteria data), classification of data (personal information vs. public news archive), relationship of data to corporate finance (accounting data vs. press releases), and many other factors. Some factors influencing security requirements are supported by national legal standards, such as personal information protection by the Personal Information Security Act (PIP, 2001), financial and accounting data protection by the Sarbanes-Oxley Act (SOX, 2002), personal information protection by the Gramm-Leach-Bliley Act (GLB, 1999), health information protection by the HIPAA (HIPAA, 1996), or the accounting information protection by the Accounting Act (AA, 1991). It should not go unnoticed that globalization often causes legislative of one country to affect business and entities in another country (Jech, 2005).

When setting security requirements, we can start with basic parameters of information security as defined by the InfoSec Triangle (Singleton, 2007): confidentiality, availability, integrity. These parameters can be further extended. Authors of (Etges, 2006) extend these basic information security parameters by: access, authentication, privacy, accountability, data retention, and the ability to be audited. We can also use the COBIT cube which defines: effectiveness, efficiency, confidentiality, integrity, availability, compliance, and reliability (COBIT, 2002).

As soon as security requirements are set, we can move on to the axis Y.

5.2. Axis Y: Measures, resource, and processes

In order to achieve desired security level and to satisfy given security requirements, we need to implement measures (in case of servers and user devices choose the right technology concepts and solutions and set technical configurations) and manage resources and processes from various domains contributing to security. Data loss prevention, patch management, disaster recovery, asset management, life cycle management, authentication system, monitoring, preventive, detective and corrective measures, incident management, documentation are only a few domains to name. Based on our security requirements, each domain will offer a different combination of technology concepts and their configurations.

We can explain this concept using an example. A PC used by a security guide at the building entrance probably does not need to be secured with hard drive encryption because this PC most likely does not store or process critical or confidential data and this PC is also relatively unimportant from the business-operations perspective. We have assigned a low security profile to this PC, and the low-security profile calls for only basic security measures such as an up-to-date operating system, password protected access, events logging, and this PC being placed in a dedicated virtual LAN. On the other hand, we might want to assign a mid-security profile to operations personnel PCs because they might store and process more important data. The mid-security profile then calls for additional security measures such as a hard drive encryption. Then, if we look at the financial director's laptop, we might want to assign a high-security profile to his device because he can be storing and carrying around with him important documents, business proposals, financial predictions, etc. The high-security profile would call for a full-disk encryption including pre-boot authentication, central device management, and analogically a more stringent mix of measures from other domains such as data loss prevention and asset lifecycle management as well. A computer of a person having an access to health records should be assigned the highest-security profile which would call in addition to previously mentioned measures also for a DLP system at its utmost sophistication. We can see this principle illustrated in Figure 5.

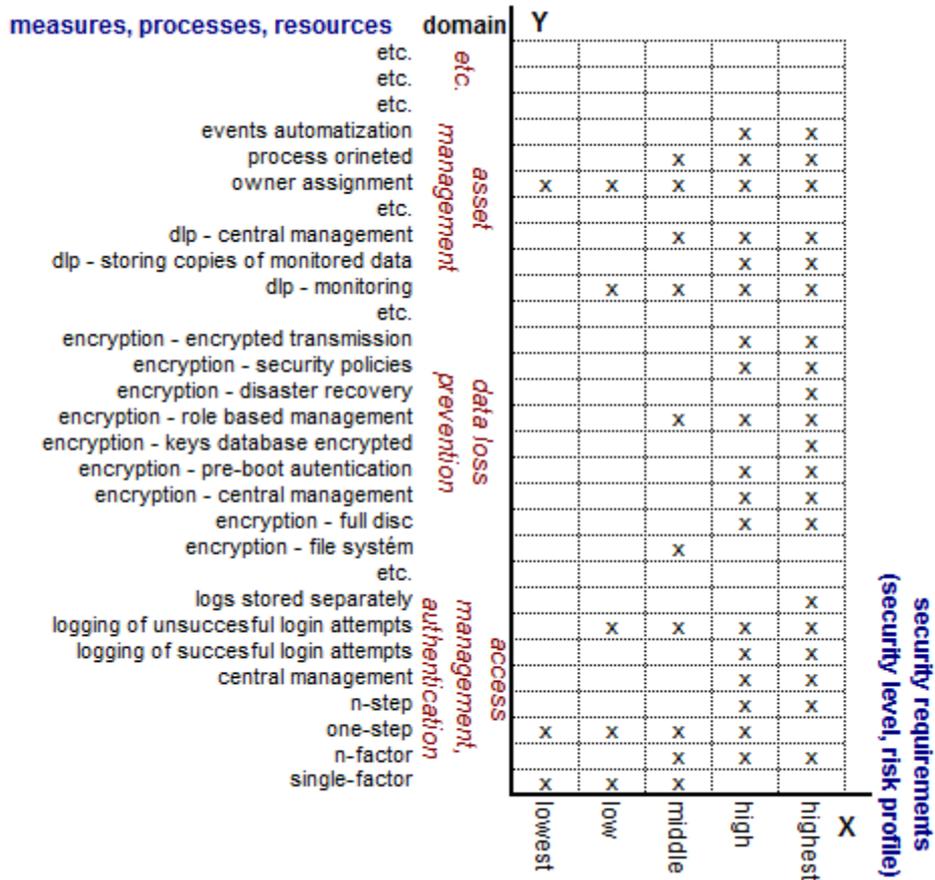


Figure 5. Relationship between security requirements and measures, processes, and resources

Higher security requirements call for a more stringent combination of measures, processes, and resources from various domains which contribute to security. Various security requirements or desired security level set on axis X call for appropriate measures, processes, and resources from given domain on axis Y.

5.3. Axis Z: Maturity

Implementing measures and managing processes and resources from given domains shall lead to an increase in security of the whole system, or in other words, to a more mature system. Enhancements in security of individual servers and user devices contribute to the security of the whole system. Various maturity levels are depicted on axis Z in Figure 4.

It is important to note that our work should not end with a simple implementation of measures. After implementing a measure or improving a process, it is necessary to evaluate its effectiveness which leads us back to the beginning of the cycle. It can take weeks or even months to implement a solution. It can take even longer between the moment when we learn about an incident and the moment when we evaluate effectiveness of our remedies. While a measure is being implemented, it can turn out that the proposed measure cannot be realized or perhaps at a price which surpasses its benefits. Before we get to the moment when we can evaluate the effectiveness of our measure, the situation and the environment can change too. In these cases, it is necessary to return back to the axis X and perhaps rethink our security requirements.

6. Conclusion

The goal of this work, is to develop a guideline which can be used by a regular auditor to successfully complete an audit of interconnected servers and user device systems in the context of information security. This guide can also be used by security managers to better manage security. Proposed model views security of servers and user devices not only as a collection of configuration settings, but it also puts their security in the context of many other measures, processes, and resources from various domains beyond the particular scope of the server or user device. Furthermore, this model implements the user perspective through security requirements and promotes continuous-improvement through a maturity model.

Presented findings are a part of current research project and will be further developed.

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DOES SYNCHRONIZATION ENSURE SIMULTANEITY?

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Keywords

Synchronization, Orchestration, System-Of-Systems, Timekeeping, Simultaneity

Abstract

The need of synchronization in complex systems is discussed. In some cases, this need is confirmed, simultaneity being one of this. Obstacles in synchronization are enlightened, and achievable accuracy is surveyed. Ways to avoid the need of clock synchronization for some tasks are mentioned.

1. Introduction

Management of complex systems depends, among other things, upon a proper timing. When several systems or processes are to be kept in sync, some synchronizing measure is needed. Other time-related aspects of the task are in effect, too – for instance a duration of a sub-process, an age of a resource, a “time-to-live” of an agent... These other aspects are, in fact, pieces of information rendered by a sub-system to a higher level system, informing about sub-system's state. The control of these time-related parameters lies entirely upon the sub-systems; for these the sub-systems need to keep their own chronometers, appropriate for the sub-systems. A question of a comparison between such duration-related pieces of information and question of an aggregation of these will be discussed in section 4.

An orchestration of the sub-systems of the system is another question. We ask if, for orchestration of its composition level, the system of systems needs an “universal” clock. Next section discusses this. Available means of synchronization are surveyed in section 3. Other managerial aims concerning time management are given in section 4.

2. Orchestration of Systems

When sub-systems are to work in sync, one of following may be requisite:

- A) Some actions should be carried out in a prescribed order.
- B) Some delay should not be greater than a prescribed limit. This is a requirement of sort of simultaneity.
- C) Some delay should be greater or equal to a prescribed limit. This is a requirement of “wait till”-type.

In case of fixed, predictable, limited-size system of systems, the task can be handled by Time-triggered protocol (architecture) (Kopetz, 1993, Kopetz, 2002), using circuit channel for periodic messaging between the sub-systems.

Let us discuss the general case. For A), if the should-be-precendent knows the should-be-successor, some passed token can serve for the should-be-successor as an allowance to start. If this is not possible or not appropriate, a controlling element can conduct the actions by waiting for the signal of the end of the should-be-precendent action to permit the start of the should-be-ensuing action. Still another way to manage this requirement is to create a time schedule to which sub-systems should act. This final way of management relies upon sufficiently precise time information of sub-systems' dispose. Either the subsystems have separate clocks, in this case these clocks should be sufficiently synchronized, or the sub-systems listen to time signals from some “universal” clock, in this case supposed transmission delay should be taken into account.

For B), a controlling element can command to start the actions; transmission delay should be taken in account. Another way is, again, to create a time schedule for the sub-systems; for this case, the same as in A) applies.

For C), a controlling element can command to start the actions; another measure is a time schedule for the sub-system, and the same as in A) applies.

3. Clock synchronization

The most accurate chronometers known today are *atomic clocks*. Precision of ground based atomic clock is within 1.4×10^{-15} , and the accuracy is less than a second per twenty million years (AIST, 2003). Combined input of many atomic clocks around the world makes up the International Time Standard, which is the primary international time standard. Atomic clocks are used also in Global Positioning System (GPS) satellites. The time precision in GPS satellites is kept using the correction of Einstein General relativity theory, because time difference between an on the ground clock and GPS satellite clock is 440×10^{-12} seconds (Ashby, 2003). If left uncorrected this would have resulted in timing errors of about 38,000 nanoseconds per day (Weis, 2005). Precision of atomic clock on GPS satellites is within 1×10^{-12} (NASA, 2011). Although it was primarily designed as a navigation system, *GPS is the predominant means of disseminating precise time, time intervals and frequency today* (Dana, 1990). Most GPS receivers lose timing accuracy in the interpretation of signals; typical precision of a receiver is under 10^{-6} second. Some commercially available GPS receivers can reach precision 15×10^{-12} seconds (u-blox, 2012).

Time servers provide for time standard distribution *in computer networks*. While some time servers use atomic clocks, the most common “true time” source for time serves is a GPS receiver. Also

another time server on the network or the Internet can be used as a time reference for a time server, and also a connected radio clock.

Other computers can utilize the service of time servers via *Network Time Protocol* (NTP) using UDP, utilize *Precision Time Protocol* on LANs, or *White Rabbit* Ethernet-based network, for instance. Any computer can adjust its clock by regulating its speed. Using “true time” information issuing from some source, offset of the two clocks, jitter and an observed delay of message transmission, the clock adjustment is calculated.

3.1. Time-triggered protocol (architecture)

Time triggered protocol serves for time synchronization and communication in networks consisting of simple devices (and maybe one or several master systems), when low latency and high dependability is critical. A typical use is in automotive vehicles and aviation. The main difference to the time synchronization dealt in 3.3 and 3.4 is that Time-triggered protocol is intended for limited system of systems, behavior of each is fixed and with no user application running on it. (For instance, ABS sensors in wheels offer no “user application”.) The speed of TTP(A) channel today is 25Mb/s, and communication rate is inversely proportional to the number of nodes in the system.

3.2. Network Time Protocol

Following examples, repeated from (Palovská, 2011), illustrate time precision achievable by NTP; NTP uses Internet routes. The first are two outputs from fis2.vse.cz, a computer in local network of University of Economics, Prague.

The meaning of columns is:

remote – addresses of synchronizing peer (the mark before means: * synchronizing master, + potential master, - out layer, i.e. peer too different from good ones)

refid – synchronizing master of each peer

st – stratum, i.e. how far is peer from exact time (stratum 1 – directly connected to atomic or GPS clock, stratum 2 – synchronizing peer is stratum 1, etc.)

t – technical info about unicast broadcast communication

when – time since last received packet

poll – interval of synchronization packets (value 2^n where n is from 6 to 10) when time server starts, asks peer within short period (each 64 sec), later server reaches more precision of its clock and can ask with longer period (till 1024 sec)

reach – reach of last 8 packets in octal notation (Each reply on request of time is one bit in one byte for each peer. This byte is displayed in octal notation, i.e. 377 means all requests have replies, 376 means last request has not reply, 357 means it was 3 successful requests, 1 unsuccessful and 4 successful)

delay – delay of packets form peer

offset – offset in milliseconds of local and peer clock

jitter – jitter of peer clock

First output:

```

ntpq> pe
      remote                refid          st t when poll reach  delay  offset  jitter
=====
-ca65sb.net.vse. 131.188.3.220    2 u 390 512 377  0.762  -0.599  3.833
*ca65rb.net.vse. 192.93.2.20      2 u 99 512 377  0.716   0.159  1.037
+ipv6jm.vse.cz  195.113.144.204  2 u 346 512 377  0.296   0.152  0.188
-jmnt.vse.cz    91.189.94.4      3 u 95 512 377  0.606  -4.214  0.339
-ns.infonet.cz  145.238.203.10   3 u 163 512 377  2.360   0.862  1.210
+lx.ujf.cas.cz  195.113.144.201  2 u 471 512 377  1.443   0.461  0.362
-ntp.t-mobile.cz 192.53.103.104   2 u 345 512 377  3.167   2.007  0.521

```

A while later:

```

ntpq> pe
      remote                refid          st t when poll reach  delay  offset  jitter
=====
-ca65sb.net.vse. 195.113.144.201  2 u 409 512 377  0.762  -0.599  3.822
+ca65rb.net.vse. 192.93.2.20      2 u 121 512 377  0.716   0.159  1.032
*ipv6jm.vse.cz  195.113.144.204  2 u 362 512 377  0.309   0.130  0.128
-jmnt.vse.cz    91.189.94.4      3 u 99 512 377  0.606  -4.214  0.233
-ns.infonet.cz  145.238.203.10   3 u 181 512 377  2.545  -0.096  1.464
+lx.ujf.cas.cz  195.113.144.201  2 u 486 512 377  1.427  -0.039  0.372
-ntp.t-mobile.cz 192.53.103.104   2 u 356 512 377  3.167   2.007  0.415

```

In this case, the accuracy can be expected about 10^{-4} second. Following two outputs are from a notebook in an home network connected by a ADSL line. First:

```

ntpq> pe
      remote                refid          st t when poll reach  delay  offset  jitter
=====
*odine.cgi.cz   195.113.144.201  2 u 1003 1024 377  14.141  0.058  1.144
-bobek.sh.cvut.c 195.113.144.201  2 u 413 1024 177  42.048 11.834 33.414
+srv1.trusted.cz 195.113.144.201  2 u 602 1024 377  14.797  -1.232 35.018
+relay.qls.cz   147.231.19.43    2 u 987 1024 377  24.733  0.585  3.320
-ntpl.karneval.c 147.231.19.43    2 u 983 1024 373  12.835  -3.195 2.469

```

A while later:

```

      remote                refid          st t when poll reach  delay  offset  jitter
=====
-odine.cgi.cz   195.113.144.201  2 u 879 1024 377  17.587  -3.036 0.716
+bobek.sh.cvut.c 195.113.144.201  2 u 287 1024 377  11.919  -3.662 0.908
*srv1.trusted.cz 195.113.144.201  2 u 480 1024 377  13.608  -3.544 0.599
-relay.qls.cz   147.231.19.43    2 u 863 1024 377  14.643  -6.692 0.046
+ntpl.karneval.c 147.231.19.43    2 u 857 1024 337  13.988  -3.156 0.442

```

In this case, the expected accuracy is above one order worse, i.e. of 10^{-3} second. When load of the computer increases, this becomes even worse.

For a computer connected to the Internet via GSM, application of NTP makes no sense because this protocol is suitable only in a case of a long-lasting connection.

3.3. LAN protocols clock accuracy

Precision Time Protocol achieves clock accuracy in 10^{-6} second range (IEEE, 2010), (Weiss, 2005). White Rabbit aims at being able to synchronize about 1000 nodes with sub- 10^{-9} seconds accuracy over fiber and copper lengths of up to 10 km (Serrano, 2010).

3.4. The future

The time dissemination is constantly developing area. F. Narbonne from LNE-SYRTE, Observatoire de Paris with his team designed system via optical fiber, with a capability of a relative frequency resolution of 10^{-14} at one second integration time and 10^{-17} for one day of measurement. (Dana, 1990).

4. Comparability of durations

Durability is measured by a kind of chronometer. For this a commonly known and accessible type of process can be used as a yardstick, either by comparing the measured process to a state in which the “yardstick” process is, or by counting how many repetitions of the yardstick process passed. One type of the latter one chronometers is clocks. Usually we don't count the clock ticks, rather we subtract the final time from the start time.

Such measurement relies on the sameness of all occurrences or repetitions of the “yardstick” type of process. In case of clocks, it relies on the same rate of the clocks.

As explained the previous section, different clocks generally tick in different rate. So, durations derived from measurement by different clock can be of different accuracy. This is to be taken into account when comparing such data; more so, if aggregations are computed. In the aggregation case the deviation may grow significantly.

5. Control and time management

In spite of ordering's being manageable by causality, simultaneity can be managed only by means of time measurement. As section 3 explained, no absolutely precise clock is available, so estimated error, offsets and deviations must be taken into account.

One another aspect is present in time management of systems, specifically that durations of sub-processes can be cost. Managing this cost comprises evidence of durations, and computation based on it. Surveillance of durations relies upon time measurement and estimation of signal transmissions delays.

6. Conclusion

Some managerial and control needs require synchronization. No absolute synchronization is achievable, so precision and accuracy should be taken in account. From section 3 it follows that accuracy in a range of 10 milliseconds is achievable using NTP protocol when appropriate time servers are chosen as time standard. Such accuracy may possibly be sufficient in systems comprising human-computer interactions excluding concurrency.

Accuracy of one-to-ten microseconds is more difficult to achieve. When we work in a small geographical area, we can use the PTP protocol. On the global scale we need to use system with GPS modules.

Some managerial and control tasks relating time can successfully and safely be arranged by causal ordering.

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TOWARDS WORKING SET BASED APPROXIMATION OF LEAST PRIVILEGE PRINCIPLE FOR OPERATING SYSTEMS

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Abstract

The principle of least privilege is becoming more and more important in access control as it can mitigate the consequences of attacks performed by malicious code or ill intended users. Establishing a strict least privilege access control policy is however very hard to achieve as it requires intensive administrative configuration. In this paper we propose a novel approach based on working sets that consider a user's past access control resource usage for approximating least privilege in an automated manner. We present the results of a first empirical analysis based on a simple variant of the model. The key concepts of an extended model which is currently being formalized and has been influenced by findings from the first data analysis is also provided.

1. Introduction

Contemporary main stream operating systems by default do not very well adhere to the principle of least privilege which states that every application should run with the least set of privileges needed (Saltzer, 1974). They rather employ an ambient authority (Watson, Anderson, Laurie, and Kennaway, 2010) security model in which a process runs in the security context of the user that started it. Consequently by default the entire logon session of a user runs with the same set of privileges, irrespective of the access rights really needed by the individual applications.

The reason for the lack of compliance with this important access control principle is rooted in the fact that true least privilege is hard to achieve. After all the permissions needed by an application are a direct result of the exercised program code. In order to know which privileges are needed for an application one would have to run the program so long as to execute every possible runtime execution path, or alternatively do a complex static analysis of the executable binary code first.

In this paper we propose a novel approach of approximation of least privilege. This method is based on the idea of working sets (Denning, 1968) created from past per user access control usage. The main fundamentals of our model are the assumption that from the large number of available applications and consequently permissions only a small subset is actively needed by the average user. These most recent applications are what make up our (main) working set whereas other

executables are not directly accessible anymore. Our second basis is the learning of typical application access control behavior inferred from runtime analysis of the exercised application permissions. First experimental evaluation conducted on a simple variant of our model make us confident that these ideas are applicable to multi purpose operating systems.

2. Related Work

Besides the mandatory operating system access control frameworks like e.g. TOMOYO Linux (Harada, Horte, & Tanaka, 2004) or Rule Set Based Access Control (RSBAC) (Ott, 2007) that focus on least privilege but require extensive administrative configuration, the only systems the author of this paper is aware of that directly rely on and incorporate the idea of working sets to achieve least privilege are Dynamic Sessions in Role Based Access Control (DSRBAC) and Working Set-Based Access Control for Network File Systems (WSBAC).

DSRBAC was developed by Mühlbacher and the author of this thesis (2009) as an extension to the RBAC model. In this model every role is associated with a time to live (ttl) value. A session is regarded as the working set of roles in which unused roles can expire and be re-added by the user. The choice of which role to expire in an active session is regulated by a well ordering according to a role's permission mightiness. As its name implies DSRBAC is tailored to the RBAC model and its inherent role concept.

WSBAC by Smaldone, Ganapathy, and Ifode (2009) introduces a per user working set for differentiating access to files on a Network File System (NFS) server depending on the location and the device of the user. Requests are treated differently coming either from within a trusted stationary in-house PC or a potentially insecure mobile device. After an administrative adjustable time, e.g. one day, only those files can be accessed from the mobile device that have been used on the workplace PC. The key difference between WSBAC and the model presented herein is the different scope of NFS server versus operating system and the associated difference of the items contained in the working set. Also WSBAC does not consider multiple working sets as well as it does not incorporate or mention a continuous refinement of the working set through a working set trimming function.

3. Basic Idea and First Experimental Evaluation

The goal of our model is to overcome the traditional ambient authority in operating system access control and instead create a positive security model (Ristic & Shezaf, 2008) which by default denies unknown or unusual access requests in contrast to simply allowing them.

Our main concept is a working set which represents the current access control locality on a per user basis. As every user interaction with the operating system (kernel) is realized through processes we regard processes as the basic content for our working set. There are two distinct phases in the system. The first one is an initial learning phase in which the working set of the user is established on a per session basis. After the learning phase a user may instantly only access those applications that have been executed in the learning phase and are currently in his/her working set. If the user runs and application which is not part of the current working set he/she explicitly has to consent its execution, e.g. through a command prompt similar to the Microsoft UAC consent prompt (Russinovich & Solomon, 2009). It is important to emphasize that the working set will continuously be adjusted after the initial learning phase, by executing previously unknown

applications and by a special trimming function for keeping the working set current and removing unneeded applications.

3.1. Considered Data and Particular Research Questions

In order to assess whether the idea of an application working set is appropriate for average operating system usage we conducted a first experimental study with three standard user clients over three months (from July to October of last year). The users are employees of a small trading company working in the positions of executive, salesperson and secretary/accountant. In this evaluation we were particularly interested in how intrusive the positive security model of the working set would be. Of special interest was thus how often applications not being part of the working set would cause a *privilege fault*, meaning need to be acknowledged by the user to be run. The second question was how well the working set could approximate the applications needed by the user on a per session basis.

The common operating system platform of all three clients was Windows XP¹⁴ and the application usage was collected by means of a Windows service using the Windows Management Instrumentation (WMI) collecting every instance creation and instance deletion event of every process. An instance creation event is raised whenever a new process is started (e.g. through double-clicking the executable file in the graphical shell) and an instance deletion event is raised as soon as the process is terminated (e.g. by pressing the close button in the window title bar).

Similar to the concept of domain paths in TOMOYO Linux (Harada et al., 2004), applications are uniquely identified by their parent/child relation and position in the current process tree. E.g. the same process binary for the Firefox web browser would be regarded as an individual item in the working set depending on whether it was called by clicking an icon on the desktop (`/explorer/firefox`) or by opening an HTML attachment in the Thunderbird mail client (`/explorer/thunderbird/firefox`). Every such application path not contained in the current working set would cause a privilege fault.

3.2. Working Set Establishment and Trimming Function

The core of the analysis is a trimming function for establishing the first working set in the initial learning phase and for keeping it as small as needed afterwards. The only predefined input needed by the function shown in figure 1 is the (administrative adjustable) number of learning sessions (`n_learn`). The algorithm is a mixture of Least Recently Used (LRU) and Least Frequently Used (LFU) and is based on a simple scoring system for deciding whether an application should be part of the next session working set or not.

The algorithm is straight forward. Every first seen application is initialized with a value equal to the number of sessions for learning (`n_learn`). If the application was contained in the previous working set and also exercised in the current session, its score gets incremented. If otherwise the application is part of the working set but was not run in the current session its score gets decremented. To account for sporadically used applications a frequency factor is considered for re-faulting applications which means applications that have been part of the working set but have been removed. They are awarded a score which is a multiple of `n_learn` and the number of times they have been removed from the working set.

¹⁴ As far as the “outdated” operating system Windows XP, which was given, is concerned it is worth mentioning that the described concept is not dependent on any particular OS

```

n_learn = Administrative specified number of sessions for learning phase
session_ts = Current session timestamp (auto increment, initially 1)
session_applications = Set of applications executed in current session
all_applications = Set of all applications ever executed
is_learning = (session_ts <= n_learn)

for application in all_applications:
    if (application.new_in_session(session_ts)):
        application.set_score(n_learn)
    elif (application.faulted_in_session(session_ts)):
        application.set_score(application.get_fault_count() * n_learn)
    elif (application in session_applications):
        application.set_score(application.get_score() + 1)
    else:
        /*Application was not in current session */
        application.set_score(application.get_score() - 1)

/*Establish and trim the working set*/
if (not is_learning and application.get_score() <= 0):
    remove_from_ws(application)
else:
    add_to_ws(application)

```

Figure 1: Working Set Establishment and Trimming Function

3.3. Results of the Evaluation

For the analysis of the collected data the learning threshold (n_learn) was set to 5. This seems reasonable given the fact that the work week of the observed users is 5 days, so after these 5 days it can be expected to have seen a user's full week application usage.

Table 1 shows that the average number faults per session are reasonably low with no more than 2 faults per user and session. This means that on the average a user will only be asked for consent once or twice in a session. The average number of applications in the working set is however significantly higher than the average number of applications executed in one session. This ratio is unnecessarily high which lead us to an improvement of the model described in the next section.

	Sessions after learning	Faults after learning	Average faults per session	Average session size (Given as number of applications)	Average working set size (Given as number of applications)
Executive	61	103	1.69	43	66
Accounting	51	88	1.73	40	61
Sales	30	44	1.47	35	50

Table 1: Basic Statistics of Evaluated Data

We present the working set chart of the user accounting/secretary in figure 2 and add that the values of the other users do not differ significantly. The working set provides a good upper limit and approximation of the average user session. The x-axis of the chart displays the observed sessions and the y-axis describes the number of executed applications. After the 5 learning sessions the working set mostly remains stable. Outliers are only found between session 35 and 42 which indicate system update installations with the characteristic phases of running many applications in a session as well as frequent restarts. As described in the next section our extended algorithm is not prone to working set distortion due to system updates. Still the figure shows that the trimming of unneeded applications from the working set works fairly reasonable, which is indicated by the working set line quickly returning to its normal value.

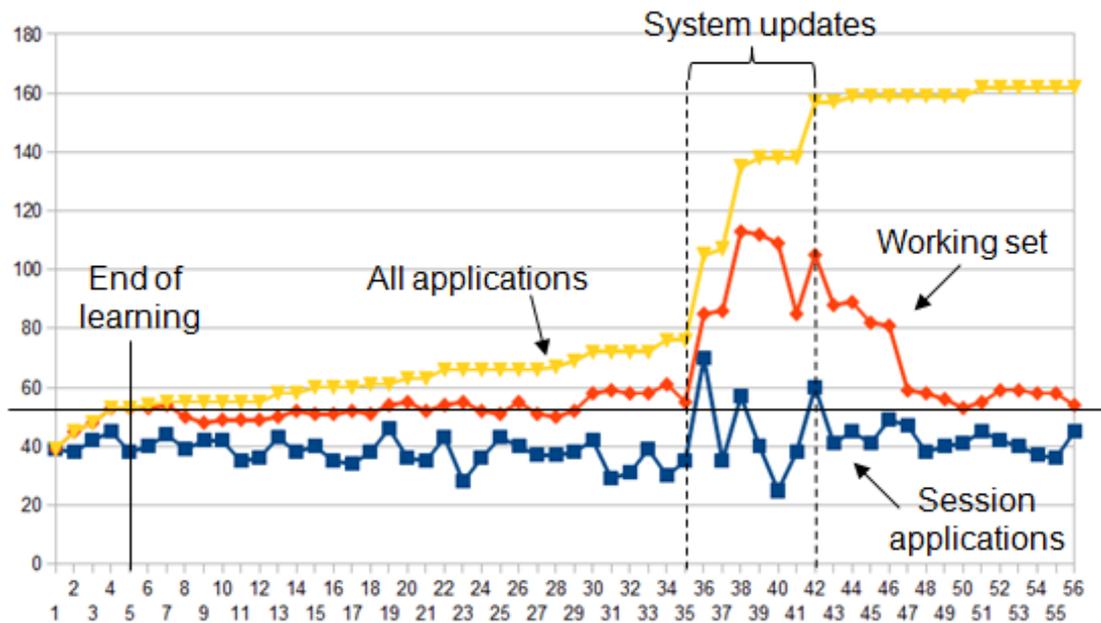


Figure 2: Working Set Charts User Accounting/Secretary

4. Extended Model

Based on the presented empirical analysis we were able to conclude important improvements over the original model which will be presented in this section.

4.1. Key Properties of the Extended Model

4.1.1. Application permission usage

A key aspect of the consolidated model is to know for each application its permission usage. It is proven by mandatory security frameworks like Grsecurity, or TOMOYO that automated policy learning works fairly well and is able to derive accurate per application policies after only a short number of application executions. Our goal is to derive so called *application roles* that resemble the typical program behavior in the current user context, like e.g. loaded libraries, network activity, inter process communication (IPC) or typical file associations. In this way we try to detect not just unknown applications but also unknown application behavior.

4.1.2. Multiple, differentiated working sets

As described in the previous section an important finding of the first empirical analysis is that the average number of applications in the working set is 50 % higher than the mean number of applications executed in a session. Also in the algorithm presented in this paper (see figure 1) every session is started with the current working set as the basis of directly available permissions, which on the average contains 50 % more applications than needed. It could be observed however that the average number of applications executed in one session remains relatively constant. To remedy these deficiencies the final model will provide multiple working sets. Most importantly a *session set* that is empty at the start of a session and only contains the applications executed in the current session. The size of this session set could be calculated automatically as the average number of executed per session applications or be set manually (by an administrator). Extending the size of the session set could also have different consequences ranging from none, over a warning of executing unusually many applications, to a hard boundary which would require the user to close an application first before being allowed to open a new one.

Eventually we imagine the model to have a differentiated and rich set semantic with an active day, week, month and complete user set that allow identifying periodically used applications as well as providing varied challenges, depending on the set a called application currently is contained in.

4.1.3. Calendar function for being independent from actual logon session

Another short coming of the simple model we identified is the dependency on the “physical logon session”. The operating system logon session is not the ideal unit for updating the working set. Logon sessions are often constraint by the operating system, e.g. if a restart is forced because of security relevant updates. Besides from that, users nowadays often use features like hibernation or power save sleep mode which do not end the physical session but possibly keep it open for days or even weeks.

That is why our extended model introduces a *calendar function* for defining the learning unit for updating the user working set. A simple and effective period of considered time is probably one calendar day which much better reflects what a user regards as a unit of work than the physical session created by the operating system.

4.1.4. Only consider user executed applications

In the first analysis all applications started while a user was logged in were considered. Although the computers were strict single user machines the traces included applications that are not directly related to the user actions, like e.g. processes started by services. This is reflected in the peak of session applications shown in figure 2 between session 35 and 42 which results from multiple system updates. However the application/privilege usage of the user did not change within these sessions but the surge of applications was rather due to a user unrelated platform specific maintenance task. E.g. on Windows operating systems getting only user related applications can be achieved by only considering the applications associated with the interactive logon session (Brown, 2000).

4.1.5. Consider session activities

To counter distorted and overly reduced working sets resulting from the application of the calendar function and an abandoned session the model should consider the foreground activity of running applications. This allows switching off the working set trimming if the session obviously is orphaned. So the model will automatically stop refining the working set if e.g. a user starts a long lasting calculation or backup process and leaves the computer for a longer period of time.

4.2. Security Goals

The principle of least privilege is approximated by the model in two ways. Firstly the working set reflects a user's current privilege requirement in the form of application roles. This is clearly beneficial over the standard situation in which all applications are always available independent of whether they are ever needed by the user or not. Secondly the application roles create a clear definition of the normal activities of an application. After a short learning phase the working set model thus creates a view that much more closely reflects the actual access control needs of a user than the standard operating system mechanisms can provide.

Given this situation the first security goal of the working set model is to identify unknown applications in a user session. With the tight observation of the user application activities it should not be so easy for a malicious application anymore to stealthily install and run itself on the computer. As mentioned we believe that asking the user for consent whether to allow running an application is a good starting point. However we also plan to incorporate a sandbox concept into the model that automatically launches new and untrustworthy applications that are not part of the working set in a secure environment. This would bear the advantage of shielding the trusted applications from the new application. Also it should greatly increase performance in contrast to running all applications in the sandbox. As the trustworthiness of the application matures through the building of an application role, it can eventually be released from the sandbox.

The second major security goal we see in the incorporation of the proposed model is that through the application roles an apparent change of application behaviour caused e.g. by malware infection should be immediately visible

5. Conclusions and Future Work

In this paper we have presented a first empirical analysis of a working set based access control mechanism that should automatically aid users in restricting their permissions to the actual resource usage and help overcome the current situation of ambient authority in operating systems. After the

evaluation of first statistical data we are confident that this model is not too obtrusive and that it can help in providing intelligent user sessions that do not contain unneeded permissions.

To formalize the extended model proposed in this paper, we are currently undertaking a more comprehensive study involving multiple users and different types of contemporary operating systems (Windows 7, Vista and XP). In addition to the process creation and termination events we captured in the analysis presented in this paper, more access control related information described in the functioning of the extended model, like e.g. opened file handles (including granted access to files, directories, registry keys, etc.), TCP/IP based network communication, loaded DLLs and some major system calls are collected.

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IMPACT OF ICT ON ECONOMY

IMPACT OF ICT ON NATIONAL ECONOMIES – OPEN ISSUES

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Keywords

ICT, Productivity, Sectoral Analysis, Cobb - Douglas Function

Abstract

Paper describes current needs for the sectoral performance analysis in national economies. In detail it summarizes current approaches applied in the ICT sector. Paper also discusses macroeconomics or econometrics methods which could be applied in this context to strengthen the sectoral performance analysis value.

1. Introduction

Actual turbulent economic environment has been completely changing since 2008, when the financial crisis has been started. Thanks to deep structural changes is also changing the role of each sector in economy. ICT sector, or better said ICT related industries, forced the economic boom in the last years of the past century and in the first decade of 21st century. The crisis since 2008 brought with it strong pressure on effectiveness and efficiency of partial industries as well as the whole economics.

From a macroeconomic point of view, the crisis will impact not only the economy as a whole and its growth but also the importance of individual branches of the economy and their impact on the functioning and competitiveness of economies of individual states. The perception of entire branches of the economy as to usefulness of their development in certain national economies or the economies of a group of countries (Visegrad Four, European Union) will change.

Need for such models has already arisen from different stakeholder domains like national economic or competitiveness councils, ministries of education or investment support agencies. (Wagner, 2011).

2. Subject area overview

Information and communication technologies (ICT) have been used in business and administration processes since the early 1970s when computer mainframes expanded on a mass scale. The boom of personal computers used for both business and private (personal) purposes and in particular the implementation of the Internet in the 1980s accelerated the importance of ICT in everyday life. The continual improvement of the quality of ICT devices and the transfer of regular economic agenda to

these devices was another reason for the rapid implementation of ICT. Empirical analyses of the impact of ICT on the economy and the entire society show that this impact is multidimensional. ICT have an impact on economic growth, productivity, usefulness and efficiency from many different points of view. In this context are important projects from the middle of the 1990s, which examined the impact of ICT on productivity at the macroeconomic level in the economies of EU states and the USA.

This contrasts with a prolonged period before the mid-1990s in which European countries experienced a catch-up with the US productivity levels. In fact, the average rate of productivity growth in European countries even fell after 1995. Van Ark et al. (2008) found that while the US labor productivity growth rate increased from 1.5% before 1995 to 3% after 1995, the productivity growth rate in Europe declined from 2.4 to 1.5%. Information and communication technology (ICT) is often argued to be the key determinant of the US productivity performance, see for example, Jorgenson et al. (2005, 2008). Stiroh (2002) found that sectors using ICT intensively¹⁵ account for the majority of the increase in productivity growth of the US economy. In other words, the US industries have been successful in transforming the new technology into higher productivity. The question is whether the disappointing European growth performance can be attributed to ineffective use of ICT. O'Mahony and van Ark (2003) found that although European ICT producing sectors experienced productivity acceleration similar to that of the US.

ICT-producers, European ICT-using sectors failed to achieve a similar development. However, the fact that ICT-using industries in Europe showed stagnant productivity growth does not in itself preclude a positive differential impact of ICT. It may be the case that ICT-intensive sectors perform better relative to non-ICT-intensive sectors in Europe, even though their average productivity growth rate declined. The general consensus reached in the growth-accounting literature as recently summarized by Draca et al. (2006) and also van Ark et al. (2007) - there has been no acceleration of productivity growth in the EU, mainly due to the performance of the ICT-using sectors. Dahl et al. (2011) also found that European industries (for 7 selected countries), which were relatively ICT-intensive pre-1995, outperformed remaining industries post-1995 in terms labor productivity growth.

The paper Dimelis et al. (2011) also investigates effects of ICT in reducing aggregate inefficiency. They used a translog stochastic production frontier for simultaneously estimation with a technical inefficiency model across a panel of 42 countries in 1993-2001. They provided evidence for a significant impact of ICT in reducing country inefficiencies and also indicated a significantly positive ICT impact on labor productivity, while it seems that a substitute relationship between ICT and non-ICT capital exists.

Rojko et al. (2011) analyze the impact of the recent (2008) economic crisis on ICT spending. The empirical findings are discussed within a broader theoretical framework of technological trends/diffusion and economic cycles. Findings: In general, a crisis always reduces spending and therefore also ICT spending. However, focusing on the recent crisis, it affected the ICT market selectively and also much less than other sectors. In addition, the empirical findings indicate that after decades of fast ICT expanse (1971-2000) we are now in the period of slower sectoral growth, which is in line with theories of super cycles, although, the authors also propose alternative explanations

¹⁵ ICT-intensity is defined as ICT capital service out of total capital service. If this measure of ICT-intensity for a particular industry exceeds the median value over industries in a country, the dummy equals 1, whereas it equals 0 otherwise. The regression analyses are also performed using two alternative measures of ICT intensity, ICT-capital service per worked hour, and ICT capital service in relation to gross output.

Current Czech literature does not mention or apply similar models to the current economic situation of the financial crisis, even though it is often said that the Czech economy is competitive or is getting there. Without a detailed evaluation of the impact of ICT on the Czech economy, any thoughts about increasing investments in ICT are unfounded.

3. Possible approach to the Impact of ICT on economics evaluation

In the IDIMT Conference session we will discuss possible approaches to the Impact of ICT on economics evaluation in detail, so in this paper we outline only the key approaches which could be used for this purpose.

The main issue is to investigate whether ICT have a positive differential impact on productivity growth in the sense that ICT-intensive industries have significantly higher productivity growth rates than non-ICT-intensive industries after 1995 (1995-2007). To properly address this question, it is crucial to distinguish aggregate macro effects from sectoral effects generated by differences in the use of ICT. The fact based evidence on industry data from the EU-KLEMS database could be used for this purpose. It comprises a large set of internationally comparable data on productivity developments at a highly disaggregated sectoral level. The database also contains detailed data on capital investments, including ICT-related capital expenditures. The panel structure of the country and industry data to control for unobserved industry-specific and country-specific fixed effects as well as time effects could be also used. This allows to identify the productivity effects of ICT within industries and, therefore, separately from productivity effects generated by changes in the business structure.

The analysis could be also extended to total factor productivity (TFP) growth in order to distinguish between genuine effects of technological progress due to ICT and capital deepening effects of increasing the amounts of ICT capital used in sectoral production.

The research could also be based on the neoclassic Cobb-Douglas two or three factor (the actual function that we will choose will depend on the suitability of the model for our research) production function, including a Hicks-neutral technical change as a limitless degree of substitution between labor and capital. It is possible to improve the production system by qualified labor and its productivity (labor dependence), by investing ICT and non-ICT capital in the production process and using this capital in production organization and by increasing total factor productivity (TFP). Added value (GVA) is a result of the production process. The basic criteria for evaluating the economic performance of the production system include economic growth (e.g. expressed as GDP growth) as well as a contribution of individual components – labor productivity, capital productivity, total productivity and other. For these factors, the behavior of the Cobb-Douglas production function in time series for the states, whose data we will obtain from relevant databases, will be analyzed. Based on the discovered outputs, we could:

- decide about the suitability and usability of certain modifications of the Cobb- Douglas function;
- estimate individual coefficients of this function; and
- formulate the model of the impact of ICT related industries on the current Czech and European economic situation.

It is also possible to apply econometric methods that control separately for macro effects, sector-specific fixed effects, and the effects from ICT use in selected countries group in Europe. We can estimate panel equations using linear or nonlinear squares with correction for fixed or random

effects in both the cross-section and period dimensions, autoregressive errors, generalized least squares (GLS specifications may be estimated in one-step form, where we estimate coefficients, compute a GLS weighting transformation, and then re-estimate on the weighted data, or on iterative form, where repeat this process until the coefficients and weights converge e.g. SUR method). In addition generalized method of moments (GMM) may be used to estimate most of these specifications with various system-weighting matrices. Specialized forms of GMM will also allow to estimate dynamic panel data specifications.

4. Conclusion

We have discussed selected macroeconomics or econometrics methods which could be applied for assessment of the ICT impact on national economies. This selection was not meant to be exhaustive - as it is still a subject of the research in progress - but rather explanative in a way to facilitate rich discussion in relevant IDIMT 2012 conference session.

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INTERMEDIATE CONSUMPTION OF ICT PRODUCTS AND ITS IMPACT ON ECONOMY OF THE CZECH INDUSTRIES

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Keywords

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Abstract

In this paper we follow our contribution to the IDIMT Conference in 2011, where we presented the system of national accounts as a useful data source for macro-economic and industrial analyses. The aim of the current paper is to show the possibilities of analyses based on the input-output tables, which are one of the two final documents of the system of national accounts. From the input-output tables we get the data on the structure of intermediate consumption in the industries of the Czech economy and compare the share of ICT and non-ICT products which are used as an intermediate consumption in individual industries. Those shares are related to other industrial indicators such as gross value added, labour productivity and total factor productivity. Based on the relations, the influence of ICT usage on the economy of industries is evaluated.

1. Introduction

Many analytical studies and publications are focused on the economic analyses of the impact of ICT on the economy (Doucek, Maryska et al., 2012; OECD, 2003; Avgerou, 2003). Last year, in our contribution to the IDIMT Conference 2011 (Fischer, Vltavska, 2011a) we presented the system of national accounts as a complex macro-economic, statistical and descriptive model of the economy which consists of data on different parts of economy. In the analytical part of our paper we showed the examples of analysis which are based on the national accounts. These analyses examples were focused on the impact of ICT on economy, mainly from the side of sources (share of ICT goods and services on total production or value added, differences in labour productivity between ICT and non-ICT industries, comparison of the shares of value added on total output between ICT and non-ICT industries, comparison of compensations of employees between ICT and non-ICT industries etc.).

In this paper, we focus on the uses side (not production of ICT, but usage of ICT). The main questions are:

1. Which industries mainly use the ICT goods and services as an intermediate consumption?

2. Does usage of ICT goods and services influence the economy of industries?

2. Data and Methodology

As a main data source for our analysis, we use the database of the system of national accounts. There are two main views on the economy within the system of national accounts. Firstly, we can consider production as a source of income, which is used for distribution, redistribution, consumption and investments. In this way, we ask “who produces” and analyse producers. Secondly, we consider production as a source of the value of goods and services. All goods and services are either produced in the economy or imported from abroad. We can also see the uses of a produced item: it can be consumed, invested, stocked or exported. Products are defined by the international standard statistical classification of products (Classification of Products by Activities, CPA) and its local Czech version CZ-CPA. We focused on the usage of products in individual industries, constructed by the international standard classification of activities (Nomenclature statistique des activités économiques dans la Communauté européenne, NACE) and the Czech version CZ-NACE.

Sources and uses of products are presented in so-called Input-Output tables (hereafter: IOT). IOT (Eurostat 2008) are divided into 4 parts:

1. Table of supply. It shows in which industries (by NACE) are the products (by CPA) produced and which products are imported from abroad.
2. Table of intermediate consumption. It shows in which industries (by NACE) are the products (by CPA) consumed as an intermediate consumption.
3. Table of final use. It shows how the products (by CPA) are used as a final use (final consumption of households, governments and non-profit institutions serving households, capital formation including changes in inventories, export).
4. Table of value added. This table shows the structure of value added in industries (by NACE): how the value added is distributed into compensation of employees, taxes on production, gross operational surplus and mixed income.

For our analysis, the table of intermediate consumption is the most valuable. We will compute the share of ICT products (by CPA) on total intermediate consumption of individual industries (by NACE) or on total output of individual industries alternatively.

As ICT products we consider products produced in ICT-related industries (divided at a level of NACE2), which means products CZ-CPA 26, 61, 62, 63 and 95.

As the second data source we use the data from the producers' side of national accounts, mainly from the income account of individual industries. At the income account, one can find the data on value added, compensation of employees, taxes on production paid, gross operating surplus and mixed income. From the additional sources included to the system of national accounts we can obtain the data on number of employed persons and on hours worked and data on the capital stocks divided into industries by NACE.

From all those data sources, we can construct indicators of labour productivity and total factor productivity for individual industries (by NACE, at a level of NACE2).

As a main part of our paper, we compare for individual industries (by NACE2) relation between share of ICT products on (a) total intermediate consumption of individual industries or on (b) total

output of individual industries on one hand and (i) labour productivity, (ii) total factor productivity and (iii) changes in value added at constant prices on the other hand.

3. Results

From the table of intermediate consumption (2010, current prices) we compute shares of ICT products (NACE 26+61+62+63+95) intermediate consumption on total intermediate consumption. In table 1 one can see 10 industries with the highest share and in table 2 five industries with the lowest one.

NACE2	Share of ICT on intermediate consumption
26 Manufacture of computer, electronic and optical products	88.38
63 Information service activities	81.97
61 Telecommunications	79.63
62 Computer programming, consultancy and related activities	64.39
95 Repair of computers and personal and household goods	55.05
64 Financial service activities, except insurance and pension funding	31.76
30 Manufacture of other transport equipment	27.35
27 Manufacture of electrical equipment	18.98
92 Gambling and betting activities	15.20
85 Education	14.21

Table 1 Industries with the highest share of ICT products on intermediate consumption (2010, current prices, %); Source: Computation of authors using CZSO (2012)

One can see that the highest share of ICT products on total intermediate consumption is measured at ICT industries (26, 63, 61, 62, 95). It is rational, because from the whole table of intermediate consumption it is obvious that the highest share on intermediate consumption is measured for the same products. Simply speaking, products of wood are consumed in manufacturing of wood, and ICT products and services are consumed in ICT industry as well.

From this point of view, the ranking for 6th to 10th places is more interesting. Among non-ICT industries, the highest share of ICT is captured for financial service activities (almost 32 %), followed by manufacture of other transport equipment (more than 27 %).

On the other hand, one can see very low importance of ICT at fishing and aquaculture, mining support service activities and three selected parts of manufacturing (see table 2).

NACE2	Share of ICT on intermediate consumption
03 Fishing and aquaculture	0.46
09 Mining support service activities	0.23
24 Manufacture of basic metals	0.15
15 Manufacture of leather and related products	0.04
19 Manufacture of coke and refined petroleum products	0.03

Table 2 Industries with the lowest share of ICT products on intermediate consumption (2010, current prices, %); Source: Computation of authors using CZSO (2012)

Similarly, we can compute share of ICT products intermediate consumption on total output of individual industries, but the result (order of 10 best and 5 worst) is almost the same.

NACE2	Labour productivity
12 Manufacture of tobacco products	2 933
35 Electricity, gas, steam and air conditioning supply	2 902
06 Extraction of crude petroleum and natural gas	2 159
61 Telecommunications	1 715
64 Financial service activities, except insurance and pension funding	1 399
68 Real estate activities	1 189
51 Air transport	1 092
60 Programming and broadcasting activities	1 070
37 Sewerage	866
39 Remediation activities and other waste management services	830

Table 3 Industries with the highest labour productivity (2010, current prices, gross value added per hours worked in CZK); Source: Computation of authors using CZSO (2012)

From another point of view, we can compute the labour productivity (as a ratio of gross value added at current prices to the number of hours worked) of individual industries (see table 3).

Between 10 industries with the highest labour productivity we can find also the ICT one (NACE 61 Telecommunications).

NACE2	Labour productivity
03 Fishing and aquaculture	177
14 Manufacture of wearing apparel	160
80 Security and investigation activities	159
56 Food and beverage service activities	157
01 Crop and animal production, hunting and related service activities	153

Table 4 Industries with the lowest labour productivity (2010, current prices, gross value added per hours worked in CZK); Source: Computation of authors using CZSO (2012)

While some results in table 3 will need deeper analysis (e. g. very high labour productivity in tobacco manufacturing), the results in table 4 do not. Two of the five worst industries are agricultural industries where the very low level of gross value added (GVA) is reached (both in comparison to the total GVA of the economy and to the number of employees). At NACE 80 (security and investigation activities) there is a very high level of competition which leads to the low level of value added and average wages. Finally, at NACE 56 there is a very high share of shadow economy. Despite the revision of national accounts in 2011, we are convinced that data on value added in this industry is under-estimated.

From the point of view of development, we can estimate labour productivity and total factor productivity¹⁶ for the ICT manufacturing and ICT services (see tables 5 and 6).

	2006	2007	2008	2009	2010
ICT manufacturing	-8.71	-11.30	-24.79	-18.68	94.33
ICT services	7.63	6.18	0.77	-3.62	-1.53

Table 5 Calculation of total factor productivity index in the ICT sector, using total employment and net fixed assets as inputs, 2006 - 2010, %; Source: Computation of authors using CZSO (2012)

	2006/2005	2007/2006	2008/2007	2009/2008	2010/2009
ICT manufacturing	-8.00	-8.57	-20.82	-16.73	108.83
ICT services	2.73	2.44	-5.14	-8.06	-0.20

Table 6 Calculation of labour productivity in the ICT sector, annual growth, 2005 - 2010, %; Source: Computation of authors using CZSO (2012)

It is necessary to note that the numbers for ICT manufacturing are strongly influenced by a very high share of intermediate consumption to the total output (more than 95 %). It causes that the amount of value added is very small so year-on-year data are influenced by those small numbers. On the other hand, deeper analysis of the development of ICT manufacturing and ICT services is necessary.

¹⁶ For the productivity analysis we used the index number approach. Econometric approach is broadly described in Černý (2011).

The second part of this paper is devoted to the correlation analysis (this approach is described in Fischer, Vltavska, 2011b) using the multiple correlation coefficient and multiple regression. We want to find out if there is the correlation between the share of ICT products on intermediate consumption, labour productivity and the development of GVA and the correlation between the share of ICT products on the output, labour productivity and the development of GVA. We choose only non ICT industries with the highest share of ICT products on intermediate consumption from the table 1 (NACE2: 64, 30, 27, 92, 85).

Firstly, we discussed the correlation between the variables in the period between the years 2005 and 2009¹⁷. We found out that there is strong positive correlation between the development of GVA and labour productivity among the industries in question. The value of correlation coefficient is 0.87 %. On the other hand there is positive correlation between the share of ICT products on intermediate consumption and GVA (0.66 %) and weak positive correlation between the share ICT products on intermediate consumption and labour productivity (0.34 %).

In case on one year analysis we found out only the correlation between labour productivity and the share of ICT products on intermediate consumption (0.65 %) but all the variables are statistically insignificant.

From the point of view of the share of ICT products on the output there is strong positive correlation between the development of GVA and labour productivity in the period between 2005 and 2009 (0.87 %) however all the variables are statistically insignificant.

4. Conclusion

This paper was devoted to the analysis of the usage of the ICT products among the Czech industries. We presented the Input-Output tables as the useful data source for the analysis. We showed how the IOT can be used for the analysis of the share of ICT products on the intermediate consumption, analysis of the share of ICT products of the total output and for the productivity analysis.

There are many ways how to analyze the ICT sector. We would like to estimate the experimental model for productivity analysis using not only labour and capital as the input but the value of ICT material, non-ICT material, ICT services and non-ICT services as well. However, this will be part of further studies.

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¹⁷ All the variables are statistically significant on the 10% level of significance.

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THE IMPACT OF ICT CAPITAL ON LABOR PRODUCTIVITY DEVELOPMENT IN THE SECTORS OF THE CZECH ECONOMY

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Keywords

Labor Productivity, ICT Producing Sector, ICT Capital, Czech Economy, Panel Least Squares Method

Abstract

The purpose of this paper is to explore of labor productivity growth in ICT and non ICT sectors in the Czech Republic. Labor productivity is observed in the 31 sectors during years 1995-2007. The article also addresses the differential impact of the use of ICT capital intensity on labor productivity growth in sectors of the Czech economy. The proposed model is estimated using panel generalized least squares method with pool dummies and period specific effects. The obtained results provide evidence that ICT producers have higher level of labor productivity growth and with increasing level of this indicator in previous year growth of labor productivity decreases. We did not find that sectors with higher share of ICT capital compensation as share in total capital compensation account for the majority of increase in productivity growth of the Czech economy during 1995 – 2007.

1. Introduction - ICT and Economics

The contemporary turbulent economic environment (Sae, 2004) places elevated emphasis on Information and Communication technology (ICT) as a main economic driver in all fields in last twenty years. Massive investments into ICT have started a large economic growth and help to weak impacts of financial crisis. On the other hand some of ICT related activities did not reach an expected success – for example the dot com boom in 90s and its intensive reduction on begin of the 21st century. There could be found different opinions how to influence nominate and real economic

growth improving ICT into praxis and how to measure their contributions to it in the world literature (Banker, 1988), (Delina and Tkac, 2010). Several aspects of the situation ICT impact on main economic indicators are analyzed, presented and discussed for example in Ministr (2010), (Fischer, Vltavská, 2010), (Maryska., & Novotny, et al. 2012), (Pavlicek et al, 2011), (Oskrdal et al., 2011)). ICT dispose by specific properties very similar to utilities (Carr, 2004). Very important fact is that ICT influence economy and its growth on two levels – on the level of direct production (ICT Producing Industries) and on the level of indirect impacts (ICT Using Industries). These effects in two levels accumulate into common contribution of the ICT to general economic growth (Maryska, 2008). Essential factors of building up of economic growth are presented on Figure 1.

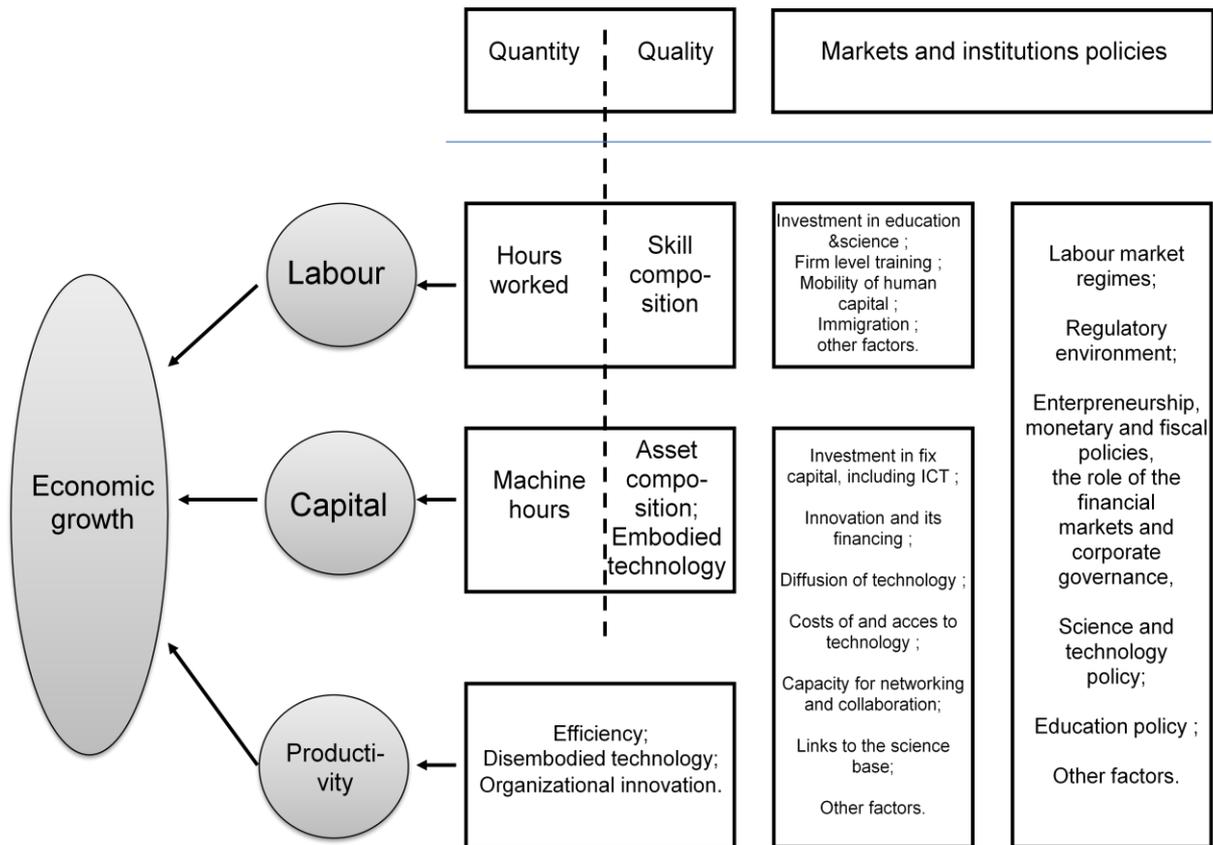


Figure 1: Analytical Framework for ICT Contribution Measurement to Economics Growth (Quiang, 2003)

More detail view on ICT influence on economic growth is presented on following Figure 2. Very important fact is that ICT influence economy and its growth on two levels – on the level of direct production (ICT Producing Industries) and on the level of **indirect impacts** (ICT Using Industries). These two levels effect accumulate into common contribution of the ICT to general economic growth. Ways how it is realized in practice are shown on the Figure 2.

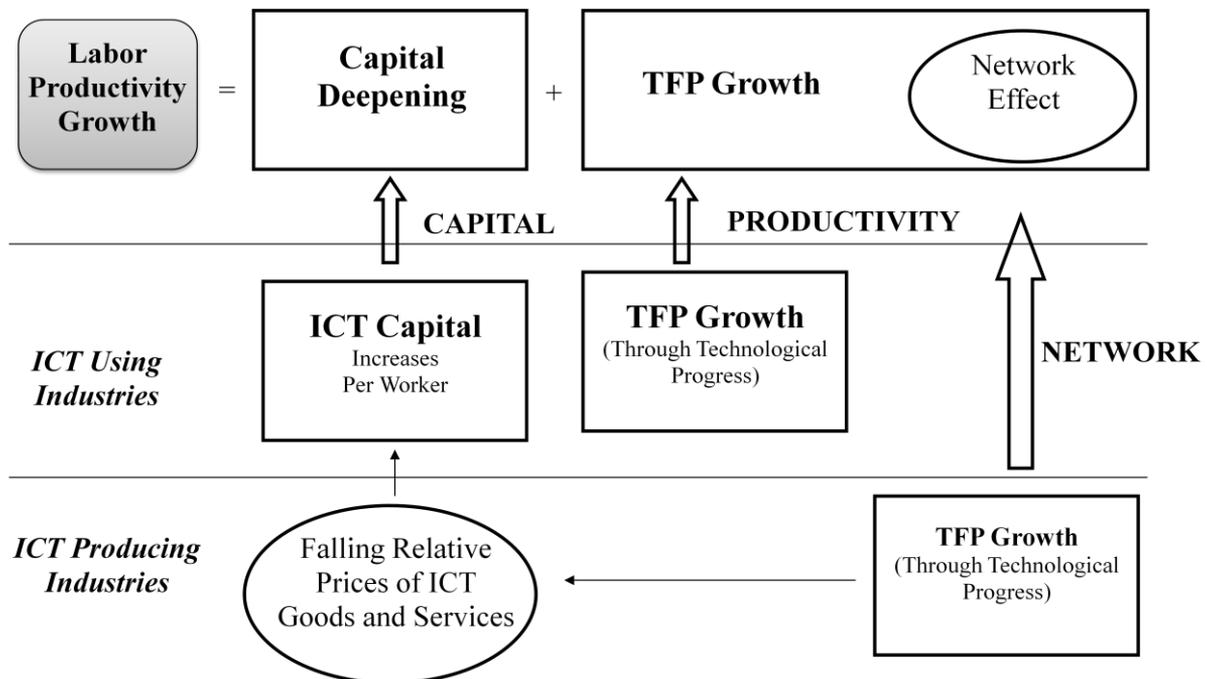


Figure 2: Processes of ICT Influence on Economics Growth (Quiang, 2003)

Process “CAPITAL - Influence of ICT Capital on Capital Deepening” – this process may lead to an increase in the real capital stock per worker, ICT related capital deepening across the economy implying a lowering of the marginal cost of capital. In practice does it represent that this process **brings new products and permanent falling prices of them.**

Process “PRODUCTIVITY - Influence of TFP in ICT Using Industries” – this is long term process and it represents innovations (structural changes in economy or in a part of economy (see Hančlová, 2012 and Nevima, Melecký 2011)) in core business through ICT improvement into practice (Basl, Simkova, 2008)). It could represent new goods and services presented on market or new channels for their distribution using ICT infrastructure (for example e-market places, e-shops, improvement of new inventions in hardware – disk fields, smart phones, tablets etc.).

Process ”NETWORK – Increase of productivity thanks to networking” – is representing the way of increasing of the economic growth by growing of direct in ICT producing and related industries. This way is typical represented by developing of new ICT products – innovation process in ICT products and services.

The literature in the possible impact of ICT on productivity growth took off from the so-called Solow paradox that although enormous technological progress in ICT production had been realized and gone along strong investment in ICT, hardly any effect on economic growth could be observed. Sudzina and Kmec (2006) point out that there exist also many papers on the topic that are not based on any quantitative analysis and do not contain any empirical data. The US studies find that productivity growth has accelerated after 1995 and it is linked to ICT and the Solow paradox is no longer applies. The growth-accounting method decomposes labor productivity into growth in labor input growth contributions by capital deepening and growth in total factor productivity. In order to assess the direct effects of ICT on growth it is needed to measure the contribution from the use of ICT capital and also the contribution from technological progress in production of ICT capital and decompose economy into ICT producing industries and ICT using industries. (Kuncova, Doucek 2011).

2. European productivity development

Since the mid-1990s, a puzzle has appeared in the development of productivity at the macroeconomic level across countries: the US economy experienced an increase in productivity growth that has not been reflected in the productivity developments of European countries. The average rate of productivity growth in European countries even fell after 1995. van Ark et al. (2007) found that while the US labor productivity growth rate increased from 1.5% before 1995 to 3% after 1995, the productivity growth rate in Europe declined from 2.4 to 1.5%.

Information and communication technology is often argued to be the key determinant of the US productivity performance. Stiroh (2002) found that sectors using ICT intensively account for the majority of the increase in productivity growth of the US economy. In other words, the US industries have been successful in transforming the new technology into higher productivity. The question is whether the disappointing European growth performance can be attributed to ineffective use of ICT.

Based on a growth-accounting framework, O'Mahony and van Ark (2003) found that although European ICT producing sectors experienced productivity acceleration similar to that of the US ICT producers, European ICT using industries failed to achieve a similar development. Our main hypothesis is based on modelling whether ICT had a positive differential impact on productivity growth in the sense that ICT intensive industries had significantly higher productivity growth rates than non ICT intensive industries after 1995 for the Czech economy.

3. Econometric model

In this section, the econometric panel model is described. This basic model for labor productivity was built by Stiroh (2002) and also used by Dahl et al. (2010). Our applied econometric model is a modified version of the model used by Stiroh and Dahl. The panel regression model can be specified as the growth rate of labor productivity, $GLP_{it} = \Delta \ln LP_{it} = \Delta \ln(Y_{it} / E_{it})$ measured in percentage levels, where:

Y_{it} is real gross output for $i=1, 2, \dots, M$ cross-sectional (sectors) units observed for dated periods $t=1, 2, \dots, T$ (ie. years 1997-2007),

E_{it} denotes the total hours worked by persons engaged in sector i and time t .

We introduce two dummy variables $Dintensity_{it}$ and $Dsector_{it}$. The dummy variable $Dintensity_{it}$ measures ICT-intensity in sector i in time t . We adopted this dummy variable definition from paper Dahl (2010) ICT capital service out of total capital service. If this measure of ICT intensity for particular sector exceeds the median value over sectors in a Czech economy, the dummy equals 1 and otherwise is equals 0. This definition provides robustness to outliers.

In order to investigate whether ICT producing industries are driving the results, we follow and modified definition by van Ark et al. (2007). The second dummy variable $Dsector_{it}$ distinguishes between ICT producing industries (i.e. $Dsector_{it}=1$) and non ICT producing industries (i.e. $Dsector_{it}=0$). We define ICT producers as:

- the ICT producing manufacturing industries D30-D33 (office, accounting and computing machinery; electrical machinery and apparatus; radio, television and communication equipment; medical, precision and optical instruments),

- the ICT producing service industries I64 (post and telecommunications) and K72 (computer and related activities),
- the ICT producing trade industries G51 (wholesale trade and commission trade).

We can specify our panel regression model:

$$GLP_{it} = \alpha_1 + \alpha_2 \cdot Dintensity_{it} + \alpha_3 \cdot Dsector_{it} + \beta_1 \cdot GLP_{it-1} + \beta_2 \cdot (Dintensity_{it-1} \cdot GLP_{it-1}) + \beta_3 \cdot (Dsector_{it-1} \cdot GLP_{it-1}) + \delta_i + \gamma_t + \varepsilon_{it}, \quad (1)$$

where GLP_{it-1} is lagged growth labor productivity, ε_{it} is an error term. We can produce estimates for two way fixed effects specification – cross-section δ_i and period effects γ_t . The first group of parameters α_1 and β_1 represents intercept and slope for non ICT intensive and non ICT producing industries. The coefficients α_2 and β_2 explain the differential intercept and slope for ICT intensive sectors as compared with first group. The parameters α_3 and β_3 denotes the differential intercept and slope for ICT producing industries as compared with first group.

For consistent estimation of our panel data model was employed the panel generalized least squares method (PGLSM) with two-way fixed effects (see Hanclova and Doucek, 2011).

4. Data analysis

In this section, the authors provide data analysis and econometric results. The applied data source is the EUKLEMS database¹⁸. This database includes data on gross output at current basic prices in millions of Euros (GO), gross output price indices with 1995 = 100 (GOP_P), total hours worked by persons engaged in millions (H_EMP), ICT capital compensation as share in total capital compensation ($CAPIT$). The database includes data for the period 1995-2007. In the following, we describe key aspects of the data set relevant for the empirical analysis.

We apply labor productivity measure for sector i in time t as the yearly logarithmic growth rate of real gross output divided by labor input:

$$LP_{it} = \frac{100 \cdot GO_{it}}{GOP_P_{it} \cdot H_EMP_{it}} \quad (2)$$

where $i=1, 2, \dots, 31$ and $t=1995, 1996, \dots, 2007$. Growth labor productivity ($GLP_{it} = \ln LP_{it} - \ln LP_{it-1}$) is measured for 31 sectors in the EUKLEMS database. Table 1 includes list of those industries. This table 1 also shows the classification in to the ICT producers (gray shading rows)) and non ICT producers. ICT producing industries are divided into the ICT producing manufacturing sector (D30-D33), the ICT producing service sectors (I64 and K72) and the ICT producing trade sector (G51), where are very unreliable data. It should be also noted that this classification is imprecise, which is due to the unavailability of more detailed information on sectoral classification for the monitored variable.

TOTAL INDUSTRIES	TOT
AGRICULTURE, HUNTING, FORESTRY AND FISHING	A_B

¹⁸ <http://www.euklems.net/>

MINING AND QUARRYING	C
FOOD , BEVERAGES AND TOBACCO	D15_16
TEXTILES, TEXTILE , LEATHER AND FOOTWEAR	D17_19
WOOD AND OF WOOD AND CORK	D20
PULP, PAPER, PAPER , PRINTING AND PUBLISHING	D21_22
CHEMICAL, RUBBER, PLASTICS AND FUEL	D23_25
OTHER NON-METALLIC MINERAL	D26
BASIC METALS AND FABRICATED METAL	D27_28
MACHINERY, NEC	D29
Office, accounting and computing machinery	D30
Electrical machinery and apparatus, nec	D31
Radio, television and communication equipment	D32
Medical, precision and optical instruments	D33
TRANSPORT EQUIPMENT	D34_35
MANUFACTURING NEC; RECYCLING	D36_37
ELECTRICITY, GAS AND WATER SUPPLY	E
CONSTRUCTION	F
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel	G50
Wholesale trade and commission trade, except of motor vehicles and motorcycles	G51
Retail trade, except of motor vehicles and motorcycles; repair of household goods	G52
HOTELS AND RESTAURANTS	
TRANSPORT AND STORAGE	I60_63
POST AND TELECOMMUNICATIONS	I64
FINANCIAL INTERMEDIATION	J
Real estate activities	K70
Renting of machinery and equipment	K71
Computer and related activities	K72
Research and development	K73
Other business activities	K74
COMMUNITY SOCIAL AND PERSONAL SERVICES	L_Q

Table 1: Channels of Contribution to Eco2nomics Growth by ICT (EUKLEMS²)

The ICT producing sectors involved in the whole Czech economy's output of 15.6 % (of which ICT manufacturing producers are 7.8 %, ICT service producers are 4.7 % and ICT trade producers are 3.1 %) according to the level of gross output in 2007. In comparison with 1995 there was an overall

increase in the proportion ICT producing sectors by 6 % mainly due to ICT manufacturing and trade producers. Figure 3 shows labor productivity growth development in the ICT sectors and the whole economy. Growth labor productivity is generally positive except the ICT Trade producers for years 1997, 2005 and 2007. The highest average labor productivity is around 14 % in ICT manufacturing sector but with the largest variability (standard deviation is 7 %). Other ICT producing sectors have average labor productivity growth about 5.5-7.1 % with the standard deviation 6-7 %. The whole economy labor productivity growth is even lower on average around 5.1 % and variability measured by standard deviation is lower on level 2.5 %. This analysis provides evidence that ICT producing sectors have higher labor productivity associated with a higher variability compared to the whole economy.

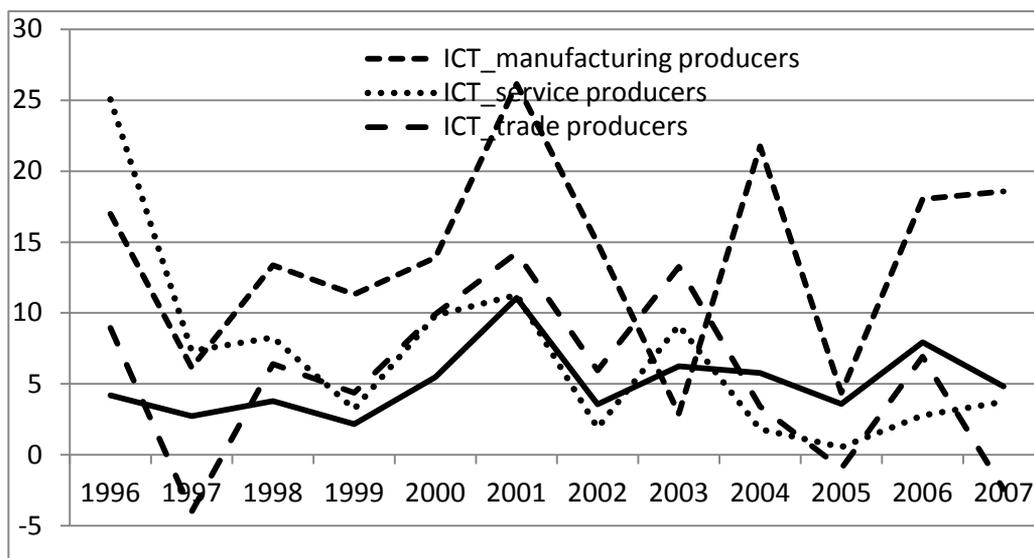


Figure 3: Labor productivity growth (%) in the period 1996-2007 [EViews, authors]

When we calculating variable $Dintensity_{it}$ for each year $t=1997, \dots, 2007$ we first determine the median of ICT capital compensation as share in total capital compensation ($medCAPIT_t$) and if $CAPIT_{it} > medCAPIT_t$ then $Dintensity_{it} = 1$, otherwise $Dintensity_{it} = 0$. $MedCAPIT_t$ values increased from 7.2 % to 9.6 % in 1995 to 1998 and has since declined to the level of 4.8 % in 2007. There is evident from Figure 3 that most of the ICT producers are also ICT intensity industries.

5. Empirical results

We estimate the panel regression model specified by equation (1) and we analyze the obtained results and their implications in this section.

We estimate our panel model using the panel least squares (PLS) method with period fixed effects (see Hanclova, 2011; Cerny, 2011):

$$\begin{aligned} \hat{GLP}_{it} = & 4.101 + 7.281 \cdot Dsector_{it} + 0.137 \cdot GLP_{it-1} - 0.285 \cdot (GLP_{it-1} \cdot Dintensity_{it-1}) \\ & - 0.194 \cdot (GLP_{it-1} \cdot Dsector_{it-1}) + \hat{\gamma}_t \end{aligned} \quad (3)$$

(0.0000) (0.0001) (0.0143) (0.0059) (0.0270)

where the value in parentheses indicates the corresponding significance level of each estimated regression parameters. The estimated model in equation (3) includes only statistically significant regression coefficients at 5% level of significance. Other regression parameters were excluded on

Wald test for zero restriction on regression coefficients. We also perform the likelihood ratio test for redundancy of period fixed effects. We evaluate the significance of the period fixed effects using sums-of-squares (*F*-test) and the likelihood function (Chi-square test). These two statistic values (2.54 and 25.6) and the associated *p*-values (0.0058 and 0.0043) strongly reject the null that the period effects are redundant. Graphical presentation of these effects over time shows a significant positive error from the long-term trend especially in 2001.

This estimated model can be specified according to the combinations of dummy variables into four groups and graphical presentation of estimated lines shows Figure 4.

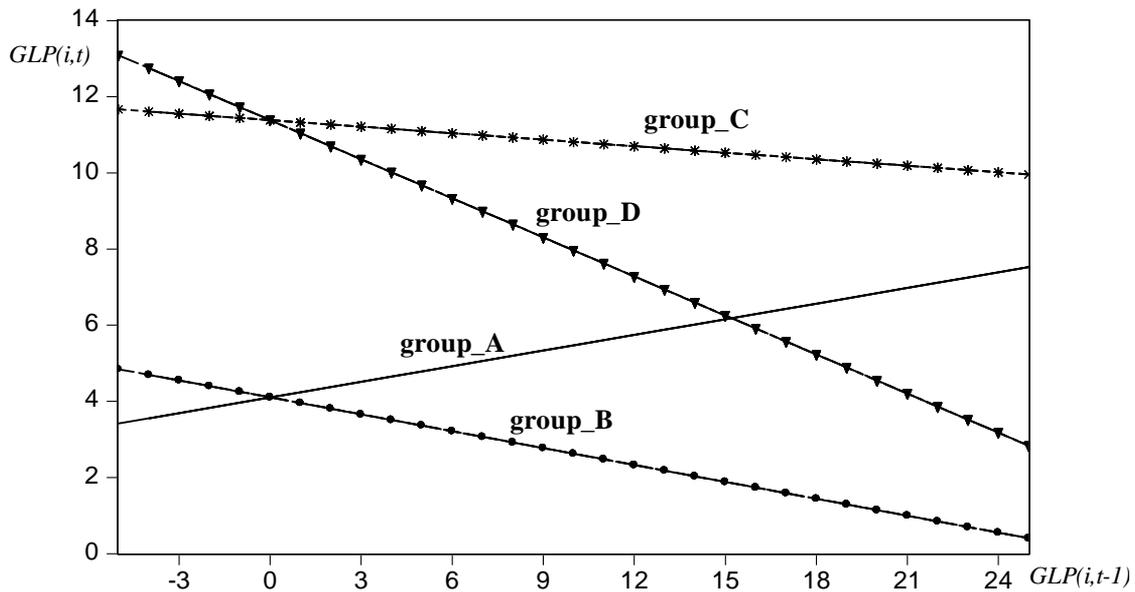


Figure 4: The development of labor productivity growth in relation to the previous value for all groups.

(EViews, authors)

First **group_A** includes the estimated line for the baseline group – *non ITC intensive and non ITC producing sectors*:

$$E(GLP_{it} / Dintensity_{it} = 0, Dsector_{it} = 0, GLP_{it-1}) = 4.101 + 0.137 \cdot GLP_{it-1} + \hat{\gamma}_t \quad (4)$$

The results indicate that the average labor productivity growth in this group is 4,1 % for zero level of previous labor productivity growth and trend dependency of labor productivity growth on previous level in time (*t-1*) is increased by 0.14 %. This group_A is the only one with a positive slope in regression function.

The second **group_B** consists of *ICT intensity sectors with non ICT producing sectors*. Estimates in equation (5) show same value of regression intercept but there is negative slope i.e. the decline in the growth labor productivity during investigated time 1997-2007 about 0.15 %. This means that non ICT producing sectors have same intercept level of labor productivity growth compared with the first group but this labor productivity growth decreases in the ICT intensive sectors by 0.29 % compared with non ICT intensive sectors.

$$E(GLP_{it} / Dintensity_{it} = 1, Dsector_{it} = 0, GLP_{it-1}) = (4.101 + 0) + (0.137 - 0.285) \cdot GLP_{it-1} = 4.101 - 0.148 \cdot GLP_{it-1} + \hat{\gamma}_t \quad (5)$$

The third **group_C** consists of sectors that have a *low proportion of ICT capital on total capital, but they produces ICT goods and services*. Estimate of the behaviour of the third group expresses

equation (6). It shows that there is higher level of intercept by 7,3 % of labor productivity growth compared with previous both group_A and group_B and we detect very slow negative trend development of labor productivity growth on previous value about -0.057 %.

$$E(GLP_{it} / Dintensity_{it} = 0, Dsector_{it} = 1, GLP_{it-1}) = (4.101 + 7.281) + \\ + (0.137 - 0.194) \cdot GLP_{it-1} = 11.382 - 0.057 \cdot GLP_{it-1} + \hat{\gamma}_t, \quad (6)$$

The last **group_D** includes of sectors that have a higher share of ICT capital and they are also ICT producers. The estimated model summarizes equation (7). We can see that the average level of labor productivity growth as intercept is the same as in the previous group_C with the high level 11,4 %. The estimated regression equation also identifies the fastest decline in the development of labor productivity growth compared to all previous groups_A – group_C (i.e. by -0.342 %).

$$E(GLP_{it} / Dintensity_{it} = 1, Dsector_{it} = 1, GLP_{it-1}) = (4.101 + 0 + 7.281) + \\ + (0.137 - 0.285 - 0.194) \cdot GLP_{it-1} = 11.382 - 0.342 \cdot GLP_{it-1} + \hat{\gamma}_t, \quad (7)$$

Estimated regression model of the growth labor productivity, expressed in equations (3)-(7) was statistically verified at the 5% significance level. At the same time autocorrelation was tested by Durbin's h-statistic (0.0005) and we can strongly rejected alternative hypothesis of the presence of residual autocorrelation. Multivariate residual normality test was tested using the Jarque-Bera joint (JB) statistic. These joint skewness and kurtosis statistics did not reject null hypothesis of multivariate residual normality. Residual variability was mainly influenced by the outliers in the sectors D30 and K71.

6. Conclusions

We can summarize the results for estimated panel model of labor productivity growth during 1996-2007 into the following conclusions:

- In the ICT producing industries is a higher level of labor productivity growth than in non ICT producing sectors measured with intercept in the regression equation (7.3 %).
- On other hand, a decline in labor productivity growth occurs in the ICT producing sectors according to the previous period and even faster than in sectors with higher share of ICT capital compensation as share in total capital compensation.
- We identify lower intercept (4.1 %) in non ICT producing industries and for sectors with low ICT capital continues increase of labor productivity growth compare to other sectors where there is a decline in growth labor productivity with varying intensity.
- The share of ICT producing sectors due to the share of real output of the Czech economy increased from 6 to 15.6 % in the period 1995 to 2007, mainly due to ICT manufacturing and ICT trade sectors.
- Labor productivity in ICT producing sector is higher than in the entire economy (the highest in the ICT manufacturing), but with high variability measured by standard deviation of 24 % to 53 % in the investigated period.
- There was very slow decline in labor productivity growth in ICT services sectors and since 2001 also in ICT trade sectors.

In conclusion, the results provide evidence that ICT-producers have higher level of labor productivity growth and with increasing level of this indicator in previous year growth of labor productivity decreases.

We did not find that sectors with higher share of ICT capital compensation as share in total capital compensation account for the majority of increase in productivity growth of the Czech economy during 1995 – 2007.

These results is in accordance with the general consensus reached in the growth-accounting literature as recently summarized by Draca et al. (2006) that there has been no acceleration of productivity growth in the EU, mainly due to the performance of the ICT-using sectors. On the other hand, Dahl et al. (2010) concluded that European industries which are relatively ICT intensive outperform remaining industries post-1995 in terms of labor productivity growth.

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TRENDS IN MANAGEMENT OF COMPANIES CAUSED BY THE IMPACT OF ICT

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Keywords

New Economy, Information and Communication Technology, Cloud Economy, Innovation, Economy.

Abstract

The paper aims to identify trends that affect or in the near future will affect management of companies. Economic theories (New Economy, Knowledge Economy and other) discussing the impact of ICT (Information and Communication Technologies) on the economy were default for the concept of this paper. These were supplemented by more recent views that already include the latest trends. Intersections of these approaches have been established trends that have the greatest impact on company or economy as a whole.

1. Introduction

The relationship between ICT and economic development is often discussed. Also discussed is the influence of this sector to other sectors of the economy. Both at the microeconomic and the macroeconomic level. The first study can be seen from the vantage point of more than a decade and it is possible to evaluate some aspects. In the context of the present state, some preliminary prediction of development can be assessed. Suggestion is made to assess the current predictions of future developments in ICT and the subsequent impact on businesses and the economy as a whole. It is the overlap effect of the technology itself in the functioning of businesses and other activities.

The article aims to confront the used terms, opinions and ideas from previous years with the current situation and the newly published views on future developments. This is not a confirmation or refutation of economic theories. It's about finding the intersections that exist in these theories. It's about identifying factors that need to be respected in the future. The default is the concept of a New Economy and related theories (Digital Economy, Knowledge Economy, etc.) to express opinions on the impact of ICT in economics. They provided the basic ideas of these economic approaches in the context of the current development, concepts such as Cloud Economy or Clouconomics. These factors will then be discussed in the context of recent technological trends and the implications for business management. Finally, trends necessary to be accepted in the present and near future will be described.

2. The New Economy

Development of information technology accelerated sharply in the 80 years of the twentieth century. People are starting to monitor their effects as well as other production factors. We distinguish the impact of macroeconomic and microeconomic level. ICT character is interesting. Penetration of ICT in all sectors of the economy led to the considerations which influence ICT compared with the effects it had in the history of railways, the invention of the steam engine or electricity use.

The world economy has undergone during its development a number of stages. The stages are characterized by a typical feature which defines the means and the development step. In this sense, the last two centuries are dynamic, which is mainly due to technological progress. For more information see Židek (Židek, 2009). Wittig reported as the primary developmental stage traditional economy, manufacturing economy, digital economy and the last (the question is how current and future extent) phase cloud economy (Wittig, 2010). In view of this text, interesting for us are the last two stages. They are derived from the increasing impact of ICT on the economy and individual businesses. There are also other economic theories being developed from 90 years of the twentieth century, which show the impact of ICT in the economy. Most attention has been paid to the New Economy. The authors are not unanimous in defining this concept. Klotz in this context asserts, "The *new* and *old* economies are not new and old economic sectors, but rather areas to which different economic rules apply. In principle it is a market model based on digital networks in which special properties of digitised goods play a central role." (Klotz, 2000, p.4) ICT offers such a range of changes in the economy, changing significantly the way it works. Thus it is not only a shift towards the service sector to the detriment of traditional sectors of the economy. The emphasis on individual changes in the functioning of the economy has a number of complementary names of the theory (according to the author). ICTs are not the only factor of changes. But play a dominant role. We define the basic pillars of these theories.

Kelly (Kelly, 1997) stresses the **network effects**, which according to him, are a source of growth. He uses the term the Network Economy. It is based on linking individual elements (electronic equipments). The quantity of products and people who share the service, causing the increasing value that is subsequently obtained. An example of this is the penetration of telephones. Greater penetration of the market brings greater value to the actual users.

Other economic approaches are the Digital Economy, Information Economy and Knowledge Economy. Here the key role of ICT is emphasized, namely **information, digital goods**. Emphasis is placed on the production of intellectual property. The virtual world created by ICT enabled production of intangible assets on a whole new level of quality. The definition of Knowledge Economy by Powell, "The key components of a knowledge economy include a greater reliance on intellectual capabilities than on physical inputs or natural resources, combined with efforts to integrate improvements in every stage of the production process, from the R&D lab to the factory floor to the interface with customers." (Powell, 2004, p.201)

Another characteristic feature of the New Economy is **innovation**. With globalization and greater competition in the market, innovation is increasingly important. More pressure is exerted on the research and development. Great innovation development is possible only in a society built on knowledge, information and related areas. Basl and Gala describe impact of ICT innovations to economics. (Basl and Gala, 2009) Doucek discusses the innovation in the context of human capital in the Czech Republic. (Doucek, 2011)

In these theories, economists have tried to capture changes in the economy. The key problem of their efforts is a problem with the quantification of indicators and their identification (in terms of separation of influence of individual factors among each other). Closer to the issue of the impact of ICT on economic indicators, see (Powell, 2004, p.207). In recent years, studies of the impact of ICT on GDP are available. See (Doucek and Hančlová, 2010) or (Červenka, 2011). These studies quantified the share of the ICT sector of the GDP for the EU Countries (or the Czech Republic). The ICT sector part of the GDP oscillates at about 5%.

For this paper, it is essential to identify the factors changes resulting from ICT. The New Economy is based on three pillars: 1) networks effects, 2) the growing importance of information assets, 3) innovation. Sevcik notes that none of these pillars is new. (Sevčík, 2007) The changes ICT have created are manifested in the speed and degree of influence on the economy. In economics, these appear repeatedly. At present, however, with greater intensity. As important as the actual factors, is the fact how the economy works: 1) the scope (geographic and quantitative or qualitative), 2) the speed of operations by means of ICT, the pace of change, 3) rate with which they are reflected in the economy, complexity influence.

All these influences are enforced through action at the micro economic level. The ability of firms to produced innovations. In the context of the article topic – in the field of ICT. The ability of companies and institutions to absorb new technology affects the whole economy. These are the key factors for economic growth. Consider firms like Google, Facebook, Oracle or Microsoft. Not only the companies itself, but also thousands of companies that are tied to their activity. We use different indicators for quantification at each level. At the microeconomic level (firm) is an indicator of turnover, profit, ROI, etc. GDP is a typical indicator of the level of the national economy. But also interesting is the number of people employed in the sector, sector share of total production, etc.



Figure 1 Microeconomic level is a key for economic growth

3. Cloud Economy, Clouconomics and other

Today, we can basically confirm the accuracy of these theories. The aim of this paper is not to verify their eligibility, but draw on the influence of current and future developments. What is the situation today? Wittig uses the designation Cloud Economy. Currently ongoing changes are characterized by the following factors. (Wittig, 2010)

- Dominance of online social networks
- Social components in most business models
- Democratization of raw computing resources
- Just-in-time IT

- Easy and widespread access to tools that enable collaboration and connection
- Multiple level conversations

It is obvious that the author is not limited to technological point of view of cloud computing. It refers to the shift caused by virtualization in general and on the implications of this shift. The so-called Cloud Computing era continues the era of Digital Economy, which is characterized by: (Wittig, 2010)

- Knowledge creates wealth
- Content is king: communication becomes a two-way process

What has changed is the variability of access to information which has resulted in massive production data. There is the possibility of exchanging data in real time and easy way. This leads to higher value of production data. Regular users are involved as well as customers. Storage options are vary a great deal.

Hinchcliffe also discusses the above trends (for details see Figure 1). (Hinchcliffe, 2011) The five main changes - trends include 1) smart devices development, 2) social media, 3) cloud computing, 4) Consumerization of IT, 5) big data - changes in approach to data processing. (it includes change in the concept of data processing, cooperation between departments, communication between the company and the surroundings). Other authors can be mentioned but in principle there is a consensus view of the developments in this area. The authors discuss the scope of impact, speed of adoption, and other implementation issues. The overall direction is generally accepted.

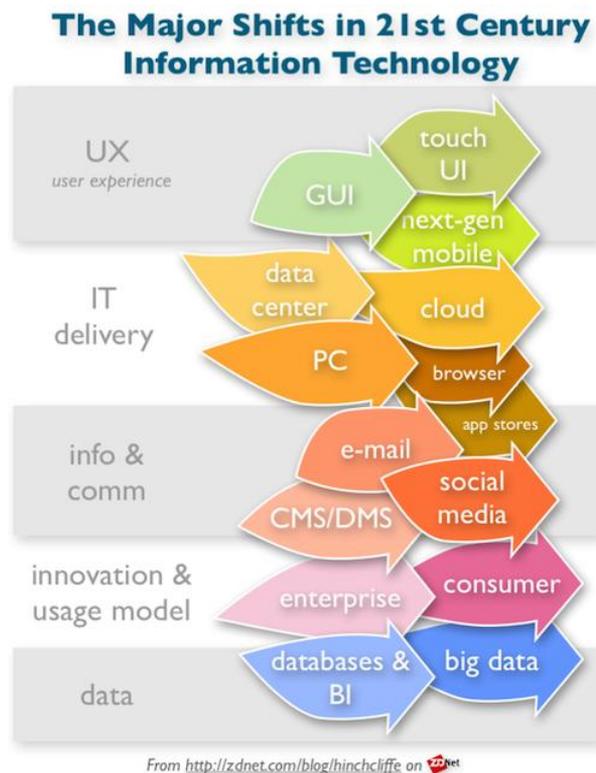


Figure 2 The Major Shifts in Information technology, source (Hinchcliffe, 2011)

4. Context and consequences

The above conclusions become default assumptions for the successful operation of businesses in the economy. Firms must accept the situation in the development and trends in the field of ICT, because they form part of the environment in which they operate. Mildeova, (Mildeová and Brix, 2011) says, "Enterprises are fully dependant on ICT, at the same time technologies cannot expect to have an impact themselves if no companies use them to innovate." The impact of ICT in the management of the company is also discussed by Voříšek. (Voříšek, 2006)

The introductory chapters contain the basic proposition of economic theory that described the major impact of innovative technologies on the economy. Although the measurability of these influences is questionable, we can conclude that the authors correctly defined the key factors. We specify the consequences of development and derive further effect on businesses or the economy as a whole.

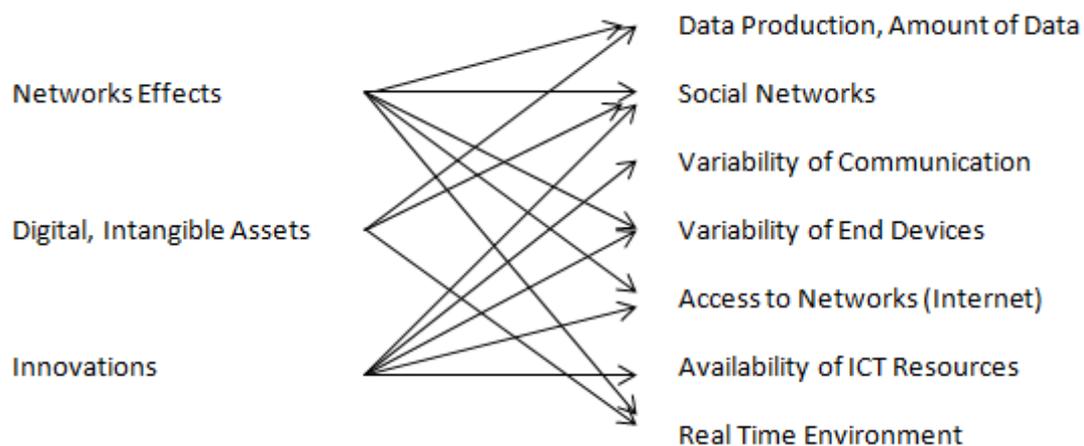


Figure 3 Primary factors in the new economy in context of recent developments

Fundamental factors still play an important role. Interesting is the synergistic effect of these factors. All enhance characteristics defined by the author of this paper. Global influence is very strong then: scope, speed and complexity (see above).

1. The fundamental impact of the development of computer networks.
2. Development of end devices.
3. The growing importance of intangible assets.
 - a. Social networks and communication channels.
 - b. There is a transfer of information (about customers, about products, opinions on products, etc.) to the site for the company's strategic advantage is the ability to use that information.
4. Speed. All processes are faster in the economy. The impact for a specific sector illustrates for example real time marketing. (Achrol and Kotler, 1999)

5. The consequences for the functioning of companies

Basl and Gala state (Basl and Gala, 2009) 1) ICT as an innovation in itself and 2) is a source for various types of innovation (product innovation (goods as well as service), process innovation,

organization innovation and marketing innovation). ICT also significantly 3) affects the external environment in which firms move and 4) affects the internal environment of organizations (Dewett and Jones, 2001). The following trends are intersection approaches by individual authors in the context of changes resulting from the development of ICT.

- Consistency between business and ICT strategies. According to Antlová (Antlová, 2008) along with the growing importance of ICT goes also the growing need for proper alignment of business strategy and ICT strategy. This also applies to ICT strategy links to other firm sub-strategies. The importance of ICT will be more pronounced for more and more companies.
- Communications. According to Tod, Dewett (Dewett and Jones, 2001) in development is the need to communicate the main benefit of ICT use in the company. With the continuous development of communication channels it is necessary to ensure their proper implementation in the corporate structure. The aspects of new communications channel discuss Pochyla. (Pochyla, 2011)
- A change in thinking (at all levels of the corporate structure). Constant search for innovation. The need to understand the importance of ICT in business. Dynamics of environment is a necessary evil, but also the possibility for obtaining benefits.
- Data processing. Readiness to various data sources and their evaluation. Hinchliffe talks about understanding the need for change within the meaning of data processing and utilization. (Hinchliffe, 2011)
- Change in understanding customers and their role in the business continuity. The customer and his views must be part of the control. This opens up new ways of communication with the customer or to obtain customer feedback. Approach to evaluation of unstructured text can be seen in Ministr. (for example web discussion).(Ministr, 2011)
- The organizational aspects of the company. ICT creates space for innovation of organizational structures. It affects the level of formalization of processes, centralization (decentralization) management, the role of individual specialization, size of units, etc. (Dewett and Jones, 2001). Much will be felt in lines which are oriented towards the external environment (marketing).
- Implementation of technology. The emphasis on shortening the time required for the adoption of technology. Scope of changes resulting from the nature of the impact of ICT on the functioning of the economy (both micro and macro level) was introduced.

Certainly not a complete list. Listed are only the factors that are most often discussed in studies and are generally accepted. A very significant is the human potential. Human resources in ICT in the Czech Republic are addressed by a number of authors (Doucek, Novotný and Maryska, 2010), (Voříšek et al, 2007).

6. Conclusion

The article summarized the changes that caused the impact of ICT on the economy (also through changes in individual companies). During the last two decades it has created a virtual world that has become part of the real world. This development is very dynamic and constantly brings technological innovation that is necessary to implement to the corporate infrastructure and the management and operation of the company.

In the introduction, economic theories explaining the impact of ICT on the economy were discussed. New developments in the prediction of this area were added. The main intersections mentioned approaches and opinions have been described. These were the basis for defining trends, essential for the successful operation of businesses in the current environment. In the conclusion, the article presents the key areas that will be affected by ICT. Authors publishing in the field agree on the big innovative potential of ICT, so for the future development of relevant companies will properly implement these technologies. It is not possible to view ICT only from a technical perspective, but to record their overall influence in the company, hence the economy. The overall effect of this influence on the economy will be stronger since the application of ICT has a strong synergistic effects.

Companies are the key to the strength of the economy and it is also true in the case of ICT. The aspects analysed above, which must be accepted for the successful development of companies. Corporate governance, with greater involvement of the ICT infrastructure as an essential tool for maintaining or enhancing the competitiveness of companies is an important element of the national economy.

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CZECH HOUSEHOLD COMPUTER FACILITIES AS A RELIABLE VARIABLE IN A LIFE EXPECTANCY FORECAST MODEL UP TO THE YEAR 2060

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Keywords

Czech Household Computer Facilities, Life Expectancy at Birth, Polynomial Regression, ARIMA, Saturation Point

Abstract

The standard of living is one of the key variables that significantly affect the trend of some demographic indicators. When modelling the trend of monitored demographic indicators, the problem that arises is that it is very difficult to quantify the living standard with the aid of specific variables or a specific coefficient. So the question arises how to express the living standard differently and whether a significant correlation exists between the imaginary “living standard” variable and some other variable which we can express realistically. The trend that is incorporated in the time series of the trend in Czech household computer facilities can be applied as quantification of the living standard trend in the case of the Czech Republic. These time series will be used to draw up models on which alternative forecasts of life expectancy at birth can be constructed for males and females up to 2060 when this model will probably stop working properly. It will be shown that alternative forecasts will correspond to the theoretical assumptions for the trend in the mentioned indicators however they will be far simpler.

1. Initial assumptions

The study will apply the classical polynomial regression approach (see. e.g. Hindls et al., 2007) and in addition the approach of authors Box and Jenkins (Box, Jenkins, 1970) for the time series analysis. An important explanatory variable that can help explain the great amount of variance in the imaginary “living standard” variable will be household computer facilities to whose future forecast the logistic “S” curve approach will be applied to achieve the saturation point (see e.g. Hušek, 2007). Data on the state of household computer facilities are determined every year by the CZSO (Czech Statistical Office) and it can be said that currently our country is in the inflection point. This approach in estimating life expectancy based on specific explanatory variables (household computer facilities) will, in practice, applied especially to the Czech Republic because after the fall of the last political regime, the standard of living began to rise for various reasons. A great amount of hidden information is concealed in households equipped with a “computer”. A household that decides to procure a computer must have an electricity connection and must have

enough money to operate a computer. A household equipped with a computer and probably an internet connection must also know how to operate a computer, i.e. not only how to switch it on and off, but also how to use its graphic interface and installed software. Currently having more PCs as such is not enough, a computer needs to have its software extended to include new versions of programmes and their upgrades. This places further and further demands on the household that owns a PC and these demands involve the need to be educated in this area. The fact that households become educated, gain experience means that this helps them not only in their private but also in their professional life. As time goes on, PCs become more sophisticated placing greater demands on the knowledge of their users and these users become more advanced in their knowledge. Better knowledge brings the higher probability of finding work, saves valuable time, earns more money and last, but not least, makes life more pleasant. All these factors contribute one way towards the rise in the standard of living, so we can claim that the increase in household computer facilities very closely corresponds to the rising living standard. The increasing living standard, among other things, is also connected with increased household consumption, increased household incomes and households being equipped with an increasing amount of durables. It will be shown that a simple approximation will help construct reliable models in a simple way, and these models will have sufficient explanatory power.

The output of the study will be estimates of life expectancy at birth using a different approach than currently used for statistical and demographic laboratories. In other countries, the authors attempted to construct the estimates of life expectancy at birth, such as Sullivan method (see Sullivan, 1970), but it is a method, that is partly based on life tables and partly on mathematical statistics. Until now nobody attempted to publish a completely different way of estimation of life expectancy at birth, and we believe that the approach with growing living standard, expressed by specific explanatory variable could be relevant for the Czech Republic. The relationship between life expectancy at birth and Czech household computer facilities can really exist, even if it is a risk, that there could be an apparent correlation. The household computer facility is one of the indicators of growth of living standard and growth of life expectancy at birth is largely the result of this growth. The impact of growth of Czech household computer facilities has the effect on the economy, because it is closely linked with the growth of living standard and life expectancy at birth. Healthier people live longer and represent more significant potential for the economy of the country.

The study of Fiala et al. (2011) expected to increase life expectancy at birth to 86.2 years for men and 90.7 years for women in 2050. The other publications talk about the possibility of convergence in life expectancy at birth for men and women (see e.g. Miskolczi et al., 2011). Our study will not consider this convergence in life expectancies. It is also important to note, that the study does not expect the change in migration policy. E.g. Arltová, Langhamrová (2010) argues, that “it is very difficult to project the future development of migration”. Migrants may have different levels of life expectancy compared with the domestic population and the sudden change in immigration policy (e.g. doubling the inflow of migrants to the Czech Republic), could disrupt the assumptions of this model.

2. Saturation of Czech household computer facilities

The time series of Czech household computer facilities has been published at annually since 1989. The last available value that the statistics contain is for 2010. In view of the above-mentioned assumption that the Czech Republic is now in the inflection point in the course of saturation of Czech households with these durables, an estimate was made of the computer facilities trend up to 2060, which is the time horizon of this study, by using the “random walk” model (see Arlt, Arltová,

2007). Let us assume that the horizon is about 48 years (i.e. up to 2060), computer facilities will rise to 94–97%. This condition is determined for the need to make further calculations and may be confirmed or refuted in future. To illustrate, this forecast is shown in fig. 1. In addition, we can expect that there will be a statistically significant rise in life expectancy at birth up to 2060 then we are no longer able, with sufficient certainty, to deduce the relevant values. Given that we expect a statistically significant rise in life expectancy at birth up to 2060 in both time series, we can also expect a relation between the 100% saturation limit of Czech household computer facilities and fulfilled potential life expectancy at birth in males and females.

Given the fact that the life expectancy trend of males and females is developing differently (and that the life expectancy of males is always lower than that of females), a differentiation will be made based on the following relations of the “PC” time series – Czech household computer facilities depending on gender by two time series:

- PC_M – Czech household computer facilities as the explanatory variable for male life expectancy, and
- PC_F – Czech household computer facilities as the explanatory variable for female life expectancy.

Therefore, we will calculate PC_M as

$$PC_M = 1 + (0.515 \cdot PC)$$

for males, and as

$$PC_F = 1 + (0.485 \cdot PC)$$

for females. The value of 0.515 or 0.485 is the share of boys and share of girls at birth that the CZSO currently recommends for selection.

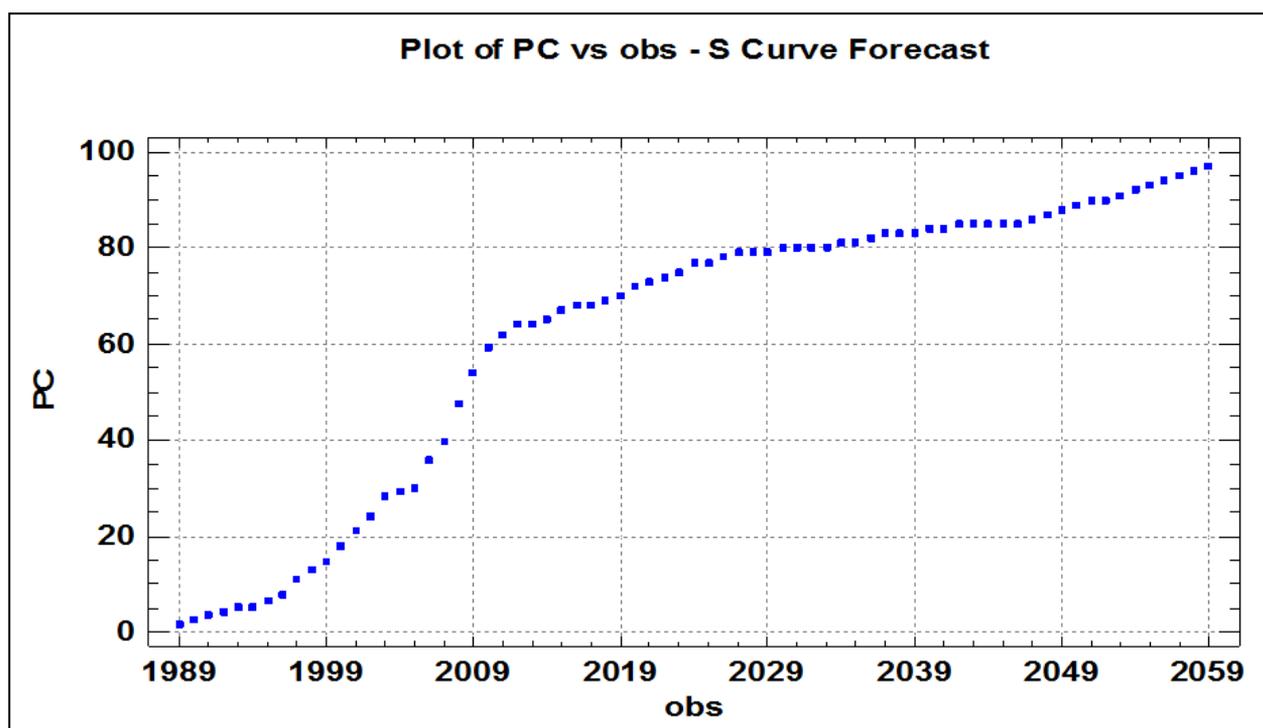


Fig. 1: Chart of the computer equipment trend in the Czech Republic up to 2010 and the subsequent “S” curve forecast; Data source: CZSO, own construction

3. Distortion of assumptions using the estimating technique of ARIMA methodology

Based on the methodology of authors Box and Jenkins (Box, Jenkins, 1970), it is often useful to apply time series modelling with the use of the trend contained in the past of these series. In case of the estimate of life expectancy at birth for males, and for females, this approach is not right. If it were to work, it could be unequivocally declared as the simplest estimating technique and the complicated approaches used, for example, by the CZSO, would not be necessary. But this approach, after being applied to the ex_M , ex_F time series (male life expectancy at birth, and female life expectancy at birth), does not work unfortunately, as, incidentally, is shown in fig. 2, and in fig. 3. By using automated sophisticated software the optimum model form was selected for capturing the trend and subsequent forecast up to 2060, or to the time of the 100% limit of saturation of Czech households by computer facilities. The ARIMA (0, 2, 2) model form is for the time series ex_M , while only the simple linear trend model has been selected for the time series ex_F . According to these models at the time of saturation of Czech households by computer facilities the male life expectancy at birth would be about 77 years, and female life expectancy at birth would be about 82.5 years, which is slightly more than today.

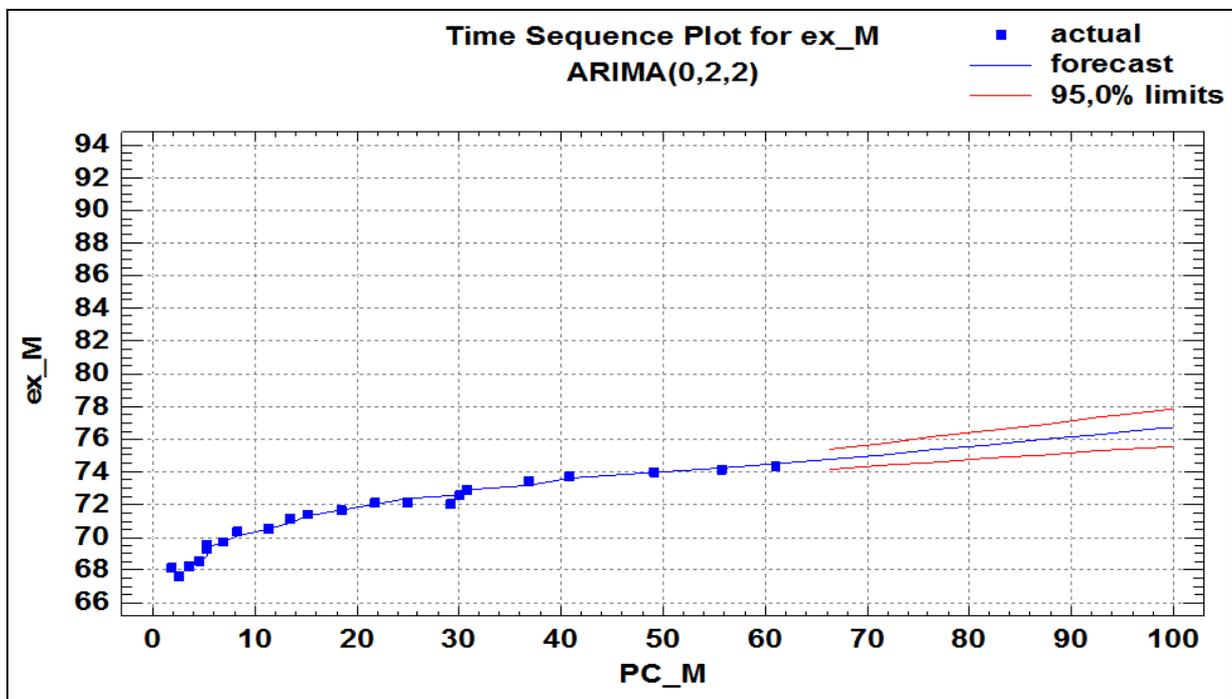


Fig. 2: Forecast of the male life expectancy at birth trend using the ARIMA model (0, 2, 2); Data source: CZSO, own construction

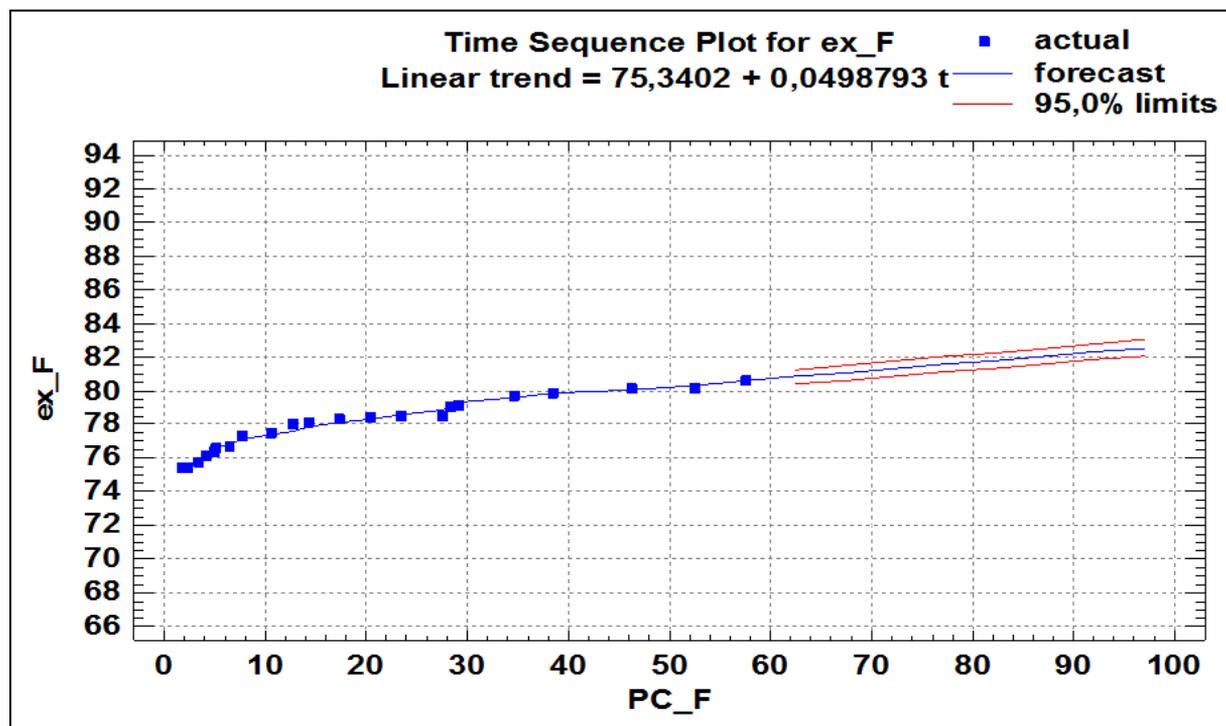


Fig. 3: Forecast of the female life expectancy at birth trend using the linear trend model; Data source: CZSO, own construction

4. Polynomial regression model for estimating life expectancy at birth

Polynomial regression appears much better and perhaps a simpler estimating technique for the male life expectancy at birth trend, and the female, respectively. From observed experience, the third order polynomial was selected for males and for females. The estimated parameters of the model for males are presented in tab. 1

Parameter	Estimate	Standard Error	T Statistic	P-Value
CONSTANT	67.4002	0.250418	269.151	0.0000
PC_M	0.347988	0.0436322	7.97548	0.0000
PC_M^2	-0.00736566	0.00177904	-4.14024	0.0006
PC_M^3	0.0000590041	0.0000194149	3.03912	0.0071

Tab. 1: Estimates of parameters for the “life expectancy at birth – males” model; Source: own construction

and we can write the resulting model in the following form

$$ex_M = 67.4002 + 0.347988 \cdot PC_M - 0.00736566 \cdot PC_M^2 + 0.0000590041 \cdot PC_M^3.$$

The parameters of the model for female life expectancy at birth were calculated the same way as presented in tab. 2.

Parameter	Estimate	Standard Error	T Statistic	P-Value
CONSTANT	75.0645	0.187971	399.34	0.0000

PC_F	0.281642	0.034853	8.08086	0.0000
PC_F^2	-0.00649184	0.0015129	-4.29099	0.0004
PC_F^3	0.0000572164	0.0000175639	3.25761	0.0044

Tab. 2: Estimates of parameters for the “life expectancy at birth - females” model; Source: own construction

We can write the resulting in the following form

$$ex_F = 75.0645 + 0.281642 \cdot PC_F - 0.00649184 \cdot PC_F^2 + 0.0000572164 \cdot PC_F^3.$$

The diagnostic tests of the model indicate that the unsystematic component of the model is not auto-correlated, is homoscedastic and has roughly a normal division. So it is possible to calculate the forecast of male life expectancy at birth, and female respectively, by using the explanatory variable of Czech household computer facilities with regard to the share of males and females in the population of the Czech Republic. The resulting estimates are shown in fig. 4 for males, and in fig. 5 for females respectively, with the calculated 95% reliability intervals.

Our assumptions are clear. At the end of 2010 the standard of computer facilities in Czech households was about 60%, (62% is about the standard in the time series PC_M, 58% is about the standard in the time series PC_F). An interval of 48 years (2012-2060) remains for the future from the mentioned 60% of facilities to the limit value of 100% of household facilities. During this time, life expectancy at birth will rise to the value of almost 88 years in males and the value of almost 94 years in females.

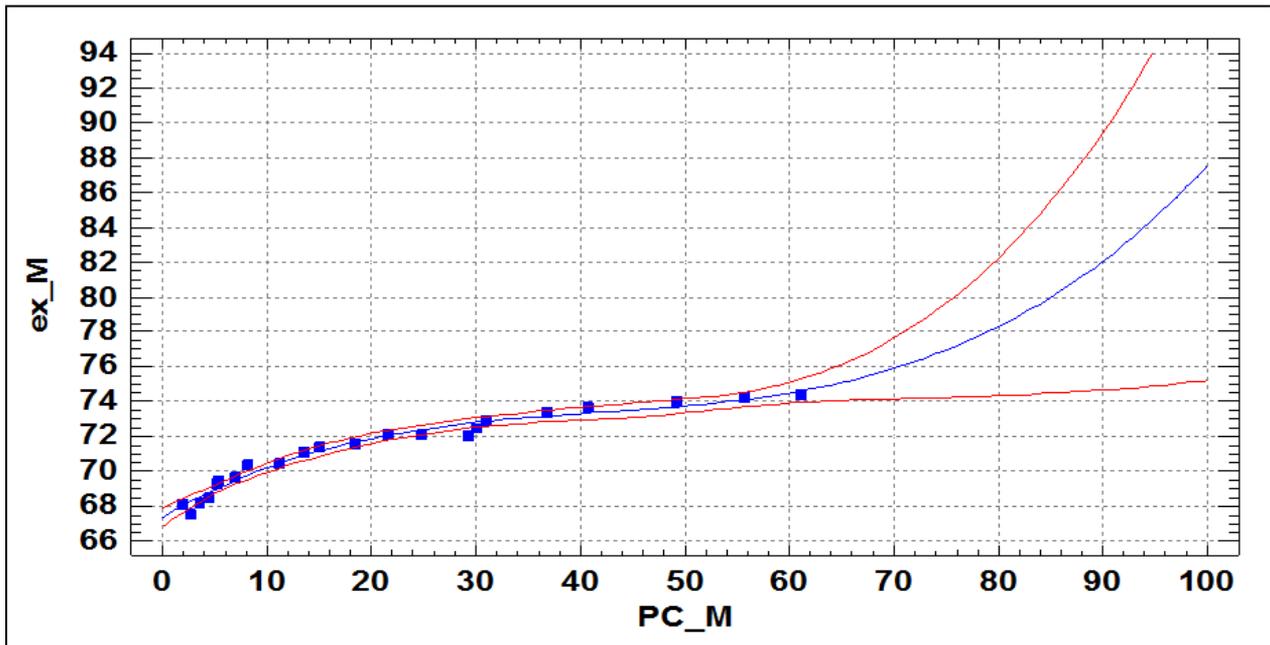


Fig. 4: Forecast of the life expectancy at birth trend in males using third order polynomial regression (+/- 95% estimate reliability interval); Data source: CZSO, own construction

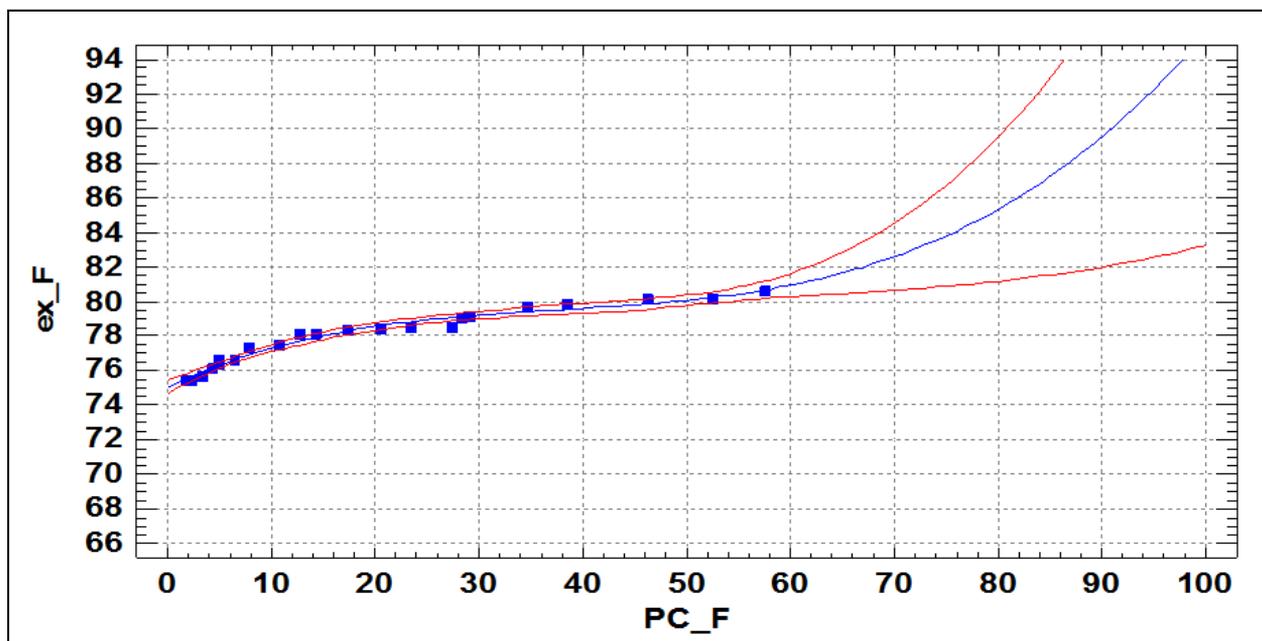


Fig. 5: Forecast of life expectancy at birth trend in females using third order polynomial regression (+/- 95% estimate reliability interval); Data source: CZSO, own construction

5. Conclusion

One important conclusion arises from the above facts. When confronting the values forecasted by the polynomial regression model in tab. 1 and tab. 2 which are shown in the charts in fig. 4 and fig. 5, we can claim that the values perfectly correlate with the officially estimated values of male life expectancy at birth, and female respectively, published in a high variant of the demographic projection of the Czech Republic compiled by the Czech Statistical Office. In the event of the revision of the computer facilities trend, it would most probably be possible to even arrive at mean values, or even lower variants. This is a very simple method of how to arrive at the explanation of the life expectancy at birth trend using a different method. The assumptions about the connections of the imaginary “living standard” variable and some realistic one by which we can numerically quantify, (in our case the computer facilities of Czech households which began to accelerate with the fall of the last political regime), apply. Therefore, we are also able to estimate life expectancy at birth in another than the traditional demographic method.

Given that we found the relationship between our estimated expectations of life expectancy at birth and life expectations, which are published by CZSO and as well as by Fiala et al. (2011), we can claim, that the dependence of acceleration of living standard, explained by specific variable could exist. The relationship between living standard and Czech household computer facilities could be duplex and therefore may affect the outputs of the market economy, which includes the people and their increasing life expectancy at birth.

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HUMAN INITIATIVES AND INNOVATIONS IN ICT

ICT AND INNOVATIONS IN CONTEXT OF THE SUSTAINABLE DEVELOPMENT IN EUROPE

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Innovation, ICT, Sustainable development, Green ICT, SME

Abstract

Information and Communication Technologies (ICT) have been identified as essential technical and technological drivers of corporate innovations in last thirty years. Information society gave a new dimension to this enforcement. The engine of innovation became the work with information instead of the improvement of traditional technology and goods production. This contribution is split into threen main parts: the suistanable context of ICT innovation and its penetration in European countries, main trends in ICT innoavtions and method for corporate innovations support, especially for SMEs (Small and Medium Enterprises).

1. Introduction

1.1. Sustainable development context

The human population is coming day after day nearer the important cross in the future. General conception of the permanent sustainable development has been crashed and actual society has to balance its existence in three dimensions – Economic, Environmental and Social. Obviously respected view on the world problems of information and communication technology (ICT) specialists and persons is oriented toward the technological dimension of the Economic part of the on Figure 1 presented triangle. Technology has been proclaimed as the mythical almighty of modern age without respecting traditional values of the society. Economic aspects are highlighted practically everywhere, but general context of economic growth related to environmental and social aspects are presented only occasionally or by non-systematic ways. We can observe demonstration

of goal directed aspects of economics development in relation to social (poverty in Asia and Africa in contradiction to wealth of Nord America and Europe) and environmental (rain forest, disappearing, Aral sea, lack of drinking water in Africa etc.) problems time to time.

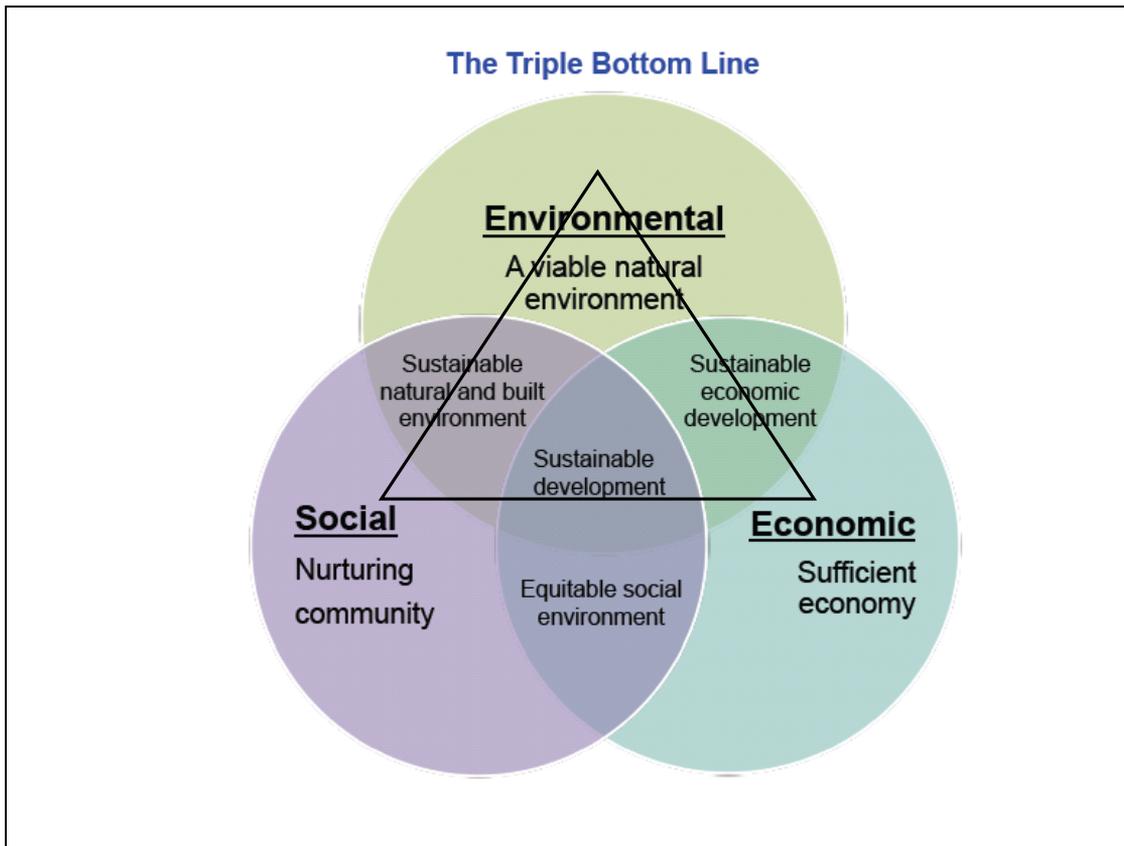
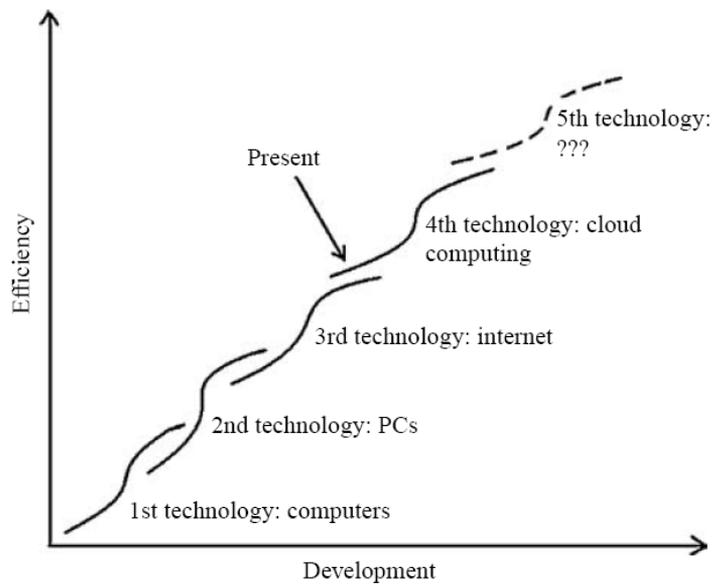


Figure 1 Triple Bottom Line (Moon, 2010)

The idea of sustainable development became a fiction in last thirty years and members of Roma club forecasted the large global crisis at begin of the new century. Almost the same catastrophically forecast has been presented by MIT experts several weeks ago, with vision of the global economic crisis and crashing of existing economic system approximately in 2030.

On the other hand the "ICT oriented" persons have all the time an optimistic vision of the future, especially those oriented on pure technology, without respecting other limits of the society and the Earth. Their vision can be presented like that one on following Figure 2.



Source: Modifications of Koh and Magee (2006)

Figure 2 – ICT Innovation Micro Cycles (Koh, 2006)

Micro-cycles, shown on Figure 2, inform us about actual situation in ICT improvement into economic environment. We can identify that current position is between the “Internet” and “Cloud Computing” micro S-curve, since the latest crisis contributed to the faster implementation of the new micro S-curve, driven by advanced, affordable and flexible solutions. (Koh, 2006). This belief is supported by prediction of most of ICT vendors, researchers and many others, that new ICT innovation represented by “Cloud computing” brings with it a new paradigm of computing. This new paradigm is expected to be a standard in a few years as a part of the evolution on “dynamic ICT”. (Koh, 2006).

The future of innovation process in the society and in ICT as well must be oriented not only on effectiveness and efficiency of new solutions, but must strongly respect other related aspects of economic development – the social and the environmental dimension.

1.2. ICT Penetration into Economy in European Countries– Potential for ICT Driven Innovations

The more the economy is penetrated by ICT the higher potential of innovations driven by these technologies is. The actual penetration of ICT into European countries is presented in following Table 1.

ID of cluster	Countries in Cluster	Average index
1	Norway	0.7855
2	Denmark	0.7176
3	Finland, Ireland, Netherlands, Sweden, Great Britain, Iceland	0.6087
4	Austria, Belgium, France, Luxembourg, Germany	0.5150
5	Estonia, Lithuania, Malta, Portugal	0.4389

ID of cluster	Countries in Cluster	Average index
6	Czech Republic, Slovakia, Slovenia, Spain	0.3790
7	Hungary, Italy, Latvia, Poland, Croatia	0.3132
8	Bulgaria, Romania, Cyprus, Greece	0.1829

Table 1 – Level of European countries Informatization (Kuncová, Doucek, 2011)

Different methods for multicriterial evaluation were used for penetration measurement. More detail description and evaluation of these methods is presented in (Kuncová, Doucek, 2011) and (Novotny, Doucek, 2012).

The aim of multicriterial analysis was to divide European countries into groups, within which the countries are "similar" in terms of observed characteristics. Due to the computing environment (MS Excel) and the possibility of better display and interpretation of intermediate results, were decided to use the Methods of Multicriterial evaluation options for this evaluation. Methods are based on the assumption of the existence of a matrix including a final list of options (alternatives) evaluated according to the final number of criteria. The elements of such matrix represent the information about options by various criteria, either in the form of ordinal (ranking alternatives according to the criteria) or cardinal (real value options according to individual criteria in different units). Depending on the type of information available they can be divided into the methods of problem solving, methods based on ordinal information and methods of using the cardinal information (Fiala, 2008).

Multi-criteria evaluation of alternatives belongs to the category of discrete multi-criteria decision making models where all the alternatives and criteria are known. To solve this kind of model it is necessary to know the preferences of the decision maker. These preferences can be described by aspiration levels (or requirements), criteria order or by the weight of the criteria (Evans, 1984), (Fiala, 2008), (Figueira, 2005).

The model of multi-criteria evaluation of alternatives contains a list of alternatives $A = \{a_1, a_2, \dots, a_p\}$, a list of criteria $F = \{f_1, f_2, \dots, f_k\}$ and an evaluation of the alternatives by each criterion in the criteria matrix:

$$Y = \begin{matrix} & f_1 & f_2 & \dots & f_k \\ \begin{matrix} a_1 \\ a_2 \\ \vdots \\ a_p \end{matrix} & \begin{bmatrix} y_{11} & y_{21} & \dots & y_{k1} \\ y_{12} & y_{22} & \dots & y_{k2} \\ \vdots & \vdots & \ddots & \vdots \\ y_{1p} & y_{2p} & \dots & y_{kp} \end{bmatrix} \end{matrix},$$

where y_{ij} , $i = 1, 2, \dots, p$, $j = 1, 2, \dots, k$ represent information about the evaluation of each alternative by each criterion.

The theory of multi-criteria evaluation of alternatives is very good established and there are available many different methods for this kind of problems. For the analysis were applied following methods: WSA, TOPSIS and PRIAM (for more information see (Fiala, 2008) or (Figueira et al, 2005)) implemented in full version of IZAR (Boksteflova et al, 2010) and Sanna (Jablonsky, 2006).

2. Trends in Contemporary ICT Innovations

From the general point of view, almost all innovating activities are closely connected with education that gives future specialists in business and also scientist appropriate knowledge background and innovating potential. Without adequate background in all appropriate fields any innovations cannot be expected. Questions connecting innovations and education are solved for example in (Doucek et al., 2012; Maryska et al., 2010). Trends in education were discussed in last three years at this meeting, but some more following trends are visible in impact innovative process:

- technical,
- social and political
- in consumption.

2.1 Technical Trends

The technical trends in contemporary ICT innovations could be described and analyzed in different ways. The traditional technical approach emphasis the topics like mobile ICT devices, software services and clouds computing solutions mainly.

These technical ICT innovation trends are regularly analyzed and proved by many institutions. One of the very important ones is the Gartner Group. For the year 2012 the Gartner has highlighted the top 10 strategic technologies and trends (Gartner, 2012). The Gartner in their trends mention for example the media tablets, mobile-centric applications and interfaces, in-memory computing, extreme low-energy servers and of course cloud computing on the top list.

From the strategic perspective there is important how these trends fit to the company's needs and when they should be implemented into strategic plans. The expected application level of the ICT innovation trends in the near future is therefore also important. In this context the Gartner also predicts that in 2013, the investment bubble will burst for consumer social networks and for enterprise social software companies in 2014. It is interesting because these social network innovations have been trend in the last couple years by the way and some companies are still thinking about that. The Gartner prediction also says that mobile application development projects targeting smart phones and tablets will outnumber native PC projects by a ratio of 4-to-1 by 2015. By 2016, at least 50 percent of enterprise email users will rely primarily on a browser, tablet or mobile client instead of a desktop client. These trends announced by Gartner could be at the minimum level somehow inspiration for those making the strategic and long term decision, especially speaking about the small and medium enterprises.

Another ICT innovation aspect is the sustainability support is lower influence on the environment and less sources consumption. Lower energy consumption is possible to indentify behind many currently discussed ICT trends. Business and IT leaders and also procurement specialists in companies must see energy costs isolated and include it as a variable element in future cloud service contracts for example. Therefore there is no surprise why the buzz word "Green ICT" becomes from this reason so popular.

This topic of "green ICT" starts to be supported by the latest strategic documents, especially in European Union. The documents like Green Knowledge Society (Green, 2009) and strategy of Europe till 2020 (Europe, 2020) are both good examples.

2.1 Social and Political Trends

The new important factor connected with ICT trends could be observed in the last decade. The technical and political trends run parallel each other. The trends in the ICT innovations are reflected for instance in the EU strategic plans. These plans are then connected with the financial support like the European Social Funds for instance. A good example is the Czech Republic. The “ICT in companies” program oriented on the ICT innovations in the SME sector has offered more than 100 Mio € since 2007 (www.czecinvest.org). This program has been running under the Ministry of Industry and Trade within the period 2007-2013. It has been oriented on the ICT innovation in traditional way like ERP, SCM and CRM systems.

Therefore it is important to know not only the Gartner’s technical predictions but also knowing what kind of political support of ICT could be expected in the near future, esp. in the following program period after 2013. The trends of ICT innovations are already now integrated in the new strategies, policies and directions of the EU. One of the bodies that suggests directions for the EU’s policies and recommends concrete actions to ensure its achievement is the ERT – European Round Table (www.ert.eu). The ERT in their vision believes that Europe should remain an attractive place to live and work in 2025, deeply integrated into the global economy as a respected partner. Europe should continue to stand for a high quality of life for its citizens. That is why prosperity and societal well-being are at the core of ERT’s vision.

2.1 In Consumption - Sustainable Growth Contra Unsustainable Consumption

Many from the EU strategic documents based their arguments on the idea of sustainability (Delina, et al., 2006). The key factors are the limited sources on the one hand. It is understandable because the resource use in Europe is increasing. The European Environment Agency Resource say that the use per person increased by 9.1% in the EU-27 between 2000 and 2007, reaching some 17 tons per person annually. Of the 8.2 billion tones of materials used in the EU in 2007, minerals and metals accounted for more than half, while fossil fuels and biomass were approximately a quarter each. Europe consumes more resources than most other regions. An average European citizen uses about four times more resources than one in Africa and three times more than one in Asia, but half of one in USA, Canada or Australia (www.eea.europa.eu).

The growing consumption needs more source, incl. energy, and produce more waste at the same time. The ICT innovation, spec. green ICT, can help to deal with the aspect of sustainability. It can help to reduce the source consumption and the innovation can support the lower energy demand of the own ICT equipments.

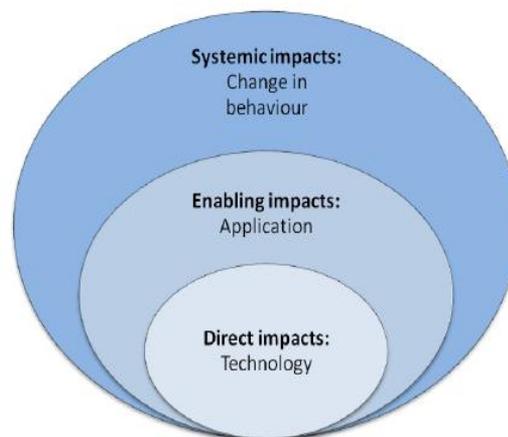


Figure 3 Framework for green ICT (OECD, 2010)

3. Methodologies and Methods For Corporate Innovations Support For SMEs

Above mentioned methodologies and methods don't cover one side of innovations – economical side. Innovations and investments into ICT and their support from the view of SMEs have to be every time analyzed also from the costs and profits view. This analysis has to be realized at the beginning of each innovation project and should be described as a crucial element of methodologies and method for corporate innovations in general not only in SMEs. But as we have found these areas are not usually covered. These areas are described for example in (Maryska, 2008; Maryska, 2009).

For the support of innovations in SMEs there is necessary to cover all aspects of the innovation mentioned above. These aspects are described on the holistic model presented on Figure 3. The elaborated conceptual model is described on the Figure 3.

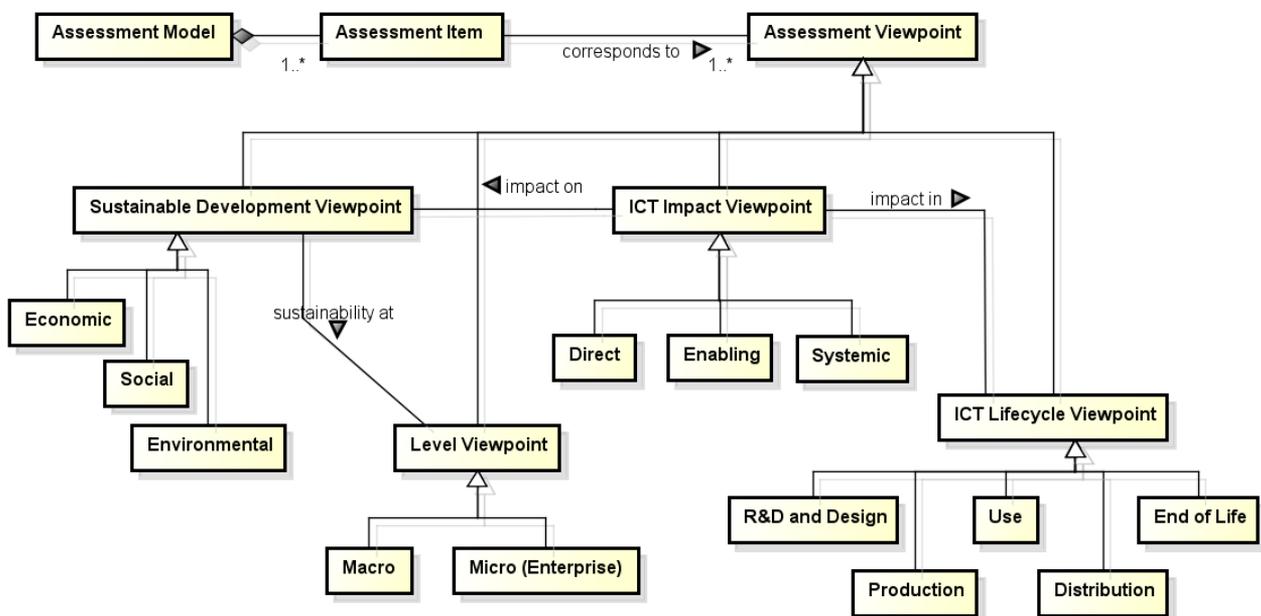


Figure 3 Conceptual model (Basl et al, 2011)

This model is the basis for the formulation of the key principle dimensions of innovation in at the micro level in a company. These ten dimensions have been named as “ten commandments“. They include:

1. Innovation strategy – principle documents.
2. Innovation rules – internal rules for innovation and improvement.
3. Risk of innovation – elimination of the threats of changes.
4. Development phase of innovation – project management.
5. Use phase of innovation – process management.
6. ICT impact view point– direct, enabling, systemic and also product, process.
7. People –corporate culture changing.
8. Lean – economic - economy, efficiency and effectiveness.

9. Green – environmental aspect.

10. Social aspects of ICT innovations.

These ten dimensions reflect all important aspects of need for:

formalization of the innovation at the strategic level and a formal way, incl. the risks of innovation change (dimension 1, 2 and 3),

management of the whole cycle of innovation, e.g. development and use (dimension 4 and 5),

innovation of all form of ICT in company, e.g. product and process (dimension 6),

changing of the attitude of people to the innovation and changes (dimension 7).

Last but not least the concern is given to the key three areas of the sustainability – economic, environmental and social aspects of sustainability.

To help the users and managers in the SMEs to improve their attitude to the sustainability and to support their development in this way the simple tool must be available. The above described ten dimensions therefore include principle statements. These statements can be answered with yes or no. The higher percentage of positive answer the better it is for the company. The statement could be use for inspiration and like “best practices” as well.

4. Conclusions

There is of course no doubt that the question of sustainability is more general and wider and does not concern the ICT innovations or companies development only. The question of the sustainable growth is very close tied with other questions like the living standard, acceptable level of unemployment or level of security for example. The current situation is maybe the important starting point for paradigm changing when principles sustainable consumption will have higher importance.

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DRIVERS AND INHIBITORS OF GREEN ICT DIFFUSION: A SURVEY IN THE CZECH SMES

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Keywords

Green ICT, Survey, Smes, Drivers, Inhibitors

Abstract

With regard to an increasing trend of negative ICT effects, a number of initiatives, that are included in the term Green ICT, have been raised aiming at minimizing these impacts. This paper presents selected results that show which drivers and inhibitors influence Green ICT diffusion in the Czech SMEs. First factors that have both positive as well as negative impact on Green ICT adoption are established. Then the survey results are discussed.

1. Introduction

Information and communication technologies (ICTs) have indisputable positive effects on the society as a whole. According to the Czech Statistical Office (Mana, 2010), ICT sector demonstrates a growing share in employment, production and added value. On the other hand, a massive development of ICT also brings along negative aspects (Petty, 2007; Webb, 2008). At first glance e-waste seems to constitute a problematic area in this matter, mainly due to an accelerated innovation cycle of ICT. However, as to the OECD (2010) it is own use of ICT that represents the heaviest negative impact on the environment, followed by ICT production.

With regard to an increasing trend of negative ICT effects, a number of initiatives have been raised aiming at minimizing these impacts. Such initiatives try to incorporate the principles of sustainable development also in ICT. Even though, there exists certain disunity in the terminology of sustainable ICT, as for example Green IT, Green IS (Boudreau, Chen & Huber, 2008), Green of IT, Green by IT (Lee, 2008) or Sustainable IT (McWilliams & Siegel, 2001). When applying the principles in a business environment it is possible to exploit the term Green ICT defined by OECD “as ICT with better environmental performance than previous generations (direct impacts) and ICT that can be used to improve environmental performance throughout the economy and society (enabling and systemic impacts)” (OECD, 2010).

While most OECD countries implemented government programmes and business initiatives, which responded to the increasing trend of negative ICT impacts, the Czech Republic on the other hand did not conduct any Green ICT programme according to OECD research (Reimsbach-Kounatze, 2009). Since the research was carried out more than three years ago, we decided to analyse the current state of promoting Green ICT principles in the Czech SMEs.

The goal of this paper is to present selected results that show which drivers and inhibitors influence Green ICT diffusion in the Czech SMEs. The following section sets out the fundamental basis for establishing those factors that have both positive as well as negative impact on Green ICT adoption. The third section demonstrates the results of our survey conducted out of a sample of the Czech SMEs.

2. Research methodology

2.1. Research Model

Green ICT can be studied from several viewpoints that were stated in the Conceptual model of the assessment of ICT impact on sustainability (Basl, Buchalcevoová & Gala, 2011). The model defines four viewpoints, i.e. Level, Sustainable Development, ICT impact, and ICT lifecycle viewpoint, which we consider as key components for tracking the impact of ICT on sustainability. In accordance with the determined goal, we narrowed the Conceptual model down at the Level viewpoint. In general, Level viewpoint defines two levels - macro and micro level whereas we focus in this research only on the micro level, i.e. businesses and further specifically on small and medium enterprises. According to Murugesan (2010), Green ICT is a widely adopted initiative in most of the large companies worldwide. However, Small and Medium Enterprises (SMEs) could greatly benefit from adopting Green ICT practices. At the same time, they are constraint from moving to Green ICT adoption in several areas (Marmaridis & Unhelkar, 2010). As SMEs in the European Union are absolutely prevailing and moreover receive a significant support of investment for their ICT innovation from the European Social Funds, we decided to focus exclusively on Small and Medium Enterprises (SMEs) in our research. According to EU document (2003), „the category of micro, small and medium-sized enterprises (SMEs) is made up of enterprises which employ fewer than 250 persons and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million”. Enterprises that are examined in this paper, play the role of a customer of ICT sector, i.e. they are situated in the phase of ICT use in terms of ICT lifecycle viewpoint.

In compliance with international surveys (Molla, Pittayachawan & Corbitt, 2009; Molla, Deng & Corbitt, 2010), Green ICT diffusion is influenced by several factors divided into two main groups:

- Drivers that facilitate Green ICT diffusion consisting of following drivers – Clients’ pressure, Competitors’ actions, Employees’ creativity, Global economic crisis, Government incentives, Government regulations, Green movements’ pressure, Green/sustainability strategy, Industry associations, ICT vendors’ pressure, Market demand, Product and market strategy, Reducing cost of ICT, Senior management vision, Social acceptance, and Suppliers’ pressure.
- Inhibitors that form barriers to Green ICT diffusion consisting of following drivers – Absence of enforceable government regulations, Fear of failure, Inadequate skills and training, Lack of business leadership on Green ICT, Lack of government incentives, The cost of Green ICT solutions, The extent of Green ICT adoption in the industry, Unclear business value of Green ICT, Lack of demand, Lack of money, Lack of senior management leadership, Lack of skills/expertise, and Not regarded as a priority.

These drivers and inhibitors serve as a starting point for our research as well. We decided to join inhibitors such as Not regarded as a priority, Lack of demand, Lack of money, Lack of senior management leadership, and Lack of skills/expertise into one more comprehensive inhibitor Low level of awareness of Green ICT. Moreover, we extended the concept of drivers and inhibitors in

our research by adding Best practices. We believe that best practices can significantly facilitate Green ICT diffusion and also accelerate an outbreak of Green ICT adoption among businesses that do not belong to the group of Innovators and /or Early adopters of innovation (Basl & Gala, 2009). Best practices can thus be considered as a driver of Green ICT. On the other hand, Lack of Best Practices may perform as an inhibitor within companies that are not Innovators and/or Early adopters of innovation, which slows Green ICT diffusion overall or even prevents it from developing directly.

On the basis of defined drivers and inhibitors we formulated following research questions. The first question (RQ1) was determined as follows: „Are the stated drivers and inhibitors of Green ICT diffusion valid for SMEs in the Czech Republic? “. The results may serve as a tool to support the drivers and on the other hand to mitigate or eliminate the effects in case of inhibitors. The second research question (RQ2) evaluated a perception of these drivers and inhibitors depending on whether a company has already applied Green ICT or not. To provide a relevant answer to RQ2 it was necessary to identify whether a company utilizes Green ICT in its management or not (RQ2-p). As stated in the introduction section, certain disunity in the terminology of sustainable ICT could lead to a misunderstanding from the respondent’s side when asking a direct question such as „Do you utilize Green ICT in management?“. Therefore, we supplemented this part of our research with other supportive questions. In addition, we developed these supportive questions to make it more evident for a company to evaluate its activities as related to Green ICT. There exist several issues that are primarily not linked to Green ICT but still considered as activities related to Green ICT. For example a matter of virtualization can be viewed from the point of ICT infrastructure efficiency (Gala & Jandos, 2007) as well as from the Green ICT perspective. The latter viewpoint can be exploited by applying appropriate procedures to operation management to minimize the power consumption. The supportive questions were associated with the aspect of ICT life cycle on the basis of Conceptual Model of the assessment of ICT impact on sustainability (Basl, Buchalcevova & Gala, 2011), i.e.:

- ICT procurement – taking account to what extent devices are environmentally-friendly through its construction and to what extent manufacturers, distributors (including retailers) are mindful of the environment;
- ICT use – energy consumption by ICT devices, as well as approaches and practices such as Print optimization, Replacement of PC by portable and mobile devices, Virtualization (desktops, servers, storage), “Power down“ devices, properly sized ICT equipment, Teleworking and remote cooperation, Teleconference as a substitute for travelling to meetings, etc;
- End of Life, thus disposal of ICT directed to re-use, recycle or ecological disposal

An enterprise able to respond at least to one of the supportive questions in a positive manner is considered as a company applying Green ICT in its management.

2.2. Research method

To obtain relevant data in order to conduct an analysis, a questionnaire survey method was implemented via the Internet. The questionnaire survey was a part of a greater research, which was focused on other aspects of sustainable development in addition to above mentioned research questions. The basic statistical sample (N) was determined based on 2nd and 3rd calls of the Operational Programme “Enterprises and Innovations” (2010) due to a previous cooperation with subjects included in the programme. Basic contact information was found for each identified subject in the sample, and the companies were subsequently asked by email to fill in an electronic

questionnaire. Data collection was carried out in November 2011 in a 10-day period. Those that did not fill in the questionnaire within the defined time frame were asked again. Data collection finished on the 24th of November, 2011. Out of the total 294 (n) sent appeals, 47 messages were returned as undeliverable (16%), 35 respondents refused to participate (11.9%) and 18 answers (6.1%) could not have been identified probably constituting spam. Altogether, 61 replies were obtained and further processed, which represents a response rate of 20.7%.

3. Survey results, analysis and discussion

Basic data presenting the results of first research question (RQ1), where n=61, are depicted in the Figure 1.

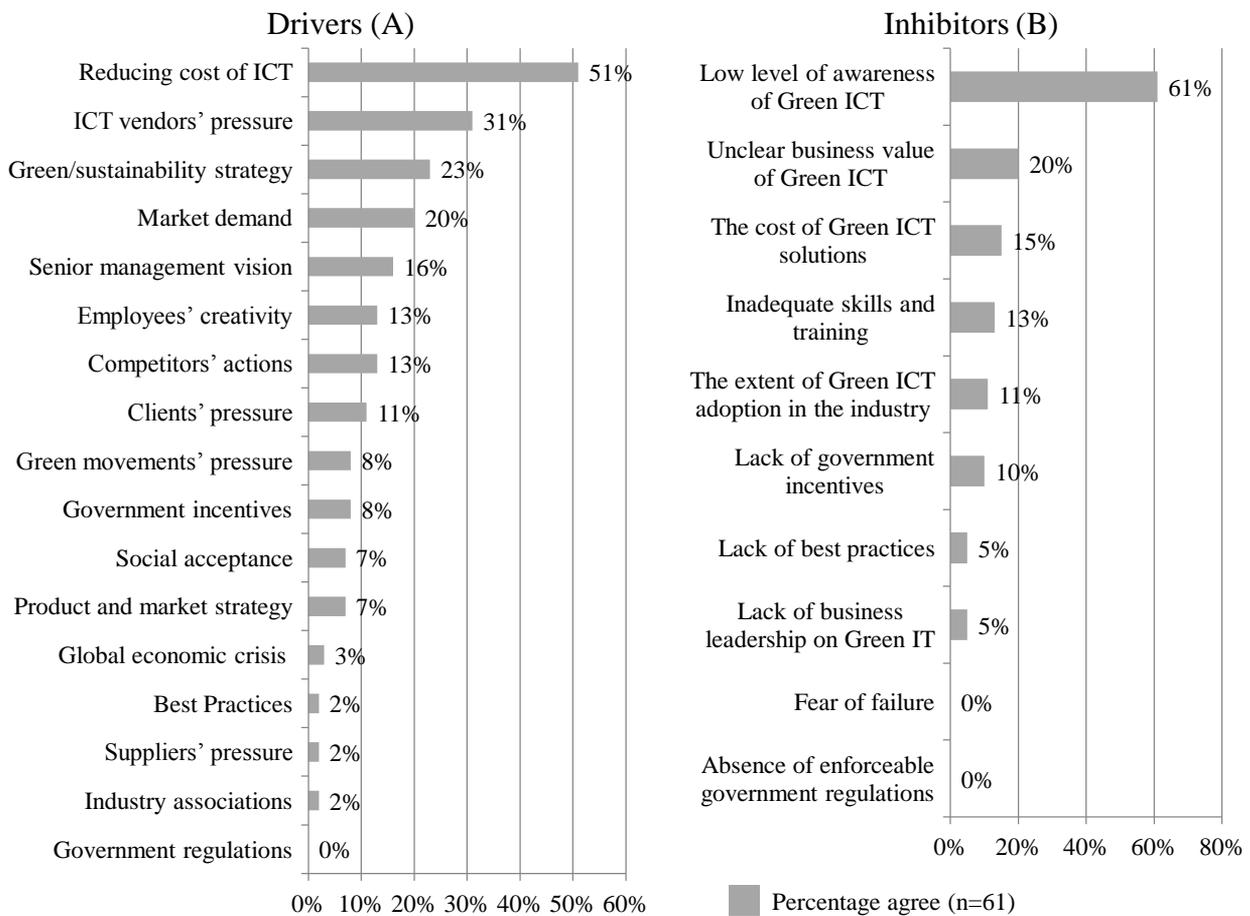


Fig. 1 Drivers and inhibitors of Green ICT diffusion perceived by the Czech SMEs

Part A of the Figure 1 shows which factors support the adoption of Green ICT practices from the respondent's point of view, i.e. determines an agreement with defined drivers. We can see that Reducing Cost of ICT represents the most frequently quoted factor. This confirms the current trend of an increasing pressure to reduce ICT budget. Unfortunately, this research does not reflect an impact of economic uncertainty and crisis when evaluating the driver. Nevertheless, this aspect also influences Green ICT diffusion into businesses.

Regarding the impact of drivers, the internal factors (e.g. already mentioned Reducing Cost of ICT driver but also Green/Sustainability strategy) belong to an important category within companies, which indicates that businesses do realize possible negative effects of ICT.

Comparing the values reached in the drivers' section of our research with the results of international surveys (Molla, Pittayachawan & Corbitt, 2009; Molla, Deng & Corbitt, 2010), the quoted percentage of each driver indicates a much lower value within the Czech SMEs. For example, considering Reducing Cost of ICT driver, this difference accounts for more than 30 percentage points in favour of foreign companies, Green/Sustainability strategy driver reaches a difference of 59 percentage points and Social acceptance driver differs from the international result by more than 64 percentage points. On average, the Czech SMEs show a lower score of approximately 38 % across all the other drivers. The only exception comprises IT vendors' pressure incl. ICT trends driver, where the Czech enterprises assign it a higher value of about 17 percentage points. In our opinion, this fact is caused by the cultural characteristics of population in the Czech Republic (Hofstede & Minkov, 2010). On the contrary, not even a single respondent considers Government regulation as an applicable driver whereas the value awarded to this driver abroad constitutes 57%. We believe that it is because the Czech government does not pay a sufficient attention to this matter in the official documents, as pointed out also in the research Reimsbach-Kounatze (2009).

Figure 1 in part B presents which factors are perceived as main inhibitors of Green ICT adoption. The absolutely prevailing factor constitutes Low level of awareness of Green ICT (61%), which is in compliance with a poor emphasis on Green ICT in national strategies and government documents. Other factors are represented by substantially lower percentage values. The second most frequently quoted factor Unclear business value of Green ICT was ranked as second in the international survey as well (Molla, Pittayachawan & Corbitt, 2009) with 48%, while The cost of Green ICT solutions took the first place accounting for 71%. Concerning Absence of enforceable government regulations, (Molla, Pittayachawan & Corbitt, 2009) indicates 33% of affirmative responses while in our survey none of the respondents mentioned this factor. It may be connected with a significant resentment to regulatory actions and also with an insufficient extension of these actions in the Czech Republic compared to other countries.

Overall, the comprehensive result of the first research question (RQ1) – „Are the stated drivers and inhibitors of Green ICT diffusion valid for SMEs in the Czech Republic?“, shows that SMEs in the Czech Republic perceive the defined drivers and inhibitors but to a limited extent in comparison with international surveys (Molla, Pittayachawan & Corbitt, 2009; Molla, Deng & Corbitt, 2010).

To obtain relevant answers to the question RQ2, it was necessary to determine the number of companies using Green ICT in the company's management (RQ2-p). By evaluating direct as well as supportive questions we have found out that 26 respondents, i.e. 43% utilize Green ICT in the company's management. We believe that this number represents quite a low percentage because in our opinion businesses should be in accordance with Directive 2008/98/EC of the European Parliament and of the Council of November 19th, 2008 on waste and repealing certain directives (European Parliament, Council, 2008) at least in the end of ICT use.

Figure 2 illustrates the perception of drivers depending on whether companies use Green ICT in their management or not.

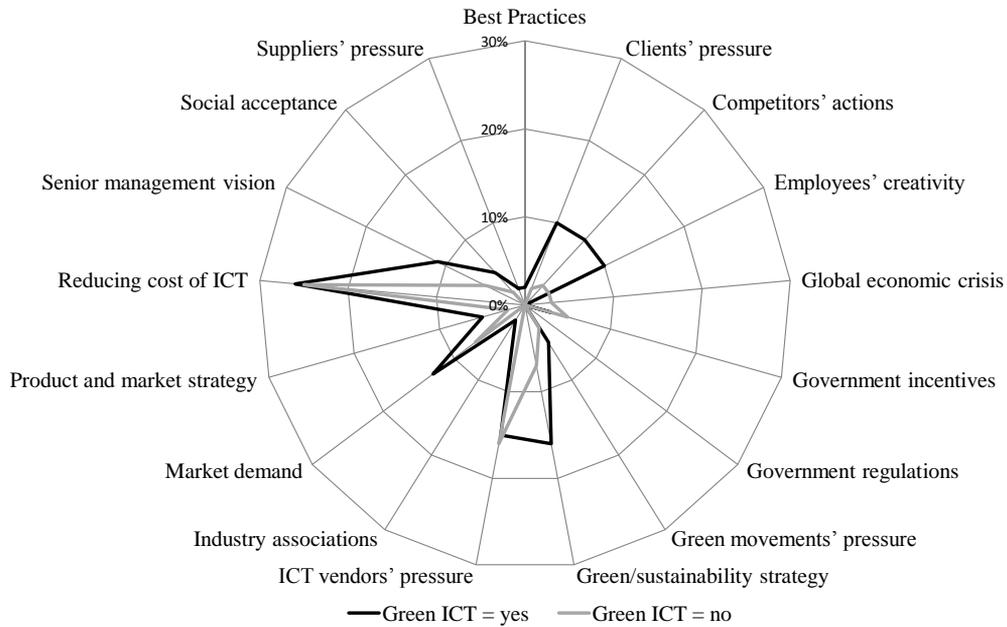


Fig. 2 Perception of drivers depending on whether companies use Green ICT in their management or not

According to Figure 2, the perception of Reducing cost of ICT factor is independent on the already applied adoption of Green ICT in a company. On the contrary, Green/sustainability strategy, Senior management vision, Market demand, Clients' pressure, Competitors' actions and Employees' creativity drivers are awarded a greater importance among enterprises that already utilize Green ICT practices. A mixture of these drivers suggests that companies that have already incorporated Green ICT into their management system do realize a complexity and also an interdisciplinary character of this matter not related only to information technologies themselves, but also to a recognition of Corporate Social Responsibility (Doucek, 2011).

Figure 3 shows the perception of inhibitors depending on whether companies utilize Green ICT in their management or not. According to Figure 3, Low level of awareness of Green ICT is perceived as a strong inhibitor in enterprises that have not implemented Green ICT practices yet (41%) as opposed to companies that already use Green ICT practices (20%). Further, companies that have already incorporated Green ICT in their management sense a greater perception of Cost of Green ICT solutions factor (11%) compared to 3% of those enterprises without Green ICT practices. Lastly, Inadequate skills and training and Unclear business value of Green ICT are perceived as important inhibitors in businesses that do not use Green ICT practices.

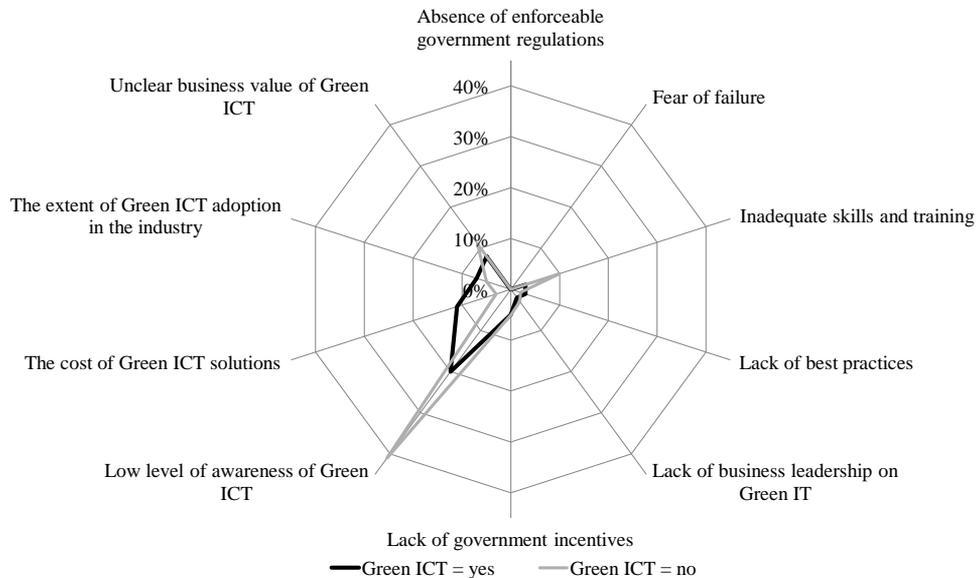


Fig. 3 Perception of inhibitors depending on whether companies use Green ICT in their management or not

On the whole, the result of our second research question (RQ2), which sought to determine whether there exist a difference between perceiving drivers and inhibitors in enterprises with Green ICT implemented in their management structure and companies with no adoption of Green ICT at all, demonstrates that the perception of drivers as well as inhibitors varies. Key differences were then commented above.

4. Conclusion

This paper presented selected results of the survey focused on Green ICT diffusion in the Czech SMEs. The survey confirmed that defined drivers and inhibitors of Green ICT diffusion are also valid for SMEs in the Czech Republic. However, they are perceived to a limited extent in comparison with the international surveys. The result of the second research question (RQ2) whether there exist a difference in the perception of drivers and inhibitors within enterprises that use Green ICT in their management and the others that do not, confirms that the perception of both drivers and inhibitors varies.

The results of the survey support our hypothesis that a lack of Green ICT support in government programmes and a lack of government incentives comprise a real barrier to a broader adoption of Green ICT practices in the Czech companies. Much more effort is needed to develop and apply clear and measurable policies and initiatives to improve environmental performance of ICT, and to apply ICT across the economy to tackle the challenges of global warming and environmental degradation.

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ACTIVE INITIATIVES TO ICT INNOVATIONS FOR SUPPORT OF COMPETITIVE ADVANTAGE

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Analysis, BI and CRM Products, Competitive Advantage, ICT Innovations, Operating and Database Systems, Petri Nets

Abstract

The paper presents and discusses the active initiatives to ICT (information and communication technology) innovation based on analysis and comparison of adopted solutions in ICT products. Confrontation of existing options is demonstrated on a security layer of selected products. The benefit of this wider analysis is an overview via operating and database systems, BI, and CRM products. A good starting point is an analysis of selected products by Petri Nets with simulation using a multidimensional and object approach. This analysis shows ways of improving individual implementations. For example, Sugar CRM offers an optimal way of restricting access by date for access control to tabs and visible records for the user. Other positive options are advanced security (validation of IP address, maximum upload file size) or logging slow queries. Improvement requires restricted access for the system administrator (inspired by the Oracle database system) or transparent user identification (as in operating systems). Another benefit would be to simplify the overall concept of the accepted security layer from five components to four by merging the user account and system administrator area or audit and logging with an advanced security area.

1. Introduction

Innovations and competitive advantages have tight binding to information and communication technology. The reason is prosaic; every product of information technology must respect actual requirements and the purpose is to help with data processing in various human activities. ICT development for a technically new or significantly improved product and process is often used in an innovative firm. (Oslo manual, 2001) A unique advantage is that innovations are used for the implementation of beneficial changes. Searching for these changes is based on a detailed analysis of existing solutions for better or new use. Competitive advantage is visible in comparison to competitors; firms must prove many different factors. The key factors are price, product and service quality, diversity of products and services, flexibility of response and decision making, and especially continuous duration of each activity – speed. (Kavan, 2002)

There exist various methods for evaluation of innovation efficiency, for example, the Summary Innovation Index that is determined by calculating a set of indicators: human resources, knowledge

creation, transfer and use of knowledge, finance innovation, outputs and innovative markets. (Žítek, 2010) The same factors and indicators for the evaluation of quality, diversity and flexibility are also needed for ICT products. Innovation efficiency is important for all firms and organizations, but for small and mid-sized firms (SMEs), it creates one essential difference. SMEs must resist the pressure of competition and markets to ensure uniqueness and uncompromising quality. ICT has the unique potential to help with needed processes and activities for SMEs that make up 99% of companies in the EU. (Small and medium-sized enterprises, 2011) ICT potential brings options for the new ability to create an optimal place of European attractiveness based on green ICT. (Basl, Buchalceková, Gála, and Targa, 2012) There are a number of programs and initiatives that link scientists, small and medium enterprises, individuals with the support of major companies, and partners. A good example is the “Voices for innovation” program (Voices for innovation, 2012), the CzechInno Association (CzechInno, 2012), or the Association of Innovative Entrepreneurship CR (AIE CR, 2012). The community of IT (information technology) professionals and businesses are supported with an aim to disseminate information about ICT needs and to find new opportunities in innovation and technology transfer. The user environment and user product perception is very important for optimal implementation of information technology. Their big potential is visible in relation to ICT service architecture like a phenomenon of present society development. (Voříšek and Jandoš, 2010)

2. Innovative Initiatives from the ICT Field

One way to innovation is based on progressiveness of the technical solution. (Dvořák et al, 2006) Services using ICT are based on applied processes with the support of needed hardware and software. These services are characterized by:

- Method of implementation,
- Number of authorized users, quantity of processed data,
- Qualitative characteristics like availability, response time, reliability, age of transmitted data,
- Knowledge about technologies for consummation selected service. (Voříšek, 2009)

This way is characterized by an underestimation of the importance of marketing research, which has resulted in poor estimation of the behavior of potential customers. The influence of the user view on information technology is clearly visible in implementing ICT products like BI and CRM products, database and operating systems.

BI products are attractive applications that affect many firms, organizations, or individuals. These products offer tools for the analysis of existing data from various sources. An innovative initiative is the concept view for the future. It includes the creation of hypotheses from historical data, the application of conclusions on current events, and finally, management of future events through predictive analysis. (Are you ready for BI 2.0?, 2011) In contrast to BI products, *CRM products* have a direct link to customers (often users of information technology). The aim of CRM innovation is to optimize customer relationship and, thus, increase long-term performance. (Neumann, 2004) For example, Sugar CRM shows more information about customer's satisfaction via Net Promoter Score (Freeman, 2012) based on centralized access to repository for all customer data, and proactive communicate with customers.

Database systems are a natural selection for storing and further processing stored data to decision-support using required information. The information forms actual data with a necessary visual

format. These systems aim to develop such architecture that ensures better scalability without loss of data availability for users. (Pokorný, 2006) The leading products (MS SQL, My SQL, and Oracle) offer a user-friendly environment for administration and everyday use to users via websites or a point-and-click environment. Special emphasis is placed on security, power, and speed for an immediate response. *Operating systems* create a background for data processing based on the optimal use of hardware sources. At first glance, these products are ubiquitous without importance of innovation with regard to little direct contact of users and clients. The opposite is true. Operating systems must be in very good condition to offer optimal process timing of urgent requests from all users and all applications.

The benefit is that small and middle-sized firms or individuals also use the above-mentioned products for the support of realized activities. They can select from commercial or open-source solutions, but what is missing are models with indicators for the management, application and innovation, including links to other areas. This situation is documented by *the Survey: business software behind the user-friendliness*, where 75% of respondents aged 35 years or less say that they use a spreadsheet like Microsoft Excel instead of enterprise information systems like ERP and CRM, because they consider these application as cumbersome. (Survey, 2011) One way to improve the current status is to simulate adopted solutions and their comparison with further visions of other innovations. An attractive way is to open simulation to various layers across the application class.

3. Methodical Approach and Simulation for Comparison

Active innovative initiative analyzes existing resolutions in selected ICT products. Selected products and systems include:

- openSolaris operating system – system from the group of UNIX operating systems. (Oracle Solaris Product Documentation, 2012) UNIX operating systems are important in building a server environment for sharing available hardware sources and accessing needed applications.
- Oracle database system – traditional system with a major market share in database solutions. The Oracle database system (Oracle Enterprise Manager, 2012) offers a powerful database system with a high user-friendly interface and automatic management based on alerts.
- Jaspersoft Suite as a BI product – an open-source solution that is dedicated to reports and analyses for performing on-line analytical tasks. (Jaspersoft Suite, 2012) The benefit is an easy menu with a browser-to-composition analysis for offered products, services, social networks (Slaninová et al, 2010), or also educational systems (Munk and Drlik, 2011).
- Sugar CRM products – an open-source solution for integrated information management regarding customers, contacts, sales, calls, or meetings. The benefit is a lifecycle of customer accounts with detailed information about activities, opportunities, or contacts. (Sugar CRM, 2012)

The selected products and systems were analyzed in given layers. This approach is suitable for developing operating systems. The benefit is the ability to divide a specified area into several (5-7) components for better simulation and mental understanding of reality. These layers are architecture, process management, file systems, user environment, and security. For example, follow lines are dedicated to security analysis. This layer is important for every ICT product with regards to user confidence, accuracy of processed data, and overall stability of the implemented system. The methodology approach is based on verified access via the MDIS multidimensional methodology

(Voříšek, 2009) with object access. Object access is necessary and selected analysis by Petri Nets allows work with the object as a transition, place, and arc. Petri Nets are specified as:

$$N = (S^{\otimes}, T, \delta_0, \delta_1), \text{ where} \tag{1}$$

- S^{\otimes} is a free commutative monoid of states,
- T is the set of transitions,
- $\delta_0, \delta_1: T \rightarrow S^{\otimes}$ give the source and target of each transition. (Abramsky, 2008)

A model where security mechanisms were implemented into Sugar CRM is shown in Fig. 1. This model is created in the Petri Nets HPSim simulating program. (Petri Nets Tools Database Quick Overview, 2012) The created model describes the implemented security composition in given product. It is apparent that security mechanisms (CRM_Sec) have been given the following relation:

$$CRM_Sec = (UA, SA, RAD, AS, AL), \tag{2}$$

where UA is dedicated to the user account area, SA specifies security for system administration, RAD defines a way to restrict access to data, AS are advanced security options, and AL are standard monitoring events in Sugar CRM. These components are created by the items for detailed specification via P_{2-i} (for $i=1-5$), P_{3-j} , P_{4-j} , P_{5-j} (for $j=1-3$), P_{6-k} (for $k=1-2$):

$$UA = \sum_{i=1}^5 P_{2-i}, \quad SA = \sum_{j=1}^3 P_{3-j}, \quad RAD = \sum_{j=1}^3 P_{4-j}, \quad AS = \sum_{j=1}^3 P_{5-j}, \quad AL = \sum_{k=1}^2 P_{6-k} \tag{3}$$

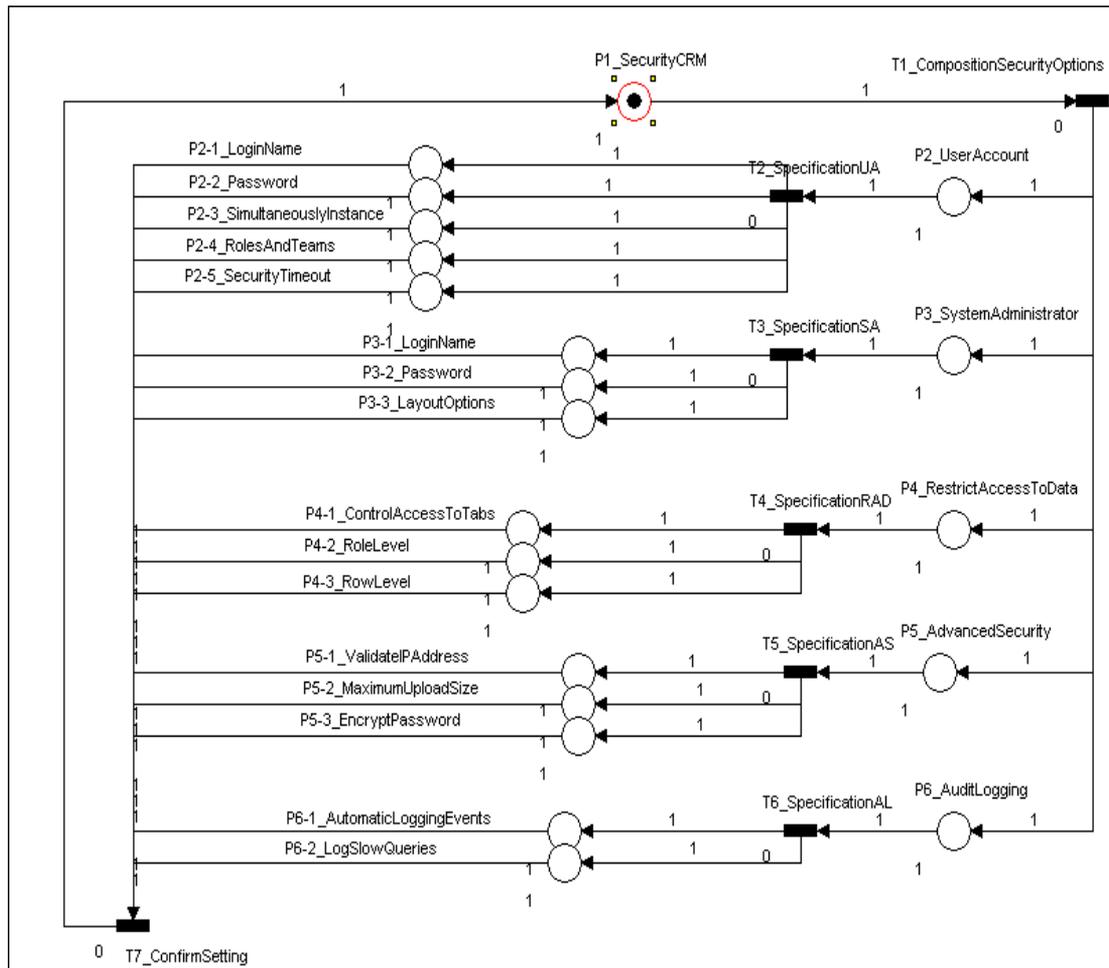


Fig. 1. A model describing security composition in CRM Sugar.

The above-specified model creates places as white circles and transitions as black rectangles. The places and transitions are linked with oriented edges. The specified places of the model are:

- P1_SecurityCRM – Sugar CRM interface also accessing security components.
- P2, P2-1, ..., P2-5 – places are dedicated for user account specification via login name, password, rules for simultaneous instances, roles and teams, and security timeout.
- P3, P3-1, ..., P3-3 – places are dedicated for system administration specification via login name, password, and layout options.
- P4, P4-1, ..., P4-3 – places are dedicated for restricted access by date via access control to tabs, role, and row level.
- P5, P5-1, ..., P5-3 – places are dedicated for advanced security options like validate IP address, maximum upload file size in bytes, and ways to encrypt passwords.
- P6, P6-1, P6-2 – places are dedicated to audit the process and monitor with automatic logging events and log slow queries.

The required transitions of the defined model are:

- T1_CompositionSecurityOptions – Sugar CRM avails setting security via tabs and buttons for correctly security and restriction.
- T2_SpecificationUA, T3_SpecificationSA, T4_SpecificationRAD, T5_SpecificationAS, T6_SpecificationAL – transitions for detail definition the security components.
- T7_ConfirmSetting – transition enabling to set and manipulate with defined components and items via tabs with buttons, check boxes, or menus.

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 – P6 create the implemented components to security control of CRM product. The created models are further analyzed by matrix algebra such as the incidence matrix and the set of reachable markings. Please see Table 1.

	Incidence matrix							t1 → M1	t2, ..., t6 → M2	t7 → M0
	t1	t2	t3	t4	t5	t6	t7	M0	M1	M2
p1	-1	0	0	0	0	0	1	1	0	0
p2	1	-1	0	0	0	0	0	0	1	0
p2-1	0	1	0	0	0	0	-1	0	0	1
p2-2	0	1	0	0	0	0	-1	0	0	1
p2-3	0	1	0	0	0	0	-1	0	0	1
p2-4	0	1	0	0	0	0	-1	0	0	1
p2-5	0	1	0	0	0	0	-1	0	0	1
p3	1	0	-1	0	0	0	0	0	1	0
p3-1	0	0	1	0	0	0	-1	0	0	1
p3-2	0	0	1	0	0	0	-1	0	0	1
p3-3	0	0	1	0	0	0	-1	0	0	1
p4	1	0	0	-1	0	0	0	0	1	0
p4-1	0	0	0	1	0	0	-1	0	0	1
p4-2	0	0	0	1	0	0	-1	0	0	1
p4-3	0	0	0	1	0	0	-1	0	0	1
p5	1	0	0	0	-1	0	0	0	1	0
p5-1	0	0	0	0	1	0	-1	0	0	1
p5-2	0	0	0	0	1	0	-1	0	0	1

Table 1.	Analysis of a model with an incidence matrix and reachable marking									
	Incidence matrix							t1 → M1	t2, ..., t6 → M2	t7 → M0
	t1	t2	t3	t4	t5	t6	t7	M0	M1	M2
p5-3	0	0	0	0	1	0	-1	0	0	1
p6	1	0	0	0	0	-1	0	0	1	0
p6-1	0	0	0	0	0	1	-1	0	0	1
p6-2	0	0	0	0	0	1	-1	0	0	1

Specified places (p_i, p_{i-j}) contain information about status in the form of tokens. Defined transitions (t_k) constitute available changes. Incidence matrix represents for places in form whole number (from positive to negative) change in number of brands.

The above-mentioned analysis is a good starting point for comparing adopted solutions in other systems and information technology product. A *strong point of Sugar CRM* security is that it restricts access to date and advanced security. Security control for a user account and logging events are standard in all products. The added value is logging slow queries to better performance of product. A *weak point of Sugar CRM* is declared in comparison with other systems. For example, every administrator evaluates a transparent user identification number like in operating systems or a list of opened log files. The Oracle database system has a strong point in its very sophisticated resolution for restricting access to data via the system administrator. The system administrator's account is a weak point of many systems like operating systems, BI, or CRM. Database systems resolve this area from the view of information misuse for unfair competition. The question for further analysis is wider implementation access to objects via given privileges in various products. The good message is that systems offer encryption for passwords or stored data.

The common relation is deduced based on the comparison of the number of implemented components in the adopted security structure via selected products (operating and database systems, BI, and CRM products). The OpenSolaris operating system offers four components: user account, system administrator, restriction data access, as well as audit and logging. The Oracle database system also offers a similar security structure range with four components, but the adopted solution respects the database system needs. A CRM product offers up to five components for security settings (user account, system administrator, restriction data access, audit and logging, advanced security). If *ImpSec* represents the number of implemented components for security structure in ICT products, then:

$$4 \leq ImpSec \leq 5 \quad (4)$$

CRM security structure use an inspirational solution for advanced security, but overall CRM security is not more stable than for example the Oracle database system; therefore, simplification is necessary. If *Future_Sec* represents the number of implemented components for a future security structure in installed ICT products, then:

$$3 \leq Future_Sec \leq 4 \quad (5)$$

CRM product evolution can continue on the idea of the Oracle database system, and can adapt an easier solution for the security structure with four components. A further question is the appropriate simplification of security structure via three components based on merging, for example, user account and system administrator areas, or audit and logging and advanced security areas.

4. Conclusion

The needs of the information and global society are dynamic and diverse. Their development influences rich interpersonal relationships and varied activities. Realized activities and processes are supported by ICT products. Implemented products must help with optimal data processing from their formation, through optimization, to necessary analysis. The aim is to improve competitive advantage with products and services offered at a higher quality. An important helper is the innovation of ICT products in this situation. There are a number of initiatives and programs for the support of innovation efficiency like Voices for innovation, the CzechInno Association, or Association of Innovative Entrepreneurship CR. They create an international environment for sharing new ideas and approaches. One way of ICT innovation is based on the simulation and comparison of adopted solutions in selected products (openSolaris operating system, Oracle database system, Jaspersoft Suite, and Sugar CRM).

The aforementioned method uses the multidimensional methodology and object access with the support of Petri Nets. A created model graphically illustrates an implemented security structure in Sugar CRM (user account, system administrator, restriction data access, audit and logging, advanced security). This model is further analyzed by an incidence matrix and a set of reachable markings. Other interesting results bring a comparison with another solution in selected ICT products. The strong and weak points of Sugar CRM security are better visible. A good CRM solution restricts access to date and advanced security for the validation of an IP address, maximum upload file size, or log of slow queries. On the other hand, transparency of user identification according to number or restricted access for the system administrator requires further elaboration. Another benefit is the definition of common relations that are deduced for the number of implemented components in the adopted security structure. CRM security is not more stable (with five components) than, for example, the Oracle database system (with four components); therefore, simplification is necessary by merging defined options.

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INNOVATIONS IN APPROACHES TO TEAM COLLABORATION

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Innovations, Groupware, Collaboration Tools, Social Network, IBM Connections.

Abstract

The purpose of this paper is to describe how new technologies can change approaches to team collaboration within a company, how they can provide new working conditions and create modern communication environment. New approaches to the team collaboration are described on the historical background of groupware development. Innovations in the team collaboration, which new information technologies bring, are presented on the example of IBM Connections product. The paper emphasizes the significance of knowledge sharing in linked network environment and necessary changes in the mentality of people who become its creators.

1. Introduction

This paper deals with innovations in the field of team collaboration supported by information systems and information and communication technologies (IS/ICT). It is relevant to mention, that collaboration and communication technologies play an important role in innovation management itself. Unfortunately many companies do not gain the competitive advantage from the usage of this big potential which new technologies provide. For instance, the results of the survey published by the consulting company “Information Architected” (IAI, 2009) highlight the lack of effective cooperation and communication in managing of innovations. Thirty-five percent from 180 participating companies stated that usage of collaboration and communication technologies within their organization is inefficient and does not contributes to improvement of the innovation management.

Enterprise Content Management (ECM) systems were identified as a good background for managing of innovations (Kunstová, 2010). ECM systems can support innovation processes by capturing and sharing the knowledge and can offer communication and collaboration tools for typical innovation methods such as brainstorming, product lifecycle analysis, cause and effect solving etc. These communication and collaboration tools, which are a good assumption for the innovation management, are the main subject of the interest in this paper from the perspective, what innovative approaches offer in the field of team collaboration.

Everybody expects that a good team will achieve better results than an individual. The question is, what further help in the team collaboration can we expect from current IS/ICT trends? After the

short recapitulation of collaboration tools development, the impact of new social networks on collaboration tools will be discussed.

2. Historical Overview of Collaboration Tools Development

The history of team collaboration with the support of information systems and information and communication technologies begins in the mid-eighties, when computer networks provided new forms of communication – email, calendar, meeting scheduling and documents sharing. These tools which integrated communication, collaboration and coordination functions for teamwork were called groupware. The goal of groupware was to seamlessly connect people, manage their work, optimize time scheduling and provide simply available content repository.

Overwhelming digital communication proves to be counterproductive in some circumstances, for example in email communication. The typical procedure is sending documents to colleagues instead saving and sharing them through a centralized content repository. The similar problem is the sending of documents to colleagues who are in the team, but do not need to use them. But the most serious problem is the loss of information. This period is therefore called the period of lost information. Examples of lost information are personal email messages or conversations which are realized through instant messaging, video or audio conferencing without content recording into shared repository. Therefore employees were encouraged to the share documents and other type of content efficiently and effectively using appropriate tools.

Rapid growth of electronic documents (Lyman, 2003) led to the creation of robust document management systems designed for documents' sharing, full text searching, workflow managing and archiving. Previously isolated applications became better integrated and since 2001 were covered by the term mentioned above – Enterprise Content Management. ECM systems encompass many applications to manage the complete lifecycle of documents and other content, groupware including. This second period was typical by increasing of the internet usage. Groupware was supplemented by instant messaging, wikis, blogs, video and audio conferencing.

The third period of collaboration tools is associated with expansion of Web 2.0 technologies and social network services. Social network services allowed people to come together online around shared interests, hobbies or causes (Gross, 2010), (Klößner, 2011). Social networks created the separated communication environment with a very spontaneous acceptance. There is a special combination of synchronous and asynchronous communication. The typical is asynchronous communication where participants publish and read information at different points in time. But at reading previously published content, the reader receives information, if the author of content is on-line and if it is possible to start a chat with him.

Documents management systems are appropriate technology for standardized processes and documentation, but are not flexible enough for a creative work, especially for a team creative work. On the other hand, social networks support a natural communication, creation of relationships and publication of information. The new potential brings collaboration tools integrating principles of social networks into companies' environment.

3. Social Network in Companies' Environment

From historical point of view, plenty of software products already have been developed to help people to communicate and to cooperate more efficiently and easily and to bring together the

knowledge and experience of team members, but social networks bring a new potential into user collaboration.

Social network is easy to access and highly intuitive and is available when the individual needs it. The most widely used social networks are Facebook, Twitter, Google+, LinkedIn and Foursquare. The basic principle of these networks is worldwide access and focus on the sharing of personal information.

Because the environment of social networks became a natural part of people communication, the new collaboration tools were developed. The original functions of groupware were preserved, but were enriched by principles of social networks. The example of this social software is product IBM Connections.

3.1. IBM Connections

IBM Connections (sometimes referred to as a “Facebook for companies”) is the closed social network within company, but across the organizational structure and over all geographically isolated locations. It is:

- a repository for documents, presentations, suggestions and contributions,
- a platform to exchange ideas or problems solution,
- a communication tool which enables to connect people with knowledge and information that they need,
- a collaboration tool which helps to find right information sources, professionals and coworkers.

The core principle of this tool is global sharing of all valuable information by community users. Creation of hierarchical structure in communities or folders is limited to two levels. Communities are group of people who share the interest to interact with each other. Communities are established as public, with open access for all employees to join, or as restricted, with limited access to particular group. Unlike worldwide networks such as Facebook, setting rules as public or as restricted is always realized only within the company.

Each employee has a profile that helps the other people to contact him and find out his interests, skills and experiences. The profile allows to tap people into the collective knowledge of others and to collaborate with them. Own communication is realized within six interconnected applications:

- **Activities.** This application helps to organize teamwork, including communication support, assigning tasks and documents sharing. For example, an activity can be a driving a sales process, a hiring of a new employee, a creation of a large document, such as corporate strategy.
- **Blogs.** A blog is a website where entries are made in journal style and displayed in a reverse chronological order. Blogs are a fast and effective way to give information about a new product or using a new technology or to present new ideas and get feedback from others.
- **Bookmarks.** This application supports sharing interesting or important bookmarks with notification possibilities.
- **Files.** This application provides a simple way to share files, information, communications, and ideas with others without sending large files through email.

- **Forums.** A forum is an online discussion board where employees can ask questions, share their experiences, and discuss topics of their interest. By participating in a forum, users can exchange ideas and leverage the expertise of other people in the company.
- **Wikis.** Wikis are collections of pages about a particular subject. Wiki members can edit or comment on the pages, or add their own pages. Teams can use wikis to create a central place to collaborate on a project or to share knowledge.

It should be emphasized that this software does not replace traditional document management systems or knowledge management systems. They still have their place in the application architecture.

Software like IBM Connections not only supports the standard processes of social communication, but it gives them a new dimension by being implemented across the company. It helps to discover who in the company is working on similar projects or trying to solve analogous problems. If employees share valuable business information, they can faster achieve targeted business results.

3.2. Use of IBM Connections – Survey among Students

Based on cooperation of the Department of Information Technology and IBM Company, the product IBM Connections was provided by IBM for testing by students in spring 2012. Students of the course Collaboration Support Systems tried the basic functions with the aim to understand principles of this product and to form their own opinion on the use of the product in the academic and business environments.

The feedback was obtained through three questions that students answered by form of a free text. The form of free text is very difficult to evaluate, but very beneficial for the collection of individual observations and opinions. The survey found out the answers to the following questions about IBM Connections:

- What functions, how and why would be possible / appropriate to use it in the academic environment?
- What functions, how and why would be possible / appropriate to use it in the business environment?
- What are the advantages, disadvantages and limitations of its deployment?

Students wrote their opinion of the use IBM Connections in the business environment from the perspective of a specific company. The basic characteristics of this company with which communication environment student was familiar, were reported in the first part of the questionnaire. The characteristics were: the number of branch offices, the number of employees (in branch offices in the Czech Republic, the number of IT staff working in the Czech Republic, an industry sector).

In the survey seventy students participated. Nobody had a totally negative mind about this product, but it does not mean that everything was positive. Views of students were critical and opened and the important thing was that their opinions were explained. Nine percent of students would not recommend the use of this product at our university. The reasons were: the expected high price, general preference of Facebook by students, sharing of information by students and teachers. Thirty-four percent of students would not recommend to implement IBM Connections in a company, in which they realized interview. The reasons were: size of the company, employees' lack of interest and unwillingness to learn new software, inappropriate industry sector. The main positive findings were following (generally expected benefits of this product are omitted here):

IBM Connections:

- solves integration of isolated communication channels which are now usually used within team cooperation (Google Docs, Facebook, email, Dropbox or Huddle),
- brings synergistic effect of collective intelligence,
- separates a social network, focusing on professional information and its publication and sharing, from widely used social networks focusing on sharing of private information,
- provides quick search for information, answers on questions or experts by tags,
- facilitates an organization of team works, when student is involved in several teams concurrently.

Especially in our university environment, implementation of IBM Connections would allow to create professional contacts across courses, study years or faculties and to keep professional contacts even after the team work.

The very important conclusion is that 95% of students agree that IBM Connection is an innovative product which employees / students have to widely accept otherwise they will not benefit from it. Acceptance of such a product, however, implies a change in user behavior. The chapter 3.3 discusses innovations brought by IBM Connections and their impact on changes in user behavior.

The product deployment process was found to be a critical success factor, which resulted from eighty-seven percent of the questionnaires. Author's comment to this problem is given in the chapter 3.4.

3.3. Innovations Brought by New Collaboration Tools

In accordance with the aim of this paper, the innovations within new collaboration tools will be identified in this chapter. The goal of innovations is to improve efficiency or competitive advantage of the one of the following:

- to offer new products or services,
- to apply new business or manufacturing processes,
- to change an organizational structure, business practices, external relations,
- to implement a new marketing method, product or services promotion and pricing.

Firstly, we can identify new services. Tags or metadata are very important part of documents shared within document management systems. Their main role is to help users to find files. With the same goal are tags used in network collaboration tools but with more comprehensive results. For example if user finds documents on the basis of selected tag, he receives list of documents with links to their authors, each document has the link to the list of other documents with related content, each author has a profile containing his interest, skills and specialization.

Secondly, because published information are not anonymous, we can identify a few self-checking processes. For instance nobody wants to be connected with poor presentation or incorrect information. All users' activities are monitored therefore everybody is under control of his behavior. This behavior is comparable with the sustainability of the quality in Wikipedia encyclopedia. Studies on Wikipedia confirm that errors and vandalism are quickly corrected and expert reviewers determined the credibility of the articles (Ofer, 2010).

Thirdly, these networks overcome limitations of existing organizational structures. Groupware is from its beginning recommended for cooperation of virtual team. Virtual teams are understood as teams with geographically dispersed members communicating primarily by using IS/ICT. The difference between traditional and social network teams is in their establishment. Traditional virtual teams are established in advance on the basis of teamwork entry conditions. If the team members do not work well together, the collaboration might not be as effective as it could be. Social network teams are not established in advance in many cases. They are created on the principles of the joint subject of interest. Users can create their own network.

Fourth, the enterprise communication network is a platform for people creativity. Cooperation across company can generate completely different ideas than cooperation within long-term communicating team. In order to profit from shared resources employees need to interact with others inside and outside of their teams. A team forum leads to greater benefits because some information has to be shared, decision processes documented, and tasks coordinated. If the membership of the forum gets too large, it is hard to manage, add, and search.

It follows that the new collaboration tool such IBM Connections contains elements that match the characteristics of innovation. Its implementation brings new opportunity how to gain the competitive advantage, its benefits could be summarized by the statement: "Knowledge management system provides collective knowledge, social collaboration tools provides collective intelligence". Cross-departmental team work becomes more efficient through increased agility and flexibility.

3.4. Company Social Networks Implementation Issues

The main problem with collaboration solutions is their adoption by employees. It is easy to introduce functionality and potential benefits, but the way, how to start with it, is difficult. Training and practicing is necessary for deploying IBM Connections too. Collaboration tools create an environment in which new ideas and new innovation suggestions may flourish. In my opinion, the preconditions of successful implementation are:

- a corporate culture that encourages teamwork, cooperation and collaboration,
- an identification of key issues that sharing of different kind of information can help to solve,
- an availability of interesting or important information immediately after an implementation of the new collaboration product,
- early involvements of teams in sharing of their outputs.

4. Conclusion

Although team members often work faster and more cost-effective when working collaboratively, many companies have problems with effective use of IS/ICT for communication, collaboration and sharing of knowledge and for creation of new ideas. From the perspective of new documents creation we can see that office applications increased the work productivity of individuals, team collaboration products increased the productivity of teams and now social network collaboration tools can increase the productivity of companies.

Apart from implementation approach and tools similar to other IS/ICT solutions, the implementation of company closed social networks requires specific approach which especially

should concentrate on company culture and psychological preparation as well as on immediate start-up interesting information availability.

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EDUART PROGRAMMING SYSTEM AND THE LATEST TRENDS IN RICH-MEDIA TECHNOLOGIES INNOVATIONS

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Rich-Media, Eduart, MERLINGO, eLearning, Programming System

Abstract

Rich-media describe a broad range of digital interactive media having been increasingly used by the Internet. Moreover, they are of support during education, where the complex rich-media visualization of the educational process becomes a necessity for the transfer of information from teacher to students. EduArt (Education Art) programming system is the new revolutionary software determined for realization of recordings based on the rich-media technologies and their on-line or on-demand publishing. This software product is considered to be the major innovation in this area and it can be operated at any workstation, notebook, netbook, mobile device, etc with the particular supported operating system. The system significantly surpasses similar commercial solutions mainly in terms of its mobility and simple operation which can be mastered even by common users. Additionally, it does not require any special training or costly hardware. EduArt system was developed in the framework of the MERLINGO (MEdia-rich Repository of LearnING Objects) project activities and it represents the latest innovation trend in the area of rich-media technologies. The MERLINGO project based on the rich-media technologies application in the eLearning environment is aimed at the development of the central repository of rich-media learning objects in the distributed environment containing teachers' presentations accessible within the national academic computer network CESNET2.

1. Introduction

The term *rich-media* was coined to describe a broad range of digital interactive media, through which it is possible to share and transfer information and communicate in various ways. Moreover, rich-media enable interactivity, i.e. bidirectional communication. As a consequence of the development of Internet, the interactivity is growing and therefore, rich-media technologies are increasingly used. The characteristic feature of the rich-media technologies is their accessibility on-line or on-demand, followed by the support of the dynamics of changes. An example can be online streaming video reporting, which is updated during broadcast, or a record of presentation placed on a web site jointly with the synchronized slide show, which the user can interactively work with. Moreover, records realized with the support of the rich-media technologies contain by default

metadata, references to other linked sources, headings, sound description and navigation through peripheral devices.

Rich-media technologies can be found in many areas of economy, but mainly at schools (e.g. record of presentations of lectures available in real time or upon request in all forms of study, social communication among the teachers and students, the support of the educational process of students with special needs, mainly those with locomotive, aural and visual disability), in medical facilities (e.g. records of unique medical interventions and their distribution in real time), in the commercial sphere (mass interactive enterprise staff training, interactive communication in geographically distant locations), in the public sector, in the press and mass media, in the culture, etc.

2. Rich-media theories

Regarding the development of information and communication technologies it is important to investigate their use and impact on quality of interaction among entities, mainly in the area of educational activities. The main objective of those investigations is naturally the selection of the most convenient technology for the given way of interaction. Currently, there are several theories dealing with various aspects of the rich-media implementation, such as *Media Richness Theory*, *Media Naturalness Theory* and *Social Presence Theory*.

Media Richness Theory (Daft, 1986) study is useful at the investigation of the influence of different communication media and their impact on understanding conveyed message. *Media Richness Theory* mainly stems from literature on computer-media communication (CMC) being often connected with business communication. In this context *Media Richness Theory* is used for analysis of the communication medium selection and especially assists in reducing ambiguity of communication through its suitable selection. *Media Richness Theory* is interpreted as the capability of a medium of conveying information, while within said theory two components of the medium applied were identified used at the information transfer involving *Data Carrying Capacity* and *Symbol Carrying Capacity*. In that theory, communication media are usually organized according to their capability of carrying information depending on the content of both components. One of the criteria for the stated organizing can be based on the capability of the medium to respond immediately via feed-back. Usually, the face to face communication medium being the direct personal communication is said to be the most effective and the richest. Less effective and less rich is then considered to be e.g. video-conference and telephone call. The least rich and the least effective are non-addressed printed news (e.g. posters).

In past, the *Media Richness Theory* was criticized by many authors due to its determined nature that cultural and social background influence the selection of the communication medium by individual, and that the method is inconsistent with predictions of the stated theory. Additionally, some of its hypotheses are missing the scientific base. The *Media Naturalness Theory* (Kock et al, 2008) is presented as an alternative stemming from the knowledge about man evolution and happens to be also identified as the psycho-biological model or the compensation-adaptation theory. It used to be applied for the understanding of the human behaviour against technologies in various connections, e.g. in education, in conveying knowledge with technology, in communication in virtual environment, in business process, team leadership in virtual team work, or in on-line learning process. The *Media Naturalness Theory* claims that in the Stone Age our predecessors communicated primarily by face to face. Therefore, the evolution pressure led to the development of our brain by this form of communication. So far, our brain has not had time to adapt sufficiently to existing forms of communications. The communication tools which suppress key elements contained in face to face communication represent cognitive obstacles in communication. That fact

is mainly obvious during solution of comprehensive complex tasks like the business processes, the development of new products and the on-line education (which, compared with other simple problems, require more intense and longer communication).

In some cases of pedagogical activity, the sense of communication is not only about the exchange of information. From time to time it is necessary for individuals to be able to understand the person whom they communicate with and to be able to empathize their acting. In that context the *Social Presence Theory* (Short et al, 1976) is important. The stated theory describes the fact to what extent a man is perceived as real in the mediated environment. Otherwise stated, to what extent we are aware that behind technologies through which we communicate the man is present. The most social is again direct (face to face) communication. Each next method reduces the communication interactivity. Entirely least social presence is exhibited by the communication medium based on a text message only. The point of education activities is to what extent communicators recognize that they are in contact with other human being and not with technology being between them. The degree of social closeness in communication can have many different impacts on participants of communication, mainly that of the level of satisfaction. The environment where participants do not feel to be recognized as individuals leads to reduction of motivation in the involvement. That is why it is important to use rich-media technologies in situations where it is desirable for the participant to identify themselves among them. However, rich-media technologies sometimes produce certain limitations and problems which must be carefully considered in advance.

3. Rich-media and the complex multimedia visualization of educational process

One of the burning questions in majority of universities in the Czech Republic is maintaining and increasing the teaching process quality at the permanently growing interest in university studies, continuous increase of students of individual study disciplines and the possibility of attending the study process in the combined and distance form of study. Implementation of eLearning technologies indeed has been of a great assistance while addressing the stated issues however it is obvious, that conventional text study supports applied mainly during asynchronous type of teaching cannot fully substitute direct or mediated interactions of teaching staff with student. The complex rich-media visualization of the educational process thus becomes the absolute necessity for the overall transfer of information from teacher to students and under given condition of the Czech tertiary education and it is necessary that the stated visualization becomes the standard part of the teaching process of all forms of studies. By using rich-media technologies currently available at many educational institutions, it is possible to carry out automated complete records of the educational process with minimum demands on financial, time, personnel and technological aspects (Di Iorio et al, 2006) and to achieve their immediate access in the environment of the central database of learning objects (O'Neill-Jones, 2004).

So the main objective of the MERLINGO (MERLINGO, 2012) project (*MEDIA-rich Repository of LearnING Objects*) is to sort out this situation radically in participating universities (i.e. VSB-Technical University of Ostrava, University of Ostrava, Czech Technical University in Prague, Silesian University in Opava, Tomas Bata University in Zlín, Technical University of Liberec and University of South Bohemia in České Budějovice) by implementing latest technologies, followed by implementation of “barrier-free” information access of students to records of presentations of teachers on-line or on-demand, by upgrading teaching process led mainly by combined and distance form, by dramatic cost reduction of operation of those technologies, by availability of the central repository of learning objects containing rich-media recordings of teaching process, by creating conditions for the establishment of collaboration with other universities and by achieving

accessibility of the project results in the form of standard services within the national research and educational network CESNET2 (*Czech Education and Scientific Network*). From this perspective, the MERLINGO project is of pilot nature in the context of Czech universities and is unique even in terms of EU universities (Martiník, 2010).

However, several years of experience with making records of presentations of teaching staff and their publishing has revealed many bottlenecks of commercially available technologies mainly involving:

- inaccessibility or difficult implementation of a programming interface providing interaction with learning management systems of virtual universities,
- relatively high purchase price of individual recording systems and the necessity of annual payment for programming support to supplier,
- technical difficulties in realization of presentations of records in locations which are not equipped with a necessary infrastructure (camera and microphone systems, sound, mixing device, etc.) requiring relatively expensive and time consuming technical support,
- impossibility to outfit each teaching staff with their own mobile recording system that could be used for preparation and publishing of a lecture at times, when such staff is outside their work place, on business trips, conferences, etc.,
- demands on technical knowledge and skills of teaching staff in case when such person is to put the recording system in operation by themselves,
- enabling easy editing and modifications (e.g. edition, post-production) of records of lectures which could be done by teaching staff without technical assistance and on a mobile device,
- software systems used for recording of presentations do not have Czech localization.

The above listed bottlenecks of commercially available technologies led to the development of the new programming product *EduArt* (EduArt, 2012), which was implemented by the MERLINGO team of investigators in cooperation with the PolyMedia Technologies s.r.o. firm.

4. Programming system EduArt and trends in rich-media technologies

EduArt (Education Art) is the new revolutionary programming system determined for the realization of recordings on the basis of rich-media technologies and their publishing on-line or on-demand. As opposed to similar commercially available products, this software can be used on any workstation, notebook, netbook, mobile device, etc. with installed operating system *Microsoft Windows* (i.e. *MS Windows XP*, *MS Windows Vista*, *MS Windows 7*). Its basic functionality is a possibility of recording and synchronization of image and sound with the presentation on a display of particular computer. It also allows teacher to use of any programming system (e.g. *MS PowerPoint*, *Adobe Acrobat*, etc.) for the presentation purposes, followed by visualizer, electronic table, tablet and other devices connected to the computer with installed *EduArt* system via standard input interface. Resulting presentation can be passed to the end user on-line or on-demand and the user can playback it anytime and anywhere required. The record of the presentation can be exported to a web server or stored on various memory media (CD/DVD/BD, USB keys, external discs, etc.). The output of the realized presentation recorded in the *EduArt* system is the presentation in HTML format file which can be playback on any web browser supporting *MS Silverlight technology* (i.e. in environment of *MS Internet Explorer*, *Firefox*, *Google Chrome*, *Safari*, etc.). In the output presentation are synchronously recorded all individual channels in the original distinction (i.e.

audio, video, images and metadata). End user can playback the presentation as it originally was, or via controller of the video-record or views of recorded slides to move forward or rewind it thus repeating certain sections, or to look at only those sections of his interest. All the channels (video, slides and sound) remain continuously synchronous. In the presentation can be stored even other metadata, such as URL images which will lead the viewer to next connected resources within the Internet (scripts, CVs, manuals, etc.). In the case of access to the presentation record on-line the *EduArt* system will ensure continuous data transfer during presentation, i.e. of its audio and video content and pages of presentation.

The key characteristics which differentiate the programming system *EduArt* from other commercially available solutions also represent actual trends in the rich-media technologies technical and ICT innovations:

- existing solutions were designed primarily as dedicated systems while *EduArt* system primarily as user software supporting communication between teachers and students,
- existing solutions require specialized and costly hardware while *EduArt* system hardware requirements are flexible and the system can be operated even on common personal notebooks of teaching staff,
- contemporary solutions were designed for IT professionals and are relatively complicated operation-wise, while *EduArt* system has been designed with respect to the fact that it will not be used by IT specialists and thus its control is user-friendly and simple,
- *EduArt* enables adaptation of existing and creation of new study materials made by rich-media technologies for the students with special needs for the supporting of the teaching process in students with locomotors, visual, aural, or other type of disability (see Fig. 1).

EduArt programming system is extensively applied at the practical application of the methodology of adaptation of existing and newly created learning objects which are adapted for the students with special needs in the present time. However, a basic ambition of the implementation team of the *EduArt* system is also the development of the own server side of this new product solution called *MediaInTouch* (*MediaInTouch*, 2012), which, unlike existing operated commercially available systems will dispose of the following new characteristics:

- full localization in the Czech language,
- full compatibility with the programming system *EduArt* and support for *Accordent Capture Station* recording systems (automatic recognition of the type of content and allocation to particular groups for publishing and cataloguing),
- possibility of pro-active informing user groups, i.e. sending information about new events (articles, presentations, invitation cards, etc.) according to each group focus (e.g. study group, study year, teaching staff, publicists, etc.),
- all activities of the server starting with automated playback and sorting data of events, followed by generation of events (e.g. articles, presentations, invitation cards, etc.), appearance of individual events, appearance and content of sent information mails, and finally to groups of users and their rights based on the system of pre-defined templates. That characteristic increases work effectiveness of all involved individuals (contributors, editors, administrators, etc.) and at the same time guarantees to the system operator compliance with all required parameters of his communications (appearance of all materials, content and principles of safety),

- complete application programming interface (API) for the software systems of third parties (e.g. learning management systems, etc.) based on the web services enabling to the authorized application full control over all functions of the *MediaInTouch* server including direct bi-directional handover of all data.



Fig. 1: MERLINGO rich-media resources with translation into the sign language

The server-side infrastructure of the *MediaInTouch* system has been designed as fully portable, and unlike similar commercial products it is not bound to a single specific server design or a set of networking protocols. For replay of presentations can be used general web server and general media server. However, current implementation of the *EduArt* system is for the time being limited as it is bound to web browser supported by the programming system *MS Silverlight*. While any www server can be used as a web server, as the media server at the present time is required programming system *Windows Media Services*. For the transfer of multimedia data between the media server and the recorder is typically used the networking protocol *MS-WMSP (Microsoft Windows Media HTTP Streaming Protocol)*, or *RTSP (Real Time Streaming Protocol)*.

5. Conclusion

Next pilot and innovation activities realized or prepared as a part of the MERLINGO project mainly involve:

- Pilot performance of indexation of audio recordings made by the rich-media based technologies and the possibility of browsing in them according to entered key words which is technically realized by using *Automatic Speech Recognition* technology with language and acoustic models adjusted to a specific nature, subject and proficiency in the specific environment. It was implemented in *NovaVoice* programming system by Consulting Company *Novasoft* firm. Indexations of individual recordings have been currently done in on-demand mode; however the aim of the investigators' team is to achieve the possibility of indexation of audio recordings and their availability in real time.
- The transcription of standard eLearning text study supports in the audio form and their availability obtained via podcasting as a part of the MERLINGO portal services.
- Automated transcription of spoken text of the lecture recorded by the recording and assistance service into the written text and their availability upon request as a part of

services of MERLINGO portal. Those services are determined mainly for hearing disability students.

For the sake of realization of the above stated activities, the collaboration with investigators' team of *IT4Innovations Centre of Excellence* project has been initiated. In the last calendar year the European Commission approved the project of *IT4Innovations Centre of Excellence* being a part of the Operational Program "Research and Development for Innovations". One of the key objectives involves the building of the most powerful supercomputer in Central Europe. Hence, it will be possible to use in Ostrava the potential of highly parallel computing environment for implementation of demanding computations in many areas of research.

The basic goal of the project in activities related to the development of the information society (IT4People) is to carry out research and development of IT also in the key area called **Multimedia Information Recognition and Presentation** (IT4People, 2012). The research team of this key area will systematically investigate the processing of multimedia data, particularly the features on the level of signals acquired by means of various sensors. This will enable multimodal information identification and retrieval as well as research in techniques of efficient computing using multimedia data. The emphasis will be especially placed on image, video and speech analysis, document and multimedia data information retrieval, imaging, visualization and modeling including human tissue models, accelerated computing using specialized hardware and techniques of semantic web, formal languages and grammars.

The above stated suggests that results of collaboration of the MERLINGO Project investigators' team with **Multimedia Information Recognition and Presentation** research program investigators' team has immediate applicability mainly in areas of indexation of audio recordings made by the rich-media based technologies, automatic lettering of audio recordings, their automatic transcription to Braille and many others.

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REQUIREMENTS OF SMALL AND MEDIUM COMPANIES ON ICT PROFESSIONALS' KNOWLEDGE

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Keywords

ICT Professional, Knowledge, Requirements, Companies

Abstract

At present days is typical still increasing dependability of all our activities and also dependability of the whole economic environment on information and communication technology (ICT). This paper is devoted to the analysis of small and medium companies' requirements on ICT professionals' knowledge in the Czech Republic. The analysis is prepared for the roles of Developer, Administrator and Business Analyst. There is described methodology of the survey and the most important information about the survey in the paper. The Results part contains detailed analysis about companies' requirements on knowledge (knowledge profile) ICT professionals. This analysis takes into account differences between small and medium companies. Detailed analysis is prepared for all of three mentioned roles.

1. Introduction

Information and communication technologies (ICT) have become ubiquitous in the globalised economy. ICT are one of the most important factors for development and economic increase in the globalised economy in last 20 years. Integration of it into every day's life reasoned our permanently increasing dependency on it. On contrary ICT is not only an opportunity but also a challenge because only adequately skilled people in ICT can bolster competitiveness of Europe. (Niitamo, 2004)

Currently is our community solving following questions: How much are we depended upon ICT? What will happen after losing ICT support for our processes? Do companies' have different requirements on employees' skills and knowledge in relation to their size?

Massive investments into ICT in the last twenty years started economic growth. The growth was shortly interrupted after the dot com boom in 90s. For ICT industry were really exciting years 2000-2008. During this period were introduced extensive investments into the ICT and the results of these investments had significant impact on the economic growth (Doucek, 2010; Doucek, Nedomova, Novotny 2010; Delina, Tkac, 2010) and companies began to emphasize Corporate Performance Management (Wagner, 2011). It can be backed up by new goods and services offered on the market or by new channels for their distribution – for example e-shops, e-marketplaces, cloud computing, providing services through model „Software as a Service” etc. (OECD, 2010;

Quiang et al., 2003). Sudzina, Pucihar and Lenart (2011) identified that the company size impacts on the efficiency of ICT, i.e. profitability increase after ICT systems implementation. The competitiveness of European industry is highly dependent on both the effective use of ICT for industrial and business processes and the skills and knowledge of existing and potential new employees.

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

These predictions have to be linked to the requirements on employees and employees' responsibility for acquiring up-to-date knowledge and also skills from different areas of ICT to strengthen their progresses. (Weiß, Dolan, Stucky, Bumann, 2004)

The quality and knowledge of university graduates in ICT fields influence the innovation in all types and sizes of companies, including small and medium companies. The impact is caused especially by knowledge and abilities acquired during education process (Ala-Mutka, Punie, Redecker, 2008):

- Supporting different senses and by providing new opportunities for creativity for the students;
- Supporting collaboration and improving both overall and individual performance;
- Supporting differentiation and diversity with a wide variety of didactical and methodological tools;
- Empowering reflection, critique and interaction with colleagues etc.

2. Problem Formulation

The area of ICT is still changing. New information and communication technologies are created and also new processes, procedures and methodologies. One of the good examples is programming languages or new methodologies used by Business Analysts as a communication language among Business Analysts, Developers and for example Enterprise Architect.

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

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

The aim of this paper is describe small and medium companies' expectation on knowledge that should have ICT professionals after finishing their studies.

3. Data Collection and Methodology

3.1. Roles

We have defined seven roles in our survey (Administrator of Applications and of ICT Infrastructure, IS Architect, Business Process Analyst/Designer, Dealer - Business Person in ICT

Products and Services, Developer, IS/ICT Development and Operation Manager and Lector in ICT). Each of these seven roles was exactly defined by the table presented for example in (Maryska, Novotny, 2012) and (Maryska, Novotny, Doucek, 2010).

3.2. Skills Categories and Knowledge Levels

We have been concentrating on the 16 skill categories in our survey. These skills categories respect Strawmen's IT curricula.

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

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

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

3.3. Survey

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

The first classification criterion (number of employees) divides companies into the 4 groups: 0- 49, 50 - 249 and 250+ employees.

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

- sectors with the lowest requirements and dependence on ICT (MIT),
- sectors with medium requirements and dependence on ICT (SIT), and
- sectors those are completely dependent on ICT (VIT).

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

3.4. Knowledge Requirements on Selected ICT Roles in Small Companies

Table 1 presents results of analysis knowledge requirements of the role Developer in small companies according to the above mentioned definition.

We see that required level of knowledge reach value 3 or 4 in ICT knowledge domain (MS01-MS08). On contrary requirements are smaller in the "non-ICT" knowledge domain. Requirements reach level 1-3 (only in MS14 level 4) in the he second one group of knowledge domain.

These results prove that role Developer is purely ICT role and people in this role in small companies do not have to have available knowledge from different knowledge domain at highest level than “Basic orientation and terminology”.

Comparison of results in columns Avg (average), Med and torque columns give us information that requirements were similar in majority of analysed companies.

	n= 15								
	Avg	Med	Mod	Max.	Min.	σ	σ^2	δ	τ
MS01	2,80	3,00	3,00	5,00	0,00	1,32	1,74	-0,44	0,04
MS02	3,53	4,00	4,00	5,00	2,00	0,92	0,84	-0,11	-0,48
MS03	2,93	3,00	3,00	5,00	1,00	1,21	1,46	0,16	0,04
MS04	3,86	4,00	4,00	5,00	3,00	0,66	0,44	0,15	-0,31
MS05	3,67	4,00	4,00	5,00	1,00	1,23	1,52	-0,84	-0,03
MS06	3,40	4,00	4,00	5,00	1,00	1,30	1,69	-0,65	-0,27
MS07	3,73	4,00	4,00	5,00	2,00	0,80	0,64	-0,42	0,38
MS08	3,27	3,00	2,00	5,00	2,00	1,16	1,35	0,34	-1,32
MS09	2,60	2,00	2,00	5,00	1,00	1,24	1,54	0,38	-0,76
MS10	2,20	2,00	2,00	5,00	1,00	1,21	1,46	0,97	0,56
MS11	2,00	2,00	2,00	4,00	0,00	1,13	1,29	0,34	-0,18
MS12	1,33	1,00	1,00	3,00	0,00	0,98	0,95	0,28	-0,65
MS13	1,40	1,00	2,00	3,00	0,00	0,83	0,69	-0,07	-0,22
MS14	3,13	4,00	4,00	5,00	0,00	1,51	2,27	-0,84	-0,19
MS15	1,53	1,00	1,00	3,00	0,00	0,92	0,84	0,53	-0,61
MS16	3,13	3,00	3,00	5,00	0,00	0,92	0,84	-0,29	1,89

Table 1: Knowledge Requirements on the ICT Role Developer in Small Companies

We find out that required level of knowledge reach value 3 in half of ICT knowledge domains in the small companies for the role Administrator. Level 2 is required in knowledge domains MS01 and MS05 and level 4 in knowledge domains MS07 and MS08. Requirements on “non-ICT” knowledge are required especially on the level 2. Knowledge is required on the level 3 only in knowledge domains MS10 and MS16. These results prove that role Administrator is purely ICT role and people in this role in small companies do not have to have available knowledge from different knowledge domain at highest level than “Basic orientation and terminology”. Comparison of results in columns Avg (average), Med and torque columns give us information that requirements were similar in majority of analysed companies.

3.5. Knowledge Requirements on Selected ICT Roles in Medium Companies

This chapter describes knowledge requirements on the same three ICT roles that have been described in previous chapter.

Medium companies require the people in the ICT role Developer have strong knowledge in ICT knowledge domain – especially in knowledge domains MS04, MS05 an MS06 that are on the level 4. Other ICT knowledge domains are required on the level 3. Values in skewness (τ) are small and they are between -1 and 1. This told us that the values are in normal distribution.

Companies' requirements on the role Administrator are different. Companies require only knowledge level 3 in ICT knowledge domains. There is only one exception in the ICT knowledge domain – knowledge domain MS07 (MS07 - IS/ICT knowledge) that is required on the level 4. Values in skewness (τ) are between -1 and 1. This told us that the values are in normal distribution

3.6. Comparison of Knowledge Requirements on Selected ICT Roles in Small and Medium Companies

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

The Table 2 describes average and median knowledge requirements on the role Developer. The Table 2 shows that median value in ICT knowledge domains are the same in small and medium companies. There are only two exceptions in knowledge domains MS02 and MS07. Medium companies require higher level of knowledge in these two knowledge domains.

Different situation is in average. We see that requirements on ICT knowledge domains are smaller in medium companies than in small companies.

	Avg (Small)	Avg (Medium)	Change	Med (Small)	Med (Medium)	Change
MS01	2,80	2,80	→	3,00	3,00	→
MS02	3,53	3,17	↓	3,00	4,00	↑
MS03	2,93	2,66	↓	3,00	3,00	→
MS04	3,86	3,39	↓	4,00	4,00	→
MS05	3,67	3,61	↓	4,00	4,00	→
MS06	3,40	3,48	↑	4,00	4,00	→
MS07	3,73	3,44	↓	3,00	4,00	↑
MS08	3,27	3,21	↓	3,00	3,00	→
MS09	2,60	2,59	↓	3,00	2,00	↓
MS10	2,20	2,45	↑	3,00	2,00	↓
MS11	2,00	1,94	↓	2,00	2,00	→
MS12	1,33	1,85	↑	2,00	1,00	↓
MS13	1,40	1,73	↑	2,00	1,00	↓
MS14	3,13	2,96	↓	3,00	4,00	↑
MS15	1,53	1,71	↑	2,00	1,00	↓
MS16	3,13	2,60	↓	3,00	3,00	→

Table 2: Change in Knowledge Requirements on the ICT Role Developer

The Table 3 describes average and median knowledge requirements on the role Administrator. Findings for the role administrator are different especially in the Avg as we see in the Table 3. The Table 3 shows that median value in ICT knowledge domains are the same in small and medium companies in almost 70% knowledge domains. Different situation is in average. We see that requirements on ICT knowledge domains are higher in medium companies. Higher requirement are required in more than 80% knowledge domains.

	Avg (Small)	Avg (Medium)	Change	Med (Small)	Med (Medium)	Change
MS01	1,96	2,40	↑	3,00	2,00	↓
MS02	2,63	3,00	↑	3,00	3,00	→
MS03	2,93	2,78	↓	3,00	3,00	→
MS04	2,67	2,78	↑	3,00	3,00	→
MS05	2,27	2,49	↑	3,00	2,00	↓
MS06	2,98	2,78	↓	3,00	3,00	→
MS07	3,47	3,59	↑	4,00	4,00	→
MS08	3,35	3,30	↓	3,00	4,00	↑
MS09	2,11	2,48	↑	3,00	2,00	↓
MS10	2,54	2,71	↑	3,00	3,00	→
MS11	1,79	2,03	↑	2,00	2,00	→
MS12	1,81	1,87	↑	2,00	2,00	→
MS13	1,70	1,74	↑	2,00	1,50	↓
MS14	1,91	1,98	↑	2,00	2,00	→
MS15	1,96	2,11	↑	2,00	2,00	→
MS16	2,42	2,64	↑	3,00	3,00	→

Table 3: Change in Knowledge Requirements on the ICT Role Administrator

4. Conclusions

All of developed countries are depending on ICT. This dependency is represent by increasing investment into the ICT, and also increasing required number of ICT specialist. Still increasing are also requirements on ICT knowledge. Lack of ICT educated professionals will have an impact on decreasing competitiveness of the whole economy, decreasing global innovation potential and this could start degeneration of our population.

Without adequate number of ICT specialists cannot be achieved required increase in GDP not only produced by ICT sector but all sectors in the Czech economy.

Our findings show us that the requirements of companies do not depend only on the ICT role but also on the size of the company.

We can say that small companies in average require ICT Developers with broaden knowledge on higher level than medium companies. But when we are talking about the Median the situation is different especially in ICT knowledge that are required on the same level in both company's size. The knowledge level required by companies in non-ICT knowledge domain is higher in small companies than in middle size companies and that means the ICT Developers in small companies has to be able also manage teams, discuss with managers and also they have to be deeper familiar with a broader range of knowledge than ICT developers in middle companies.

We found out really interesting fact in ICT Role Administrator. When we have compared average requirements on knowledge in medium companies and small companies we have found that in middle companies administrators have to dispose broader knowledge almost in all knowledge domains than in small companies and in median should dispose in majority the same level of knowledge in both size of companies. The reason for these findings is especially in amount of different technologies that are used in small and medium companies. Small companies usually do not use so much different technological platforms (operation systems, software, hardware etc.) as middle companies. Administrator has to be able solve various problems with various technologies and also various users and the users is reason why administrators in medium companies have to also dispose a higher level of non-ICT knowledge.

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THE PERCEPTION OF USER SATISFACTION IN CONTEXT OF BUSINESS INTELLIGENCE SYSTEMS' SUCCESS ASSESSMENT

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Keywords

Information system, Business Intelligence, user satisfaction, success assessment, quality factors

Abstract

Success of Business Intelligence system's implementation depends on a variety of critical success metrics. An evaluation framework is then a vital help to conceptualize an assessment of success of such computer system as an important part of the information system of a company. The paper introduces analysis of a research model that presents such a framework. The model is based on a concept of DeLone and McLean's model of information system success. The aim of the paper is to present analysis of the research model that is conducted using correlation analysis and analysis of variance. Results show interesting results about relationship in the research model towards the assessment of Business Intelligence systems' success.

1. Introduction

Today's business organizations are evolving entities that are heavily influenced by changes and new opportunities in their business environment. Innovations are important drivers of change in the organization and decisions and actions made by today's companies often heavily depend on the usage of ICT and various information systems (IS). Use of information systems and appropriate ICT means is needed to effectively coordinate their actions and communicate with the market and agreeing with Basl, Gála, Šimková, & Hrabě (2010) the use of ICT is usually perceived as a key to gain competitive advantage, they identify ICT as a key innovation driver.

Although the use of the IS/ICT is an important competitive differentiator, agreeing with Mildeová & Brixí (2011), while using ICT the people still have to do most of the work and actual decisions are still made by people who leverage outputs of the information system through specific ICT means. The ergonomics of ICT usage then needs to be counted with when a company wishes to establish a rigorous IS/ICT success assessment methodology. The methodology should consider not only hard performance metrics, but also perception of its characteristics by users (soft measures). Decision makers could then gain vital advices where to target their strategic support of further innovation initiatives based on either bottlenecks or performance accelerators, as perceived by IS/ICT users.

Information system's component that is closely connected with the achievement of business' success is the Business Intelligence (BI) system. According to Turban, Aronson, Liang & Sharda

(2007) the BI is commonly referred to as an umbrella term for architectures, tools, databases and also methodologies that generally enable effective decision-making process through information and application of specialized software tools. BI tools are intended to supply key business users with information they actually need, in proper structure and exactly when they need it – information is needed to gain business insights (Wixom & Watson, 2010). And since the access to such business insights (information) presented in the right time and structure usually means competitive advantage the information then represents a catalyzer of innovation and therefore we decided to put a stress on the assessment of a BI system's success in our research.

1.1. Foundations of success evaluation framework

From a holistic point of view the more is the organization dependent on ICT the greater is the performance of business processes affected by information system's quality (Ministr & Števkó, 2010). If the system is designed poorly or user-unfriendly, the performance of business process activities can be greatly degraded (taking into consideration execution of tasks within a business process activity). It can jeopardize anticipated benefits to business value for the organization from using the information system (Duggan & Reichgelt, 2006) and even successful achievement of business goals.

A success evaluation framework presents conceptualization of complex relationships between success factors and provides purposeful abstraction of the success evaluation process. The acquisition of scientifically and practically approved success metrics is a good way of achieving success assessment framework's relevance. Stair & Reynolds (2010) point out that from the user point of view a quality of information system is usually characterized by metrics of flexibility, effectiveness, accessibility and timeliness of outputs, measured on a component and also system level of resolution. Taking into account these considerations and other relevant studies dealing with information system success topic we specified a research model that focuses on Business Intelligence system's success assessment as an initial step in our further research in this field.

The aim of the paper is to present evaluation of relationships between specific success dimensions in the research model that conceptualizes Business Intelligence system's quality assessment. The model encompasses specific aspects of information system's usage in the company since aforementioned aspects present possible areas where IS/ICT innovation processes could start in.

The paper is structured as follows. The next section describes data and methodology used to evaluate the relevance of the model. The third section presents description of the research model. The fourth section presents results of the research model's evaluation in BI systems' conditions and their discussion. The last section then presents summarization of the paper.

2. Data and methodology

The empirical data for the evaluation were gathered among 62 representatives of medium to large organizations, active in manufacturing (57%), retail (34%) and public administration (9%) sector. The questionnaire contained questions about attitudes on respective factors of the research model using a 6 point Likert scale (where 1 presents the lowest and 6 the highest level of agreement with/preference of respective success factor). Respondents were active top (12%), middle (26%) and operational managers (16%), analysts (28%) and also administrative workers (18%), all stated as active Business Intelligence system's users. The evaluation will be carried out by analysis of correlation method and analysis of variance method (ANOVA).

3. The research model

As a framework for the model of Business Intelligence system's success assessment research we initially used DeLone & McLean's model of information system success assessment (DeLone & McLean, 2003, see figure 1). It is a theoretical concept for assessment of user satisfaction with information system's usage factors, structured into 7 dimensions. While each dimension can be characterized by a set of respective factors, DeLone and McLean do not indicate specific factors to be used. They rather present principles of each dimension's construction and their purpose, so the actual user of the model can use it in a desired way.

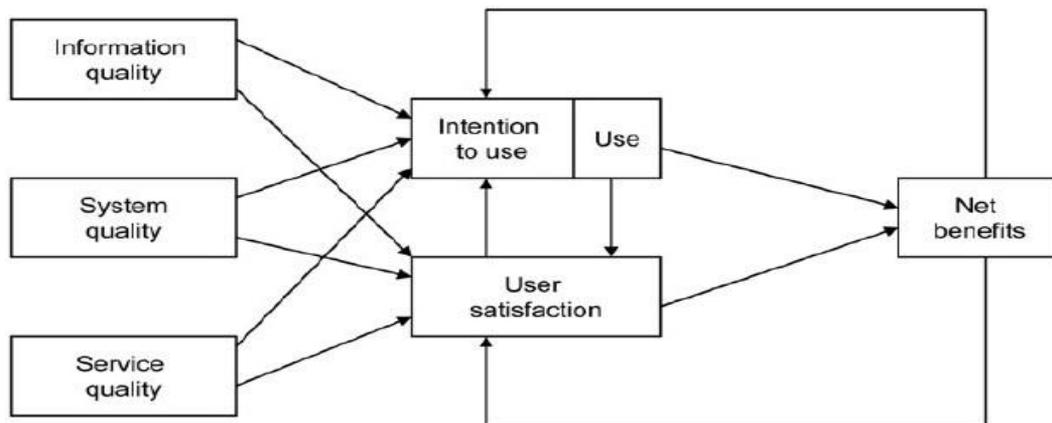


Figure 2: DeLone and McLean's information system success assessment model (DeLone & McLean, 2003)

- The *information quality* dimension measures semantic success of information presented by the information system (DeLone & McLean, 2003; 2004).
- The *system quality* dimension is intended to measure technical success in means of its operating and functional attributes (Wu & Wang, 2006).
- The *service quality* dimension reflects the importance of services and support in successful information system (Chen & Cheng, 2009).
- The *intention to use* dimension is seen as a current and future attitude to use the system as it is (DeLone & McLean, 2003).
- The *use* dimension should measure to what extent the system is really used and together with the intention to use dimension are referred to as closely interrelated (DeLone & McLean, 2003). That is to be considered carefully, because of different attitudes of users to what the same system should do and what it really does depending on the users job position (Wu & Wang, 2006).
- The *user satisfaction* dimension measures if the user is generally satisfied with the system as a whole (Wu & Wang, 2006; Chen & Cheng, 2009).
- The *net benefits* dimension is intended to feature individual and organizational benefits and overall effectiveness of the system usage as viewed by the system's user. DeLone & McLean (2004) admit that use of financial measures (e.g. TCO, ROI etc.) is possible and better indicator of success. In our work we used the net benefits dimension as an abstract measure since we see the use of respective financial measures if specific applications where the model could be used as a more concrete success assessment methodological framework.

To specify respective success factors we reviewed respective journal articles and other publications, to gather information on what factors various authors commonly use when applying DeLone and McLean’s model on their research tasks and also what critical success factors are commonly mentioned in context of Business Intelligence implementations. Table 1 shows results of our review.

Information quality (InfQ)	System quality (SysQ)
accuracy	system’s reliability
currency	flexibility (adaptability to changes)
relevance	system throughput
completeness and consistency	responsiveness
understandability (e.g. proper format)	accessibility
Service quality (SerQ)	integration
reliability of services	portability
service staff working efficiency	ability to locate data
expertise of service staff	ability to view context (access to metadata)
extent of end-user training	proper level of detail (granularity of data)
communication during system’s changes	data quality
Intention to use (IntUse)	system’s security
users actually need the BI	Net benefits (NetBen)
proper motivation for usage of BI tools	perceived task productivity and innovation
Use (Use)	customer satisfaction
frequency of use	perceived increase in management control
time of use	increase in decision-making relevance

number of accesses	User satisfaction (UserSat)
job/decision making performance	just an indication of overall level of satisfaction
users' cooperation on further BI projects	

Table 1: Success factors derived from literature review

Each dimension's success factors were represented by a respective number of variables (questions in the survey that was administered to respondents) as follows: InfQ (8), SysQ (15), SerQ (11), IntUse (5), Use (4), UserSat (1), NetBen (7).

4. The evaluation of the research model and discussion of results

Before the evaluation of relationships between dimensions could be administered, the internal consistency of dimensions was tested. Internal consistency was tested using Cronbach's alpha coefficient and the value should not fall under 0,7 (Wixom & Todd, 2005). Every dimension (excluding UserSat, which was represented by only 1 variable) showed internal consistency above the value of 0,7 (see Table 2).

Dimension	Alpha	Actions necessary for the given value of Alpha coefficient
InfQ	0,76	Exclusion of 1 variable - negative correlation with other variables
SysQ	0,88	Exclusion of 1 variable - negative correlation with other variables
SerQ	0,82	-
IntUse	0,84	-
Use	0,71	-
NetBen	0,85	-

Table 2: Internal consistency of each dimension – alpha coefficient values

Correlations between dimensions were then computed to assess associations according to specified relationships on one side and to uncover possible new relationships on the other side (Table 3).

	InfQ	SysQ	SerQ	IntUse	Use	UserSat	NetBen
InfQ	1	,742**	,240*	,397**	,311**	,498**	,286*
SysQ		1	,177	,173	,283*	,422**	,176
SerQ			1	,241*	,248*	,244*	,301**
IntUse				1	,542**	,661**	,673**
Use					1	,260*	,538**
UserSat						1	,429**
NetBen							1

** Correlation is significant at the 0,01 level (1-tailed)

* Correlation is significant at the 0,05 level (1-tailed).

Table 3: Correlations between research model’s dimensions

Analysis of correlation showed statistically insignificant associations between system quality and intention to use. Another association was discovered between information quality a system quality and information quality and service quality – it will be analyzed in the ANOVA (p-values significant on 0,05 level will be marked with the asterisk *).

Variable	Sum of Squares	df	Mean Square	F	p-value
InfQ	23,363	17	1,374	5,678	,000*
SysQ	27,854	31	,899	4,404	,000*
SerQ	26,804	29	,924	4,113	,000*
Use	13,320	23	,579	1,048	,439
NetBen	22,637	20	1,132	4,067	,000*

Table 4: ANOVA between UserSat as dependent variable and related independent variables

Table 4 shows that except for the Use dimension all dimensions exhibited significant relationships with UserSat dimension. Insignificant relationship between Use and UserSat could mean a little disappointment of respondents in our sample with their currently used BI tools.

Variable	Sum of Squares	df	Mean Square	F	p-value
InfQ	16,906	17	,994	2,205	,019*
SysQ	19,830	31	,640	1,126	,375
SerQ	19,702	29	,679	1,269	,258
UserSat	16,313	4	4,078	11,427	,000*
NetBen	30,066	20	1,503	9,648	,000*

Table 5: ANOVA between IntUse as dependent variable and related independent variables

Table 5 shows that except for SysQ and SerQ dimensions all other exhibited significant relationships with IntUse dimension. Our sample then shows that in case of Business Intelligence system the users' intention to use the system is possibly not influenced by system and service quality.

Variable	Sum of Squares	df	Mean Square	F	p-value
Use	21,291	23	,926	2,460	,007*
UserSat	8,001	4	2,000	4,116	,005*

Table 6: ANOVA between NetBen as dependent variable and related independent variables

Table 6 shows that all related dimensions exhibited significant relationship with the NetBen dimension. Table 7 shows significant relationship only between InfQ and SysQ. Table 8 proves that the relationship is mutual. Relationship InfQ and SerQ were not proved (see Table 9). Relatively close relationship (according to correlation coefficients and ANOVA) between SysQ and InfQ could mean that users in our sample interpret the quality of information produced by the system as closely related to how the system performs.

Variable	Sum of Squares	df	Mean Square	F	p-value
SysQ	15,904	32	,497	2,713	,004*
SerQ	9,462	30	,315	,832	,692

Table 7: ANOVA between InfQ as dependent variable and related independent variables

Variable	Sum of Squares	df	Mean Square	F	p-value
InfQ	19,127	18	1,063	4,480	,000*

Table 8: ANOVA between SysQ as dependent variable and related independent variables

Variable	Sum of Squares	df	Mean Square	F	p-value
InfQ	14,812	18	,823	1,786	,060

Table 9: ANOVA between SerQ as dependent variable and related independent variables

According to ANOVA results we created a view on relationships between our proposed dimension and their respective factors in our research model based on DeLone and McLean’s information system success assessment model. Figure 2 depicts all the relationships that were proven according to presented ANOVA results.

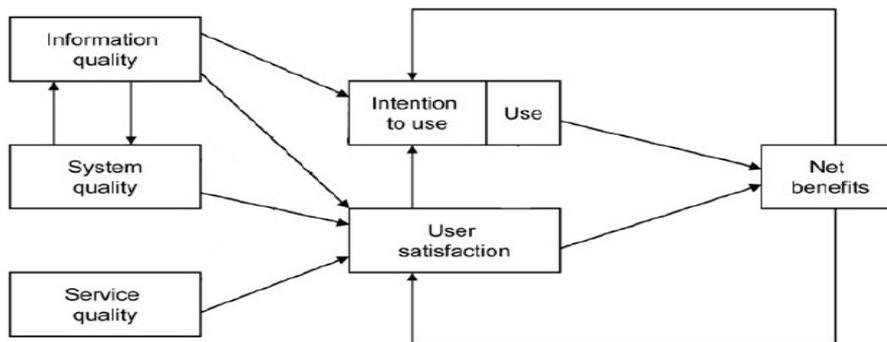


Figure 3: Relationships in the research model according to model's evaluation results

5. Conclusions

The paper dealt with analysis of relationships between success dimensions in a research model intended to model success dimensions of the Business Intelligence system according to their perception by its users. The research model is based on the DeLone and McLean’s information system success assessment model. The analysis of results revealed that some relationships that were present in original model were not proven to be significant (according to our data) while new mutual relationship between System quality and Information quality was discovered.

In Petter, DeLone & McLean (2008) there is an evidence of numerous other respecifications and applications of the original model in various other situations (e-commerce, knowledge management system, etc.) so our results show another possible appearance of original DeLone and McLean’s concept in the situation of Business Intelligence system’s success assessment.

The model however serves primarily as a conceptual framework for subsequent applications so there is basically no possibility to obtain any numerical valuation of success from the model. Nevertheless the model offers solid foundations for further applications using simple or advanced quantitative methods that can help to valuate overall success or other subsequent and related measures. Therefore the model’s potential goes further beyond the initial concept (e.g. Němec &

Zapletal, 2012 – a part of the model was used to create hierarchy of decision-making criteria for application of the Analytic Hierarchy Process method).

The success assessment methodology that can be built over the model and its structure would take into account important aspects of information system's usage and quality with their relationships and thus can help to steer processes of adoption or creation of IS/ICT innovation in the right direction. Our further work will focus on assessment of more possible ways how to effectively apply our research model in more specific situations and cases to fully exploit its potential.

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REALIZATION OF SOCIAL RESPONSIBILITY

EMPIRICAL DATA ABOUT SOCIAL RESPONSIBILITY IN SLOVENIA

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Abstract

Problems related to promotion of social responsibility include unclear information about its consequences and attained preconditions.

Social responsibility (SR) is a complex construct applied to various degrees, means and ends in the social sciences as well as in the managerial practices. This problem was only partly resolved by the new ISO 2600 standard on social responsibility, published in November 2010 (See: ISO 26000 2010). The ISO 26000 brought to the forefront two novelties: the interdependence and holistic approach as the linkages between the 7 core subjects (organizational governance, human rights, labor practices, the environment, fair operating practices, consumer issues, and community involvement and development). However, the standard has a recommendatory status, which makes it flexible and avoidable, at the same time, legally, but unavoidable in market competition.

Does and to which extent, if it contributes, SR contributes to the successfulness of the organizations was the main research question of the structured interviews and surveys conducted in 2409 selected Slovenian organisations, in which the managers and employees were involved. The following hypothesis was tested: SR in Slovenia is based on four fundamental constructs (Good Relationships

with broader environment, Relationships with employees, Customer relationships, and Leadership/company policy). The results showed that the Customer relationship is the most representative construct of the SR in Slovenian organizations.

1. Introduction

Social responsibility (SR) is a complex concept, which combines various aspects that are unfortunately often treated as separate issues (community, environment, employees, market, etc.). In November 2010, ISO 26000 standard on social responsibility was published (See: ISO 26000 2010) that addresses seven core subjects of social responsibility: (i) organizational governance, (ii) human rights, (iii) labor practices, (iv) environment, (v) fair operating practices, (vi) consumer issues, and (vii) community involvement and development. As crucial novelties, compared to other international documents on SR, we can highlight interdependence and holistic approach linking the seven topics. Nevertheless, it should be emphasized that managers will deal with SR only, when it will be economically beneficial and not merely a “virtual/real charity” and cost. All of this is the reason why this contribution is aimed to present / demonstrate the opposite: SR is not an end in itself, it is not only a cost, but it also, or first of all, contributes positively to the performance of organizations. According to this, the main objective of the research was to develop valid and reliable measurement instrument for SR and to measure SR level in Slovenian organizations.

2. Briefly on social responsibility (SR)

The management literature acknowledged social responsibility as an important corporate duty (Quinn, Mintzberg and James, 1987; McGuire, Sundgren and Schneeweis, 1988) that refers to a company's ability to provide benefits to society (Swanson, 1999; Wood, 1991). It includes the economic, legal, ethical, and discretionary expectations of society (Carroll, 1979). SR is becoming more and more a hot topic for business reasons (Gerzema, 2010). Writing about SR can be found (also) with following authors: Božičnik et al. (2008); Daft and Marcis (2001), Esposito, 2009, and earlier; Steiner and Steiner (2003); Lahovnik (2008); Martin (2001); Prosenak and Mulej (2007 and 2008); Prosenak, Mulej and Snoj (2008); Schwartz and Carroll (2003); Hrast et al., ed. (2006, 2007, 2008, 2009, 2010, 2011, 2012); Knez-Riedl (2007a, b, c; 2010); Waddock and Bodwell (2007); Crowther and Caliyurt, ed. (2004); Crowther et al., ed. (2004); EU (2001; 2011); etc.

After surveying the relevant literature, Prosenak and Mulej (2008: 10) defined SR as a concept in which the care for social and environmental problems should be included in activities to achieve humans' goals. SR scoops three dimensions: (i) social, (ii) environmental and (iii) economic.

EU definition (2001, 347 final: 5; sum. after: Mulej and Hrast 2008: 43) is also important for this contribution: »...SR of companies is a concept, with which companies voluntarily implement social and environmental care into their business activities and into their interactions with participants«.

But companies are people's tools; that's why SR should be considered an ethical guide to humans when active and making decisions. SR can therefore be viewed as a business strategy (Esposito 2009). (Corporate) SR is becoming a more and more important activity of social subjects. In this perspective the organisation is intertwined and interconnected with its “surrounding” society not for the sake of solving societal problems, but to live up to its role of social actor in order to stay in business (Schoemaker 2006: 460). There is emerging evidence that SR, if effectively implemented, can have a significant impact in motivating, developing and retaining staff as well as influencing other stakeholders in a positive way (Strandberg 2009: 6). But still there are numerous

organizations, which understand CSR only as undertaking some donations or philanthropic activities. In its true sense CSR rather constitutes a strong commitment to social obligations and internationalization throughout the organizational culture which lays emphasis on the execution of the obligations towards the employees and involving them in responsible endeavours (Sharma et al 2009: 207).

There is a question to which extent and in which form do organisations in reality perceive and practice SR. One of the goals of a certain study that was conducted among Lithuanian organisations was to determine to which level SR is implemented in their politics; possession of such corporate SR policies as corporate value statement, code of ethics, CSR statement, and diversity statement. Results of this study show that 68% of respondents have a code of ethics, 59% have a corporate value statement, 52% have a diversity statement, and 38% have a CSR statement. The practice is consistent among all types of organisations, as no statistically significant differences were determined (Kazlauskaite and Bučiuniene, 2009).

SR's development in companies was a topic in many debates throughout the 20th century (Esposito 2009). Several above authors mention both a »shareholders aspect« and a »stakeholder aspect« and the question for which of the two groups the company is responsible; answer to this question is important for easier assigning of company's position in society. The definition of CSR, which is mostly used in EU's documents, is company's voluntary care for its stakeholders and for quality of their relations, but this is changing in the new document (EU, 2011) that was published after our investigation. Štoka Debevec (2007) summarized the CSR stakeholders: (i) employees, (ii) suppliers, (iii) nature, and (iv) society.

The new EU's definition is more flexible: SR is responsibility of companies for their impacts on society (EU, 2011); it is no longer limited to free will, but a list of activities is suggested for companies and EU member states to undertake in the years ahead. Besides, ISO 26000 no longer speaks of corporate SR; it includes all organizations (ISO, 2010).

2.1. Attributes of Social Responsibility (SR)

SR concerns organizations' ability and willingness to meet the economic, legal, social and environmental interests of stakeholders. Its development and successful implementation attract long-term positive image for the enterprise amongst stakeholders and foster opportunity for increased values and bigger profit potentials. Willard (2005) argues that even though business organizations have always responded to "stakeholder" demands, they have since the mid 1990s been responding to powerful interest groups, green consumers, activist shareholders, non-governmental organizations and government, making urgent demands for social responsibility. Business organizations are more and more coming under pressure by increased public awareness, different interest groups, legal and governmental concerns and media coverage to behave in a socially responsible and ethical manner (Carroll and Cannon, 1997; Jamali and Sidani, 2008).

The concept of CSR was still lacking an encompassing definition in the time of our investigation, which is reported about here; one will see whether the ISO 26000 (ISO, 2010) and EU's document (EU 2011) will change this situation. McGuire (1963: 144) defines CSR thus: "The idea of social responsibilities supposes that the corporation has not only economic and legal obligations but also certain responsibilities to society which extend beyond these obligations". More recent definition from EU Commission (2002: 347), "...CSR is a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis". The Friedman's neoliberal definition even prohibited CSR by saying that business of business is business, limited only by law; the resulting market fundamentalism caused monopolies causing the current world-wide economic, social, and environmental crises.

2.2. Social Responsibility and Benefits from it

Nickels and Wood (1997: 92-93) say that the SR concept has expanded to all organizational areas; SR is based on the conviction that companies shouldn't only care for their profits, but should also contribute to prosperity in society.

In a longer term SR contributes to their profits by helping them avoid cost of strikes, riots, lost markets, renewal of natural preconditions of life, health care etc.; these costs are not visible in accountancy, but crucial (the 2010 case of Greece nearing bankruptcy shows this; so does the case of the oil catastrophe on the south coast of US; and many others cases reported about in daily press over the recent years).

SR behavior reaches beyond acting according to law and avoiding unethical deeds; it includes an active involvement in society and a help with solving problems of society. By Johnson and Scholes (1997: 211-212) SR of companies includes their actions on internal (care for employees, working conditions and working place and working order adequacy) and external basis (care for environment, safety of products and services, market and suppliers choice, employment, and local society activities). Frideric, Davis and Post (1988: 33) consider the following areas as central in SR: (i) quality and safety of products, (ii) consumers relations, (iii) employees relations, (iv) charity and care for people, (v) society relations, (vi) care for environment, and (vii) economic influences.

Need of many to emphasize SR as necessary feature of companies, shows how distant have companies become from their natural role: companies became self-purposed. Goerner et al. (2008) emphasize that the American capitalism has changed into something against what it has arisen centuries ago; they even claim it is anti-constitutional. Toth (2008) similarly thinks that the current model of capitalism is obsolete and needs renovation. Božičnik et al. (2008) talk about negativism of capitalism due to its lack of systemic and hence SR behavior. Klein (2009) in her work talks about capitalism of disaster. Klein (after Štefančič 2008) explains in her book *The Shock Doctrine*, 2007, where lies the trick of the modern world and modern capitalism, modern wars, and modern catastrophes.

The main economic benefits of SR working of organizations – to be added to the above mentioned prevention of costs – include: (i) better image and reputation, (ii) higher capability to attract capital, partners, customers etc., (iii) better opportunities for establishing and maintaining connection with decision-makers, policy creators and other stakeholders, (iv) higher productivity and quality, (v) higher sales and consumers loyalty, (vi) better supervision and risk-handling and (vii) higher loyalty of employees and continuity of employees (Rebernik et al. 2002: 95). The practicing businessman Quinn (2006) made similar conclusions: SR pays, in a longer term, at least.

Prosenak and Mulej (2008: 10-11) say that SR is welcome also because of the following issues: (i) climate change, (ii) natural resources limitation, (iii) growing differences and stress, and (iv) global competition, etc. These issues are becoming objectified circumstances letting humans forget about the humans' impact over their making. On the other hand, SR helps people at large enjoy benefits of a broader and longer-term treatment of nature around them.

Mulej and Hrast (2008: 47) also summarize common denominator of definitions of SR and of its benefits. SR can also mean an upgrade of non-formal system thinking methods. But it can also mean a lot more – a new way from the humanity's blind alley. From the phases of competitiveness based on basic resources, investing, and innovating, humankind is coming closer and closer to its phase of affluence (summarized after Porter, 1990): affluence is considered to be both a climax in human wishes and a blind alley: more and more people, because they have everything they consider necessary, no longer have motivation to work and shop. SR can also mean a path towards peace in the world. SR, combined with behavior, matching requisite holism, and with creativity, oriented

towards Fromm's passage of human from owner to creator, could save the current human civilization, so the latter wouldn't deteriorate like all the others have in their time of affluence. SR is a process of social innovation and humans' rightfully wanted goal (Mulej and Hrast 2008: 41). This process is crucial for supporting human well-being (WB), which is a way to requisitely holistic/systemic behavior of humans.

2.3. Methodology

A quantitative (structured survey) research method was deemed appropriate to enable calculation of actual measures of concepts. A new measurement instrument was developed in three phases. In the first phase, in-depth interviews were conducted with the senior managers in 15 organizations. In the second, questionnaire was built upon the literature survey and in-depth interviews, piloted on smaller sample. Following the results of exploratory research some modifications of the layout, wording, and number of the questions were implemented. Final measurement instrument of CSR consisted of 22 Likert type questions on the 7 point continuous, self-generated scale.

In the third phase a computer assisted web interviews were the basis for data collection. 2409 organizations were randomly selected from the organizations with more than 15 employees in Slovenia. Only organizations with more than 15 employees were chosen since authors assume that those with fewer employees have not developed a requisitely holistic/formal Human Resource Management. The population of companies was determined from the database of The Agency of the Republic of Slovenia for Public Legal Records and Related Services. First, the target group (CEOs or members of the Board of Directors responsible for HRM) was identified in each of the organization and then contacted by phone. Potential respondents were provided with the web link with the questionnaire and asked to fill them out. A total of 320 usable responses were obtained from the managers, representing a response rate of 13.3%.

Type of market	Frequency
Manly providing end customer services	67
Mainly providing B2B services	108
Manly providing end customer products	40
Mainly providing B2B products	101
Missing	4
Total	320
Size	
Large	23
Medium sized	74
Small	221
Missing	2
Total	320
Industry	
D - Manufacturing	79
K - Real estate, renting and business activities	20

F - Construction	50
O - Other community, social and personal service activities	12
G - Wholesale and retail trade	77
H - Hotels and restaurants	6
I - Transport, storage and communication	16
Missing	60
Total	320
Title of the respondent	
CEO	148
Board member	21
Executive Director	14
Manager of HRM department	26
Manager of General Department	37
Did not want to answer	74
<i>Total</i>	<i>320</i>

Table 1: Descriptive statistics of the respondents

3. Dimensionality, reliability and validity of the measurement scales

3.1. Dimensionality of the constructs

For all three constructs the exploratory factor analysis as well as the confirmatory analyses was performed. From 22 initial indicators for SR, 14 indicators that adequately explained the CSR construct were left after the EFA and entered the CFA. In the process of EFA one-factor model where constructs were conceptualized as one dimensional were compared to multi-factor model where constructs were conceptualized as multi-dimensional (table 8). The results of the multi-factor model show a large drop in the χ^2 statistics. Also other fit-indices were much better in the multi-factor model, which means that multi-factor solution outperformed the one-factor solution on all absolute measures (χ^2 , GFI, and RMSEA), incremental fit measure (CFI), and parsimonious fit measures (χ^2/df). In the final solution SR constructs was reflected in four sub-constructs, namely relationships with employees, relationships with broader environment, customer relationships, and leadership.

One-factor model	Multi-factor models
CSR	
1 factor (14 indicators) $\chi^2/df = 96.816 / 77$ $p < .05$	4 factors (14 indicators) $\chi^2/df = 139,871/71$ $p = .000$

RMSEA = .190	RMSEA = .055
NFI = .661	NFI = .940
NNFI = .623	NNFI = .960
CFI = .681	CFI = .969
RMR = .158	RMR = .067
GFI = .699	GFI = .941

Table 2: Summary of statistics for one-factor and multi-factor model for SR

Construct	Items	Mean	Stand. deviation	Factor loadings	CR	AVE
CSR						
Relationships with employees -	We are careful and fair to our employees, so we do not have experiences with their dissatisfaction (strikes and bad work).	5.83	1.298	.779	.86	.61
	Social responsibility is understood by us as fairness without abuses in relationships with employees, business partners and others beyond limits prescribed by law.	6.01	1.221	.861		
	Corporate social responsibility to employees is based on care for pleasure, creativity and safety at work, which exceeds the level prescribed by law.	5.85	1.315	.807		
	We encourage employees to strengthen tolerance and harmony in the workplace.	5.79	1.270	.677		
Relationships with broader environment -	We consider the principles of environmental protection - in the manufacturing and / or service process.	6.11	1.118	.856	.83	.61
	We encourage our employees to carefully handle materials and energy (production, offices).	5.95	1.174	.806		
	We reduce the amount of	5.66	1.409	.717		

	waste and packaging, we clean our sewage, in the chimneys we have modern efficient filters, etc.					
Customer relationships -	We are a very reliable business partner (buyer and seller).	6.48	.813	.798	.75	.43
	We raise awareness of our customers about a sustainable / safe use of our products (services).	6.12	1.078	.512		
	We regularly settle our obligations to suppliers and other business partners.	6.04	1.271	.594		
	In presenting our products (services) do not deceive customers (we always fulfill promises we have made).	6.51	.828	.692		
Leadership -	Socially responsible business is part of the policy, strategy and tactics (daily practice) of our organization.	5.79	1.309	.864	.90	.75
	Organization is based on social responsibility strategy to honestly treat the environment, community, businesses, employees, managers, owners.	5.71	1.276	.891		
	The organization defined its social responsibility in its vision and / or in the mission and both are regularly exercised in daily practice	5.43	1.469	.838		

Table 3: Factors and their Means, Standard Deviations, component reliability and average variance extracted

3.2. Reliability of the scales, discriminant and convergent validity

Reliabilities for four constructs shown in table 3 were assessed with composite reliability measures. All composite reliability indices were higher than .60 and ranging from .75 to .90.

Discriminant validity was tested with several CFA's for each possible pair of constructs, first allowing for a free correlation between the two constructs and then fixing the correlation between the constructs at 1. The chi square differences between the fixed and free solutions were significant every time at $p < .05$ or higher. Discriminant validity of the constructs was further evaluated with the Fornell and Larcker (1981) test, which suggests that the square root of the average variance extracted for a given construct must be greater than the standardized correlation of the given construct with each one of the other constructs. A Fornell-Larcker criterion was met for all constructs shown.

Convergent validity measures the coherency across within each construct. Two methods were adopted for measurement of convergence validity. First, the average variance extracted was calculated for each construct (see Table 3). For the majority of cases AVE is greater than .5, with the exception of customer relationships constructs. Factor loadings for all the indicators are statistically significant and greater than .5, which also means that convergent validity is established.

3.3. Construct validity

For the purpose of testing the proposed hypothesis the structural equation modeling was implemented. The chi-square of 132.7 (71 degrees of freedom) was statistically significant, which suggests that model does not perfectly fit the data. Since Bollen (1990) suggests that a perfect fit may be an inappropriate standard, also other indices were used to evaluate the measurement model. These were all higher than the 0.90 benchmark, with GFI=0.93, TLI=0.93 and CFI=0.95 and indicated that the data fits the model. Similarly, the levels of misfit were tolerable (RMSEA=.052; RMR=.074), all below the relevant benchmark of 0.08. This means that one can support the construct validity of the simplified measurement model.

4. Results of a survey

The results are shown in the table 4 below from which we can observe, that the surveyed organizations mostly agree (mean value 6,01) with the statements that they see social responsibility as fairness without abuses in relationships with employees, business partners and others, beyond the limits prescribed by the law. Organizations also largely agree (mean value 5,85) with the statement that corporate social responsibility to employees is based on care for pleasure, creativity and safety at work, which exceeds the level prescribed by law.

Authors notice that surveyed organizations to a lesser extent (mean value 5,79) encourage employees to strengthen tolerance and harmony in the workplace.

	Mean	Std. Deviation
We encourage employees to strengthen tolerance and harmony in the workplace.	5,79	1,270
We are careful and fair to our employees, so we do not have experiences with their dissatisfaction (strikes and bad work).	5,83	1,298
Corporate social responsibility to employees is based on care for pleasure, creativity and safety at work, which exceeds the level prescribed by law.	5,85	1,315
Corporate social responsibility for us is understood as fairness without abuses in relationships with employees, business	6,01	1,221

partners and others beyond limits prescribed by law.		
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Table 4: Mean values and standard deviations for the statements concerning the social responsibility of respondents' organization about relationship with their employees (Relationships with employees).

Although respondents largely agree (mean value 6,11) with the statement that they consider the principles of environmental protection – in the manufacturing and / or service process, they hardly agree (mean value 5,66) with the statement that they are reducing the amount of waste and packaging, we clean our sewage, in the chimneys we have modern efficient filters, etc... More information is in table 5.

Hence, we can conclude that organizations care for the environment, but only to the extent that is legally prescribed. Organizations also strongly agree (mean value 5,95) with the statement that they encourage their employees to careful handling with materials and energy (production, offices).

	Mean	Std. Deviation
We reduce the amount of waste and packaging, we clean our sewage, in the chimneys we have modern efficient filters, etc...	5,66	1,409
We encourage our employees to careful handling with materials and energy (production, offices).	5,95	1,174
We consider the principles of environmental protection - in the manufacturing and / or service process.	6,11	1,118

Table 5: Mean values and standard deviations for the statements concerning the social responsibility of respondents' organization about environment (Relationships with broader environment)

Results in table 6 shows that organizations mostly agree with the statement (mean value 6,51) that in presenting their products (services) they do not deceive customers (and that they always fulfill promises made). Respondents also agree with the statement (mean value 6,48) that they are very reliable business partner (buyer and seller). These answers are quite congruent, since standard deviation in both cases is under 1.

	Mean	Std. Deviation
We raise awareness at our customers on a permanent / safe use of our products (services).	6,12	1,078
We denote the ingredients on our products correctly and honestly.	6,26	1,109
We are very reliable business partner (buyer and seller).	6,48	0,813
In presenting our products (services) do not deceive customers (we always fulfill promises made).	6,51	0,828

Table 6: – Mean values and standard deviations for the statements concerning the social responsibility of respondents' organization about customer and other business partners (Customer relationships).

Results show that organisations to a large extent agree that socially responsible business is part of the policy, strategy and tactics (daily practice) of surveyed organizations (mean value 5,79). The organization has a social responsibility defined in their vision and / or in the mission and both are regularly exercises in daily practice has 5,43 degree of agreement.

	Mean	Std. Deviation
The organization defines social responsibility in its vision and / or mission, and both are regularly exercised in its daily practice.	5,43	1,469
Organization is based on social responsibility strategy to equally treat its environment, community, business, employees, managers, and owners.	5,71	1,276
Socially responsible business is part of the policy, strategy and tactics (daily practice) of our organization.	5,79	1,309

Table 7: Mean values and standard deviations for the statements concerning the social responsibility of respondents' organization about management (Leadership)

5. Conclusion

Social responsibility is a concept, which nowadays tends to influence the way organizations design their policies, strategies and activities and how they generally conduct their work. Basically, social responsibility represents a linkage of honesty and reliability without abuse of influence/power between organizations and constructs such as social environment, nature, employees, and other organizations. Despite the fact that there is an issue concerning the lack of indicators which could directly show the benefits of social responsibility for organization we have strived to demystify this problem through a research, which was the foundation of this article. The hypothesis which was tested is: SR in Slovenia is based on four fundamental constructs (Relationships with broader environment, Relationships with employees, Customer relationships, and Management/company policy).

For the purposes of the research we have firstly used a quantitative research method (structured survey) to enable actual measures of concepts to be calculated. A measurement instrument was developed and in-depth interviews performed. Upon the results the questionnaire was prepared and a computer assisted web interviews were conducted. 2490 organizations were randomly selected of which 320 responded. Respondents were individuals responsible for HRM in certain organization. The questions were related to the social responsibility of their organization in relation to their employees, environment, community, costumers and other business partners, and management.

Descriptive statistics showed us that the surveyed organizations agree that social responsibility is unavoidable in dealing with their employees. That is why they care for healthy work climate, safe working environment and, of course, also for the well-being of their staff. For respondents' organizations is SR understood as fairness without abuses in relationships with employees, business partners and others beyond limits prescribed by law.

Environmental protection is also an important aspect, which is according to the results of the research taken into consideration by organizations involved in the research. Respondents' organizations consider the principles of environmental protection – in the manufacturing and / or service process. They also reduce the amount of waste and packaging, we clean our sewage, in the chimneys we have modern efficient filters, etc...

The surveyed organizations also try to be socially responsible in their relationship with customers and business partners. They claim that they do not try to deceive their customers by stating

something misleading about their service/product. As a consequence they also believe that they are very reliable business partner and they expect the same from their suppliers and customers.

Results of the research indicate that managers in organizations also tend to work socially responsible. With this they mean that annual reports reflect actual business situation and that social responsibility is a part of the vision/mission, policy, strategy and tactics of the surveyed organizations. Management should be more involved in the various interest groups, which conduct socially responsible activities and projects for the development of society.

Social responsibility is increasingly becoming a vital concept, which has to be integrated in every organizations and by that we do not think only about a beneficial marketing gesture, which may or may not lead to a (short-term) profit. Organizations have to realize that social responsibility provides an important link between different constructs and that it has to be requisitely holistic implemented in the strategies and activities of organization through their holistic approach. And if organization succeeds to cope with the complexity of social responsibility, then we believe that financial benefits will emerge.

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**AN INFORMATION-BASED VIEW AT THE
'COMMUNICATION FROM THE COMMISSION TO THE
EUROPEAN PARLIAMENT, THE COUNCIL,
THE EUROPEAN ECONOMIC AND SOCIAL
COMMITTEE AND THE COMMITTEE OF THE
REGIONS: A RENEWED EU STRATEGY 2011-2014 FOR
THE CORPORATE SOCIAL RESPONSIBILITY' (EU 2011)**

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Corporate Social Responsibility, Invention Innovation Diffusion Process

Abstract

The Commission aims to create conditions favourable to sustainable growth, responsible business behaviour and durable employment generation. Social responsibility requires processes of innovating habits of all humans, societies and especially all decision makers; towards required and requisite holism, based on ethics of interdependence. Such changes should assure that social responsibility will develop into real innovative solution of current social problems. Corporate social responsibility concerns actions by companies over and above their legal obligations towards society and the environment. Draft suggestions in three groups of criteria for an informal system about social responsibility of organizations are presented. Horus award in Slovenia was introduced to promote public awareness about meaning and importance of social responsibility and encourage such behavior in Slovenian organizations.

1. The selected problem and viewpoint

Information is influential message made of clearly readable data. Action plan is expected to provide such information. The European Union's document addressed here provides for some information, but it needs many more details to be able to manage and monitor actions in EU member states, which EU tends to promote with its document.

2. Selected quotations from the addressed document (EU, 2011)

The following quotations make full economic sense as parts of a macro-economic and political document, but they hardly provide a basis for reliable reporting about the countries' and organisations' practice of implementation of social responsibility.

Corporate social responsibility (CSR) concerns actions by companies over and above their legal obligations towards society and the environment. Certain regulatory measures create an environment more conducive to enterprises voluntarily meeting their social responsibility.

A strategic approach to CSR is increasingly important to the competitiveness of enterprises. It can bring benefits in terms of risk management, cost savings, access to capital, customer relationships, human resource management, and innovation capacity.

Because CSR requires engagement with internal and external stakeholders, it enables enterprises to better anticipate and take advantage of fast changing societal expectations and operating conditions. It can therefore drive the development of new markets and create opportunities for growth.

By addressing their social responsibility enterprises can build long-term employee, consumer and citizen trust as a basis for sustainable business models. Higher levels of trust in turn help to create an environment in which enterprises can innovate and grow.

Responsible business conduct is especially important when private sector operators provide public services. Helping to mitigate the social effects of the current economic crisis, including job losses, is part of the social responsibility of enterprises. CSR offers a set of values on which to build a more cohesive society and on which to base the transition to a sustainable economic system.

The economic crisis and its social consequences have to some extent damaged consumer confidence and levels of trust in business. They have focused public attention on the social and ethical performance of enterprises. By renewing efforts to promote CSR now, the Commission aims to create conditions favourable to sustainable growth, responsible business behaviour and durable employment generation in the medium and long term.

The Commission has identified a number of factors that will help to further increase the impact of its CSR policy, including:

- The need for a balanced multi-stakeholder approach that takes account of the views of enterprises, non-business stakeholders and Member States.
- The need to better clarify what is expected of enterprises, and to make the EU definition of CSR consistent with new and updated international principles and guidelines.
- The need to promote market reward for responsible business conduct, including through investment policy and public procurement.
- The need to consider self- and co-regulation schemes, which are an important means by which enterprises seek to meet their social responsibility.

- The need to address company transparency on social and environmental issues from the point of view of all stakeholders, including enterprises themselves.
- The need to give greater attention to human rights, which have become a significantly more prominent aspect of CSR.
- The need to acknowledge the role that complementary regulation plays in creating an environment more conducive to enterprises voluntarily meeting their social responsibility.

The remainder of this communication presents a modern understanding of CSR, including an updated definition, and a new agenda for action.

3. Social responsibility – suggestion of potential measurements

Social responsibility (SR) requires processes of innovating habits of all humans, societies and especially all decision makers; towards required and requisite holism, based on ethics of interdependence (natural and economic) instead of independences (except the legal one). Such changes should assure that social responsibility will develop into real innovative solution of the current social problems.

We understand social responsibility as creation and transfer of requisitely holistic and socially beneficial ideas, knowledge and inventions that consider interdependence in business and social environment. This is a very important reservoir for all humans, except the exploitative monopolist and similar people, which abuse their power and influence, without thinking, that such behavior can be only short lived and will cause revenge. The practice of some large banks and financial firms, even states (e.g. in north Africa) in recent years provides cases of it.

Idea creation processes need supportive environment and management. During the processes of developing these ideas into novelties, inventions and innovations useful for many members of the society and other stakeholders, one can encounter numerous resistances and difficulties. Especially the influential decision makers or people holding powerful positions are strongly opposing introduction of these inventions or even suggestions of social responsibility. Social responsibility means innovation of our habits, values, culture, ethics and norms toward interdependence and holism. It is a very complicated and complex topic, goal, and process that is needed always and all the time and is related to all areas of our human activities. We understand social responsibility as innovation of habits, values, culture, ethics and norms, resulting also in business innovations in companies. The most important role is with all influential persons and decision makers. We include the innovations of management style, management methods, methods of cooperation, and on the next level all organizational innovations (ISO, 2010: ISO 26000; EU 2011).

For an idea to be developed into innovation of socially responsible behavior a diffusion process is needed. Very few ideas survive the development process into innovation, and social responsibility innovations encounter even many more opposing processes. They above all need the political will and support, especially with setting good examples and requisitely holistic management processes (Rogers, 2003; Ženko, Mulej, 2011). Diffusion processes include useful novelty, communication channels, time and social systems management. A lot of time, will and patience is required (see Mulej 2010a).

In diffusion processes of social innovation, here: social responsibility, an important role as promoter and communication channel, is with the government. It can be local, national, or even supranational government. Beside the government, important actors are also ministries, non-

governmental organizations, chambers and similar organizations, which are responsible for such and similar areas of social activities and have the important role to be promoters and actors in diffusion processes of social innovations and with them social responsibility as alternative. Such behavior could become even the only acceptable and allowed in the future.

In some countries social responsibility already became an important project and e.g. in Great Britain ministry for social responsibility (under previous government) was formed. Due to the seriousness and complexness of the current situation as well as the resistance of the influential people on the other hand, we believe that supranational strategy of development of social responsibility as invention-innovation-diffusion-process (IIDP) should be accepted. In the framework of EU, its directives or guidelines should be incorporated into national legislations and from them with diffusion methods among people into their everyday practice.

Development of supranational as well as national strategy of development of social responsibility should also include a clear plan of lobbying with relevant bodies or organizations of EU and national governments, as well as with local bodies and organizations (see EU, 2011).

A part of humans is already aware, that all of us have to renew our values and thinking processes, since all of us are influential. All of us are owners and undertakers of processes, which we create and take part in; so all of us should be responsible: have the right to use without abuse. A part of humanity is already aware, that we need to innovate our habits and the holistic renewal of social-economic system is no longer a choice, but a necessity (Mulej, 2009). Besides of innovating ourselves one also must innovate the criteria one uses to measure ones' own success, which we have developed ourselves now.

4. Draft suggestions for an information system about social responsibility of organizations

The economic role of social responsibility is to enhance long-term economic efficiency and effectiveness that is visible in business results and conditions, expressed as business excellence attained by technological and non-technological innovation. Hence, we suggest three groups of criteria; all of them reach beyond the short-term profit and need adding opportunity calculation to the traditional accountancy and cost-benefit:

1. Business excellence;
2. Innovation results¹⁹;
3. Social responsibility.

Ad 1. Business excellence²⁰;

Business efficiency:

- Overall productivity as estimates of GDP per person employed,

¹⁹ Innovation results are backing improvements in criteria that are listed ad 1 and ad 3.

²⁰ SOURCE: document received from Inesa Ganidze and Nana Maisuradze, Georgia, by e-mail in April 2012. The cited measures do not consider social responsibility, but tend to express more the traditional approach. Still, the list is quite comprehensive and therefore close to requisite holism, including some indicators tackling social responsibility. They are found especially in the criteria sets on Management practices and Attitudes and values. Consideration of synergies based on interdependencies of viewpoints that are covered by the given criteria might be a next step of development.

- Real growth of overall productivity as percentage change of real GDP per person employed,
- Labour productivity as estimates of GDP per person employed per hour,
- Real growth of labour productivity as percentage change of GDP per person employed per hour,
- Agricultural productivity as related GDP per person employed in agriculture,
- Productivity in industry, as related GDP per person employed in industry,
- Productivity in services, as related GDP per person employed in services,
- Productivity of large corporations,
- Productivity of companies,
- Productivity of small and medium size enterprises.

Labour market:

- Compensation levels of total hourly compensation (wages and benefits) for manufacturing workers,
- Unit labour cost as percentage change in manufacturing sector,
- Remuneration in services professions as gross annual income including bonuses and supplements,
- Remuneration of management as total base salary including bonuses and long term incentives,
- Remuneration spread as ratio of CEO to personal assistant remuneration.

Relations:

- Working hours as average number of working hours per year,
- Labour relations with positive influence on production,
- Worker motivation,
- Employee training as high priority in company,
- Industrial disputes as lost working day per 1,000 inhabitants per year.

Availability of skills:

- Labour force as number of employed and registered unemployed,
- Labour force as percentage of population,
- Part time employment as percentage of total employment,
- Female labour force as percentage of total labour force,
- Foreign labour force as percentage of total labour force,
- Attracting and retaining talents is a priority in company,
- Brain drain of well-educated and skilled people in economy,
- Foreign high-skilled people are attracted to your country,

- International experience of senior managers is generally significant,
- Competent senior managers are readily available.

Finance:

- Banking sector assets as percentage of GDP,
- Financial cards in circulation as number of cards per capita,
- Financial cards transactions in USD per capita,
- Investment risk as Euro-money country risk overall (scale from 0-100),
- Banking and financial services support business activities efficiently,
- Financial institutions transparency is sufficiently implemented,
- Finance and banking regulation is sufficiently effective,
- Risk factor in financial system is adequately addressed.

Market efficiency:

- Stock markets provide adequate financing to companies,
- Stock market capitalization in billions of US\$,
- Stock market capitalization as percentage of GDP,
- Value traded on stock markets in US\$ per capita,
- Number of domestic companies listed on stock markets,
- Shareholders' rights are sufficiently implemented.

Finance management:

- Credit is easily available for business,
- Venture capital is easily available for business,
- Corporate debt does not restrain the ability of enterprise to compete.

Management practices:

- Adaptability of companies to market changes is high,
- Ethical practices are implemented in companies,
- Credibility of managers in society is strong,
- Corporate boards do effectively supervise the management of companies,
- Auditing and accounting practices are adequately implemented in business,
- Customer satisfaction in companies is emphasized,
- Entrepreneurship of managers in business is widespread,
- Social responsibility of business leaders is high,
- Health, safety and environmental concerns are adequately addressed by management.

Attitudes and values:

- Attitudes toward globalization are general positive in your society,
- Image abroad of your country encourages business development,
- National culture is open to foreign ideas,
- Flexibility and adaptability of people is high when faced with new challenges,
- Need for economic and social reforms is generally well understood,
- Corporate values take into account the values of employees,
- Value system in your society supports competitiveness. ²¹

Ad 3. **Social responsibility**

Mulej (2012) includes among the economic criteria of social responsibility:

- Normal and regularly paid salaries and wages,
- Normal investment funds,
- Business excellence according to the standards of EFQM,
- Satisfactory and adequate, but not exaggeratedly high managers and owners payments,
- Permanent circle of business excellent and socially responsible purchasing and sales business partners,
- Zero legally disputable deals,
- Prevailing of long term and broad measures of business success over short term and narrow hearted,
- No abuse of power over people and natural conditions for human survival,
- Payment to influential people on long term basis, including payment in shares,
- Organizational and ownership relations, which are as close as possible to the Mondragon cooperative model,
- Career promotions to influential positions similar to the model of the long term best companies in the world (called 'visionary companies'), as described by Collins and Porras (1997, Collins, 2001, Collins 2005),
- Acting according to Creech (1995) model of five pillars of total quality management, defined as interdependence of total quality of products, processes, leadership (i.e. cooperative management), commitment and organization based on integrative management and adequate motivation of coworkers;
- Methods of creative cooperation, ideas creating and decision making are applied such as Six hats from dr. Edward De Bono and Nastja Mulej, our USOMID and similar (Mulej M and N, 2006, DeBono, 2005),
- Renewal of the organizational practice in line with criteria of Horus Award (see next chapter),

²¹ We do not tend to support competitiveness alone, but also ethics of interdependence and holism as basics of systemic behavior that receive support from ISO 26000 and EU 2011 too.

- Rewarding of all organizational members in line with criteria of ‘innovative business model’ (Mulej et al, 2008),
- Government creates and maintains preconditions to be appealing in line with 3T model (Tolerance, Talents, Technology) (Florida, 2002/2005) and having innovative regions (Potočnik, 2011).

5. Horus - Slovenian Award for Social Responsibility

IRDO (the Institute for the Development of Social Responsibility) and PRSS (the Slovenian Association for Public Relations), under the auspices of the President of the Slovenian Republic, dr. Danilo Türk, publish their call for granting the Slovenian Award for Social Responsibility once a year. This is done in co-operation with numerous other interested professional organisations.

With the Slovenian Award for Social Responsibility – HORUS – IRDO, PRSS and partners wish to award holistic approaches to social responsibility (SR). SR means a lot more than charity; it is honesty beyond the one required by legislation, and without abuse.

The HORUS Award is intended for companies and institutes in Slovenia, which are aware of their SR and include SR in their work: in relation to the environment, to their employees and other company stakeholders, business partners and the wider social environment - and in product and service development. It is essential that SR is included in the strategic management of organisations (companies, institutes, associations) and in their business practices. This is also true in a time of crisis, as SR yields benefits in the long run.

In November 2010 the ISO 26000 Standard on SR was released. It includes seven topics, which were already included in the HORUS Award at the time of its inception in 2009. Both concepts that link them were also covered – the interdependence of subjects, measures, people and their organisations - and the holistic approach to these.

IRDO and PRSS and partners are glad to see more and more companies in Slovenia responding to their call; this year they hope to also welcome institutes. Filling out the questionnaire helps the applicants create their own strategy of social responsibility and business excellence. The HORUS award givers are certain there are many companies and institutes matching the HORUS criteria in Slovenia; that is why they are looking forward to presenting the applicants’ achievements in the development of SR.

5.1. About the HORUS Award; Mission and basic goals of the HORUS Award

Mission of the HORUS Award

The mission of the HORUS Award is to encourage ethics of interdependence, holistic behaviour, active innovation, and business responsibility in Slovenian organisations. The HORUS Award givers want to strengthen awareness about social responsibility, and to alert everyone about our interdependence, which some are not fully aware of. This makes them often one-sided rather than holistic, and therefore unsuccessful. One should remember that every individual is responsible for every action inside and outside his/her organisation. All individuals, together with their leaders, create an effective, responsible, or irresponsible, organisation. The Horus award givers want to promote good practice publicly, encouraging companies to have more responsible and effective operations.

Vision of the HORUS award

The vision of the HORUS award is to become a leading Slovenian award concerned with balanced and innovative SR. IRDO's archive of awarded award-winning companies is becoming a library of Slovenian good-practice examples of SR; it is becoming an indispensable reference source of knowledge and recognition in this field.

Goals of the HORUS award

- Public awareness about the meaning/importance of SR;
- Promotion of socially responsible companies' practice long term;
- Education about the latest practices of SR in Slovenian and foreign companies;
- Awarding the most socially responsible organisations;
- Publishing a manual with examples of good practice of SR.

5.2. The Horus name

Why was the name HORUS chosen for the Slovenian award for social responsibility?

HORUS is a God, which represents the higher consciousness about the planet Earth and is responsible for human development; that is why he was chosen as a symbol for the Slovenian social responsibility award.

HORUS is one of the ancient and most famous Egyptian gods. The Egyptian word "her" (hor, har), from which the name originates, means "the one from above" or "distant one". In mythology, HORUS was presented as a divine falcon. It is also symbolically presented as a stylized eye – the symbol of the sharp falcon eye. The eye has become a symbol for integrity, health, firmness and perfection.

5.3. The HORUS sign

Permanent development is always linked with the green color. Green and blue have always symbolized the planet Earth. This is represented as the pupil in symbolized Horus eye. One can also see the upper and lower "pupil" as hands which are hugging the world. One can understand the eye symbol as the eye of God, which watches the Earth, us - or the eye of every one of us which reflects the Earth and everything we do with it – good and bad.

5.4. Call 2011, 2012

The Slovenian Social Responsibility Award HORUS is open to small, medium and large companies and institutes in Slovenia. Applicants must demonstrate at least one year of activities and projects in practicing SR. These projects should show long-term benefits for employees, the environment, the community, buyers, and others. Applicants should exceed minimal, legally determined business standards. Companies can apply, even if their efforts have not been recognised with certificates, awards, and recognitions. Companies and institutes that are applying for the Slovenian Social Responsibility Award HORUS must conform to HORUS standards and must not be subject to legal processes, in court or before business authorities, because of their operations. A company or institute which does not meet the minimal standards on all levels may not apply for the Slovenian Social Responsibility Award HORUS.

In 2011 the HORUS call for these categories was announced; in 2012 the call will be similar:

1. Call for the Slovenian social responsibility award HORUS (for companies and institutions)

2. Call for special recognition in the frame of the Slovenian social responsibility award HORUS (for Slovenes abroad, for journalists and in general).

5.5. Criteria in HORUS award questionnaire

1. Environmental responsibility and sustainability
2. Responsibility to employees
3. Responsibility to Communities
4. Responsibility to customers and suppliers
5. Leadership
6. Involvement of social responsibility in the company's strategy and compliance with international guidelines
7. Stakeholder involvement
8. Action plans and key success factors
9. Measuring the results, communication and reporting of social responsibility
10. Certificates, awards in the social responsibility field

Details are visible at www.horus.si.

6. Conclusion

With these criteria, estimations on SR might be able to depend less on organizational PR statements that otherwise may prevail, and on organizational perception what is innovation, business excellence and/or SR.

As economic criteria reflecting success in the invention-innovation-diffusion processes the suggested data might be useful.

Data about SR could be collected on the basis that IRDO has created and applied with its HORUS award for socially responsible organizations.

Data about business excellence could be collected on the internationally agreed basis of the European Business Excellence Award.

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IS SOCIAL RESPONSIBILITY A VARIABLE?

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Corporate Social Responsibility, Ethics, Economics, Participative Economy

Abstract

Social responsibility is a part of ethics. In my article I want to point out the difficult position of social responsibility within business sphere because of its contradictory character. I think its position is correct, social responsibility as a part of ethics is not unambiguous and always questions both its principles and the world around. In my article I'd like to show that every human activity is evaluated from the ethical perspective. However ethics itself is contradictory and fluctuates between respect for the other and general rules. Economics is in its on homo oeconomicus based position grounded on selfishness and shows no respect for the individual. Ethics can't respect such a position and opens view for other perspectives. At the end of the article some economic models will be shown which can decrease the tension between economics and corporate social responsibility.

1. Introduction

Social responsibility is a part of ethics and ethical considerations can and should be applied to it. I will try to show some of their consequences.

The title of my paper begs a question. What can social responsibility (CSR) be, if it isn't a variable? We are used to expressing the features of our world in variables. We are used to measuring wellbeing of a nation in GDP/capita, average income or amount of investments; equal opportunities compliance in number of women in managerial positions and political functions; respect towards nature in number of national parks, number of protected animals, etc. The variables needn't be quantities, qualitative variables are also acceptable as in researching people's opinions, monitoring different jobs different social groups have in society, level of heterogeneity in protected animals, etc.

Variable is something that changes within a certain horizon. All the above mentioned variables are formed under some circumstances, in a certain perspective, in a horizon, in a world. They are visible and thematized, their world remains hidden and almost secret, even though without it they wouldn't be understandable. Maybe we could also say the variables are formed when we consider something fixed as a parameter, but we must be careful with such a description.

The common horizon of the above mentioned variables is instrumental rationality trying to find means for our ends, individualism, self-interest, economics, preference of material goods, utility,

market economy and generality. I will try to outline another horizon consisting of ethical responsibility. And I think social responsibility represents this new horizon. It is a conflicting idea as it has to, but cannot be grasped in ethical rules. It is a kind of paradox. When we are realizing CSR we are realising the conflicting idea combining general rules and respect for the specific individual. Finally we will learn economy is always evaluated from the ethical perspective, but its disrespect for the individuality of the other is a source of conflict with CSR.

2. Variable and horizon

The distinction between the variable and the perspective must be considered when realizing social responsibility. The difficult question we must ask is whether we can just add one more requirement, one more variable to the current economic perspective or we must change the perspective in order to realize social responsibility.

What would it mean, if social responsibility were a variable? It would mean that it could be contained in a distinct thing called a variable. This variable would be outside of ethics. It would mean we can look at the world without the ethical perspective that we can stand outside of ethics while analysing social responsibility. To see social responsibility as a variable it must be indebted to no ethical point of view. It must stand outside ethics and ethical perspective. It must be objective and non-normative. But I think we can't. Even the task to pursue truth is based on ethical assumption that truth is better than untruth. One is never outside ethics and outside responsibility. One's conscience can persuade us. Social responsibility as a variable must be not only ethically neutral (ethical equality to all), but ethically free (outside of ethics). Social responsibility as a variable constructs a relationship between ethics and economics where ethics has the ethical position of someone needing help from a stronger agent. If it were left on its own, it could destroy the seemingly positive connotation of economics as the right one. The general utilitarian economic ethics can be endangered by more intimate and singular ethics of responsibility.

The social responsibility is not just a variable that could be added to ethically neutral economics. It is a horizon in which economics is always already placed. This variable only reveals that the economic myth is only one of the myths and shows its limits, to use Barthes's words. Social responsibility and ethics can't be isolated from how one sees the world, especially the world of ethics. There is no uninterested objective standpoint.

Social responsibility as a variable means that social responsibility can be isolated, incorporated, balanced, etc. – that it is a discrete phenomenon. Because some ethical insights can be added to economics, it should mean the whole ethical variable can be added, too.

But ethics is not something that can be added, it is rather something through which we see the world. I think permanently. If it is a worldview, then it can't be a variable, because a variable is something placed in the world. It helps us to place things we meet in our everyday world. It can't be placed because it is the place. Why do economists want to find place for ethics and social responsibility? Maybe they fear that their own privileged perspectives may be displaced or replaced by another ethical standpoint. The inappropriate questions might disturb the traditional worldview in which they see the world. They want to place it in a variable from their own perspective which means reducing it to their own perspective. They defend it through it. The classical utility and classical perspective will be something against which any ethical contribution will be judged. It is a response to the ethical attacks of the recent years. Ethics questions the classical economic tradition itself. The question we may ask when facing ethical problems may be 'if the classical economic worldview is the right one', and if things should be the way it tells us, it will be critically evaluated and corrected.

And only because the economic point of view also includes questions of right and wrong – which sees other ethical positions as threatening – can economists find place for social responsibility at all. Because economists see social responsibility and ethics as too idealistic and in need of practical correction, they betray their view is ethical, too.

To conclude, ethics is not a variable, it is a permanent perspective. We always see the world through it. There are many ethical perspectives and we can't just add one variable from one perspective into another perspective. Economics also has its own ethical perspective differentiating between right and wrong which is translated into effective, profitable and ineffective, unprofitable. Social responsibility presents another ethical perspective endangering the economic one. What is the problem with economic ethics, if we may call it ethics?

3. Alienation

The problem with economic instrumental rationality is alienation from labour, alienation from nature, alienation from full human life, alienation from others. And CSR tries to find a way back from alienation towards full human relation respecting individuality.

We live in a world where sensory perception and human desire are omnipresent, pleasure depends on accumulation of more and more things, people want new and newer experiences. Consumption is self-constituting, self-breeding and self-referential (Elliot, 2009, 18). People define their identities in terms of what they own rather than in terms of what they think or do. Production has changed into consumption and industrial world into post-industrial service-governed world. In life, today gratification and pleasure is predominant. Freedom means freedom to consume.

E. Fromm in his *Sane society* (1955) reflects that individuality is related to the person's social character. He asserts that intimacy can flourish only in creative social relations. Without them the self is poor and leads pathologic narcissistic life.

H. Marcuse in his *One-dimensional Man* (1964) blames the era of advanced consumerism for reduction of individuality, dissent, and opposition. Capitalism of our age creates one-dimensional man with false consumer needs and integrates individuals into the smooth running of a system of production, domination and social inequity. The feature of the modern world is according to Marcuse conformity. People see themselves as extension of objects they are producing. Products are reciprocally extensions of human minds. Marcuse thinks people have true needs to be creative, independent, autonomous fully participating members of societies, but the system (i.e. social and economic order, 'normality') imposes on them its own needs. One of these artificial needs is consumerism. People are not free independent autonomous beings thinking critically. They are free to choose between different types of products only.

R. Barthes is another example of an author who identified distorted world perception. In his *Mythologies* (1973; 131-132) he writes that "the meaning is distorted by the concept". The meaning of a signifier consists of two parts; one is full and forms the meaning, one is empty and is the form. The signified (concept) distorts the full meaning. Distortion doesn't mean obliteration. The full meaning remains there deprived of memory. It is, in other words, alienated. However, for Barthes we can achieve only an unstable grasp of reality, we can't see it in its wholeness. But that is another topic.

J. Habermas in his *Theory of Communicative action* (1984) distinguishes instrumental action aimed at goal achievement from communicative action, which is self-reflexive and open to the ideas of the

partner in dialogue²². Its aim is to reach understanding of the situation and about the partners' actions. Both participants can learn from the dialogue and reflect on their premises. The aim of teleological action is to make somebody do something. The partners have in mind the realization of their aims only. The communication is thus one-sided.

We have seen there is something unnatural in economic rationality, no full relation of man to his others and his world can be found, the relation is not individualistic, it is too general and self-centred, the human relations do not fulfil their potential, people don't understand their lives and their comrades, they are manipulated etc. What does the CSR show us? Can it help? I will start with the idea of ethics developed by E. Levinas. I think social responsibility points in this direction stressing the individual character of ethics as well. And we will see the immanent conflict between general and individual within ethics which complicates the matter.

4. New horizon open by CSR

E. Levinas developed ethics of responsibility. This ethical approach is individualistic. General ethical ideas are according to Levinas incapable to grasp the individuality of the other, who is more than conceptual knowledge. They hide the basic desire to help another person.

According to Levinas (Smith, 2003) being is not synonymous to goodness, they are rather antithetical. We cannot find a non-contradictory ethical system, which is in compliance with our world. We always have to make a decision, which is problematic and sacrifices something. All three modes of being that Levinas distinguishes (life of the living, the existence of human beings, the reality of things) contain some violence. "The life of the living in the struggle for life; the natural history of human beings in the blood and tears of wars between individuals, nations, and classes; the matter of things, hard matter; solidity; the closed-in-upon-self, all the way down to the level of the subatomic particles of which physicists speak." (Levinas, 1998, XII) The character of being is orientation toward itself – selfishness. In responsibility for the other, in concern for him being is transcended. There is no parity between the other and me. The other is always better than me. Any gratitude would involve us in the economic dialectics of counter-value. In ethics the stability of being is interrupted. Such an ethics cannot be preached. It is paradoxical, but the 'I' takes responsibility for something it couldn't have influenced, even for the evil against itself.

According to Bergo (2011) ethics is for Levinas free of deontology, utility, control, prediction and manipulation. Rationality cannot get out of metaphysical totalizing systems (i.e. mental pictures), it always constructs or presupposes them. There is no bridge between practical and pure reason. Rationality always leads to instrumentality. The ethical ground is particularity, which is for man the face-to-face relationship. Responsibility is related to transcendence. But transcendence is in Levinas's terms lived and factual. It is true, it cannot be presented to the 'I', but on the other hand it is the face-to-face relation and lives from our everyday enjoyment and desire, even though it precedes them. Human existence is full and creative before instrumentalist rationality. We are always already in social relations, we have always already been affected by the other. The other's face is not an object; it is an expression which affects me before I can reflect on it. The face commands and summons: "Do not kill me." It resists my freedom. It is a combination of resistance and defencelessness. The other's face invokes shame. Freedom experiences itself as unjustifiable. The other is the origin of 'I' as its passive resistance holds the other outside the structure of force

²² Habermas actually distinguishes in his book four types of action: instrumental, normative, dramaturgic, and communicative.

and conflict and as it demands from me. This transcendence belongs to another order than being; it is a possibility that something different than consumption and rationality may take place. Levinas's ethics is singular and contradicts the general rules. Therefore it is impossible to give general guidelines, ethics must only respond to the calling of the other.

J. Derrida developed this line of thought in his later work. In the *Gift of Death* he stresses the dualism of responsibility. It is both historic and a-historic. Historicity must be admitted or one is closed in totality. But historicity must be open as a problem. Leithart (2006) says responsibility involves both knowledge of one's actions (one must know what one is doing and for what reasons) and ignorance (if one would just follow or develop one's knowledge, it would be no responsible action, but technical use of one's thinking or mechanistic application of a theorem). One is always in the general and trying to transcend it. Responsibility is the development of the subject as liberty, singularity, responsibility and being before the other. The other has infinite alterity. Responsibility is an act of faith and is always paradoxical. The highest form of responsibility is death as one sacrifices everything for the other and can't be rewarded. One is never responsible enough as one is finite. In death we are unique, singular and called to responsibility. It is the same with decision, which is also singular. At the moment it tries to translate into language it loses its singularity and becomes general. Ethics means transcendence of ethical principles, of general duty into absolute singular duty. But every decision is tragic. When I sacrifice for one person I can't be responsible for another one.

5. Conflict between economics and CSR

To return to social responsibility I think it represents the transcendence surpassing the level of economic rationality. It wants to show respect for the other at the expense of generality and rule following. Its definitions can prove the conflict. But generality can't be removed completely.

Some argue (Basu & Palazzo, 2008) that the reason for the emergence of social responsibility included the scandals in the eighties and nineties. In spite of the fact the concept of CSR is older, it proves that CSR is related to some discomfort and discontent with the way economics worked and evaluated things.

I don't want to say companies are just merciless calculating machines, but they are goal-governed and their aim is to maximize profit. CSR seems to disturb their essence. It reminds us: the economic logic is not the only one. If we have a look at some definitions of CSR (Shafiqur, 2011) and compare especially those of M. Friedman with the rest we will see the contradictions. The behaviour of companies is based on protestant ethics (Weber). It pursues its own profit, is individualistic, rational and to some extent selfish. It requires reciprocity and rewards. It is scrupulous, but gives nothing for free.

5.1. Definitions of social responsibility

The conflict between instrumental rationality and ethical responsibility can be seen even in the definitions of CSR.

Kuhn and Shiver (1991) state that the call for CSR came from outside the corporate area: from the unions. One of the earliest definitions is from Bowen (1953) who defines CSR in the following words: "It (CSR) refers to the obligations of businessmen to pursue those policies, to make those decisions, or to follow those lines of action which are desirable in terms of the objectives and values of our society." (Bowen, 1953, p. 6). Here the concept of responsibility starts to play its role. But doesn't it also harm the substance of companies as self-centred? Companies are generally not

charitable. Heald (1957) is more specific on that and is aware of the conflicting interests. He defines CSR as follows: “CSR is recognition on the part of management of an obligation to the society it serves not only for maximum economic performance but for humane and constructive social policies as well.” The fifties were characteristic by the fact that managers started to recognize the fact they had some obligations towards the society.

Davis (1960) also felt the confronting forces between business and CSR. He defines CSR as businessmen’s decisions and actions taken for reasons at least partially beyond the firm’s direct economic or technical interest.

In Frederic’s view (1960) the competition as principle of economic life is almost lost. He says “[Social responsibilities] mean that businessmen should oversee the operation of an economic system that fulfils the expectations of the public. And this means in turn that the economy’s means of production should be employed in such a way that production and distribution should enhance total socio-economic welfare (Frederick, 1960). Similar statement can be said about the Walton’s definition (1967).

M. Friedman represents a view which stresses the roots of economic life. In his article (Friedman, 1970) he says “There is one and only one social responsibility of business – to use its resources and engage in activities designed to increase its profits so long as it stays within the rules of the game, which is to say, engages in open and free competition without deception or fraud” (Friedman 1970). Later definitions fluctuate between these two aspects sometimes aware of their contradictory character, sometimes not or less so.

Shafiqur (2011) provides a thorough overview of aspects stressed in different time periods: In the 50s CSR stressed obligation to the society; in the 60s the relationship between corporation and society was stressed; in the 70s stakeholders’ involvement, well-beings of citizens, a philosophy that looks at the social interest: help solve neighbourhood problems; improve the quality of life; economic responsibility, legal responsibility, ethical responsibility, and discretionary responsibility were important; for the 80s voluntariness; economically profitable, law abiding, ethical and socially supportive; economic, legal, ethical and voluntary or philanthropic were stressed; in the 90s stakeholders’ involvement; obligation to society; environmental stewardship; people, planet, profit were highlighted; in the 21st Century dimensions of integration of social and environmental concern; voluntariness; ethical behaviour; economic development; improving the quality of life of the citizens; human rights; labour rights; protection of environment; fight against corruption; transparency and accountability were the issues for CSR. Always something ethical, responsible and contradictory to the self-interest of companies is there. The liberal principles of free competition were weakened. Recently we could register the ISO norm 26000 (2010) dealing with CSR. It identifies six core subjects of CSR: human rights, labour practices, environment, fair operating practices, consumer issues, community involvement and development. Its general proclamations don’t explain how far the company should go in the respect of its stakeholder’s interests. At the extreme the company could lose its identity and act only in accordance with its stakeholder’s claims. In the norm’s definitions the interest of the company is almost lost and the consequences of such an approach were not drawn. Another important document is the Renewed EU strategy 2011-14 for Corporate Social Responsibility. Its definition of CSR as “a process to integrate social, environmental, ethical, human rights and consumer concerns into the companies’ business operations and core strategy in close collaboration with their stakeholders, with the aim of maximising the creation of shared value for their owners/shareholders and for their other stakeholders and society at large; identifying, preventing and mitigating their possible adverse impacts” doesn’t consider the self-interest of the company. The strategy doesn’t mention any limits or problems of CSR.

6. Future

The conflict to which CSR leads may be summarized as the conflict between general principles and respect or responsibility for the other in the form of human, society or nature. The main idea of ethics is the aim to respect the other. To communicate this mission it translates it into many general guidelines. However none of them is able to fulfil the requirements of the individual other. To address him we must be less general and closer to the individual. And economy based on self-interest doesn't show any space for the other. Are there any economic concepts that allow responsibility for the other?

We will never be close enough to show full respect for the other, but we can get closer. In recent economic literature we can trace two ways how to show more respect for the individual. They differ in their radicalism. Both agree that the wage share on GDP decreased in the last 40 years. (OECD, 2007), (Glyn, 2012) It means employees' work was not evaluated and the employees respected and that has led to current problems. The former approach was developed by J. Stiglitz in his famous Stiglitz Report (2010). He actually proposes a reform of current economic and financial institutions. The latter more radical approach consists in participative economy and deglobalization and seems more promising from the CSR point of view as it goes closer towards individuals. Employee involvement and participation is a hot topic in management, but participative economy tries to think the idea further.

6.1. Economic models respecting CSR towards employees

One of quite famous models showing respect for individuals is the participative economic model developed by Michael Albert and Robin Hahnel. It is based on participative decision making as a mechanism guiding production, consumption and allocation of resources in the society. It is an alternative to both capitalist and central economy. It is based on equity, solidarity and self-management. This model can be applied to politics and culture as well. It is actually a further developed type of cooperative.

Deglobalization is another model which stresses diminishing interdependence and integration between units around the world. It can be also called relocalization. It needn't mean the end of integration, it will just return the economic dependence to the local area where possible. Maybe we will be forced to this type of relations by the economic crisis and lack of energy resources.

7. Conclusion

To sum up social responsibility is not a variable as it is a horizon or perspective through which we always see the world. It means economy is always ethically evaluated. CSR is actually ethics applied to the economic area. And ethics is always critical to economy as they contradict one another: ethics is related to the respect for the other (it can be a person, nature or society) whereas economy is based on self-centred approach and instrumental rationality. It can be said it is farthest from ethics as it shows the smallest amount of respect for the other. It is limited and one-sided. I have proven the contradiction on the definitions of CSR and their development. But ethics is also internally paradoxical as it wants to be responsible for the other, but there are always more others, ethics becomes general and moves away from the individual. So it fluctuates between individuality and generality and makes everything uncertain. In fact that is its task: to show us that we have never come to the end, that there are always more perspectives, more to do.

In the final more practical part of my paper I have proposed two economic models which are closer to the individual and show some respect for him. I think they will contain more respect for the individual, but less respect for the general. Its best times seem to end as the balance has been deviated in its direction too much.

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HUMAN (WELL) BEING AND RESPONSIBILITY - NATURE, ARTIFACTS, REALITY, HUMAN MODELS, BELIEF AND RESPONSIBILITY

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No problem can be solved from the same level of consciousness that created it.

Albert Einstein

Keywords

Well-being, Knowledge, Information, Data, Responsibility

Abstract

Advanced systems thinking is based on evolutionary foundations, i.e. on the physical nature of whole universe. Physical systems are not only artifacts (thus man made systems) but also all natural world including both in-/animate worlds that form our life environment. Operation of artifacts involve our performance and facilitate our social environment and increase (sense of) our “wellness”. However their excessive use negatively influence natural environment and endanger our existence.

Both congenial domains - system science and cybernetics - have contributed to human facility to design and realize artificial systems by an essential way. Origin of computer stems from cybernetics’ ideas and all digital technology make current artifacts much more sophisticated. Also system engineering that has promote construction of extensive (rather that complex) systems and has brought an important shift in technological advancement. Let us remind that technology constitutes not only of technical systems but also of their use that change the society.

Applicable principles of both disciplines mentioned above have become a familiar ingredient of technical branches in so far as original theory back out of the common awareness. Moreover expectation insert into them have fairly failed in the area of social systems and possibilities to manage them. We should also remember the fact that just sixties topped off landing on the Moon was is considered to be last optimistic decade. First years of seventieth are connected with the “first petroleum crisis” typing global problems of these days. Despite of further technological development they rather enlarge and obtain new dimensions.

1. Man as an Observer

System philosophy differs “systematic” and “systemic” thinking - the first corresponds to engineering approaches while the second reflects spontaneous order of natural world (incl. society).

Also advanced - second order cybernetic constitutes peremptory change when explain man as a physical system. Its behavior depends on previous interaction within man's environment that constitutes his cognition and/or (tacit) knowledge.

Let us briefly remind basic shift in basic ideas as well as real principles:

- System theory newly accentuates dynamic (procedural) approach including self-organization and pattern formation/maintenance. System isn't understood as black box but its inner complexity plays an essential role. Very popular is the concept of "Complex Adaptive systems" which is changing nature and behavior dependently on initial conditions.
- Advanced cybernetics uses this tenets as well as the accordant thought and explains human cognition as a self-organization of an autonomous nervous system. Information received from the environment as well as from the observer's body participates on this process. In this way such (abstract) entities as consciousness, cognition and/or knowledge emerges from process commonly called "learning" or "knowing". These affect his physical and mental (cognitive) activities later.

Major attention is oriented toward a few considerable distinctions human has in comparison with other animals:

- Its knowing has an intentional nature and human doing is purposeful e.g. it is not only adaptive but rather proactive;
- Formed and/or distinguished patterns bear on an abstraction pertinent closely natural language, semantic information (of its meaning is interpreted by individual observer) and its social communication;
- Just communication or better conversation allows sharing individual knowledge.

These matters change the nature as well as complexity and evolution of social systems on principle. Due to growing use of information and communication technology we share up an immense amount of communicated data. Meaningful information depends on individual knowledge and two phenomena are put in an (extenuated) appearance:

(1) The nature and seriousness of culturally formed knowledge changes and dilates gap between physical and social reality.

(2) New ways of self-organization commonly understood as social stratification emerge or act unprecedented way. Just media and used ICT plays in these process an important role.

Both disciplines point out an essential force of human knowing - at theoretical level at least: Decisive part of systems researchers execute "constructivist point of view", thus distinction of (physical) reality and human cognition. The advanced cybernetics explains man as observer that is physical systems constituting knowing (knowledge) that affects his behavior (dealings) consequently. Such cognition/knowledge plays a pivotal role in all human doings including mental activities such as thinking, communication, learning, modeling, decision and others. (Exnarova, et al, 2011) These activities are either conscious (also rational) or they are subconscious (intuitive). Despite this, their influence has an intentional nature - i.e. they relate to known entities and initiate activities that are orientated by past experiences (knowing). The appropriate knowing |(knowledge) obtains next dimension through human communication and other ways of human interaction including corporate activities. The great and still misty is also nature of human language and/or representation of reality through symbols plays a considerably position in this process. As such they administer to evolutionary processes not only in (knowledge) society but in (global) world. In other

words - our intentional knowing influence spontaneous processes and change simple evolution to co-evolution.

2. Man as a wilful creator

Focus on human knowing and/or evolution opens many new questions such as: *What is natural, what is artificial? How intentional knowing and decision influence evolution? And also What is the nature and origin of human knowledge?*

To explain them we can modify distinction between mate-knowledge of both cybernetic streams that Pangaro has entered:

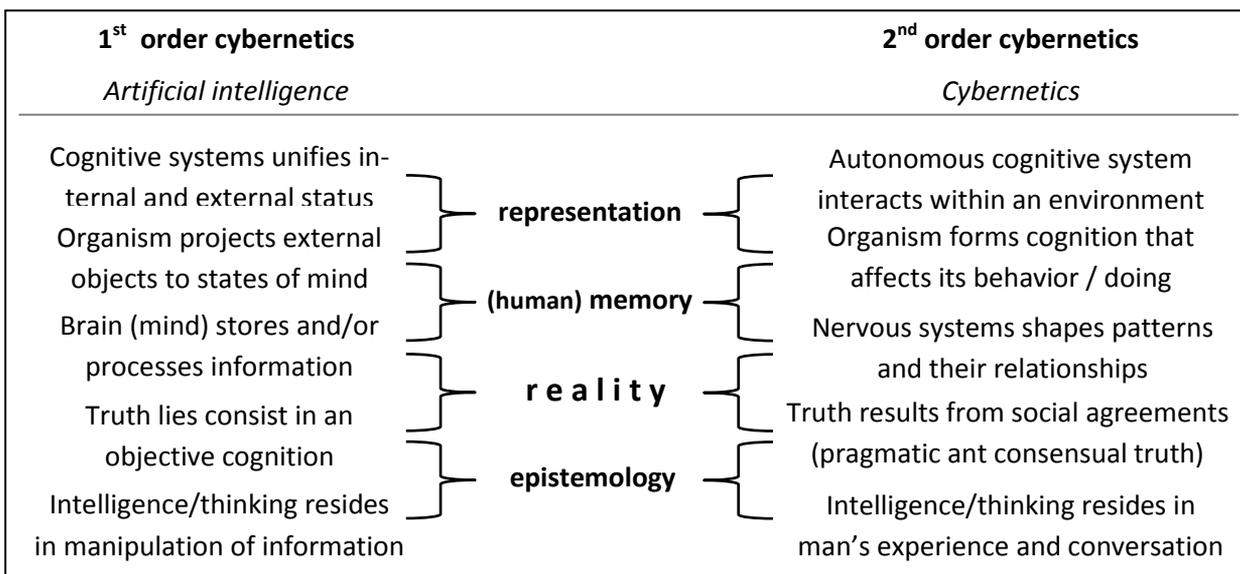


Figure 1 – Understanding basic concept that distinct first and second order cybernetics

Pangaro using similar picture explains the distinction between contemporary cybernetics on the one side and artificial intelligence on the other side. We use this picture to advert to different ways of an insight of some cognitive entities or better their concept. The protagonists of both speak about cognitive approach, but the left of them use concepts typical for (first order) cybernetic from the fortieths.

However the understanding to the nature of human, its cognizance as well its behavior brought an essential (paradigm) shift. It is apparent in traditional disciplines such as typically in philosophy (Popper, Habermans), psychology (Piatget, Maslow). We can find wider connections in other fields such as pedagogy (Bloome), linguistic (Pinker) and other (anthropology, neuroscience...). Also ideas of original - first order - cybernetic have contributed to interdisciplinary scientific domain called "cognitive science". Many from eminent authorities have interdisciplinary qualification often associated with physics and/or mathematics. Michael Polanyi was a physician, obtaining a medical diploma, also Douglas Hostadter was originally a physician who is interested in logic, mathematic, computer science... and cognitive science. Item F. A. Hayek known at first as liberal economist graduated law and political science but he also studied philosophy, psychology, and economics; he also participated in Macys conference relevant to self-organization. He paid pays high attention to knowledge its nature and meaning (1945, 1995); his Nobel price lecture is named *The Pretence of Knowledge*.

Cognitive science is basically oriented to the study of the mind and its processes, often connected also with information processes. The four entities mentioned in the picture No 1 are among basic concepts of it and two ways of their explanation epitomize two paradigms and/or two diverse Weltanschauungs:

The first and older doctrine has immediately contributed to the creation of computers and contemporary “digital” information and communication technology. It also forms the mental background of artificial intelligence. Such thought is rooted in two important ideas affecting science in the middle of last century: behaviorism and logical positivism. Nowadays both these theories are fought off but their influence is very forcible still.

The second theory bears on “cognitive revolution”, shunts concepts of mental states and lays emphasis on cognitive processes. Jerome Bruner warns that connection of behaviorism and mentalism is misguided and highlights the meaning “that human beings created out of their encounters with the world...” (Bruner 1990, p.2). Such consideration corresponds with contemporary systems theory as well as advances - second order - cybernetics. In this sense also human knowledge is explained as emerging from endless learning process of observer’s (individual’s) interaction within his environment. It covers not only sensual (empiric) perception of physical signals, but also communication (of lingual information) within social surroundings.

Confessors of the first paradigm muse on knowledge as static entity having a universal relevance and usually speak about declarative and procedural knowledge. The knowledge itself they define as a set of “pieces of knowledge” and/or (misty) organized information. In this conception knowledge is confused for facts described or appertains to some circumstances and/or problems.

Advocates of the second pattern differentiate tacit and explicit knowledge and point out priority of the first of them (Rosický, 2010). The explicit knowledge is embodied through signs and/or symbols and corresponds with lingual presented information of its meaning cover knowledge (and intention) of its author. It initiates mental activities of its receiver who - using its tacit knowledge - interprets its meaning. This results into physical and/or empirically apparent behavior as well as to wider intellectual activities including re-creation of original tacit knowledge. Some of these activities have consciousness nature, however interpretation and also knowledge transformation are mostly implied and subconscious.

To confront both conceptions we can diversify knowing natural process and knowledge emergent from it. In the first case the “knowledge” has tacit and also holistic nature – it covers the previous “knowledge” in an instantaneous and actual context. To express it outwardly we must use symbols that partly (imperfectly) represent cognitive processes – we lost many from authentic circumstances and we also chance upon limited abilities of language. Mentioned difference bears on the nature of human cognition and human aptitude of abstraction – to create patterns and denote (qualify) them by signs. It is also pertinent to distinction between (material) reality and human model of it that not only problem of commonly comprehended models (incl. mathematical models) but also information presented by language.

Many other concepts of knowledge - such as “explicit knowledge” and “organizational knowledge” are only metaphor and we should be conscious of this. In similar way we should mention the concept of *embedded knowledge* i.e. tacit knowledge of author (man, observer...) that initiates his activities. He embeds it into all artifacts mentioned as “physic systems” in next section of this conference. But also all information systems and all ICT application called as artificial systems are based on knowledge of their designers. We should awake to - and we adduced it a few raw above – that also each information (message) presented by language and or symbols (incl. numbers) is externalized knowledge and or comprehend the knowledge of its author.

3. Nature, complexity and oddity of society

Here we must remind the “Turing test” - not in order to support or to impeach it but to emphasize basic and unaccounted-for questions. Turing (1950) starts his deliberation by the question “Can machines think?” and points out difficulties to explain its meaning in an instant. Due this he transformed the problem (situation – not question itself) to famous “imitation game” referring to the ability/inability to differentiate answer of the computer (machine) and man.

The problem of embedded knowledge is expressively outlined by professor Weizenbaum who first suggests the program simulating the dialogue between man and computer. He refers to its principles including dealing with words (signs, data) pursuant to grammatical rules. The title of his book “From Judgment To Calculation“ (1984) proves to be very apposite. He was shocked that people - nota bene therapists - are not able to detect shallow nature of such interview: Simple usage of words without making sense (Flog a dead horse). By the way – Weizenbaum is a particularly cognizant corrector of prevailing naive however idea about benefits given through progressive computerization. Known is his notion (presented in Wall Street Journal as early as 1999) “The Internet is like one of those garbage dumps outside of Bombay .”

Both Turing’s problem to explain the meaning as well as Weizenbaum’s surprise agree with Searle and his boggle Turing test that refer to human intentionality (Searle, 2003). Just meaning of some message and or the meaningful information is a matter of intentional knowledge. Let us remember two major attributes of intentionality and/or intentional consciousness (Rosický 2012):

- Orientation of human consciousness (mind, cognition) towards determined entities (objects), and
- Intention as rational (purposefully oriented) contemplation derived from expectations coupled with such entities.

Intentionality as well as consciousness, entities and other used words represent concepts understood on attributes fasten on them. However we can explain their nature by focusing on physical processes of autonomous nervous system. Such approach we briefly presented it in the past (Rosický 2012, Rosický, Pavlicek 2011). In similar way also Pinker - next prominent exponent of cognitive revolution - alleges human cognition in spite of not using system theory and cybernetics consistently. Nevertheless he defines few principles of advanced cognitive science. Let us cite two of them: (i) Mind as a complex system composed of many interacting parts and (ii) Mental world that is grounded in the physical world. Their nature can be explained through (self-organizing) processes within complex nervous systems (Maturana (1978) using his original terminology speaks about Biology of Language). Such approach disputes dualism including conceptions of information and/or knowledge that separate them from their material (physical) substance. Most people incl. many professionals don’t appreciate functionality of information processing and/or cognitive processes on physical environment.

Let us remind the aspects of natural and processes within autonomous and very complex nervous systems:

- The signals acting as inputs come (i) from an external environment (empirical perception) as well as from the body (emotions & feelings);
- Last practices/progression affect actual learning process; in other words previous knowing / knowledge influences transformation of it and (re)creation of (new) knowledge;

- Self-organizing nature of mentioned process forms patterns of entities observed within an environment that have the intentional nature resulting from a coupling internal and external signals (information).

Such patterns constitute entities – “thing” that we reckon for really existing objects. Such approach is the typical demonstration of “naive realism” that obscures actual and natural distinction of reality and knowing (Rosický, Pavlíček, 2011). Nevertheless these objects represented – substituted – by nouns constitute the building blocks of our mental models. They are coupled (i) with set of attributes (presented adjectives) and also with “values” or rather attitudes. As such emerges known objects that form our expectations and consciousness as well as sub-consciousness decision and intentional doing. Let us remark that also that consciousness or rational reasoning embodies sub-consciousness aspects corresponding with tacit knowledge. Conformation of natural language enables to generate much more complex models of reality to us: Conjunctions and prepositions simulate relationships and verbs hold liable transformation and enable to model processes.

These facts resulting from the subjective experiences (see Havel, 2007) form an essential phenomenon of knowledge - it isn't objective images (mirror) of the world. It is intentionally constituted by observer. However - in spite of subjective experiences of (physical) observer - it is not subjective due to communication within social environment. Winograd and Flores (1997) accent its actual character appositely through adjective “individual”: Such actual/tacit knowledge isn't neither objective nor subjective.

The nature of human knowing is an oddity of the observer: It transcends habitual adaptation and moves man toward proactive, purposeful, doing. As such it incites and fortifies social progress whose concept has roots just in this knowledge and/or Weltanschauung (paradigm) shielding it. And finally human knowledge forms misty border between natural and artificial and changes evolution into co-evolution. This fact forms the basic aspect of our responsibility - scilicet self-reflection including individual and badly limited knowledge (what is entirely anything else than “bounded rationality”).

Intentional human knowing is also a distinctive aspect of social systems and their complexity that diversifies social autopoiesis (Luhman, 2006) from its original concept of Maturana and Varela (1998). But it produces other (often neglected) aspects e.g. dramatic growth of fluctuation playing important role in self-organization of society. This fact results from the nature of linguistically presented information and conventional deeply rooted mistake that doesn't discriminate data and meaningful information. Actually we communicate only data, while the problems of true knowledge emerge and grow to be crucial. Moreover many people who interpret the same data interpret - due to individual nature of their knowledge – different meaning that influences not just their behavior but also (and namely) their knowledge (and/or Weltanschauung).

Just interaction within society - including communication of information - plays an extraordinary role of social systems being connected with the emergence of culture. This results in new reformation of society and emergence of culturally (not nationally as in history) based societies.

4. Mediated information and understanding

Each information technology mediates information and changes process its communication. Let us mention three from notable aspects resulting from the progress of ICT:

- The shift from offline transmission (written/printed messages) to online communication (wire, telephone, broadcast). This advancement stands on an essential increasing of data signaling rate and possibility to mediate information in “real time”.

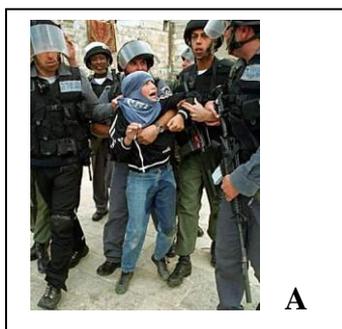
- Changes in a ways of authors and receiver of information including an emergence of mass media, originally as newspaper. Primitive online transmission had disposition characterized as “1:1” however broadcasting changes it to 1:N. Such advancement laid the foundations of “global village” (McLuhan, 2003) and is one of basic accelerators towards globalization.
- Form of presented information arises from presented signals and their empiric perception. ICT made possible dealing with signs for a long time, but just recently it enables to deal with (1) holistically presented reality such as pictures and/or movies and/or (2) with sound and music. McLuhan’s characteristic of media and his discernment of “hot” and “cold” media bear on the shift from simple (cold) message to its emotional effects.

Digital information and communication technology that is based in binary coding and knowledge embedded into the software covers all these aspects. It contemporary fashion undoubtedly culminates in the internet that adds some further and important facets namely:

- Multi-media coverage transcending until (computer based) virtual reality and
- Communication that can be characterized as M:N run in real time and supported by multi-media form (Pavlicek, 2008).

These facts are usually connected with the concept of information overload however the impacts are much wider. We can specify three other aspects of internet that justify its compare to garbage:

- Prevailing amount of information (information sources) is oriented to emotional activities often cut-off from reality. Computer games are the typical example but also social networks embody similar peculiarity: Stakeholder – gaining (only) jolly emotions - live through virtual reality. Such imaginary experiences (i) change value and/or expectation and (ii) participants are not able to solve real problems and/or deal with stress.
- Credibility of included information constitutes an essential problem relevant to credibility of information. Its traditional simplification on dichotomy “information – des-information” doesn’t represent complicated reality as well as process of verification confined to information source. The anonymity of sources gets on internet new dimension. Even well known and reputable author can not guarantee true information past all doubt (also experts are fallible...). Moreover necessary selection of (sources of) information as well as its accessibility incl. its location plays important role. As an example we use two pictures that describe “the same situation” – see Fig. 2.
- Many journals and newspapers printed the “A”. Due to great its emotional charge it encircled whole the world and provided information for millions people and affected their knowledge as well as public opinion. The second picture “B” taken just few seconds before was published rarely. Presentation of only one of them (A) provides garbled information...



Both picture were
acquired on Temple
Mountain Jerusalem

Reuters 6. 4. 2001



Figure 2: Two sources of information in context

- Also relevance of information plays a considerable role and bears on the problem and information necessary for its solution. However speaking about “necessary information” we could accept the concept of objectively given knowledge that is surely false. Actually we shall consider rather “requisite information”. It depends on two its major aspects: (i) the nature and/or complexity of real problem (improving system) but also (ii) real knowledge of observer and/or his understanding problem (system). Many (most?) often unacceptably simplify problems by virtue of insufficient knowledge (making reference to Occam razor).

5. Conclusions

Above briefly sketched problems point to increasing uncertainty and disturbance that mediated information ICT and internet bring to us. Many-techno boosters don't reflect or hardly confess that reality totally contradicts to the notion of increasing amount of information decreasing uncertainty... Perhaps basic idea itself isn't wrong but it is based on the notion (Weltanschauung) of finite reality that is evidently incorrect. On the contrary - problems of understanding complexity of real world and/or natural processes of their significant aspect lie in the very nature of human knowing. And it brings an adventure: systemic risk, that we are neither able nor disposed to accept. Problem of the contemporary “Global world” does not appertain only to engineers and/or technical systems but to all the people and their “rational” behavior proceeding from common knowledge. Such problem apply also to society and systems usually denoted as social-economic, or economic-technical.

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THE CONNECTION OF PSYCHOLOGICAL WELL-BEING AND SOCIAL RESPONSIBILITY

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Abstract

The main focus of our paper is the connection between psychological well-being (PWB) and social responsibility (SR); new, completed model of SR shall include also (psychological and emotional) Well-being (WB) of many. In the paper we will firstly present the PWB and then we will present the results of the empirical research of PWB of employees in organizations in Slovenia. Summarizing the essential hypotheses from the Smiths's basic economic theory and modernization in terms of SR and presenting new views on SR, aimed to match the basic goals of society, we completed up the model of SR including WB of many. We made a connection between PWB and SR.

1. Introduction

Economy, in both daily practice and in theory, is too often considered to be something of its own rather than as a tool serving human happiness and well-being. Humans are not only economic beings – producers, exchangers, and consumers – but multilayered. It therefore makes sense to deal with the topic of well-being (WB). This paper focuses on psychological well-being (PWB).

Social responsibility (SR) is becoming more and more a hot topic (for more information see Šarotar Žižek et al., 2011). 1.5 million hits on an official EU website about SR proves it to be an important topic (Mulej et al., 2009, p. 4), Google gives you 413 million hits on SR.

In the paper we will describe PWB and SR. We will present also the connection between PWB and SR. In the first part of this paper we will present the basics about PWB. We will particularly focus on Ryff and Keyes multidimensional model of WB (Ryff and Keyes, 1995), while our research is consisting of the mentioned model. Then we will present the results of our empirical research of PWB in companies in Slovenia. To analyze PWB in Slovenian organizations, we used mainly descriptive statistics of indicators for PWB of employees. In the second part of the paper we will describe SR. Based on the essential hypotheses from the Smiths's basic economic theory and modernization in terms of SR and presenting new views on SR, aimed to match the basic goals of society, we completed up the model of SR including WB of many. Namely, we detected very little attention to the single human beings as the background of implementation of SR in practice.

In our research we examined the following hypotheses: (1) Employees in Slovenia are satisfied with their lives and with themselves. (2) SR supports PWB and vice-versa.

2. Psychological Well-Being

Since the human is also a spiritual being, psychologists Jung, Goldstein, Maslow and Rogers that have emphasized the concept of self-actualization, and Frankl, who exposed the meaning of life, developed a new positive psychological form of eudaimonic direction, and linked it with the concept of psychological well-being (Musek, 2008, p. 143). This means that eudaimonic tradition was formed by authors that speak about self-actualization and meaning of life (existential, phenomenological and humanistic psychologists). Psychological well-being covers several categories such as subjective evaluation of emotional and cognitive satisfaction.

Jahoda (1958) directed her research on positive psychic health. She analyzed the existing scientific literature for previously known variables that are associated with normal psychic function on the one hand, and pathological psychic and emotional functioning on the other. It is worth pointing out that all researches before this primarily considered pathological and normal functioning as the absence of pathological. Therefore, Jahoda decided to explore the field of optimal or successful functioning in terms of content, and not merely as the absence of negative.

Ryff (1989) and Ryff & Keyes (1995) developed a questionnaire with six elements on the basis of the existing literature on psychic health: (i) acceptance of one-self, (ii) positive relations with others, (iii) autonomy, (iv) environmental management, (v) meaning of life, and (vi) personal growth. These six elements determine the emotional and psychic health (Ryff & Keyes, 1998). Authors provided evidences that eudaimonic life, as shown in psychological well-being, can affect some psychological characteristics, which are related to immunological functioning and health concerns.

2.1. Empirical Research of Psychological Well-being in Organizations in Slovenia

In the project mentioned in footnote 1 we surveyed organizations in Slovenia. During the period from the 1st of April 2011 until the 20th of June 2011, we collected data about employees in Slovenia. In the mentioned project we measured the requisitely holistic well-being (subjective emotional well-being, psychological well-being and self-determinations) and also observed the social responsibility and performance of organizations. The survey sampled 320 organizations. We received 470 completed questionnaires²³ from our respondents.

In Table 1 we present our results with indicators of psychological well-being by Ryff and Keyes (1995, p. 720). We measured psychological well-being via Ryff & Keyes (1995) who developed a questionnaire with the above six elements on the basis of the existing literature on psychic health; the result of our preliminary research was the questionnaire, adapted to the Slovenian circumstances. We used a five-step Likert scale, where we indicated statements and then our respondents had to indicate the level of agreeing with the statements.

	N	Average Scores		Skewness		Kurtosis	
		Mean Value	Standard Deviation	Statist.	Std. Error	Statist.	Std. Error
Work and other statements generally do not affect my decisions.	466	3.30	1.084	-.425	.113	-.581	.226

²³ The research instrument - the adapted questionnaire used in the empirical survey in Slovenia in 2011, was previously tested and validated: 150 students were enrolled in the trial phase performed in May and June 2010.

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I trust my opinions, regardless of what others think.	465	3.84	.972	-.795	.113	.242	.226
I am happy with myself regardless whether others accept me.	465	3.86	1.082	-.852	.113	.039	.226
I managed to create my life in accordance with the objectives I set by myself.	465	3.79	.977	-.770	.113	.370	.226
I usually take good care of my prosperity.	466	3.87	.911	-.829	.113	.800	.226
I control different life situations.	462	4.13	.818	-.913	.114	.971	.227
I am a personally developed person.	464	4.28	.753	-.918	.113	.761	.226
My own view of myself and the world changes with new experiences.	465	4.23	.809	-1.051	.113	1.128	.226
For me life is a continuous process of learning, changing and growing.	464	4.58	.716	-2.004	.113	4.783	.226
I offer others: food, time, neighborhood and friendly assistance....	464	4.27	.836	-1.235	.113	1.750	.226
I am ready to share my time with others.	465	4.44	.698	-1.335	.113	2.578	.226
I'm loving and friendly.	462	4.45	.725	-1.382	.114	2.235	.227
Others have more from life than I do.	462	2.64	1.321	.160	.114	-1.165	.227
I am confident and positive about myself.	463	4.13	.932	-1.222	.113	1.585	.226
About myself, compared with others, I often do not think positively enough.	464	2.68	1.395	.093	.113	-1.414	.226

Table 1: Descriptive statistics of indicators for psychological well-being of employees²⁴

²⁴ It is measured on a five-step Likert scale: 1- I do not agree; 2- I partially do not agree; 3 - neither agree nor disagree; 4- I partially agree; 5- I agree.

From the table of descriptive statistics (Table 1) one sees that the highest mean value is achieved by the indicator “For me life is a continuous process of learning, changing and growing”. The highest dispersion of responses measured by standard deviation is achieved by the indicator “About myself, compared with others, I often do not think positively enough”. That means that the answers of respondents were under this factor the most varying. The lowest values were reached by the next indicators: “Others have more from life than I do” and “About myself, compared with others, I often do not think positively enough”. If we analyze the data in terms of skewness and kurtosis, the data suggests that most of the coefficients of kurtosis and skewness are on an interval between -1 and 1. The negative and positive values of skewness show that the distributions of the empirical data are asymmetric to the left and to the right. We can also see that there are six indicators with a negative skew lower than one (“I am ready to share my time with others”, “I am loving and friendly”, “For me life is a continuous process of learning, changing and growing”, “My own view of myself and the world changes with new experiences”, “I offer others: food, time, neighborhood and friendly assistance”, “I am confident and positive about myself”). Data show strong concentration of the respondents agreement with the statements on PWB written in parentheses and thus showing high levels of PWB expressed with these arguments.

In summary, Table 1 shows that most respondents agree with the argument “For me life is a continuous process of learning, changing and growing”. So, for the respondents life is an on-going process of learning, change and growth. The lowest mean rate of agreement was measured for the following statements: “Others have more from life than I do” and “About myself, compared with others, I often do not think positively enough”. Notwithstanding the previous sentence, it can be concluded that employees in Slovenia are satisfied with their lives and with themselves. The first hypothesis can therefore be confirmed.

3. Social Responsibility

3.1. Definitions of Social Responsibility and its Stakeholders and benefits of SR

EU definition of SR (2001, 347 final, p. 5; sum. after: Mulej and Hrast, 2008, p. 43) is: »...SR of companies is a concept, with which companies voluntarily implement social and environmental care into their business activities and into their interactions with participants«. More definitions can be found in Šarotar Žižek et al. (2011).

Nickels and Wood (1997, pp. 92-93) say that the SR concept has expanded to all organizational areas; SR is based on the conviction that companies shouldn't only care for their profits, but should also contribute to prosperity in society. SR behavior reaches beyond acting according to law and avoiding unethical deeds; it includes an active involvement in society and a help in solving problems of society. By Johnson and Scholes (1997, pp. 211-212) SR of companies includes their actions on internal (care for employees, working conditions and working place and working order adequacy) and external basis (care for environment, safety of products and services, market and suppliers choice, employment, and local society activities). Frideric, Davis and Post (1988, p. 33) consider the following areas as central in SR: (i) quality and safety of products, (ii) consumers relations, (iii) employees relations, (iv) charity and care for people, (v) society relations, (vi) care for environment, and (vii) economic influences.

SR, combined with behavior matching requisite holism, and with creativity, oriented towards Fromm's passage of human from owner to creator, could save the current human civilization, so the latter wouldn't deteriorate like all the others have in their time of affluence. SR is a process of social innovation and humans' rightfully wanted goal (Mulej and Hrast, 2008: 41). This process is crucial

for crisis prevention and solving, because the essence of SR is prevention of abuse of legal, economic, and natural laws. SR is intended to replace short-term and narrow standards with broader and more long-term criteria of what is right and what is wrong, and later on to establish what is beneficial and what is not (Mulej and Hrast, 2008: 46). Thus, SR supports human well-being (WB) and vice-versa.

3.2. Essential Hypotheses from the Smith's Basic Economic Theory and Modernization in Terms of SR

Tóth (2008, pp. 100-102, 132, 147, sum. after: Mulej and Hrast, 2008, p. 42) exposes the following thoughts of A. Smith, the main author of economic theory:

- The ancient socio-economic systems were not fairer than capitalism – a free market economy; however, justness was very often considered more important than profit.
- A. Smith criticized the concept of limited liability.
- Capitalism, despite strengthening its aspirations for moral relativism, erases the idea of fairness from the economic thinking. (See: Quinn, 2006; etc.).

Mulej (2008, pp. 2-4) exemplifies the above summaries in terms of relationship between economics and SR:

1. Market, in which the highest value is achieved by anyone that attracts users the most, can function as an invisible hand (Mulej and Kajzer 1998a, b).
2. Free market is a relationship in which nobody has bargaining power/supremacy and therefore cannot abuse his/her influence. »Laissez-faire« teaching reflects this with its demand that there should be no monopolist. This isn't completely practiced these days.
3. Because entrepreneur's profit is a difference between expenses and selling price, decision is crucial on what is considered expense and what is rather laid-off or (at least temporarily) unpaid bills.
4. A. Smith and K. Marx tried hard to make models with which one could preserve the village solidarity from pre-industrial times in the industrial economy and society (Walker, 1978). Large and global companies, controlling the capital, often consider solidarity an expense, which is often wrong in long-term perspective, at least. In their fight against this short-sightedness and misuse/abuse, Dyck (2008) and Goerner et al. (2008) quote and argument, similarly as once did Smith, that companies should not be independent legal entities, but (legally also) tools of people, who accept their personal responsibility concerning their functioning.
5. It should be emphasized that A. Smith's »Wealth of Nations« has been published long after his »Moral Sentiments«. It should also be emphasized that his first book has served as a foundation for his book on wealth of nations.
6. A. Smith talked about the invisible hand as a tool of interdependence; interdependence is emphasized in Chinese Yin and Yang, Greek and Hegel's philosophy of dialectics (Engels, 1953; Petzinger, 2000; Delgado & Banathy, 1993; Mulej et al., 2000; etc.). Interdependence was also emphasized by (i) Bertalanffy (1950 and 1968, edition 1979, preface) and (ii) Lovelock under hypothesis of Gaia (Crowther and Ortiz Martinez 2004, p. 104), which claims that organisms are interdependent in nature and therefore influence each other, even though they are not visually and directly connected. Crowther and Ortiz Martinez (2004) conclude that the recent selfish desire for monopoly from 1990s has been replaced and

super-ceded by care for SR; thus, SR is on the daily agenda of companies, governments, and citizens all over the world.

7. The current so-called financial crisis of the world economy isn't simply a financial crisis; it is first of all a crisis of the basic socio-economic concept and results from abuse of A. Smith's findings, of the French and similar revolutions, modern constitutions of western democracies, and United Nations Organization's basic documents (See e.g.: Esposito, 2009). Goerner et al. (2008) find the current practice of USA economy violating the USA constitution.
8. Benefit has limits. That is why a perspective is recommended that will enable us to see long-term and indirect benefits, too, instead of the short-term and narrow perspective.
9. Is invisible hand only a matter of coincidence, or a consequence of circumstances, or is it sub-conscious, bringing humans into an unexpected state? Today we can, at least in an indirect way, see some strong and visible subjective hands of the influential ones. An example of a dangerous visible hand is the Bilderberg Group (Estulin, 2008).
10. Porter (1990; sum. after: Mulej, Hrast & Prosenak, 2008, p. 182) showed that the development of competitiveness had progressed through four phases: from competing with natural resources through competing with investing, after that competing with innovating, and at the end we come to the fourth phase, the phase of affluence, that necessarily follows, according to the past experience. Affluence is both wonderful and dead alley: it destroys motivation for hard work, thus causing crises. A fifth phase could provide for a way out from the current crisis, but it still must be created being founded on connecting (i) SR as a form of manifestation of behaving of people according to requisite holism, and (ii) creating the supremacy of the creative class for humans to get nearer to Fromm's passage from human owner to human creator (Mulej & Prosenak, 2007). In this contribution we add that humans as individuals as well as society have to aspire to the achievement of requisitely holistic human, who, in today's world, is unfulfilled and faces emptiness in his/her existence.

3.3. New Views on Social Responsibility

There are many new views concerning the SR development. We will summarize some propositions that will help us develop our own view concerning SR as a tool of solving the given financial crisis by reaching requisite holism of behavior. WB of many rather a few only should result.

SR is supposed to constructively contribute to solving of complex issues, such as: (i) climate change, (ii) limitation of natural resources, (iii) increasing differences and stress, and (iv) global competition (Prosenak and Mulej 2008, pp. 10-11). They write also about deficiency in the present concept of SR. Therefore, these authors find the present concept of SR no requisitely holistic solution; that is why we need the dialectical-systemic approach to the problem, which will include and connect all necessary aspects in a new synergy for achieving requisite holism. WB of many rather a few only should result.

Considering that all subjects are inter-connected and therefore interdependent, we should strive at as-holistic-as-possible quality of life (requisitely holistic objective and subjective WB) and at human solidarity as a part of equality and brotherhood along with freedom. WB has its roots in acknowledging the meaning and strengthening of ethics of interdependence, and respect for ecological sensibility and natural limitations; SR hence demands reconciliation of narrower, broader, short-term and long-term perspectives with ecological and other nature-respecting views as necessary elements of values of people, expressed as SR (Prosenak & Mulej, 2008, pp. 13). This

shows that SR could be an efficient concept also against the current so-called financial crisis, but it must be completed up with the law of requisite holism/wholeness, which helps humans to attain requisite holism of behavior, which is a foundation to socially responsible working. WB of many rather a few only should result.

Compiling the essential hypotheses from the Smiths's basic economic theory and modernization in terms of SR and new views on SR can let us conclude that SR supports PWB and vice-versa; the second hypothesis can thus be confirmed.

4. Conclusions

The results of the empirical research about PWB presented in this paper can let us confirm that employees in Slovenia are satisfied with their lives and with themselves. The qualitative research of the Smith's basic economic theory and modernization in terms of SR, as well as of new views on SR can let us confirm the hypothesis that SR supports PWB and vice-versa.

Whatever the views on SR are like in literature and political documents, we detected very little attention to the single human beings as the background of implementation of SR in practice.

As a basis for completing up the SR model, we took a connection between socially responsible action and WB exposed by Prosenak and Mulej (2008, p. 13) aimed to match the following basic goals of society:

- It is necessary to take care of holistic quality of life and (objective and subjective) WB.
- Human solidarity needs to be strengthened (it should result from awareness of the meaning and strengthening of ethics of interdependence), but include the needy ones only anyway.
- One also must take in account ecological sensitivity and natural limitations, demanding reconciliation of economic and ecological and also other perspectives that include respect towards nature as an essential part of values of people, which is expressed with SR.

The completed up model of SR guides the definition of the human action course aimed to create as-large-as-possible social and personal WB. In accordance with model in Figure 1, requisitely holistic and socially responsible behavior has a positive influence on three areas: (i) increasing of objective WB (influence A), (ii) preventing of negative and strengthening of positive influences on natural and social environment (influence B), (iii) positive influence on increase of holism of subjective starting points of people (influence C). SR also receives support from WB.

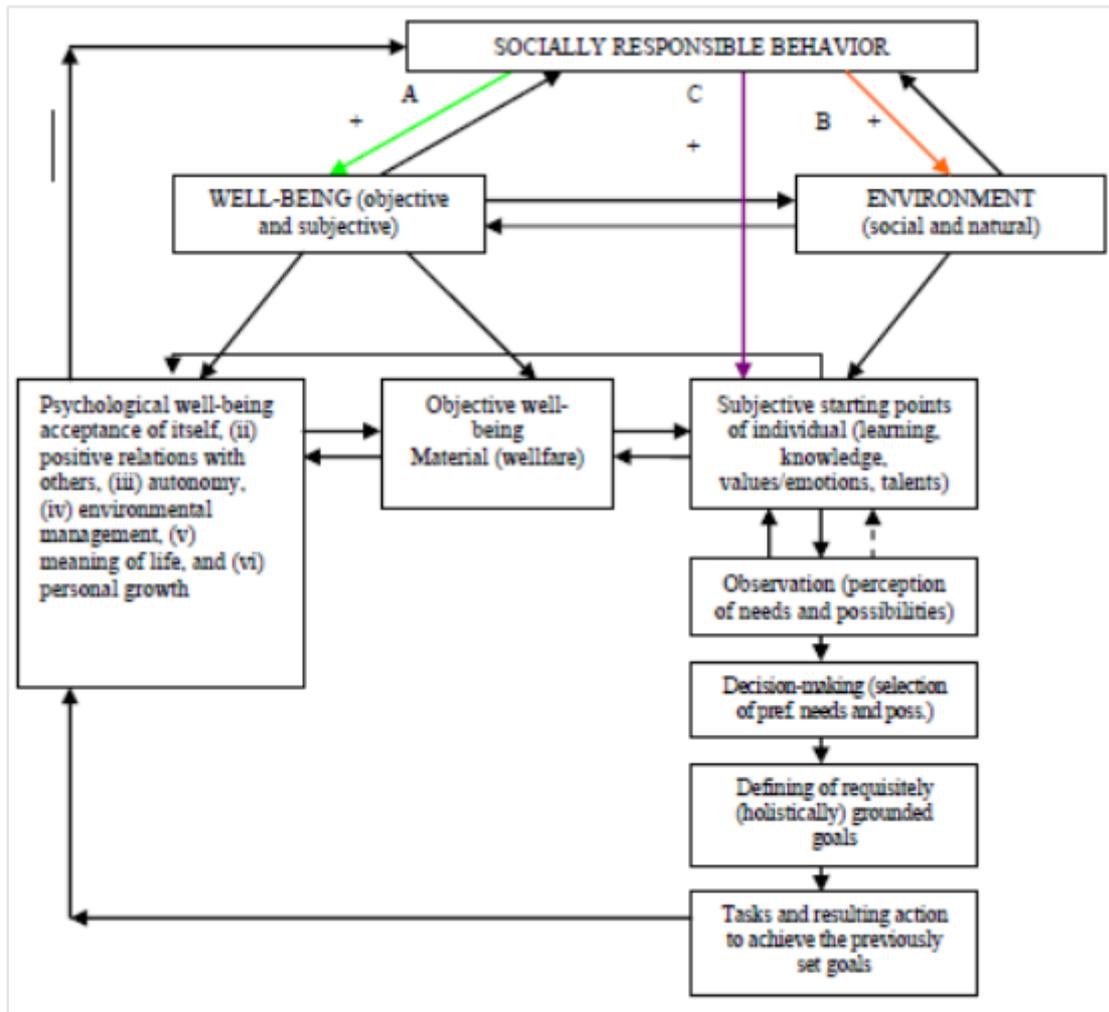


Figure 1: Model of SR – including WB of Many

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SOCIAL COMPUTING FOR COOPERATION

SOCIAL NETWORKS NEVER FORGET - THE END OF PRIVACY AND RELATED PROBLEMS

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Keywords

Behavior, Social Network Sites, Privacy, Web 2.0

Abstract

Young people share even the most intimate details of personal life on social-networking Web sites, such as MySpace, Facebook, Twitter, Youtube and Flickr, portending a realignment of the public and the private. Social-networking sites allow seemingly trivial gossip to be distributed to a worldwide audience, sometimes making share rumors by millions of users across the Internet. Public sharing of private lives has led to a rethinking of our current conceptions of privacy. Our society today faces the problem of non-volatility of internet information and has to find some feasible solution in order to deal with it.

1. Various Intentions for Social Networks

Social Network Sites are websites that allow users to upload information to a social network, create a list of online friends, and browse the profiles of other users of the network (Wikipedia, 2012). The websites have membership rules and community standards. Users disclose identity-relevant information via their profile to others. This information is either referential, directly referring to a person, or attributive, describing attributes to the data subject (Randerson, 2007). Although most laws and regulations restrict the access to referential information, attributive information is not protected as such. However, the aggregation of large amounts of attributive information of user profiles poses new privacy risks.

Information spreads faster through a Social Network Sites than through a real-life network. Information might be disclosed to a group of people unexpectedly, because the digital information is easy copyable, can be stored indefinitely and is searchable (Downes, 2005). It especially harms users when information travels through different spheres, and ends up with people whom it was not intended for.

Furthermore, Social Network Sites have financial incentives to generate revenues from the information users upload. The usage of most of these websites is free, and social network have to make up for the incurred costs by generating revenues from the identity-relevant information of their users. The most common way to achieve this is to create marketing profiles of users and serve them with targeted ads. As social network and their marketing partners obtain more information about their users, informational inequality arises (O'Reilly, 2005). Because the social network have more information about their users and users are not in a position to bargain about the terms at

which they disclose their information, an architecture of control surfaces, leaving the users vulnerable to harms.

A reason to restrict access to the information is the prevention of information-based harm (Hesse, 2007). Some activities that harm users need specific information on the data subject before they can be executed, such as a Social Security Number to obtain credit. Indeed, your address and current employer can be used to determine when you are not home and this increases the possibility of criminals breaking into your house.

2. What makes Social Networks so popular

Many people besides friends and acquaintances are interested in the information people post on social networks. Identity thieves, scam artists, debt collectors, stalkers, and corporations looking for a market advantage are using social networks to gather information about consumers. Companies that operate social networks are themselves collecting a variety of data about their users, both to personalize the services for the users and to sell to advertisers (Charnigo, 2007).

2.1. Types of Social Networks

There are many types of social networks available. This fact sheet examines the privacy and security implications of using a few of them. Most social networks combine elements of more than one of these types of networks, and the focus of a social network may change over time. While this fact sheet does not address every type of social network, many of the security and privacy recommendations are applicable to other types of networks.

Personal networks: allow users to create detailed online profiles and connect with other users, with an emphasis on social relationships such as friendship (Gilbertson, 2008).

Status update networks: designed to allow users to post short status updates in order to communicate with other users quickly.

Location networks: designed to broadcast one's real-time location, either as public information or as an update viewable to authorized contacts.

Content-sharing networks: designed as platforms for sharing content, such as music, photographs and videos.

Shared-interest networks: built around a common interest or geared to a specific group of people.

2.2. Social Networks and Contradicting Interests

There is a bunch of application fields for social networks where the interests inside their user group are clashing. Imagine the cooperation between teacher and students where questions regarding evaluation issues can be seen as a threat for the teacher. Or if you have a closer look into an enterprise environment where the selection of potential future staff is based on good or bad information extracted from the network.

2.3. Potential Threats

Identity Theft: Identity thieves use an individual's personal information to pretend to be them – often for financial gain. The information users post about themselves on social networks may make it possible for an identity thief to gather enough information to steal an identity (Garfinkel, 2000).

Malware: Malware (malicious software) is a term that describes a wide range of programs that install on a user's computer often through the use of trickery (Boyd, 2008). Malware can spread quickly on a social network, infecting the computer of a user and then spreading to his or her contacts. This is because the malware may appear to come from a trusted contact, and thus users are more likely to click on links and/or download malicious programs (Barnes, 2006).

2.4. How to stay safe, private and secure using Social Networks

- Become familiar with the privacy settings available on any social network you use.
- Don't share your birthday, age, or place of birth. This information could be useful to identity thieves and to data mining companies.
- Remember that whatever goes on a network might eventually be seen by people not in the intended audience.
- Don't post your address, phone number or email address on a social network. Remember scam artists as well as marketing companies may be looking for this kind of information. If you do choose to post any portion of this, use privacy settings to restrict it to approved contacts.
- Be cautious about revealing personal information.
- Be choosy about contact requests - criminals "collect" friends to hurt people.
- Be aware that your data is stored on other computers.
- Do not enter confidential information about your employer and your work in the network.
- Check critically, what rights you give to the operators of social networks on the set of your images, text and information.
- Do not click on random links - social networks are increasingly used in order to conduct phishing.
- Talk to your children about their activities in social networks and explain them about the dangers.
- Be aware: The network never forgets.

3. Conclusions

Social Network Sites track the activity of their users on their own websites and those of their marketing partners. They are able to gather unprecedented amounts of secondary personal information on their users, sometimes even without the informed consent of the users. The information on the websites can also easily be used to damage someone's reputation, and with the large amount of attributive data on social networks, it is not difficult to reverse engineer information needed to steal someone's identity. Although there is no proof that these things are affecting all users of social networks, experts agree that they affect a significant amount of users and can cause great damage to the users.

Information you disseminate through social networking sites remain forever in the network. Even if you delete your account, so it's almost impossible to remove links and comments in other sections.

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THE COOPERATION OF TEACHERS AND STUDENTS ON FACEBOOK

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Abstract

The importance of social media is increasing with time. Besides the users themselves the strengths of social media (in particular the marketing ones) are also used by other important parties such as companies promoting their products, or non-profit organizations. That is why social media and above all its main leader Facebook are increasingly used at schools and universities. This paper points out the practical use of Facebook for universities, where the multiplication effects of this social network were activated by cooperation between teachers and students, when solving scientific and innovative projects or in the actual learning process. At the same time, the possibilities of effective use of quantitative (statistical) methods within the economy were documented, particularly in the marketing research. Such efficient cooperation brings new opportunities and enriches both disciplines.

1. Introduction

Sudden changes in the market such as the global financial and economic crisis and especially the emergence of social media, has created a need of prompt reactions and precise decision making not only for company's managers, but also for leaders of other organizations and institutions including schools. The negative consequences of global crisis have an important impact on changes in customer demand. When determining the changes in demand, it is important to know the wishes and needs of the customers. The main change in marketing at all levels is thus the omnipresent dialogue. There is a dialogue between the companies and their customers, and also between the customers themselves.

1.1. Social media a marketing

Customers nowadays do not trust the traditional ways of advertising messages and therefore the significance of other media types, such as social media, increases. If the ATL (simply said mass media advertising) and the BTL (all other forms of advertising aiming at direct addressing of potential or current customers) communication advertising messages are consistent with shared opinions, the company is not endangered. Once the "official" advertising comes into conflict with the shared information, this situation can result in serious damage to the brand that could be built for decades. (Kozel, 2011).

At present, customers are interested in "real information". With social media, people can share information and strengthen the effect of the rumours (*WOM - Word of Mouth*). This actually means a transfer of information from one person to another in the informal way. The existence of websites where customers write their views and opinions, or the thematic groups on social networks has fundamentally changed the way of shopping. While several years ago the most significant criterion was the price, nowadays the most valuable seem to be this shared information. And the value of this information especially within the communities is remarkably higher than the information spread traditionally by the producers of products and services.

There are a number of discussions that address this matter, so the determination of the type of sentiment within individual discussions is not an easy task. This information, however, is important for majority of people offering their products as well as for potential buyers. Therefore software tools that enable sentiment evaluation in texts automatically according to statistical methods (see Ministr, 2011) are developed. To persuade the external communities with its messages, the company goals, culture and also the content of these messages must also be shared by its internal community (employees). Otherwise the ATL and BTL communication is untrustworthy. Positive or negative personal experience is complemented by the experience of other people in the community and that is the essential part of WOM.

1.2. Social media and schools

During its development the social media has changed from the tools serving explicitly communication of selected users and community members to sophisticated applications enabling to enjoy a great amount of attractive and complex ways of communication, fun, news or education. Besides social networks the group of social media also include blogs, forums, wiki, social backup systems, and shared multimedia or virtual words. On a global scale as well as in the CR are the social networks used the most; its main representative is again Facebook – not just among regular users, but also among companies and other relevant subjects.

The number of Facebook users has already outreached 750 million. In addition to that the statistics also say that people divide their time spend on the Internet accordingly: 22,5% social networks (out of which 62% Facebook) and blogs, 9,8% playing games, 7,6% e-mail, 4,4% watching videos, 4,3% sending messages, 4% browsing information, etc. (Nielsen, 2011). In the last five years the share of Facebook on the internet visit rate has grown continuously in all regions of the world. Five years ago the global penetration of Facebook was represented only by 12%, nowadays it can be stated at 55% of the Internet population. (comScore Data Mine, 2012).

The companies soon acknowledged the fact that the way to win the customers consists in unconventional approach such as making the advertising fun for its recipients. To make this even more effective it is essential to support it with communication campaign that is consistent with the information provided on Facebook. The above mentioned facts also apply for schools. Universities slowly start to use the privileges that social media offer for communication with potential

applicants. Due to the aiming of this message the communication becomes more effective and cheaper compared to other communication tools.

Moreover the potential students do not look up the relevant information about the university primarily in the newspaper or magazine advertisings, not even in the printed catalogues, nor at the university website, but the most important factors these days are the shared experiences and expressed satisfaction or disappointment of current and past students. For that very reason the marketing-oriented educational institutions try to actively communicate with their internal customers – employees, who pass their attitude towards the school onto their students by showing either active or passive approach in the classes. Apart from the classes where students can directly interact with their teachers, they are also able to communicate with the management of the school via chat or social networks, etc. and express their positive or negative experiences to other members of the community.

At a time when government budgets lack the money dedicated to further education of teachers, the speculations about the gradual reduction of full-time education in favour of distance studies at all levels of the educational system. In these cases the social media may play a great role on the ground of its addressing nature as well as discrete close communication. The users of social media provide by only mere use of it an unlimited amount of data, which may serve as a review of their education as well as the criterion of its quality.

2. The aims of the projects

The Faculty of Economics, VSB-TU Ostrava (FE) uses for the marketing communication among other its Facebook page where the offer of education services is presented. In a long term view the technologies enabling other forms of education are available (particularly distant studies and e-learning). At the same time the added value of full-study program increases as a result of these technologies and mainly thanks to the CMS Moodle - virtual learning environment, lecture notes are presented online and students are able to discuss the lecture contents or subject organization. They can also download their thesis and projects here or practice their skills and knowledge by the means of various control mechanisms, particularly trial tests.

In recent years the initiatives, which actively use the social media, have arisen within the FE. These are usually students of the faculty who create working groups on Facebook that are used for an informal discussion about specific subject or field of study and also to share the information from the seminars as well as the information about tests and examinations. More and more frequently many educators and researchers at the faculty engaged in active use of the benefits of social media in education and also in scientific research. The following pages will present examples of projects where Facebook was, is or will be used. These were a joint project of teachers and students of the Faculty of Economics, VSB-TU Ostrava. The projects were chosen advisedly to demonstrate three different efforts those projects aimed at. That will allow to present added value and variability of social media contribution.

2.1. Research project by SGS

One of the aims of the research project "Possibilities and limits using traditional methods of segmenting the users of social networks" was to determine whether there is a willingness of students to work together with teachers in a research project through social network Facebook, how much time they spend on social networks and what they do there and last but not least to define their relationships to risks of social media use. As the main methods of data collection were chosen

those that took place on Facebook: focus groups, controlled experiment, observation and questioning. For the analysis of collected data the class characteristics (gender, class and level of study) were used. The main methods of data analysis included the analysis of contingency tables, chi-square test and analysis of variance; in case of fulfilling different aims of the project the factor or cluster analysis was also used.

2.2. Project aimed at development of the Moravian-Silesian Region

In a current project entitled “The region to itself” the students together with their teachers try to resolve the demand of a company based in Moravian-Silesian region and work on the preparation and process of “First regional homepage”. Facebook serves as a communication channel between submitter of the project, teachers, and students and also as a future communication tool between the submitter and the target groups of the project. Project’s goals are to support the regional economic situation, connect small and medium local enterprises, public, educational, government and other institutions and increase the regional awareness.

2.3. Educational project PHOENIX 2.0

The aim of the project "Quantitative and Economic Literacy as a Path to Competitiveness in a Knowledge Society" (PHOENIX 2.0) is above all the innovation of present education on economic faculties corresponding with the current requirements of competitive advantage within the knowledge society. The main steps of this innovation are strengthening of economic and quantitative literacy and convergence of both of these now largely isolated spheres. Social media should replace some out-of-date visual elements of the education and social networks should work as a testing basement of the teacher-student communication. This may serve as alternative to already existing formal information channels which are not accepted by students as much as Facebook.

3. Methodology and Selected Results of Projects

3.1. Research project by SGS

Methodology and outcomes carried out by the means of focus group and controlled experiment on the Facebook social network are detailed in the textbook IDIMT 2011 (Kašpar, 2011). The main attention is therefore focused on the methodology description and main outcomes of other part of the research project SGS - a quantitative questionnaire survey identifying the behaviour of university students on social networks. The questionnaire, which had also other thematic tasks, was formed by four groups of questions:

1. Set of 30 questions, which aimed to express the approach and opinions of the respondents to various issues of today’s world,
2. Set of 13 questions, which represented the intensity of different forms of respondents’ behaviour on the social networks,
3. Set of 10 questions, which expressed the time spent and frequency of various behaviour of the respondents on social networks,
4. Three identification questions, which represented the characteristics of the respondent – sex, year (1.-5.) and degree (bachelor x masters) of the study and also the place of residence (home x out of home).

As the entries for the question sets the qualitative research techniques (focus group and brainstorming) were chosen and then performed on the group of respondents. Final form of the sets was consequently modified by professional consultants from among university tutors – sociologist and specialists in the field of ICT. Data collection was done by online questionnaire survey (CAWI) with the use of FREE VYPLNTO.CZ services. To ensure maximum unpredictability of selection all students of FE were addressed via email and directly at classes. 627 respondents filled in the questionnaire (11% of all addressed students). 13 questionnaires had to be removed.

To keep the proportional share corresponding with the division of basic file the re-evaluation of each group of respondents was carried out according to the actual distribution of EF students in the environment of the IBM SPSS Statistical Programme. The destination file can be therefore overviewed as the representative sample of the entire student population and the obtained statistical description of data (especially the relative frequency of each response) may due to the large sample size be considered statistically significant estimates of the basic file. (Disman, 2002).

Student's behaviour on social networks was initially studied on the set of 13 questions (items) asking questions such as: "When using Internet I am looking for .." etc. Students evaluated their behaviour online with each item on ordinal scale from 1 (always), 2 (often), 3 (average), 4 (exceptionally), 5 (never). When analyzing the distribution of responses to individual items three types of division may be recognised according to placement of mode (top, the most frequent values) - (mode is located in the second or fourth variation – 8 items), extreme nonconformist attitude (mode is located in the utmost, i.e. first or fifth variation – 4 items) and neutral attitude (mode is located in the middle, the third variation -1 item).

It turned out, that in this set the division with one top, which represents a moderate version of the move to a position of the view (often vs. rarely) predominated. When searching for the most outstanding opinions the average score was calculated initially for each of the item, which is the indicator being very often used with "Likert scales" for the purpose of evaluation and mutual comparison of the items in the set. (Gavora, 2010). If we consider the items with averages core lower than 2, 5 or higher than 3, 5 as an outstanding nonconformist opinions we obtain the following results:

Services (+)	Score	Services (-)	Score
Chat with friends	2,15	Prize competition	4,53
Information about school	2,23	Voting	4,46
Information about acquaintances	2,45	Online games	4,35
Photographs	2,47	Invitations	3,70
		Jokes	3,69
		Thematic discussions	3,58

Table 1 & 2: The most and least used services

It can be stated that students prefer the „common” web services such as communication and information search especially in relation to study even on social networks. At the other end of the scale are on the contrary various forms of online entertainment. The approach of the students towards social media is rather conservative, which is certainly very interesting finding.

When sorting the answers to the identification questions it proved that those factors (sex, grade, place of residence) did not have any significant influence to the answers as a whole. To test the impact of factors the analysis of variance (ANOVA) was used. Out of this perspective the student community seems homogeneous, internally undifferentiated.

3.2. Project aimed at development of the Moravian-Silesian Region

All students of Marketing and Trade were encouraged to cooperate on the project via direct mail and directly at classes. Out of them 40 filled in the online questionnaire on VYPLŇTO.CZ FREE. These students subsequently attended four focus groups; each session was attended by 8-12 students. Under the supervision of the Department of Marketing and Trade teachers (marketing research specialists) who were presenters of the focus groups, the students tried to find the answers to the questions oriented in particular at defining:

- the target groups of the project – product suppliers, information suppliers, customers, users of other services, partners,
- main problem areas and areas of research - the target groups, motivation, communication, competition, product.

The problem areas were further decomposed by the use of brainstorming to e.g. tools, content, characteristics, needs, motivators, etc. For each problem area special team consisting of 2-4 members were created led by a teacher. Furthermore, the partial tasks are also continuously announced and after their completion students are rewarded. As the main communication tool for all interested parties the Facebook is used. At first a closed working group was created. At present the Facebook is used to increase the awareness about the project by the means of viral marketing (Přikrylová, 2010). Facebook and other social media will play the key role when addressing and motivating the selected target groups of the project.

The final outcomes of the joint work of students and tutors should in the final form be the market analysis of Moravian-Silesian region, SWOT analysis, proposal of motivation model, product development, product design testing, proposal of marketing communication, proposal of marketing strategy and creation of business plan for an innovative product. To fulfill the project's goals the cooperation of teachers and students is important and may be beneficial for the project in the following analyses, methods and processes: analysis of secondary and tertiary sources, brainstorming, focus groups, projective techniques, interviews, pretests, posttests or goals such as prioritization, planning programs and project management in the preparation stage of business plan.

3.3. Educational project PHOENIX 2.0

At present, there are several CMS Moodle installations on FE, one of which includes 225 courses, another one represents an archive of courses from the past years and others are mostly local Moodle installation of some departments or projects. Although Moodle is not a typical social network, this platform brings together students with their teachers outside the classroom and also provides a great environment for communication. The symbolic designation of the project PHOENIX 2.0 shows the proximity of the project with the concept of Web 2.0, in which social networking tools, especially communication and collaboration have a very important functionality.

Continuous quantitative online analysis of secondary data resulting from the use of Moodle by students, educators, and subsequently the solver of the PHOENIX 2.0 project to realise that students use some of the communication tools of the project very rarely. Whereas sending messages is quite heavily used, especially in the direction student -> teacher (there is minimal risk of spam

compared to regular email), forums are used predominantly by tutors to announce news to students. Open discussion between students or even chat is not being used on Moodle platform at all. The findings show that students do communicate between each other, but on different platforms (Facebook). The new version of CMS Moodle 2.1 therefore enables the integration of Facebook into the Moodle courses, which is a solution that should suit both sides –tutors as well as students.

The outcomes of the analysis of primary data will serve as groundwork for further activities of the PHOENIX 2.0 project solvers. The outcomes were obtained via quantitative questionnaire survey, the methodology and other outputs were presented in section 3.1 of this paper. The research team took into consideration among other also the risks connected to the use of social networks. A part of the first set of 30 questions, which aimed to express the approach and opinions of the respondents to various issues of today's world ("what is your approach to these statements"), were also four questions which state the opinions of students on the matter of security on the Web and social networks. Respondents answered on five-point ordinal scale starting with "I agree strongly" to "I very strongly disagree." Out of the description resulting from the frequency of answers the following findings have been found:

- students mostly believe that they can secure their own data and consider privacy when using social networks very important, the need of security is even stronger than the need to protect themselves against spam and advertising,
- the threat to those who provide their personal data on social networks is being perceived ambivalently – half of the respondents think that it is only this "incautious" users who are threatened, the other half do not agree with this statement.

The analysis of contingency tables containing categories of these matters and issues of identification, which was supported by Pearson test of independence (based on chi-square distribution), showed, that the main differences in opinions are between men and women. While the female students consider the privacy on social networks crucial, men students are much more troubled by spam and advertising.

For quantitative (metric) variables in the questionnaire (10 questions with optional integer (cardinal) responses), which represent the level, respectively frequency of use of social networks and their functionalities, the basic statistics were identified - mean value and sample standard deviation. High predicative value of the obtained data can be indicated by the average rate of participated students (94, 8%).

The obtained data can be summarized as follows:

- students spend almost 4 hours a day on the Internet, out of which 1,5 – 2 hours on social networks (5-6 days a week),
- they visit one social network (Facebook), four groups of interest (profiles) and have 200 friends on average,
- they click the „like“ button once a day and create less than one contribution,
- they are active on social networks 1/3 of the time, they spend on average 15-20% browsing the social networks while at school.

Behaviour of students on the networks is again relatively homogeneous (similar), variability of quantitative indicators (apart from few exceptions) differs only by several percent (measured by coefficient of variation).

When examining the mutual influence of the distribution of attitudes to security on social networks (ordinal categorical character) and the frequency and intensity of visits and service use whilst there

(quantitative metric character) the analysis of variance (ANOVA) was used (Hendl, 2009). Different factors have a different impact on various quantitative indicators of respondent's actions on social networks. The only indicator that shows the dependence of all four factors (opinions on security on social networks), is "the number of days a week spent on social networks". On the contrary two of the variables did not prove any significant association with the stated factors – "Average number of hours spent on the Internet during the day" and "Average number of clicks on the "Like" button a day".

4. Conclusion

Social media and networks have significant potential for effective cooperation between students and teachers. The aim of this paper was to present three different projects following different objectives, which in practice proved right. Facebook played a significant role in all of these projects as a mutually working communication tool between students and tutors.

Facebook also proved to be very useful within the field of science, especially when testing the research hypotheses and obtaining primary data from the target group of university students. The knowledge of social network environment and student's behaviour brings added value to the cooperation on e.g. an innovative project for the external submitter, because the proposed solutions are unconventional and help meeting the project objectives for selected target groups. The educational project thanks to integration of Facebook into its existing technological equipment of the faculty enables the creation of new educational and communication technologies adapted to the needs of students. On the other hand, data obtained by active usage of online applications may be used for further research activities, respectively new research field called Learning Analytics.

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IMPACTS OF ICT ON SOCIETY

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ICT, Evolution, Complexity dynamics, Meaning dynamics, Society.

Abstract

Connection and co-action guided by communication signify the beginning of Life. Biosemiotics disclosed the simultaneous emergence of meaning (Hoffmeyer 2008); research on consciousness and higher consciousness (e.g. G. Edelman 1992) revealed the base of grouping and social communication (TNGS). In accord Luhmann (1984, 1998) identified social communication as the kernel of any social unit. The impact of Information and Communication Technology (ICT) is analysed before this basic scaffold. Exhaustive listings of the impacts of ICT on virtually all levels of societal life and development seem abundant. The paper tries to anchor ICT and its social consequences in social evolution and networking.

In evolution and history, means of communication acted as driver, symptom and result of historical social/societal status, of rise or fall. Coding and sign structures culminating in languages shaped and shape social connections of any kind. They determine internally the relations within the system as the base of identity, externally they specify the relations to the relevant environments. From the individual to world society, social units are manifested by the communication systems constituting them. Beginning with first oral articulations communication acted the pivot of civilisation, of culture; rooting in sound language developing into scripture and techniques of information transfer and processing,. ICT not least affects the mental sphere: the understanding of human in her/his world: identity, destiny and programmes to co-act.

1. Prologue: Life, Information, Communication and ICT

At the base of cultural and societal change, advances in communication technology stimulate the development in togetherness and societal constitutions. ICT is, if not solely yet essentially, about social and societal communication. To understand ICT, the basic functions of communication may be recalled, relating to the evolvement of human societies and their survival and development. At the origin of life lies connection, mutual interference exchanging information, and subsequent action. Environment appears, first scarcely distinguished as a space, a resource; soon differentiating into the risks and chances of co-operation and into the battlefield of competition. Inner environmental communication is distinguished from communication with the outside environment. Around specific communication networks life units grow. Ever more intricately structured social units arise; habitats appear. Communication based control ultimately gives rise to consciousness and higher consciousness. Communication rests on the models of the environments which it constructs and adapts to in the communicative act. Communication leads co-action and co-

evolution. Complexity and meaning dynamics culminate in the emergence of homo sapiens sapiens. Human societies arise, prompting social networks and mental constructs.

With language communication develops into a phenomenon separately to be observed and acting as an active network of its own. It evolves into modes of representation, of information to be communicated as to affect and effect. It acts as a symptom, as a driver and a result of human and societal development. Information and in-formation develop their own dynamics, as do their social functions. Notably, following the principles of evolution, dynamics appear as complexity dynamics and meaning dynamics. ICT – Information and Communication Technology - develops its own dynamic potentials in technology, in social function and in organisation. Combined they drive complexity as well as they are instrumental to cope with complexity by ascribing meaning, reducing thus complexity to levels that can be handled. They stimulate the development of meaning, meaning in turn carrying novel communicative structures. Thus ICT conveys the mutual inter-action, the co-development of complexity and meaning dynamics. Their mutual interference can be acknowledged as cultural development. Communication manifests the means, modes and the ways humankind writes in its own language its indigenous evolution, its history and, to be stressed here, that of its habitats.

Seen within the evolutionary scaffold, selected phenomena may be pointed out. They will signify the present state of the ongoing revolution of information and communication. They will look for trends probably forming the nearby future. The web of driving interconnections comes rather complex. During development a multitude of strands constituted, often run at different velocities and into different directions. Any overall picture will be mosaic and to the actual situation only. Reference to nodal points keeping society together or, in reverse, endangering togetherness will reveal developmental nodes and possible future trends.

The late expansion of ICT ‘beyond PC’ has gained a high complexity in itself. It alludes to the increasing liberation of computing from captivities of space and time, of position and location. Not that the PC will lose its functions as a working tool. But digital mobile gadgets as smart phones and tablets allow computing in effect anytime and anywhere, ‘UbiComp’ stands for ubiquitous access to almost any topic. ‘Cloud computing’ offers among others a comprehensive access to any net, employed by specialized bite sized apps. Tele-services of all kind are attached: from tele-medicine to digital payment. Body computing will change not only medicine but also human behaviour related to body performance and body monitoring. Personal computing devices adapt to behavioural habits, customizing services rendered. There are but very wide limits to content processing, to memory access e.g. via internet tracing and to transfer, to whatever use. Religions claimed that every human being is naked before God. Is society and are its individuals and institutions, also nearing total translucency to whomever may want to investigate?

2. Information Society: On Life Control and Learning

A global society needs be a society with highly sophisticated information and communication networks. A main reason appears, that margins for decision in ever more areas of resources narrow down. Stocks accessible in any assets grow more scarce and more costly to be made available. A threshold is encountered enforcing sensible decision making concerning life substrates. A sufficiently detailed transparency must be attempted. Information must be ready; if possible instantly, at real time, as to prevent, to balance and to optimise.

Information and communication are parameters of control. The more complex a system grows, the more sophisticated control becomes paramount. Observant control is requested, the more various when the meaning structures extend, and the smaller the margins turn out for option and actions

choice. By ICT human society tries to cope with complexity dynamics and meaning dynamics. To be successful, ICT needs in particular the informational and control means towards to detect, assess, and control imbalances arising. ICT is but the necessary pendant to an ever more complex actual world and its rapid change. It may be argued, that even more tight control is necessary, as too many resources still are wasted, their distribution remaining too imbalanced, the deterioration of social systems progressing and power being misused.

In evolution and in life systems it is the mode of control that makes the difference. Analytically and very roughly, two modes of control may be distinguished. The *first* is defined by action and response: adaptation, passive and active; exploiting the chances given. It rests on memorized experiences and models of re-action encountered retained in memory. Following biosemiotics, life systems carry imbedded models of themselves and of their own past and future. These internal models learn from the results of past decisions made. Whether a system will survive and evolve or end in an evolutionary cul-de-sac is decided by natural selection. Either the evolutionary course sensibly exploits life potentials and opens new options, or the systems will decline. Control systems embedded in life systems will employ the chances by environment in a mode of self-adaptation and self-organisation. Too rigidly specialized life system eventually will face extinction. The role of ICT in detecting, in early warning and in balancing increases.

With arising consciousness and higher forms of consciousness, *second*, trial probed and response evaluated gained an complementing voluntary character of control. Decisions now will but partly follow patterns prescribed by memory. They may be influenced in degree and eventually even may stick to non-compulsory optional strategies. Control achieves a purposive character. ICT becomes the essential implement of anticipation and anticipatory control.

In well exploited and specialized environments the option and action spaces of self-organizing control and voluntary control are confined. Relating to the inner environments as e.g. the internal organisation including consciousness, restrictions turn up as specialisation and resulting inflexibility. In outer environments, restraints evidence the limits of resources for future development. Control in 2012 has to align to all environmental control parameters of planning in its operation, investment and strategy. Self-organised control, in addition, has needs account for confinements given by the existing organisation of the actual system. Naturally dependencies overlap and must be seen as a network rather than a set of preconditions. The situation applies to any social/societal system. Only by advanced ICT, technology, software, and methods sufficient control may be achieved. E.g. modelling and simulation of complex societal systems build the core; covering local and aspectual as well as global and overall sectors of development. For example the project of the 'Sentient world', runs war games on the grandest scale. Global reports (e.g. the Club of Rome) show the complexity of the issue and its inherent vagueness. Critics contemplate whether reliance on too complex simulation might turn out an illusion trap. The fate of the sorcerers apprentice looms in any application of advanced ICT.

Control in life systems amounts to most comprehensive learning. Inquiry needs investigate which way ICT interferes with learning habits. It needs analyse for example how ICT may enhance, restrain or change modes of learning. Learning provides but central example for the impact of ICT, open or hidden, on societal systems. ICT assisted learning affects the individual as well as the societal level. It covers the local as the worldwide scope under technical, civilisational and cultural aspects. To be emphasised is the urgency to explore the capacities of ICT to encourage life long learning. It provides an example for the development of the capacities to sustain, to improve qualities inherent in ICT societal learning programs. Such will focus e.g. on the properties of programming algorithms and of software used to support systems control. It will centre on interfaces to, on integration of natural learning capacities as inborn on the one hand, and ICT

computer assisted learning systems on the other hand. Institutions of any kind need be by virtue of ICT more effective learning systems. Steps ought be well considered and be incremental. Programming and ICT systems design ought emphasize learning faculties of any controlling software as used in any societal sector. Business ICT for long understands controlling as a learning process. Related to the educational systems: Inborn learning capacities need be integrated; implying cultural learning habits and institutions. How can ICT improve?

3. ICT Changing Society: Whereto?

Communication constitutes life systems and guides their development. Communication means connection, networking, tuning, adaptation, co-ordination, co-operation. It manifests the core of logistics, as it does of control of any kind. Higher consciousness developed with communication. On this base social societal units rose, from groups up to imperia and modern states.

The logistics of information concerning resources provide the skeleton for any purposive interaction. To grasp the impacts of ICT on societal structures a logistic approach needs be engaged. It comprises the analysis of the role ICT usurps in worldwide environments, as e.g. the rise of a global society. Communications logistics react to the imminent limits in an ever more refined technological civilisation. The argumentation following will confine on societies inner environments and the internal societal networking at critical points.

What constitutes society, keeps society stable, what drives a society apart? Which role is ICT assigned to? In an ambiguous course answers extending evolutional/functional contemplation scarcely can be given. A critical perspective expounds but positive or negative consequences for narrow sectors. As complex as the network of society itself, the process of its change will be. It may suffice here to identify essential challenges to be met, the risk and chances given and the obstacles arising to meet them. Lat not least: What to do, which policy to adopt? Political issues need be accounted for. Political analysis by other authors will be pointed to in the references.

In the highly complex social/societal network encountering dynamic change, four sectors of societal consequence are singled out. Symptomatic, *first*, for developmental proves the relationship between the individual and the public. It determines the flexibility to adapt and the space open for creativity, novelty, innovation. Stability, balance and control, *second*, can be but a floating equilibrium searching for new potentials. Underestimated since incremental is the alteration of *third*, habitats. They shape the perception, the evaluation of the social environment. Habitats affect the readiness to actively guide change by diligent learning They mould the way life is experienced and reaction/adaptation. Co-determining the atmosphere, the 'Zeitgeist', *fourth*, habitats purveys the awareness that a thorough rejuvenation of society is due.

1. Culture is based on a fluctuating equilibrium between the individual and the public. Western culture, susceptible of individualism, differs e.g. from Chinese Confucianism valuing the collective before the individual. ICT both diminishes the individual space (privacy) multiplies (social networks) social connections. Moves can be traced by data sampling internet sellers as and by criminal data guzzlers. Data can be misused, retraced back and used e.g. for blackmail. Every act is recollected: no false step is forgotten; no limitation is left for sinners. Google announced an institute investigating the interdependence between Internet and society. sampling will cover the entire range of interest to Google. A main target will be to understand how data can be achieved, be assessed and be evaluated for commercial utilisation. Likely data assembled can be captured e.g. by governmental agencies. The access for data criminals depends on their skill to play hide and seek with security measures. Privacy lost and not to be regained? Will a new asceticism try to save last intimate spaces? There is little chance. Brain pictures will bet scanned, brains will be picked – and

eventually controlled remotely. 1984 has been transgressed by reality. The (ab-) use of (multi)media seems to add to a virtuality. Virtual TV-reality, the internet, the I-pod, computer games create a 'reality' of their own. When entertained we are indirectly guided what to think and how to feel. - Such quasi de-personalization by virtuality of parts of individual (and social) experience will affect a central core: identity. On experiences how gained (in a virtual world?) will identity rest, on values how found, on expectance how formed? Creative learning by experimenting and doing will rarely be taught and exercised. How far will the 'entertained' subject be able to self-critical self- organisation, to self-responsibility?

2. In times of change stability needs be floating. It rests on resources, strengths and potentials ready to adapt pro-actively. In critical sectors of society the capability to innovate increasingly bancs on personal experience and on software. In the financial sector computer-based super fast transactions led to non-controllable oscillations. The software itself is a protected competitive tool and top secret. Internet security measures – and law - seem doomed to be always three steps behind. Contrariwise bureaucracy has not learned yet to use ICT e.g. for the assessment of laws before they are released. Nor can ICT sufficiently be employed to curb the endemic parasitism, corporatism and misuse of the 'social net'. ICT enforcing the 'nerves of government' empowers too often bureaucracy. Security, in reality and felt, has always been a critical issue to healthy societal development. It lags dangerously behind criminality, petty and big; from internet defraud to identity theft. Malware and grey zones are multiplying. Defraud, economic espionage and theft via internet amounts to losses of hundreds of billions per year; not to count the drawbacks in innovation capacity and market share. If most to regret: following Ian Morris the driving motivators in history prove greed, sloth and fear. Their counterparts empathy, hard work and courage have little chance to win over. ICT represents a main weapon and a battle ground.

3. As above ICT affects the societal and the mental habitats. Its hardware based control begins to dominate daily environments and habitual behaviour. Robots and recently bio-robots do not confine to industrial production operation and market services. Remote meters electricity consumption in private households extend surveillance to the private life sphere. They will take over personal services as in health care. Handy, smart phone, I-pod, blue tooth and the like broadcast private customs and continuously monitor the exact position of the bearer. They are open source for economic abuse, defraud, or surveillance. The individual becomes transparent to virtually to anybody with means and energy. Finance authorities enjoy access all to banking data. Big and small non-brother networks are watching everybody. Sceptics asked why government is needed, since tax authorities, corporatists and ICT media already rule essential parts of the nation. By support of ICT the degenerated social welfare nets are misused and exploited for commercial, political and corporatist causes. Control, if possible at all, is obstructed by politics. Those who benefit pay it all themselves at a very high price. A critic named them 'happy slaves', since, like Esau in the bible, they lost their freedom for a doubtful fake security.

4. Attempts to resume need articulate as a question. How does ICT influence society's ability to rejuvenate? Life appears a continuous co-evolution with environments; the inner environments affecting the outer ones and vice versa. Decisive for the outcome – new thrivability, stagnation or decline and ultimately extinction - proves the capacity to learn. Learning is learning from the past by memory, from chances risks and experience. It relies on the faculty of controlled anticipation. Learning means to look for new potentials, to open and to employ them. It is strongly coupled with self- organisation. Individuals as social units are dependent on self-responsible decision and action, reality based and purposive. ICT has developed dynamics of its own. The complex software of ICT carries a set of (hidden?) potential purposes. They often go unquestioned as to their assumptions and possible consequences. Which meanings need be purposefully and added? How to identify dangers and avoid them, to detect, to evaluate? Again, the base capacity to uphold and to improve is

learning. It is learning from actual experience, its is meta-learning reconsidering the modes to learn (as by ICT). Anticipative learning must meet future challenges. It needs be closely observed and controlled how ICT shapes the instrumental means holding and forming the preconditions and purpose for societal rejuvenation or decline. .

4. Challenges, Risks and Chances

Will society guide and control ICT or will ICT guide and control society? The quest cannot be decided by wishful purpose. It needs be found out by repeated trial and error in a process of ‘evolutional’ learning from practice for practice. Nevertheless, basic lines of thought relating to the constitution of societies need be remembered and eventually re-invented. From the societal point of view, the following aspects may be pointed out. Approaches are related to the systemic preconditions for a society to remain flexible to respond to prolonged change. In terms of complexity and meaning, such profound changes will eventually imply points of bifurcation, of phase transition, facing a singular stage of developmental stress. Historically points of no return have lead to revolution, inside and outside the society. The power shift often culminated into civil war or war battles between imperia. Phase transitions seem to be unavoidable. Their disruptive consequences need be attenuated by anticipative policy and action.

The first candidate to support a preventive policy is ICT itself. A technology as powerful cannot be fully regulated. So far it just happened. What ought be done is to observe its consequences of the third and second order more closely without curbing its self-organizing contributions. A recent example is given by the property rights. How free is the internet? Which rights need be protected, and how can it be done without diminishing the advantages? Need property rights be redefined? Even institutions indirectly affected need be observed. To focus e.g. on codified right: The internet gave rise to the privatisation of jurisdiction /executive. Private lawyers de facto took partly over e.g. as debt collection agencies, infringement watchers of copyrights etc. The internet creates ever more grey zones. Driven by the growing number and the complexity of cases pending justice is in danger to drift to an justice of lawyers, of judges and of settlements.

Thrivability, adaptability, resilience and rejuvenation of societies should be understood more thoroughly. Complexity and semiosis sciences will contribute. Recent research results. in network theory (‘small worlds’, ‘weak links’) reveals means to supply societal resilience against disturbances (Csermely 2009). Concepts from complexity research may be applied to social structures. So it ‘Swarm’ theory. Advanced modelling permits simulation of highly complex social topics. Findings from advanced systems sciences (including systems interference) are tested. The turn in scientific epistemology itself alleviates inter-, cross- and transdisciplinary research. The restrictions from a physics based ‘closed’ paradigm opens if reluctantly for the systemic inclusion e.g. of environmental and phenomenological aspects.

Social sciences need to continue to open for experimental evidence, statistical methods and for simulation. They ought not work free of value positions, but must be transparent as to their value based assumptions. Base concepts of social/societal policy are to be questioned to their feasibility to sustainable social politics. Subsidiarity and solidarity, as most of the basic concepts of welfare, need be reconsidered and reformulated. In principle any social / sociological concept rests on an assumption what a society should be and how it should be controlled. They are to be reconsidered. Globalisation resulting confrontations of differently constituted cultures (Judeo-Christian, Confucian, Buddhist, Hinduism and others) stimulate welcome coercion for inter-religious, intercultural studies. The resulting knowledge should be used to reconcile in particular sacrosanct cultural presumptions. The state of the European social culture – inside and outside the EU

extending over the Atlantic – presents pressing cause; e.g. fundamentalism of many kinds. ICT may opens new frontiers for intercultural societal research.

Democracy is seen the best conceivable form of constitution. Its base can be found in participation of human beings regardless of all phenotype differences. The scaffold of participations remains, in terms of the ‘French revolution’, *liberté, égalité and fraternité*. Translated: Freedom, Equality, Brotherhood. In the actual state Equality and Solidarity seem by far to outpace the notion of Freedom, leading to a general impasse. The cause appears bureaucracy and the wish of government for subjects easy to govern. Freedom means – see above – self-organisation open and self-responsibility demanded. Not only clan constitutions certify ossification. Any election in Western democracies show severe deficiencies in that respect. The consequences are obvious in the crisis of political parties and so called Euro- crisis. The crises reveal the ignored degeneration of democracy (and of the culture behind). Power to self-organise and to create is lost, permeating governmental institutions and procedures. Political correctness only will succour to deny and ossify the situation. ICT could be turned into a powerful –if painful - instrument to encourage rejuvenation. Presumed that media will resume fully their proper functions to inform and enable grounded opinions; not to emotionalise or to enforce current opinion streams following Political Correctness (PC) and but to entertain.

To reconsider will not be an easy task. Not merely because it is complex and meeting a complex hardened inflexible environment, but because it craves answers to requests concerning meaning, purpose and intent. And presumes the will and the ability to learn.

5. Epilogue: Meeting Singularity. A Strategy

“ Society needs prepare for revolutions *overtaxing our cognitive and emotional capacities*. In all ...dimensions we transgress into a *novel constitution of society*...different from modern society in all means to process *meaning, in institutions, theories, ideologies* and problems.” [Th.A. Becker NZZ 07.02.2012 Translation, omission and emphasis by the author]

Urgently the explosion of ICT, technology, application implication, and the imminent ‘singularity’ are discussed. Singularity comes as a certainty. Ian Morris (Morris 2011) ends his monumental research with the notation of a singularity; Ray Kurzweil (2005) puts the term into the title of one of his books. Open remains how the singularity, the actual point of no return will materialize. The process has already began. We need to find answers how to meet actual break downs and catastrophes. Emergency plans and procedures need be designed. To overcome we need understand evolutionary, historical scaffold and the causes (formal material, efficient, final) of what may happen. The central facts are simple in principle and extremely complex in realisation. Closing the circle, the argument returns to the prologue of this paper.

Life rests on connection; it begins with relations, with mutual influence and co-evolution. Symbiosis evolves; resources and habitats are exchanged. Cooperation exploits scarce resources, competition favours the life unit with the better means to gain them. Selections sets in. Life needs not be optimal but be possible. Niches are populated. Networks formed in inner and outer environments, complexity increased with variety. The primeval intent of survival and development differentiated into purposeful intent. By rise of (higher) consciousness meaning constituted, arranging in mental constructs. Life being experiences the world guided by its own physio-psychological preconditions. It perceives the world it co-acts with as unique. So do human beings. So does the proverbial man on the street, the scientist and the politician. Yet all life worlds are interdependent in the networks of life, connected by symbiosis, competition and co-operation. They co-evolve with the meaning behind. ICT appears as a extension of the communicative faculties

serving life. Serving following which purpose, which intent, which meaning? Survival and development are not sufficient, nor the quest for power. Meaning behind need complement. Meaning manifests the interdependence of life securing balance and open potentials. ICT is to be shaped, controlled and employed to a decisive agency.

The future cannot predicted; probabilities are but a measure of not-knowing. That underlines the necessity to think about the prospective of ICT technology and the technology derived; including the possible applications and their impact on society. Human beings need invent narratives of the future. We need dialogue with the future imaging it, trying out how ought it be, might be, could be. The dialogue is precondition to prepare for action as to remain master of the future. It must be meaningful learning and conscious learning process to take full advantage of the evolutionary capacities of ICT.

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VISUALIZATION OF THE DISCUSSION CONTENT FROM THE INTERNET

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Abstract

The paper describes possible ways of web content discussion visualizations. It focuses in particular on ways to show relationships between users, topics and sentiments of social media contents. Developed analytical and visualization portlets for Liferay Enterprise Portal are also described.

1. Introduction

21st century brings fast pace of life and its logically associated rapid development of technology. Some technologies make life in social society easier, others more complicated. The product-oriented market became the market for services, which also brings a new perspective on competitiveness (Klöckner, 2010; Doucek 2010). The marketing came into prominence, but it was often understood incorrectly or incompletely. Social relations between people were significantly shifted to the level of relationships on social networks. The term "social media" is quite misleading. In relation to the social function of evoking a sense of the social impact of media in general, unilaterally. To a certain level it is so. However it supports an idea that television or press can be also classified among social media. Relationship of media to society is not supposed to be one-sided. All today known as social media has to have one specific feature - interactivity. Social media is not responsible just for spreading information among society, but it should also use the activity of their customers.

Social media is based on digitally coded data transfer, Web 2.0 platform, priority of real-time communication and many-to-many communication model. It is aimed at large communication interaction and the development of social relationships. Creating a community networks of users and the virtual world enable to integrate people into groups. Virtuality figures here as something intangible that does not exist here and now, something you can't really live on the outside, but only inside of an individual - emotionally. Communities in virtual space are described as communication between groups with common interests and values (Preece, 2000), (Pochyla, 2011).

Social networks are the most popular social media today. By Nicole B. Ellison, professor of the University of Michigan, the social network can be defined as a web service that allows individuals (Boyd, Ellison, 2007):

- to create a public or semi-public profile within a limited system,
- to specify a list of other users with whom we want to be in a relationship,
- to see a list of individuals who interact with individuals from our list within that system.

Social networks are a typical representative of Web 2.0. Building block is the user himself. He, as mentioned, participates in content creation and also forms a network with other individuals, who ultimately create community. The market of social networks is huge, but almost all benefit will get the few platforms in the head with Facebook, which is confirmed by claims of Roger McNamee, technology investor, who put a lot of money into social networking (O'Reilly, 2011).

2. Social media as a marketing tool

Social media, especially the already mentioned social networks and discussion forums are very powerful marketing tool completely, used most in the last few years and getting more and more popular. Success is primarily supported by huge mass of people who visit virtual spaces (Vilamová, at al., 2011). The voice of the individual has tremendous power in this environment - draws others to action, creating a psychological effect. And also this is the kind of marketing, which is less expensive than conventional marketing campaigns and also provides the possibility to analyze the environment and position of the company on the current market. Marketing in social media, however, must be dealt with an experienced marketer. Needs analysis, human approach and correctly worded responses of marketers are important prerequisites for successful marketing in social media (Evans, 2008; Ministr, Števkó, Fiala, 2009).

In discussion forums and also in discussions in social networks, there is formed a natural sequence of comments to posts and a discussion thread is also being created. This thread is sorted chronologically, thus creating a kind of time series to which individual comments are recorded. Comments may also react on the original post or on an existing comment. A discussion thread, therefore, arises gradually as a cluster of responsive comments and users (Johnson, 2011). These clusters are very valuable to marketing strategy. They use visible acquaintances between users, their common interests, sympathies and antipathies, and just on the basis of this information can then be targeted propagation.

Marketing departments typically select the largest group of users of social media discussing the chosen topic, and here it starts its strategy (Pochyla, Rozehnal, 2011). Instead of flooding advertising to users which lurks in the email or banner on each web page, advertising gets through friends and it is sufficient to send such notice or advertisement was applied on just one thread, one channel. No spam.

The primary need of every company and marketer is to find out as much as possible about social networking and user forums, especially for these clusters and user comments. For effective analysis of customer satisfaction and it is necessary to find out:

- who is discussing,
- what is being discussed,
- how many contributions of users the discussion contains and for what time,
- what is it's sentiment and it's color.

In the following text are presented visualizations dedicated for marketing purposes, which are integrated by the creative team into an analytical portlets for an enterprise portal Liferay.

3. Visualization of time series

The most commonly used view of the discussions is currently visualization of their development over time using 2D graph where the x-axis represents time and y axis the observed quantity. It is increasingly moving away from the original point and bar graphs, which are currently being replaced by functions. One of the possible uses of this type of graph is shown in Figure 1. This is visualization of the number of discussion visitors showing the total number of visitors and the number of discussing visitors.

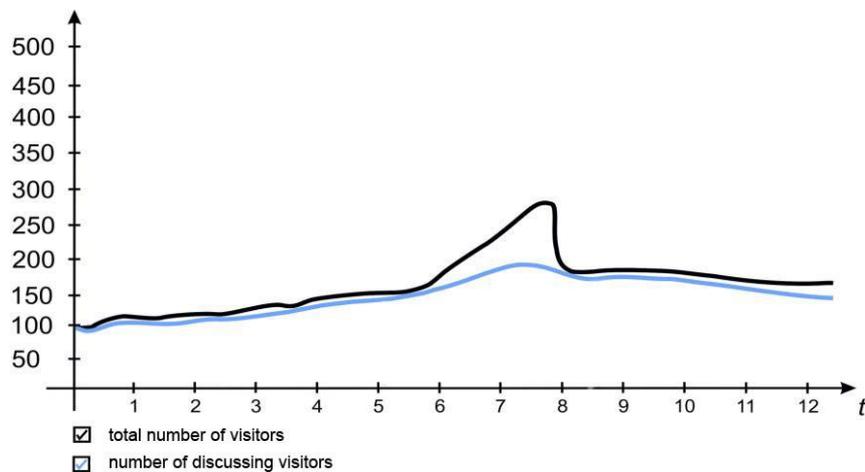


Figure 1: Visualization of the number of visitors at the time of discussion.

Another possibility is the use of visualization of time series variance of some variable which occurs above the posts. For example, the variable of how is the thread over time close, respectively isn't close to a particular topic, but in the similar way can be represented a sentiment in the discussion or amount of positively and negatively evaluated contributions (Hančlová, 2006).

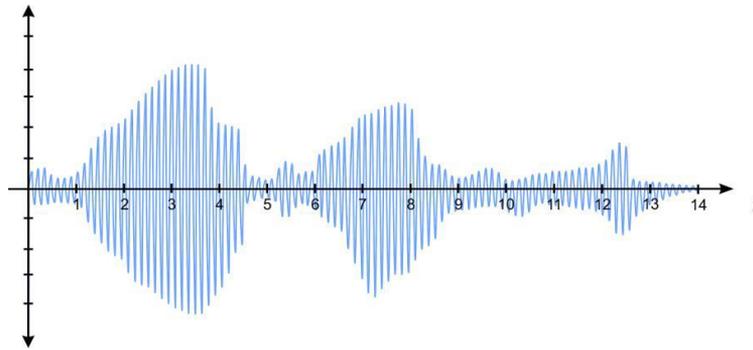


Figure 2: Visualization of the range of the discussion within the variable in time.

Figure 3 shows time series visualization of two different variables. In this case, it shows the number of visitors of the discussion and its sentiment. At the same time it can show interval when was the selected user present in the discussion, which is particularly important to identify so-called "strong players" who affect attendance, theme and sentiment.

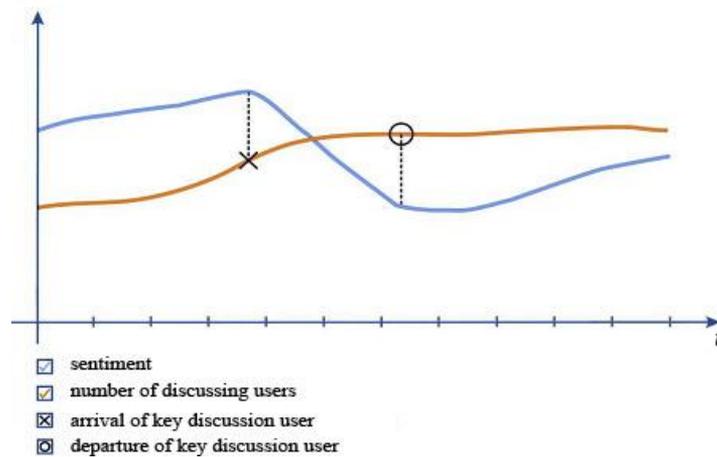


Figure 3: Illustration of arrival and departure of key user.

4. Branching visualization

A separate issue in the area of visualizing discussions is illustrating of branching in time. For these purposes are used "spectrographs". This is a representation of discussion branching, while individual branches or parts have a different color from the color spectrum. Different colors represent different values of monitored variables in the discussion. Typically, the color is used to represent the number of users, number of reactions on posts, proximity to the topic or sentiment. Time on this chart goes from left to right.

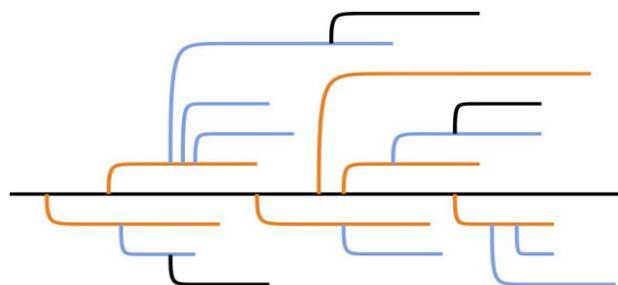


Figure 4: Spectrograph.

Similar capabilities as a meaningful spectrograph have a diagram in Figure 5. This is also an illustration of discussion branching. Time is represented by concentric circles ("rings"). Beginning of the discussion is in the middle, for example it can be an introductory article. Other contributions are represented by nodes. Unlike the spectrographs it can simultaneously affect multiple variables. For example the direction of thread in the direction of x and y axis can represent how the contributions relate to any two topics (each axis represents one topic). It is also possible to use color and size of knots.

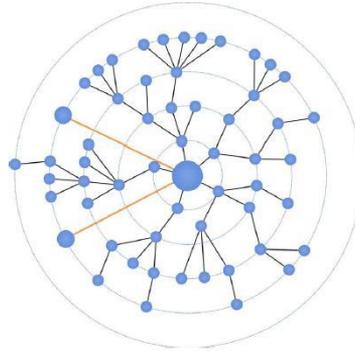


Figure 5: Visualization of branching and topic in time.

5. Topic visualization

Another visualization, which is used to illustrate the topic of the contributions, is use of the thematic n-gons. They don't capture time, but individual contributions are placed in the form of points in the regular polygons, where the particular sides represent individual topics of discussion. The closer to the edge the post is, the more it is related to a given topic. This access allows in a larger number of contributions and suitably chosen sequence of edges illustration of the thematic clusters of contributions.

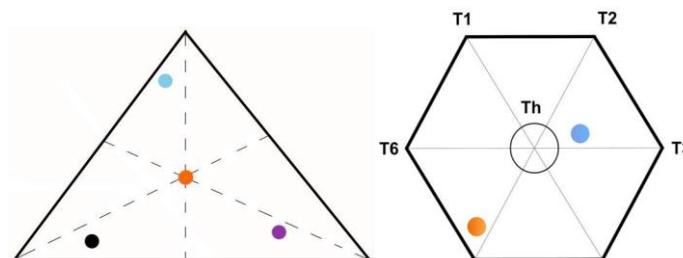


Figure 6: Visualization of the topic in the n-gon.

6. Analytical portlets

The industrial partnership of the Faculty of Informatics of Masaryk University and the IBA CZ is based in collaboration with other partners on development of new analytical and visualization tools in the field of unstructured data. These tools work primarily over the data coming from the Internet social networking, expert forums, FAQ documents and archives (Ministr, Ráček, 2011).

As a carrier platform is used Liferay, which is an enterprise portal based on Java EE, which allows easy integration of information, applications and processes. Portal presents the information to its visitors through a web interface that can be adapted to the momentary needs of individual users.

The basic building blocks of a portal are Java portlets, which are web components designed to integrate Web applications and portals. Portlets are used as interchangeable components of the user interface that provides the presentation layer. Interaction of portals and portlets is provided by the API. Portlets are based on Java technology and in its nature are similar to servlets. Like servlets and portlets are managed by the container. Portlet receives and processes requests by which it changes its content.

Figure 7 shows a newly developed analytical portlet with a spectrograph that displays the sentiment in the discussion. The distance of contributions is represented by points (circles) is in proportion to the time period that elapsed between the posts. For clarity, the contributions are numbered according to order. The color spectrum in this case serves to visualize the sentiment. Thickness of the lines between nodes (contributions) is in this case attendance (number of views) discussion in a given time period.

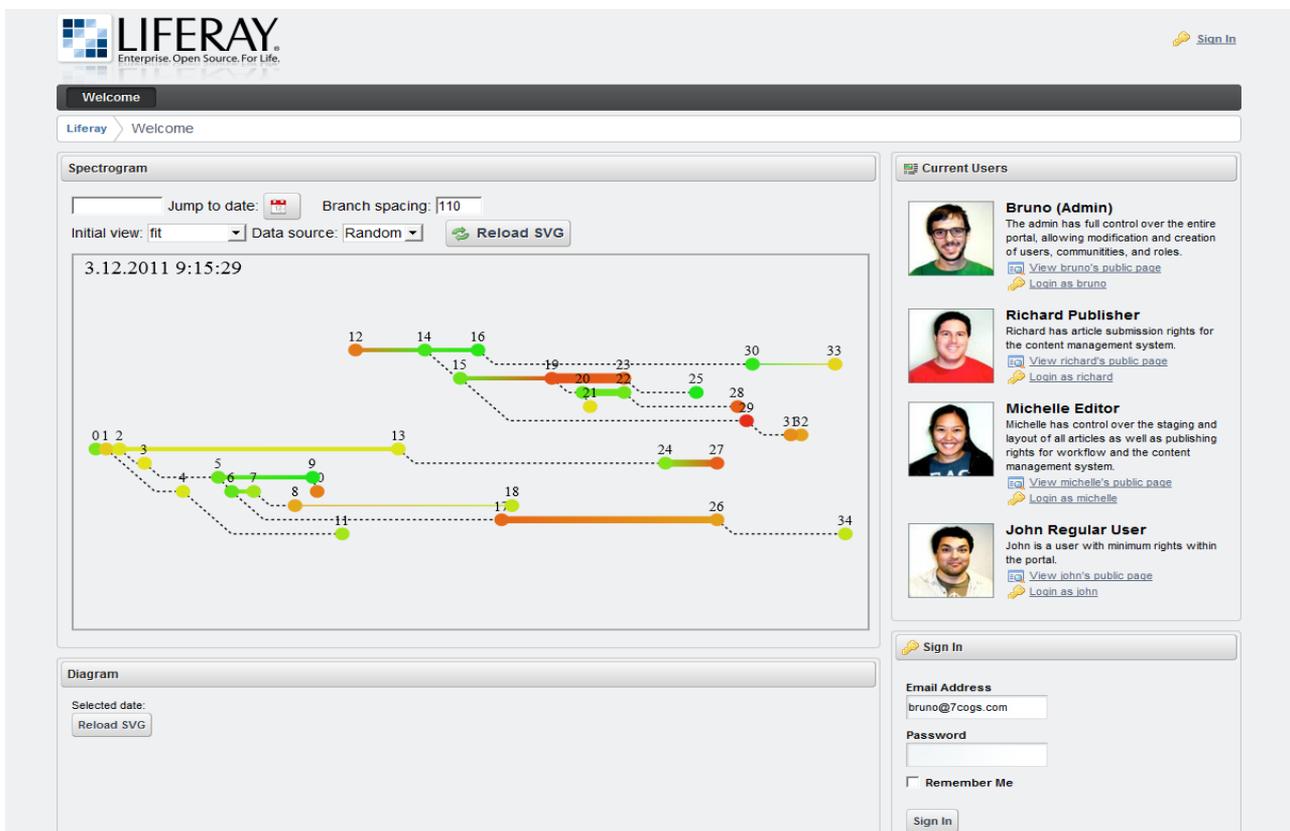


Figure 7: Liferay portlet with spectrograph.

7. Conclusions

Liferay platform proves to be suitable for implementing the above described analysis and visualization portlets. The system is in the final phase and portlets for attendance, topic and sentiment analysis are currently deployed in production environment.

Analytic functions were developed especially over the data of expert discussions of a technical nature (e.g. discussions about mobile technologies) and the data from the field of finance, in Czech, Slovak and English. In the future, there are plans to expand to other European languages including Cyrillic texts.

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FUTURE OF INTRANETS AND SOCIAL NETWORKS IN THE ENTERPRISE

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Keywords

Intranet 2.0, Social Networks, Enterprise 2.0, Knowledge Management, Information Sharing, Online Communication

Abstract

This article is focused on recent development and opportunities in the field of Intranets and social networks that increasingly affect the daily operation of thousands of companies and educational institutions. People who use social networks in their personal lives can easily take advantage of these modern tools in carrying out their daily duties. Executives must understand the benefits of the social networks, and must seek new ideas and opportunities for their employees and the general public. Rapid expansion of the social networks is associated with the necessary changes that require careful planning and management. The article also describes links between instruments and offers a comprehensive look at the actual use of specific services and applications in practice.

1. Introduction

Millions of people around the globe are using social networks. This phenomenon belongs to the corollaries of the Web 2.0, in companies often known as Enterprise 2.0. This concept deals with implementation of the Web 2.0 tools into company processes, thus supporting the cooperation of employees, partners, suppliers and customers, and to engage them in newly arisen networks of people who need to be accessed to similar type of information. (Miller, 2011)

Having provided the introduction, it is vital to define the term of social intranet this paper deals with mainly. In some sources the term Intranet 2.0 can be perceived, which is, in my opinion, identical to social intranet. Social intranet is loosely defined by (Ward, 2011) as “An intranet that features multiple social media tools for most or all employees to use as collaboration vehicles for sharing knowledge with other employees. A social intranet may feature blogs, wikis, discussion forums, social networking, or a combination of these or any other social media tool with at least some or limited exposure on the main intranet or portal home page.”

It is the two basic functions used in social networks, services and online applications that may be beneficial to the companies. As a result, social networks may replace current intranets, whose functions and services are incapable of satisfying employees' and business partners' latest demands and needs. Bearing in mind the essence of social media, it is vital to assign responsibility to

employees, thus enabling them to share information and knowledge, and to participate in the development of this up-to-date form of communication.

In addition, social media can also be highly contributory to the day-to-day work practice, as they can enhance the quality of communication and cooperation not only among in-house and external employees, but also with clients and, last but not least, the management: networks provide novelty and creative ways of systematizing the attempts to gain knowledge and ideas from the subordinates. The rise of social media also strongly supports the endeavor of “open innovations” by enabling the companies to create channels of communication with their clients and partners, who were formerly difficult to reach and to keep permanent and deliberate contact with. Engagement in the process of setting the media into practice enhances both the employees’ involvement, and the possibility of alternative forms of employment, such as work from home. Towns and cities which make use of social networks aim to expand and enrich their communication with more information-skilled citizens and find their way towards young generations. Social networks, in particular those professionally focused, show how extraordinary a tool they are in terms of acquiring new business contacts and of recruiting prospective new staff.

According to a Facebook statistics published by socialbakers.com, in June 2012 were in the Czech Republic more than 3,646,700 users. These data show that 35.75% of Czech citizens have a Facebook account, and as much as 54.84% when considering the Internet users alone. The total number of Facebook users has increased by more than 143,920 in the last 6 months. (Socialbakers.com, 2012) More than a half of them have not yet reached 24 years of age, and 28% falls into the age group 25-34. Consequently, the Czech Republic has quite a sound base of professionals accustomed to daily and qualified usage of social networks, who are bound to begin, or already have begun, to look for a job. According to (Doucek, 2011) the main goal of actual period is to align supply with demand between e-skills. One of the e-skills can be rational usage of social networks.

2. Strategies, Trends and Challenges

To grasp the possibilities that social networks and applications in company intranets offer, it is important to differentiate between several types of users and their ICT knowledge. They are going to participate in the creation or consumption of the intranet portals content, and it is therefore important to satisfy their needs in the solutions implemented. ICT knowledge is very crucial and important for all types of online activities as described in (Maryška, 2010), (Ministr, 2010). The basic typology of social-network users comprises, according to (Hrouda, 2009) five basic groups.

1. Inactives – regarding social media, they show no signs of activity. They neither read them, nor are they interested in or knowledgeable about them.
2. Spectators – read blogs, listen to podcasts, watch other people’s videos, read online forums, reviews and customers’ evaluations.
3. Joiners – maintain their social network profile, they join social webs (blogs, Twitter, Facebook, Google+, LinkedIn, etc.).
4. Collectors – use RSS feeds, provide online votes for websites (e.g. Digg.com), add tags (e.g. Delicious.com).
5. Critics – post reviews and ratings of products and services, comment on other people’s blogs, contribute to online forums, write or edit articles on wiki.

6. Creators – publish their own blogs and websites. They create and post videos, audios or music. They write and publish articles and stories on other people’s webs.

2.1. Trends and challenges

Currently, we are finding ourselves in the stage of quite radical changes in approach towards company applications and their usage. The users are increasingly confronted with new interfaces and forms of exchanging and sharing information. And enterprise intranets are not lagging behind. As Dion Hinchcliffe (2010) states, we are leaving the 1.0 era of intranets, which in their most modern form have been focusing on some self-service, integrated applications, and some content management and heading into the 2.0 era, which will be more socially networked, peer produced, autonomous, and loosely organization. The main target is to create a social operational system that will provide an unrestricted interconnection between company applications and social networks. As demonstrated in Figure 1 we can distinguish three main models of social intranets.

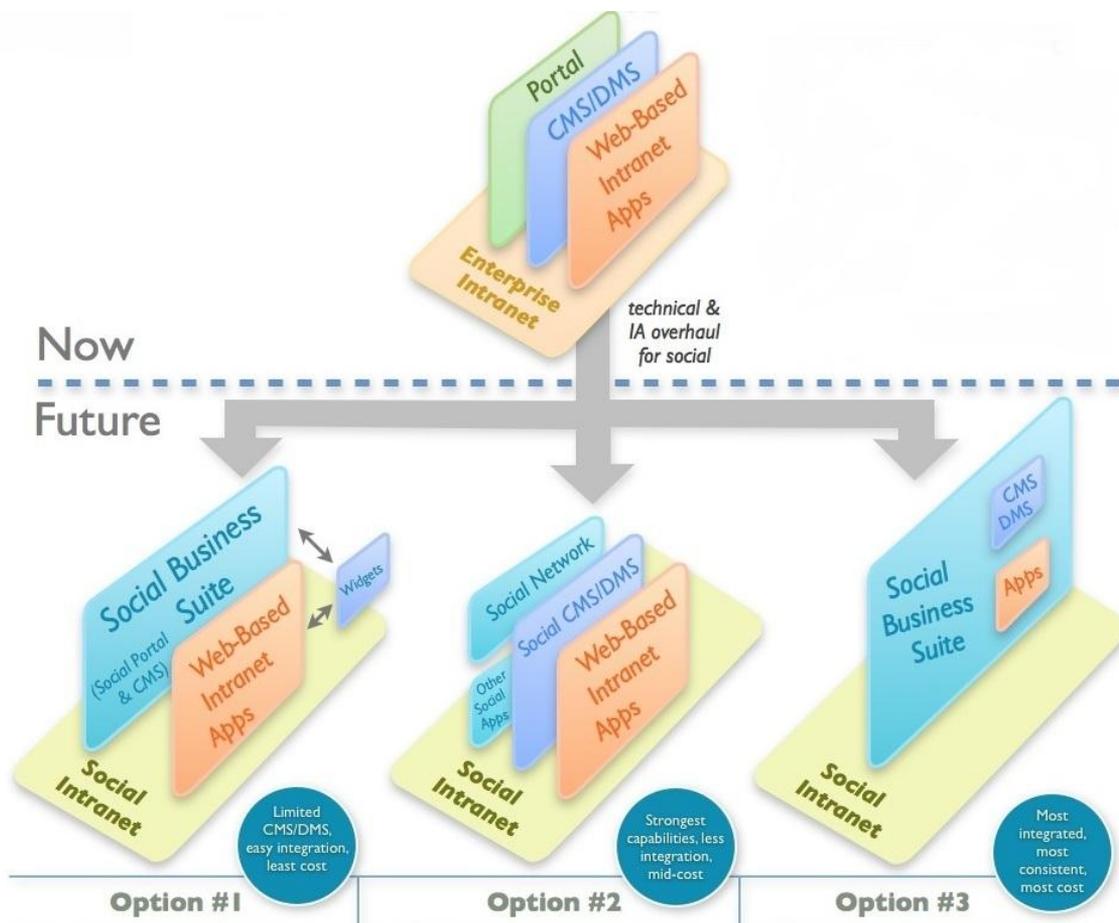


Figure 1: Three variants of Social Intranets Hinchcliffe (2011b)

According to (Hinchcliffe, 2011b) following three models will be leading high-level approaches to social intranets:

1. The core intranet based on a social suite. Legacy Web-apps located elsewhere on the network with lightweight integration. In this model content and document management will move to the social intranet while older apps will stay where they are. When integrated is needed, lightweight widgets or apps can be deployed.

2. The social intranet is divided up into two social platforms that each has unique functions and strengths. This is for organizations that need industrial strength content and document management features with social editing.
3. The social intranet is delivered via a social business suite with all or most intranet apps running within it. For organizations that see the long term direction of their intranet as based on social technologies, this option is increasingly supported by available enterprise social software platforms.

There can be other ways to build and manage the social intranet, but most of scenarios will end as one of the three models mentioned above.

2.2. Measuring of Social Network Usage

Currently, the perception of value of social media is mainly based on soft indicators. The enterprises are persistently concerned about the feedback on efficiency and usage of social media on intranet. By no means is it possible to speak about elaborate methodology of measuring the return on investment or profit definition. And it is mainly the companies that already have implemented social media in their intranet that have been confronted with problems:

- It is difficult to measure social media through external instruments, as there is no ICT support as far as integration of these into the intranet is concerned.
- Social media were launched as a pilot project, i.e. without any wide-ranged discussion on strategy, which is why it is quite complicated to measure their total efficiency.
- Editor of social media writes a report identifying the most discussed topics. It is a very complex way to define the relevancy of content and information on the portal.
- Companies calculate the visitors to discussants ratio, thus evaluating the popularity of the topics or groups involved.

2.3. Persisting Concerns

Numerous Czech companies also have persisting concerns regarding financial contributions of social applications. A survey carried out by Manpower last year, aiming to ascertain how employers in the Czech Republic and other 35 countries perceive the contribution of social networks, showed that in the Czech context, social networks are understood mainly as a threat. Employers are hesitant about either loss of productivity or reputation. (iHned.cz, 2011)

Majority of managers nowadays realise, however, that social networks are, at least, worth monitoring. Most doubts can be summarised in the following points.

- Uncertainty about the real contribution to the company – absence of matrices for ROI calculation or economic advantages of social networks on intranet portals.
- Risk of decrease in employees' productivity (loss of time) – there is no way of monitoring the activity on social networks. There is a very fine line between personal life and company culture.
- Information detection – the possibility to track down the information or the author who submitted it to the system. Further information regarding to analysis of unstructured text (Ministr, 2011).

- Data protection – grave risk of information leaks. By their very nature social networks are susceptible to quick spread of sensitive information.
- Language barriers and unstable environment – some interfaces of up-to-date online applications do not necessarily have to be provided in Czech. This is also associated with instability of users' environment, which is quite flexible in online applications and social networks.

3. Experience with Implementation

From the viewpoint of implementation of new applications and services into current intranets, two approaches can be defined.

Quick implementation – the need to find the way to overcome risks associated with the implementation of not only new tools, but also particular new enterprise processes.

Slow implementation – the risk of loss of employees who expect that innovations are reacted to also in internal communication. Loss of customers accustomed to daily use of Web 2.0 tools.

Experience shows that the crucial value for companies is elimination of barriers resulting, for example, from official company hierarchy. Individual employees may generate an added value for their company, even outside their field of work. Another option is creation and description of wiki acronyms and a specialized term, which helps new employees, come to grips with the company and participate in its projects.

As regards implementation, it is worth mentioning that employees have a greater tendency to take part in discussions if they see a direct advantage – for themselves, indeed. As describes (Kass, 2011) a large risk is low engagement in the creation of the content and its updating on the part of the employees and managers. The main reason for this failure is that the projects are carried out void of any strategies, aims and even content, which is in social media a crucial element. If the companies want to entice their customers or partners to engage in social intranet, they have to prepare adequate content and maintain it properly. It is unacceptable to ask partners for cooperation on, for example, a wiki project without the basic content and its structure being outlined.

New cloud computing trends can be very useful for companies to reach new online services and applications to improve the quality of intranets (Tvrdíková, 2011). The employees' interest in social media is also often caused by the I-have-seen-this-great-tool-on-the-Internet effect, and then they fail to consider the contributions to their company. Young employees are often led by hipness and by the tendency to have what others have. In some cases, there are real advantages for the company connected with rapid access to the application, but they are difficult to distinguish and to enumerate.

Implementation can also be based on negative experience which some companies with social networks have. Except for some pilot wiki projects, a company does not make use of social media on the intranet. However, ICT department have prepared a presentation for the management where the risks resulting from failure to implement social media to the intranet network have been highlighted. Facebook was used as an illustration of posts abusing the company name. This information contributed to implementation, monitoring and evaluation of social media on a weekly basis as described by (Hinchcliffe, 2011a).

Influence of social media on intranets has been thoroughly researched since 2006 in terms of Global Intranet Strategies Survey. According to (McConnell, 2011) it has been proved that more than 60% of organizations that implemented social media observe their advantages in the following

areas: efficient knowledge sharing, better knowledge ability of employees and increased engagement in company processes. More than 30% of organizations also claim that faster problem-solving and decision-making processes, decreased use of emails, and finding of experts not known up to that time occurred.

3.1. Politics and Rules for Social Networks

Owing to the bad economic situation and persistent threats of global economic problems, companies currently deal with other priorities. This is reflected in the absence of strategy or strategic plans for implementation of social applications and services into company intranets and extranets. Initiatives regarding implementation of social media thus arise from the inside of the companies, from young people – the grass roots often realise the contribution of instruments for undertaking earlier than the management, and they are able to use them in internal processes, as stated by Nielsen (2009) or Vyšehradský (2011).

Companies often create manager of social media, a new role for active approach towards managing and administration of content on social networks – manager of social media. It is a relatively new role, since 65% of organizations created it in recent two years. It is mostly associated with administration of the intranet or of the tools for cooperation. Further information and details regarding to ICT human capital are described in (Doucek, 2009).

New way of creating content needs new rules and standards for its usage. The rules are basically based on trust and company culture. In terms of these rules, the users can discard content defined as unacceptable. In organizations, there have to be codes of communication that cover all media. There also exist companies that on the one hand have the rules for social media, but on the other hand claim that the best tool is trust in their own employees. The institutions, however, generally add that the activities on the intranet are interconnected with the database of employees.

Such binding rules for publishing content on social networks are rather exceptional in the Czech Republic. According to (Zandl, 2009) most companies fail to have special rules and limitations or, strictly speaking, they tend to follow the opinion that the users of social applications should know themselves the rules for posting. No binding company rules are defined, which is adequate until the first problem or conflict occurs. This pertains to both company and private accounts of the employees.

4. Conclusion

For many organizations, an intranet makes a fundamental change in organizational communications, and also, business process. Intranets allow employees to communicate in real time (web-conferencing, micro-blogging, etc.). The main advantage of newly integrated services and applications is the variability of access to these new media: from the outside of the company building or from mobile devices. The latter are a platform often used for updating information or acquiring them when needed.

Based on my findings, in the corporate strategy it is necessary to clearly specify the way of use of social networks and intranets. The minimum requirement is to monitor the social networks. Objectives, based on this strategy, must be very clear not only to management but also to employees and customers themselves. These two groups of users would be the main creators of content on social networks and intranets. The employees should have a natural approach to social intranets and the company should support and encourage users' participation in the automatic

content creation. The use of social networks and collaborative intranet cooperation must be supported by trainings and changes in a well-established routines and processes of the company.

It is still true that in most businesses the top management is not adequately active in introducing social media into the company intranet. Companies should realize that successful implementation of tools and a social application does not take place over night. Pilot projects can be a short-time commitment, as opposed to the adaptation of social networks which bring about changes in company policy and culture. These changes always occur in the long term. At this juncture, there is no clear answer about the length of implementation of social element in intranets. Based on experience, however, it can be assumed that the implementation is a matter of 3-5 years (Nielsen, 2009). This is the reason why hesitation might result in serious problems in competitiveness over the upcoming periods.

In terms of social media intranets, it is important for companies to focus on the large groups and satisfy their needs and desires for authentic stories from the company that incite outstanding ideas or products. Critics and creators will join. The largest risk is the failure to participate at all. The unwillingness to communicate via social networks, or at least to monitor them, always leads to financial losses.

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AUTOMATING WEB HISTORY ANALYSIS

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Abstract

Web browsing becomes more important as more and more applications are moved towards the WWW. Consequently traces of such web activity are increasing in importance for law enforcement or companies. But the web browser market is getting more fragmented, as more browsers are being used, and even a single person might employ different browsers on several devices, like both IE and Firefox on a PC, and another one on a mobile device (PDA/Pad). This paper lists the information which can be found for the three most important browsers (IE, Firefox, Chrome) and presents a tool for collecting and collating web history information from a forensically acquired media for all users and all browsers in a forensically sound way.

1. Introduction

Computer forensics is an important area of investigating criminal or undesirable activity. In many cases a very prominent part (often the most important one) is browser forensics, i.e. scrutinizing the activity of the suspect on the computer regarding web browsing. This consists of identifying the behaviour in as many details as possible, regarding for example:

- Which web pages were visited
- What content existed on these pages and whether this content is still available (on the computer – in the web it might already have changed or been removed)
- Was the user there intentionally or was it a popup, dynamically loaded image etc.
- Can we find hints to external services (Webmail services, file storage, ...)
- What additional information is available (e.g. visit count, usernames/passwords)

This is difficult in practice, as previously there were only few browsers (e.g. predominantly Internet Explorer 6), but their number has grown over the last years and several browsers are currently increasing their share of the audience (Chrome). This number is potentially growing, as PDAs and Pads again provide different browsers, or at least different versions or configurations of them. Another difficulty is that many persons use different browsers (e.g. IE for business applications requiring it, Firefox for “normal” websites, and Webkit on their Android Smartphone). To obtain a complete picture of the web-related activities, the individual results therefore need to be combined. This leads to difficult and time-consuming gathering of data from different sources and various formats with the subsequent need for collating the results, which is exacerbated by the fact that

most tools exist for some browsers only and produce output in their own special format. Additionally many common (rather simplistic and not suited for forensics) programs only allow inspection via a graphical user interface of a limited set of data, but no export for further handling and contain no provisions to ensure the chain of custody or at least data integrity.

What is needed is a tool to automate collecting data from various sources and integrating them. As computer forensic is still an area for experts and often needs automation, it should offer a command line interface for unattended operation or scripting. Ideally the software should also be independent of the actual web browsers (e.g. Firefox lets you access the cache through the URL “about:cache”), so it can be used on images of the file system. A first (and currently limited to the web history, cookies and cache) example of such a tool has been implemented and is presented in this paper. Additionally it describes and analyzes the information present in several important web browsers in detail.

2. Data stored by the different browsers

A lot of data is potentially available in a browser, although not everything is shared by all browsers, exactly the same, or there at all. Therefore it is important to identify a “baseline” of information which will exist for all of them. This information can then be compared and is the minimum to be expected for evaluation. Additional information might exist, if a specific browser has been employed, but is not necessarily present. This investigation is limited to the most important browsers at the moment: Internet Explorer, Firefox, and Chrome. Additionally only recent versions of them are described (several years old ones might contain different data, employ a different format, or use different locations for storing it).

One additional difficulty exists: most (or all) of this data is not stored if the browser is used in a “private” mode (“Private Mode”, “InPrivate Browsing”, ...). Even then traces might remain on the disk (e.g. Internet Explorer does store some data on the disk, but deletes it on leaving this mode), especially in the paging file, which contains copies of parts of the RAM. However, there is neither a guarantee for this, nor is this a complete or consistent view and it might also contain traces from very old activities, other users, and browsing in “normal” mode. This is therefore excluded and remains a task for manual recovery through experts.

What is not investigated here too, are extensions: A large number exists in different formats, depending on the browser. These may store any kind of additional data like searches, download histories, page ratings etc. A manual inspection which plugins/extensions are present is therefore a necessity. Only for some very common ones would integration into an automatic system be worthwhile.

2.1. Common aspects

When URLs are stored, they are typically full URLs, meaning they include any parameters which might be present. These can be very interesting, e.g. when using search engines. All major ones do not use the POST method (search words would be encoded in the HTTP content part), but rather the GET method, where search words are encoded into the URL. This might be even more interesting if auto-completion is activated, as then a multitude of requests may exist in the history, showing the typing sequence, including any searches not actually executed.

2.2. Internet Explorer

Internet Explorer forensics is problematic, as most data is stored only in binary files in an undocumented format. A large share of this data has been decoded in the meantime (Jones, Firefox Profile Folder), so it can be extracted. For many elements separate tools exist, where unification is a necessity for analysis. It must also be noted, that the hit count (for URLs, cookies etc.) is not necessarily accurate in Internet Explorer (Andrews). Regarding the various most interesting elements, the following data fields can be retrieved:

- **Bookmarks:** URL and icon-URL are stored in the bookmark file. The file's creation date shows the date and time when this bookmark was stored. As they cannot be created without user intervention, they show intentionality.
- **History:** Last modified time and last access time, URL, hit count (index.dat; these files are a special file type and are used for several elements and exist in multiple locations). A very important part (see common elements) for forensic analysis. Potentially problematic is, that the history does not show web pages but all elements (images, stylesheets etc.), and that there is no guarantee for intentional access to them. All embedded elements are loaded automatically (→ history entry) and even web pages can be "added" to it without user intervention (iframes, moving to a page or opening a popup through JavaScript).
- **Typed URLs:** Manually typed URLs are stored in the registry. As a timestamp is available only for the whole key (but not the individual values), only one time of modification exists, which is the time the last URL was typed. The list is limited to the last 25 and Internet Explorer stores only those URLs, which are fully manually typed. If a URL is begun but automatically completed, it will not be stored here (Wong).
- **Cache:** File creation time (stored in the file system, allows identifying the first visits), last modified/last access time (date and time of last change of the content of the file which was seen and the last time this element was displayed), hit count (how often this element was show; see above for reliability), HTTP headers (typically not very interesting), URL and filename (index.dat) and file content (file system, separated into cache directories). In practice the cache is today not that useful anymore, as it will contain only files where caching was not prohibited by the server. This is typically done for dynamically generated pages (which change often and must be reloaded on every visit) or because of security, like webmail, where all static content (advertisements, menu bars etc.) will be cached, but the page showing the message text not.
- **Cookies:** Name and value (as set by the server), the domain/path this cookie will be sent to, expiration and creation time, whether to send it across unencrypted connections (all from the cookie file), last modified time (index.dat: the last date and time this cookie was set, not necessarily the last time it was sent to the server!), hit count (not very useful for cookies!)
- **Form completion data and stored passwords:** Name/value respectively username/password are stored in several places. However, in recent versions they are mostly inaccessible without knowledge of the URL, as this is used as their encryption key. Therefore this URL must be known, retrieved from the history etc. (Sofer, Sachdeva 2009, Passcape) for accessing the data.
- **Certificates:** Certificate content and private keys (encrypted) are stored system-wide and are typically of very little interest. Only if client certificates are used or additional server or CA certificates have been installed these could potentially be useful.

2.3. Firefox

Firefox used in early versions are very strange and complex file format, but since version 3 the data is quite easily accessible as several SQLite databases (Koepi, 2010).

- **Bookmarks:** URL, title, date added/last modified as well as its location (menu bar, folders etc.) are stored in `places.sqlite` (table `moz_bookmarks`). Additional information is available in combination with the table `moz_places`, identical as for history entries (see below). Forensically this data is very important. Some additional information, last bookmark folder used, bookmark descriptions, date of addition and of last modification is in table `moz_items_annos`.
- **History:** Common elements include URL, title, visit count and date/time of the last visit (`places.sqlite` in table `moz_places`) (Guðjónsson 2009, Mozilla Firefox 3). Additional information is whether such a visit was “hidden”, i.e. through a RSS, iframes, or Javascript calls. This can be useful to confirm (a denial) of an intentional visit. The field “typed” specifies, whether the user typed at least a portion (autocomplete; more information in the table `moz_inphistory` on what was actually typed) of the URL manually. The field “frequency” is a measure (not count!) of how often a URL was visited and how recent the last visit was. It is used to determine the ordering of suggestions for autocompletion. The actual sequence of visits is stored in `moz_historyvisits` where for each visit the preceding “location” is listed together with a timestamp of the visit, a session identifier (allowing reconstruction of visits belonging together) and a visit type. The latter describes how the user “arrived” as this visit: by following a link, typing an URL (possible in combination with autocompletion or through selecting a history entry) or using a bookmark. This includes separate values for downloads, permanent and temporary redirections, and embedded content (images, iframes, and frame content) too.
- **Cache:** Complete request string (URL), file size, expiration/first access/last access timestamp, access count and the HTTP response header. The file data itself is stored in three different archives (small/medium size files) or directly on the disk (files larger than 12 kB) identically as received from the server without any changes, but under a random name to be found alongside the other metadata (Ritchie 2012, FfFormat).
- **Cookies:** Name/value pairs of the cookie content, the host/path they will be sent to, which connections to send them over (encrypted only, ...) as well as expiry, last access, and creation timestamps are present (`cookies.sqlite`).
- **Stored passwords:** Password for sites are stored in `signons.sqlite` in combination with `key3.db` (master key for decrypting saved password). Information contained is the username and the password, hostname, how often it was used, form submission URL, and relevant field names, as well as timestamps for creation, last use, and last password change. This is extremely important as reuse of usernames and password for different sites and services. Also the timestamps allow retrieving a lot of information regarding web site visits is common.
- **Form completion data and search history:** Field name and the stored value, how often this information was used, date/time of first and last use (`formhistory.sqlite`). If present, this is very useful information as it contains content as well as timestamps. Under the name “searchbar-history” the information from the web search field is stored. Note that this information may be encrypted with a master password (similar to stored passwords).

- Certificates: Specially accepted certificates (certificate exceptions; could not be verified as valid, but the user confirmed these) are stored in the file `cert_override.txt`. These signify that the user has visited a site presenting these certificates at least once and intentionally confirmed to go there. However, this does not prove that the user visited a specific site: they might have been presented by any site, especially as they were seen as untrusted by the default algorithms. The certificates themselves are stored in `cert8.db`.
- Download history: The source and destination of downloaded files (unless cleared) is found in `downloads.sqlite`. This additionally includes start- and end time, referer (web page from which the download was initiated, file size, mime type, and state (and a few other less important elements like preferred applications for opening). Additional info is contained in `places.sqlite` (`moz_annos` and `moz_anno_attributes`) regarding the filename of downloads.
- DOM storage: Allows web pages to permanently store data similar to cookies as name/value pairs under the same-origin policy (`webappstore.sqlite`). Forensically this is potentially very interesting as a lot of data may be stored, but because of infrequent use by web pages this seems to be practically of less importance.
- Website-specific data: Firefox stores a few preferences for sites, namely up- and download directory as well as whether the content should be shown in full zoom or not (`content-prefs.sqlite`). The individual settings are not that interesting, but the groups show often visited sites, which may be useful as corroboration and as proof that some content was downloaded. Additional information can be found in `permissions.sqlite` regarding allowing popups, installing extensions, setting cookies, and showing images. Within `places.sqlite` (`moz_favicons`) is information about the website icons, including its URL (requested only for site visits, therefore useful), and an expiration timestamp.

2.4. Chrome

Google Chrome uses a SQLite database, similar as Firefox. However, the database structure is completely different and some elements are stored in different formats.

- Bookmarks: URL, title, date added/last modified as well as its location (menu bar, folders etc.) are stored in “User Data\<<Profile>\Bookmarks” in JSON format.
- History: This is split in three tables in the file “History” (older entries: file “Archived History”): segments (high-level organisation, typically only top-level and second-level domain; additional data includes a time slot and a visit count), urls (title, visit count, how often typed manually, and timestamp of last visit), and visits (visit time, previous page). Visits additionally provide the transition method, i.e. the method of moving there (clicking on a link, typing the URL into the address bar/selecting it there respectively the same regarding keywords, automatically/manually loaded in a subframe, start page, form submission, page reload, client/server redirect) (kristinn 2010). Visits are distinguished from URLs in that a reload or re-visit will be added as a new visit, but remains a single url table entry.
- Cache: Apart from the actual file content and size, the cache (Chromium projects) contains the complete request string (URL), the HTTP response header, how often this file has been used respectively fetched from the net and the creation/last use/last modified times. Similar as in Firefox smaller elements are stored in “aggregated” files, while larger content is stored separately under a random name.

- Cookies: Name/value pairs of the cookie content, the host/path they will be sent to, which connections to send them over (encrypted only, HTTP, ...) as well as expiry, last access, and creation timestamps are present (file “Cookies”).
- Form completion data: Field name and the stored value, how often this information was used, date/time of creation (tables autofill/autofill_dates in the file “Web Data”). Special tables exist for emails, names, phone information, company profiles, credit cards and IE 7 logins (used for imported passwords). The table “keywords” in this file actually contains the search engines configured for the browser. The name stems from the keywords used as a “prefix” to use a search engine different than the default one. The search keywords are stored in the file “History” in table “keyword_search_terms” – these only cover what was sent to a search engine and reference the URL (and all associated data).
- Stored passwords: Password for sites are stored in “Login Data”. This contains not only the URL where it was found, but also to where it was sent, potentially allowing to trace spoofing attacks. Additional data is the signon realm (domain), whether the SSL connection was valid, whether it was blacklisted by the user (to not remember the password) and a creation timestamp. Unfortunately, the password is encrypted with the password of the current user as additional input (HoToGeek).
- Download history: Within the file “History” the table “downloads” stores the full destination path+filename, the source URL, start and end time, received and total bytes (allowing to determine whether the download completed), as well as whether the file was opened (note: only through Chrome; external opening through the explorer is not stored!).
- Website-specific data: WebSQL Databases (alternative to Web Storage; deprecated since 2010 (W3C) but used by Google) are stored under “User Data\<Profile>\databases”, with the directory names of such separate database files (for each site) stored in Databases.db. This is in itself not very interesting, but it shows visits to certain sites and, depending on what these sites store, potentially very useful content (Example: Offline Google Mail). Data for Local Storage (alternative to Web Storage) is similarly found under “Local Storage” under the website’s name. The quota manager seems to be used to track the amount of storage used by these databases (but not in KB). It contains the origin (same as the start of the subdirectory names under “databases”) as well as last access/modification time.
- Other data stored are Web site icons in “Favicons”. These may be very useful as not only the icon itself is stored with its source URL and last update time, but also which pages reference them. This might be the home page only or on every subpage (especially common with CMS), resulting in a potentially large number of additional URLs (albeit without a timestamp).
- The “typed URL predictor” contains information on which URL was finally accessed when entering an URL manually. For each character typed (“w”, “ww”, “www”, “www.” ... “www.google.at”) the final url as well as the number of hits and misses are stored. This does not only store manually typed URLs but also shows approximations of frequencies of visits. Known shortcuts are stored in “Shortcuts”, where the text is associated with an URL, the page description, the last access timestamp, and a frequency counter (number of hits).
- The “top sites” (shown in empty tabs/at startup) are stored in the file “Top Sites”. Information present are the URL and its rank, the title, a thumbnail, last update timestamp and redirects (URLs where you got redirected to when clicking on the original URL, e.g. www.bing.at → www.bing.com/?cc=at). Additional data is less useful and is used for

selecting which icon to show (e.g. “boring_score” is a measure for the uniformity of the brightness of the icon!).

- General browser-specific preferences are stored in the file “Preferences” in JSON format. This includes the potentially interesting section on `dns_prefetching`, i.e. which DNS names will cause prefetching to occur. Obviously this means that these already have been visited (but perhaps only indirectly through images, pop-ups etc.) at least once. Stored sessions/tabs exist in a custom binary format.
- Visited links are stored in the file “Visited Links” in a custom file format. This is actually a hash table with fingerprints of the URLs

3. Implementation

A very important aspect of computer forensics is authenticity and integrity of evidence. It is therefore necessary to include hash values for all source and result files and work on forensic copies of media, typically disk images. These and other necessities led to the design and implementation of a tool to extract browsing data from multiple sources (several users) within files from several browsers and compile them to a single collection. This is especially important, as e.g. IE deletes data from the cookie, cache and history storage separately, so to achieve the most comprehensive view all elements must be combined.

3.1. Existing tools

Some tools already exist to help in the evaluation of browser data. The most important ones are:

- Web historian (Mandiant): A Windows tool to extract the web, cookie, download and form history from IE, Firefox, Chrome, and Safari. Apart from the GUI output is possible in HTML, XML, and CSV. Working on disk images is only possible through manual mounting and special configuration, which is a significant drawback. Some analysis functions (website frequency by domain, daily timeline etc) are available. It supports setting a UTC offset to account for timezones. No command line interface is available, so it is unsuited for automation.
- Historian (GaiJin): This Windows tool supports extracting cookies, downloads, bookmarks, history, form data, and cache files from Chrome, IE, Firefox, and Opera (not everything from each browser, however). It creates hash values of the source files in the output. Export is possible as text and CSV, but can be customized through templates. This is purely a “converter”, i.e. there is no possibility of inspecting the data through the GUI, and it can be used through the command line.
- Pasco (Pasco) and Galleta (Galleta): Open source tools for parsing Internet Explorer `index.dat`, respectively cookie files. Very useful for these purposes, but no other functionality at all. They are available in source code and run on Linux too.

Several other tools are available, but these are predominantly Windows-only tools, merely support small areas (typically cache viewing only) and have little, if any, export functionality. These, as well as those described above, therefore suffer from some shortcomings, especially automation and Linux compatibility, necessitating a new tool.

3.2. System description

This command line tool extracts the history, cache, and cookies, and produces a timeline, and groups individual requests to sessions. The output is possible as text, CSV, XML, or a SQLite database. As the tool extracts all the browser information from the whole disk image, the results might be very large, e.g. on a server with numerous users. Therefore it can be restricted to certain users or browsers. If desired, it employs an external tool (CGSecurity) to try to reconstruct deleted files which might contain additional information to be extracted. As a special feature it is possible to compare the cache against the current state of the webserver, i.e. the tool will retrieve the found URLs and compare the webpage/image/... against the data found in the cache, in this way ascertaining whether the resource is still available and whether it has changed in the meantime (or some manipulation has taken place – which is the case remains for the examiner to find out). Cookies received here are compared to the ones saved as well.

The tool was implemented as a set of bash scripts employing only common external programs and can therefore be run on any kind of Linux, and even under cygwin in Windows (with the exception that write-protection of input files cannot be enforced and only NTFS and FAT are supported as file systems to be investigated, as opposed to all locally mountable file systems under Linux).

3.3. Data extraction process

The process of extracting the data is rather complicated and contains several elements which are functionally not really necessary, but are useful (or required) regarding the use of the results as evidence (e.g. creation/verification of hash values; early unmounting etc.). The process is as follows (see also Figure 4 for structure and sequence of the tool; Prock 2010):

1. Analysis of the parameters and their checks and verifying prerequisites (external programs ...).
2. Mounting the source image as read-only: This is necessary as the program should never be run on the system to be investigated itself, but rather on a forensic copy.
3. User accounts are searched for and their operating system is identified. The latter is necessary, as the location/names of files depends on them. The supported OS “versions” are Linux, “old” windows (XP and 2000) and “new” windows (Vista, 7). For “exotic” languages additional (trivial) code would have to be added, as in Windows e.g. the relevant folder “Documents and Settings” receives its name in the installation language (e.g. for a German Windows version: “Dokumente und Einstellungen”).
4. Afterwards an independent search for all browser directories is performed. Only after they have been found they are assigned to the users identified in the previous step. In this way also copied or moved directories can be found, as only for typical filenames is searched. As these are the same and independent from the installation (OS as well as browser) language, all versions can be found. If the user cannot be identified, the directory is still investigated and assigned a unique number instead of a user.
5. A temporary working directory is created and the relevant files copied there from the source image. Here simultaneously hash values are calculated to ensure that no modification takes place during investigation.
6. The (optional) next step consists of searching for deleted files with PhotoRec (see above). This applies to SQLite databases and index.dat files. However, this is typically of little use,

as these files are commonly not deleted and created anew, but rather truncated or data removed/marked as invalid/... internally, while leaving the file itself “intact”.

7. Afterwards the source image is unmounted to protect it from any possible modifications.
8. For each browser a specific script is started (after creating a suitable database), which extracts the respective data and stores it in the individual database. This would (potentially, not implemented) allow parallelisation to increase the speed (for typical computers, i.e. used by a single or few persons, speed is not a problem). Partially also external programs are used (Internet Explorer: Pasco and Galleta are used for analysis of cookies/index.dat files). Extension of this phase is possible in two directions: the existing scripts could be enhanced to extract additional data, or new scripts can be added easily to cater for additional browsers. Because of the modularity, both are quite simple and only the second influences only phase 4 (new browsers might need additional regular expressions for identifying their folders).
9. The hash values of the files are checked that no modification occurred during the data extraction phase.
10. If requested, all the found URLs are retrieved for later manual comparison (see above), and some tests are performed (comparison of the page title; ascertaining whether the page is in the cache and if yes, whether it is identical; comparison of the received cookies with those found on the disk).
11. The individual browser sessions are ascertained – as far as possible – through heuristics, and the individual results assembled into a single database.
12. All logged errors (hash values, downloading etc.) are shown as well the output in the desired format is generated. Finally the temporary files are deleted (after archiving them, if configured).

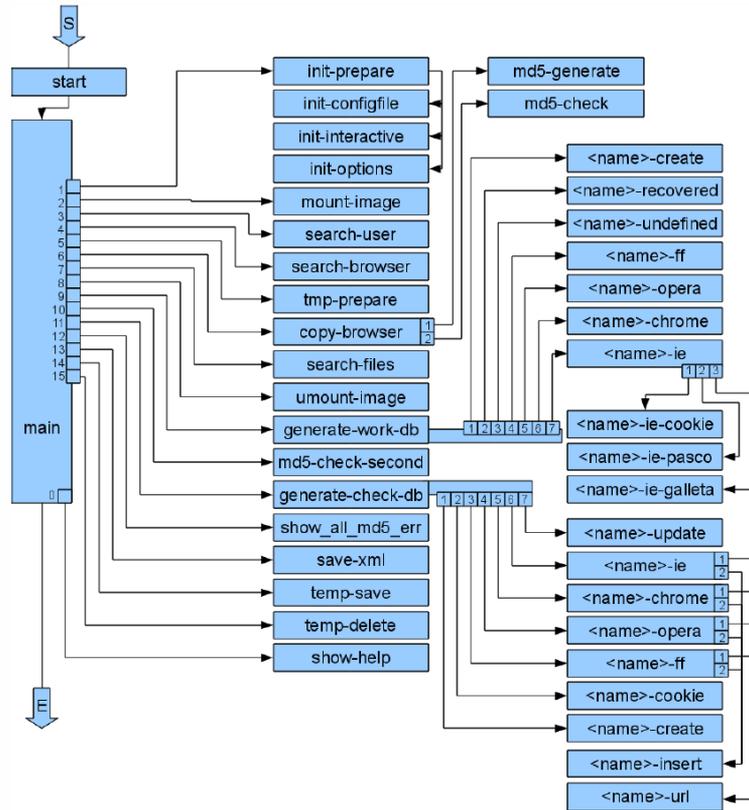


Figure 4: Structure (and simultaneously showing the sequence of operations) of the tool

4. Conclusions

The program is limited to extracting and collecting the data (as all other tools), but performs at least some additional preprocessing. The interpretation of the results still remains for a human investigator. However, as a basic framework its extensibility is very useful and the comparison of pages/cookies to the “current state of the web” helps in interpreting/analyzing/assessing the results, something not present in other products. Only a potential drawback is that browsers not covered yet might provide various other data. This requires only an extension of the final result database by additional columns (quite trivial to implement). If they are just “renamed”, i.e. the content is the same as in another browser, those columns could be reused – but care must be taken to check that it is not just similar but that its semantic is exactly the same.

Possible extensions are the addition of further browsers, like Safari and especially those from mobile devices (often Webkit-based, so quite similar to Firefox/Chrome and to each other), extracting more information from the individual browsers, and support for multiple images or continuing (e.g. for adding data from mobile phones, which would be a separate forensic image). Also elements to ease interpretation could be added, like visualizations (timeline of pages, perhaps with thumbnails generated from the cache or newly downloaded pages – the latter perhaps with a gray overlay as distinction) or search functionality (keywords already searched for in cache/downloaded pages/cookies/URLs during extraction).

Another direction for enhancement is improving the preprocessing to reduce the work for humans. Possibilities in this direction could be assigning cookies to webpages based on their domain and the downloaded pages or their times, integrating strategies for removing content by the browsers (as far as known), a ranking of confidence (e.g. cookies or cache file(s) present or missing), or integration

of the Web archive to compare not only against the current state of the web, but also against the then-existing one (if present).

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**SUSTAINABLE ECONOMIC GROWTH THROUGH
ENTERPRISE NETWORKING: IDEAS AND
APPROACHES**

PERSPECTIVES OF ENTERPRISE NETWORKING FOR SINGLE E-MARKET

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Keywords

e-Marketplaces, Transparency, Networks, Monopoly, Innovations

Abstract

ICT infrastructure and services plays crucial role in B2B relations. Business networking through ICT contributes to higher transparency, competitiveness and development. Perspectives of wide single electronic market based on acquisitions of electronic marketplaces, integrations with legacy systems or interoperability with other market platforms is new economic challenge. In the paper, perspectives of this innovative market model is discussed in line with network related externalities regarding price and market transparency, anti-competitive actions, lower prices, more balanced wealth distribution and bounded innovation.

1. Introduction

In current economy, where ICT plays a crucial role for being competitive and effective, businesses and especially small and medium-sized enterprises (SMEs) are facing higher pressures of flexibility and efficiency than ever before. The core business processes need to be supported by innovative but mainly effective ICT-based systems and tools. One of the crucial business success factors in new global and more transparent economy is cooperation and collaboration in whole business value chain on vertical but also on horizontal collaborative base. On the other hand, consumers are facing to new opportunities to find more suitable products and services using new ICT tools and network environments and services.

That's why the participation in networks has nowadays become crucial for esp. small and medium sized companies that want to be successful and stay competitive. eCollaboration can help rapidly answer to market demands. To be successful in this dynamic and globalized business world new business models, strategies, principles or technological solutions are needed. One of the most crucial issues is enterprise networking through efficient ICT based solutions.

European Commission in its former strategies presents the importance of networked future where ICT plays crucial role in enterprise networking. This issue played and still plays significant role in IST related framework programmes objectives. According to these objectives, business network environment should be based on interoperability, standardization, trusted environment and multidisciplinary research in this area as crucial success factors. The interoperability of enterprise

applications is especially important issue for the new collaborative business networks with self-organising, self-optimising and evolving features.

2. Rise and falls of electronic business networks

Generally, ICT based enterprise networking should bring to economy higher transparency, competitiveness and efficiency which should contribute to economic growth. During the past decade, where B2B e-commerce was presenting as new business collaborative concepts, many rises and falls were seen. Some called it as the golden age of B2B e-commerce, others as the height of insanity. The e-marketplace (EM) era was characterized by huge flow of capital into EM projects but in parallel huge rise of risk for entrepreneurs and e-market makers involved in supply chain innovation and experimentation. Despite of many best practices in this field, there still remain doubts about the perspectives of EM concepts. On the other hand, we cannot forget, that thanks to these innovators we have high value collaborative technologies for supply chains today as e-procurement or e-sourcing solutions in form of reverse auctions, supplier portals, standardization in business communication and exchanges, collaborative demand planning, etc. Although, some of successful marketplace technologies and solutions show, that the concept was proven and now it is the time to find way how to overcome constraints emerged within this period.

B2B e-marketplaces or sometimes called exchanges supported in new and efficient way a wide range of business processes. The history shows a different ways in these innovations. When we focus on e-services provisions we see two basic historical paths - centralistic and decentralistic. In pure centralistic approach, which dominated in the beginning of EM and general B2B e-evolution, electronic marketplaces were portals or platforms integrating huge number of potential business partners with functionalities for sourcing and negotiations. New added functionalities in collaborative processes as joint demand planning, just in time improvements, market information or other high effective solutions caused natural growth of EM solutions on the market. Decentralistic approaches, which were driven also by European Commission for example in their Digital Ecosystem concept, were focused on peer-to-peer approaches, where decentralization was crucial factor for ensuring lower technical risks, self-regulation and self-adaptation features.

Regardless of initial e-market maker incentives, e-marketplace concepts were based on removing information latency in the supply chain and enabling more transparent and efficient collaboration between participants on the market. The character of ICT networking for business which reflects mentioned benefits is primarily based on transparency. Low transparency reduces probability for new business interconnection and relations. Moreover, price transparency should reduce prices and increase quality of product and services, market transparency should reduce market entry and monopoly situations creation. The same benefits were basis for private networks based on EDI or other standards, although these concepts were more buyer-centric solutions as real market networking.

That's why enterprise networking and e-marketplace concept was naturally taken as a new economy model for doing business. But when we are looking back into past decade, too much of business network services failed in market penetration.

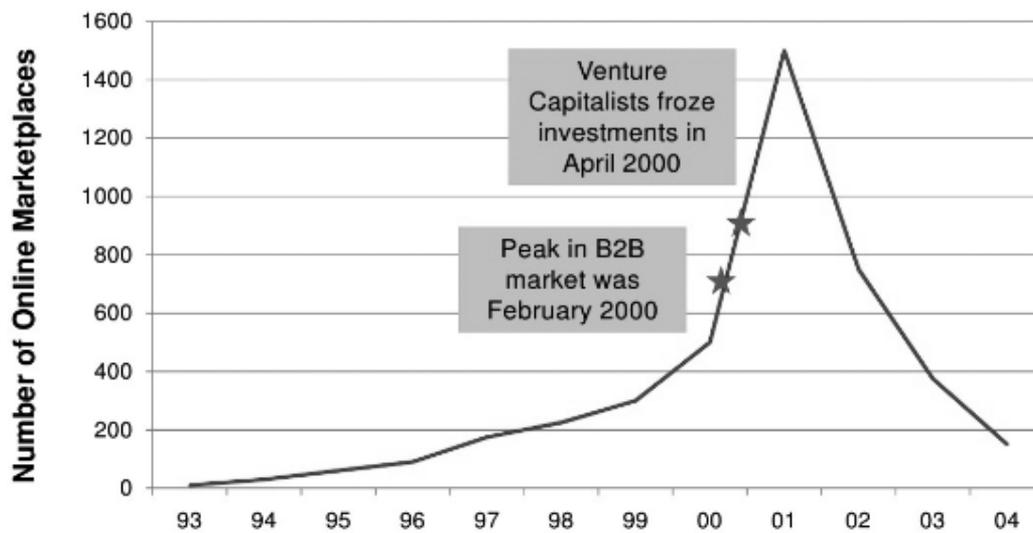


Fig. 1 The Shakeout in B2B Exchanges; Source: Day et al. 2004

When we compare successful and unsuccessful cases, we can identify more common features for this inconsistency in EM evolution:

Versatility in utility model – many of EMs were based only on price reduction feature through matching buyers and sellers of goods to achieve better price. It is similar to reverse auctions solutions where eRA providers are still convincing only with price (in better case total cost) reduction. But EM concept is based on broader range of criteria as trust building, information accuracy, contract execution support, effective planning, joint business or development actions and generally market intelligence.

Liquidity – EM or any networking concept is based achieving critical mass of users and products. Rapid growth of EMs was for someone paradoxically but logically as a weakness. The most effective EM in liquidity parameter is one single e-marketplace throughout whole traditional market to involve all active users in the economy. Rapid growth in the beginning of ICT based business networking caused logically high number of new platforms with insufficient number of participants. Difficulties in adoption of new standards, organizational and process changes also caused not very wide EM concept adoption and then low liquidity on the EMs.

Trust –EM solutions were new technological products which are characterized by low willingness to adopt and to trust. Trust in this field is possible to divide into three generic domains. Trust into the environment characterized by institutional and governance form and set of rules as code of conducts, trust into new e-technologies or services which should be integrated into existing business processes and trust into unknown parties which is crucial on the platforms integrating huge number of market subjects. Trust into environment is also determined by ownership model. EMs evolved into three basic organization and ownership models – consortia, private and independent marketplaces. Consortia and private marketplaces were characterized by owners’ incentives to conduct business on their own platform which was offered also to competitors or other market subjects. In this case, we see many initiatives taken by users against marketplace owners because of doubts in their objectivity and transparency. Many antitrust actions finished standard format of B2B vertical marketplace as in Covisint case. Low trust into unknown parties within many EMs was caused by absence of suitable trust building services and also services supporting long term relationships and loyalty building. Together, security issues raised as a crucial factor (Doucek 2008).

Integration – on one side, several EMs being freed from the limitations of legacy applications allow seamless usage of EM's services, absence of integration with internal ERP systems was also the disadvantage. Integration allows many features for optimization and automation. Although due to too deep transparency, the integration was often considered as risky solution. Especially in consortia and private marketplaces participants revealed through integration their "business secrets".

Cultural Resistance – Another factor marketplaces underestimated was cultural resistance. Part of (esp. older) managers have barriers to transition to e-marketplaces. Some culture, esp. in emerging market were still very strongly dependent on standard business habits based on face-to-face "secret" negotiations where trust in existing relations prevailed over benefits offered by EMs.

Moreover, *disintermediation* as a dynamics and more effective economic solution drivers threatened part of traditional supply chains. This was also the reason why long term contracts and other bundling practices slowed EM concept adoption. Last and not least factor was performance management based on innovative models (Gavurová 2011), where successful business strongly depends on exact formulation and measurement of objectives and processes.

Despite of unsuccessful cases, benefits and good practices remains and prove the benefits of enterprise networking concepts. Some of marketplaces such as Global Health Exchange (GHX), Exostar and Elemica have transformed their value propositions into a long-term business models. Several success stories as Alibaba, ChemConnect, Elemica, but also more private centric solution for sourcing provided by Ariba or other sourcing providers are examples of new and efficient ways how to conduct business in digital era and utilize network effect.

3. Economic constraints and opportunities for ICT based enterprise networking

Successful business examples mentioned above are still far away of the real enterprise networking concept supported by European Commission's strategies. Few efficient business networks based on really versatile functionalities and wide utility model are still rare and wide or single European ICT based SME's networks still absent. European initiative on European Single Electronic Market reflected necessary aspects for new networked economy, although the emphasize on platforms development and their market penetration get weak throughout past years and SMEs have still problem to find optimal suppliers or business partners and to utilize benefits of eCooperative and eCollaborative business networks. Is ICT based enterprise networking really worthy and how to manage networking evolution for the economy benefits?

First, we need to examine general economic benefits of ICT based enterprise networking or generally network effects in economy. Many studies deal with network effects and diffusion theories in innovations. Diffusion in our context is the adoption of ICT network services which implement us into the relevant network as an agent. Generally, the number of new adopters in a certain period of time is usually modeled as the proportion of the group of market participants that have not yet adopted the innovation (Weitzel et al 2003). Most of the traditional approaches focus on the relationship between the rate of diffusion and the number of potential adopters.

For modeling the diffusion of network effect products, three areas of deficit are eminent: critical mass phenomena are not sufficiently analyzed, real life diffusion processes cannot be explained, too, and the interaction of potential adopters within their socio-economic environment is not sufficiently elaborated (Schoder 1995).

Of course, the innovations diffusion models and strategies are important, but to examine the way how to adopt without proper understanding of “what will happen” is dangerous.

Network effect literature is generally based on the neo-classical assumptions where all agents not only know their own action space and utility function but likewise have a complete and realistic model of all the other agents' current allocation, action spaces and utility functions as well. In a neo-classical "exchange economy" this assumption may lead to a unique and Pareto-optimal equilibrium, but only in the case of no network externalities or indivisibilities (Weitzel et al 2003).

But real business and social world is more complex and suffer from high level of uncertainty and heterogeneity in economic environments which bounds effective decision making of socio-economic agents (Doucek 2004). Inefficiencies in traditional theories led Weitzel et al. (2003) to propose Interdisciplinary Network Theory, where a necessary condition for developing an operable view on networks was the one, that can be accepted by economists as well as researchers from social sciences is to incorporate the concepts of bounded rationality, uncertainty and incomplete information and social embeddedness. These assumptions are in line with our mentioned barriers and character of ICT based business networks. Bounded rationality is nowadays generally accepted assumption which complicated economic and social analysis. Although, game theory and other behavioral theories have significantly contributed to better understanding of bounded rationality and its impact. Uncertainty and incomplete information is in my eyes more significant problem related to ICT based business networks which definitely deals mainly with increased transparency and efficiency (which is based more on specific ICT services as networks as a infrastructure). In the incomplete information situation, uncertainty increases the cost of transaction or searching/sourcing. Such an externality harms economic environment and suitable IT networking services can significantly contribute to better business environment and trust within business relations. Increased transparency deals with uncovering market and market information by ICT and ICT based networks to all participants (Janke 2011). Generally, it should lead to market and price transparency where the transparency refers to the level of current trade (e.g. price) information accessible to participants by market makers (Ozcelik and Ozdemir, 2011).

When we consider size of the network we can accept the assumption that the increased number of network participants (size of the network), the increased level of market transparency. Nowadays we know only fragmented market with number of e-marketplaces. But through acquisitions and e-marketplaces and business networks interoperability, the single business network as a digital form of traditional market is possible. Of course, it requires some support by policy makers, ERP or legacy system providers and acceptance of companies. Within the single e-market, transparency will rapidly grow but what will happen with the prices, antitrust issues or wealth distribution?

3.1. Market and price transparency in B2B commerce

Increase in transparency in market and across global supply chains is crucial issue for most important economics from U.S. to European countries. Increasing market transparency contributes to price tracking and readability and results in higher market efficiency. This issue affects also Business-to-Business (B2B) exchange markets or business networks in general, which aggregate buyers and sellers around the world, causing the decrease in information asymmetry (Hansen et al., 2001). According to Zhu (2004), transparency becomes one of the key features that distinguish digital exchanges from traditional markets (Zhu, 2004). On vertical marketplaces suppliers can see who is selling which parts, at what prices, and in what quantities. In many other exchanges using reverse auctions, participants see all competitors and their bids, historical behavior and general market information.

Price transparency is considered also by OECD as important issue for increasing benefits of buyers unless it results in considerably increased risks of collusion among sellers. One way to describe price transparency is to refer to the costs in time and money required to discover actual transactions prices. The lower are the costs, the more transparent is the market. A certain level of price transparency is necessary for competition and to be able to compare prices. Some other studies are measuring level of transparency directly on B2B exchanges as a level of e-services providing tools for more transparent bidding and negotiation as for example reverse auctions (Soh et al., 2006). According to OECD (2001), under certain conditions, increased price transparency can in traditional market significantly increase the probabilities of conscious parallelism and anti-competitive co-ordination. In a sufficiently concentrated market, the process could start by one seller simply raising its price and watching to see if others follow. The price leader's risks in doing that are lower when sellers are quickly and accurately informed of price changes, especially if buyers are not. But this situation is not common for pure electronic market, where price information for buyers is almost perfect. In addition to facilitating conscious parallelism, increased price transparency could also encourage tacit or outright collusion by generally making it easier for co-operating firms to detect and therefore punish deviating firms. The situation in electronic market is more effective as broadness and distance free character of information in electronic channels support multi-cooperative consortium creation which reduces parallelism from this point of view.

Summarization of negative aspects of transparency presented by another studies (Soh et al 2006; Zhu 2004; Ozcelik and Ozdemir, 2011; Gu and Hehenkamp, 2010) are as follows:

- High price transparency negatively affects sellers what can be solved through compensatory benefits or differentiated strategies. As e-markets are place for both side of players as buyers and suppliers, price transparency should be managed in optimal way between them.
- In the case of fewer sellers and highly differentiated products high price transparency is unlikely.
- Certain types of companies (e.g., high-cost suppliers of substitute products) will lack the incentives to join the exchange as information transparency hurts more than helps them. In contrast to the widely held belief about its benefits (the so-called information transparency hypothesis).
- Price and market transparency is sometimes in contradiction to anonymity and confidentiality requests of participants.
- Too much market transparency harms competition when entry becomes less profitable and hence less likely. As a consequence, market breakdown occurs more and oligopoly less often, both of which effects reduce welfare. As the main result of Gu and Hehenkamp (2010) shows, the welfare-diminishing effects dominate when markets are sufficiently transparent.

Generally, price and market transparency is very difficult to measure and most of studies rely on game theories and strong assumptions in their models which often are in contradiction with many real situations. But the message of these studies is logical and clear: on one hand price and market transparency have positive impact on prices and quality for buyers, on the other hand it is the barrier for seller to enter the e-market. Market transparency needs to accept some level of confidentiality in some cases.

3.2. Monopoly creation in business transparent networks

Networking concept from our point of view is similar to perfect and transparent market with high competitive pressures. This character could lead us to accept the assumption that no monopoly or oligopoly is possible to be created in such networks. According to several studies, network effects are an important factor that determines market structure and the results observed in Internet markets (Kesan and Gallo, 2003).

Within past decade, two kinds of monopoly related to electronic marketplace or ICT based business networks emerged. First, is monopoly of EM providers, where networking platform plays role of natural monopoly. Example can be seen in Covisint or other marketplaces. In this case, each player on the market is interested in joining bigger group of potential business partners. That's why they prefer platforms with already high number of participants. It leads into natural form of monopoly as all marketplaces or networks with lower number of participants are discriminated through their value. Although this leading marketplace has significant benefit, it doesn't assure the winning position in long term period as it was shown by Covisint case. In natural monopoly, participants have to be satisfied with services and have to have high trust into the environment. Antitrust policy can play a significant role in determining inefficiencies in this field. But this monopoly creation is possible only in fragmented market as for example situation within past decade.

Another form of monopoly is characterized of monopoly creation within the network. Only small number of studies deals with monopoly and antitrust issue within ICT based networks as for example big B2B vertical or horizontal marketplaces. The most efficient network evolved in the future, where all marketplaces or business networks will be integrated and interoperable in one single electronic market with characteristics which will reduce opportunities of monopoly creations. Of course, in traditional theory also in the transparent market it is possible to create monopoly situation. In OECD report (2001) which deals with traditional market, presents the impact of several factors influencing how increased price transparency could affect the probability of anti-competitive actions exist. For example, market and product characteristics, type of transparency based on marketplace governance (in the case of e-marketplaces) or degree of aggregation, age and type of information exchanged. Most of these factors are obvious for traditional market where physical distance plays a role in obtaining perfect information and are able to be avoided through wide electronic network environment with suitable electronic services. In general, we can say that anti-competitive actions in electronic environment are more problematic as in traditional market.

According to Kesan and Gallo (2003), the Internet opened the gates for a new era of more competitive markets. However, they found that specific characteristics of the network in which markets operates in the Internet do not necessarily enhance market competition. They observed in longer period that the number of competitors shrink and market structure becomes more concentrated. We find that the level of investment is higher in the case of competition and the benefits are higher under a monopoly. It means, companies will have incentives to control the market by investing strongly in the first period and to then reap monopoly profits for example by developing non-compatible technologies or product to bound other players.

They argue that firms will still want to develop different strategies to control markets and decrease competition. This kind of anti-competitive actions and monopoly incentives are traditional to human and business being because of dominant objectives to earn and gain more. But this is not related to changing traditional environment into digital space or networks.

Despite of small number of studies in the field of monopoly and anti-competitive actions in wide electronic business networks we can follow the main assumptions - the higher transparency and wider network with low cost of entry, the less possibility to act anti-competitively or at least

because of social network concept and reputation building higher probability to act as efficient monopoly. Efficient monopoly is in line with Schumpeter’s opinion, which didn’t see the conflict between competitiveness and monopoly. In dynamic market process, the competition is enforcing through innovation process. It is absolutely different from neoclassical approaches, where monopoly and competitiveness shows opposite sides. In wide network systems, savings are generating from network effects and size of production and network effects and monopoly are closely interconnected. In new network economy, also small companies can be successful and after that they can play temporary or efficient monopoly in trusted network environment.

3.3. Distribution of wealth, trust and innovation potential

Finally, when we consider the network and transparent character of future market, we need to focus also on wealth distribution. It reflects price reductions and lower anti-competitive situations, where the financial flow is reduced and more sources remain equally distributed among all market participants. On the one hand, it can be perceived as positive feature as most of participants will have higher financial sources for future actions or their development. On the other hand, it can cause paradoxically the slowdown of innovations in economy.

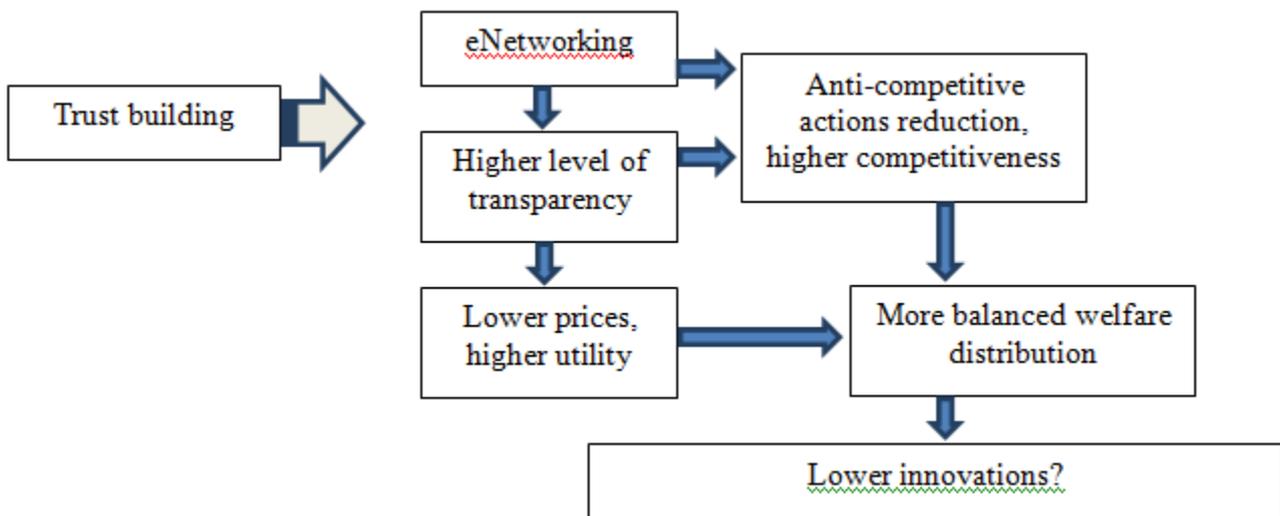


Fig. 2 eNetworking impact

More balanced wealth distribution will disable to aggregate higher financial source for bigger innovation projects by former quasi monopoly players. Although, it doesn’t necessary means, no innovation process will continue. Financial instruments for funding new innovative projects will still remain. Only ineffective monopoly aggregation of sources will be reduced. The social networking approaches through reputation building models in new business networks will regulate more effective and efficient wealth redistribution and seem to be most crucial factor for sustainability and efficient development.

4. Conclusion

The current business environment is affected by ICT innovations which lead to electronic business network development. Some of B2B electronic marketplaces, which were successful in past decade, have proven network concept for B2B future also in more fragmented form. Wider B2B networking through electronic marketplaces acquisitions, integration with legacy systems and mutual

interoperability would lead to single electronic market with new characteristics as higher transparency and competitiveness. It will cause price reduction, increase in quality of products. Although, electronic business networking concept should lead to perfect information, competition and transparent market; some externalities can emerge. Despite of small number of inefficiencies presented in studies mentioned above, wide business network supported by ICT infrastructure and services can lead our business environment to more effective and competitive place with new perspectives. Although, the suitable trust building mechanisms are necessary to play self-regulative role and reduce potential externalities in form of anti-competitive actions. One open issue remains – will price reduction and higher transparency lead to lower innovations through more balanced capital or wealth distribution? I hope not. Networking concept will never affect the financial instruments for funding new innovative projects in inefficient way.

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B2B NETWORK PERFORMANCE: PRACTICAL ASPECTS OF NETWORK SUPPLY ADEQUACY INDICATOR

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Keywords

Business Market Statistics, B2B Network, Index, Indicator, Electronic Reverse Auction, Business Data, Supply, Demand

Abstract

Adoption of different B2B networks leads to the increased efficiency of the networked companies' business processes. Cornerstones of this increased efficiency are enhancements in collaboration, communication and knowledge flow inside of the companies. The potential of business network's impact on companies' efficiency is still not depleted as network gathers different information about the networked environment. This can be used for assessment of either companies or the whole network in order to perform in more efficient way. This idea was elaborated by Janke in 2011 resulting in the concept of Adequacy of Network Supply Indicator. This paper presents the practical issues connected to implementation of the indicator in case of electronic reverse auction as a procurement tool. At the end of the paper, the presented approaches are supported by practical examples based on real data of a private and a public company and first results are discussed.

1. Business networks and companies' performance

In recent years, the adoption of business-to-business (B2B) networks and the digital business ecosystems have been discussed and deployed in order to provide space for easier cooperation among companies and other actors. A B2B network, the structure in which different nodes presented by companies are related to each other by specific threads presented by relationships between them (Håkansson and Ford, 2002), helps companies to communicate and collaborate in easier way. The digital business ecosystem, developed later on, enhances the communication and collaboration advantages of B2B network by introduction of collective learning and knowledge flow among actors (Van Egeraat and Curran, 2010; Nachira et al., 2007). In both cases, networks are based on ICT solutions.

Business networks, besides providing space for easier companies' communication, collaboration and eventually knowledge sharing processes, aggregate market data describing companies' everyday behaviour (Janke, 2011). The data can be used for different analyses depending on companies' needs. As Janke (2011) states, this business market data include companies' behaviour in procurement processes describing for instance:

- demanding processes (e.g. number of requests for information – RFI, proposal - RFP or quotation - RFQ),
- the way, the procurement was conducted (e.g. number of invited suppliers, number of suppliers that attended the selection procedure, what mechanism was used for procurement negotiations),
- results of procurement processes (defining e.g. the winners, disqualified, final price),
- time sequences (e.g. suppliers' reaction time needed to send quotation, information),
- levels and changes in companies' reputation (e.g. rating and references).

Monitoring this data brings brand new space for further company's internal processes optimisation, as in not networked conditions, companies have been able to collect information concerning merely their own behaviour (Novotný, 2009). Companies' managers have been using different evaluating metrics for companies' processes in order to make decision making more efficient. (Kaplan and Norton, 1992), (Maskell, 1991) and recognizes financial metrics for strategic goals evaluation and non-financial metrics for operational assessment. Balanced Scorecard System and its usage is mostly discussed (Kaplan and Norton, 1992 and Gavurová, 2011). Concerning procurement processes, (Stewart, 1995), (Gunasekaran et al. 2004) and (Delina, 2004) provide metrics which can be used for increasing the efficiency of supply chain management (SCM).

As market aggregated data concerning companies' behaviour is available, brand new analyses can be conducted. Companies and other network actors can now assess its behaviour in contrast with other companies or actors (benchmark analysis) or can analyze business network (partial market) conditions in a different way. Hence, this newly gathered business data concerning companies' "everyday" behaviour acts as a new source for different analyses for better decision making in order to increase the efficiency of business processes.

In networked business environment, the basic goal of company's processes optimisation is amended by the goal of the whole network optimisation. A modern business-to-business network provides very complex inter-correlations between its various actors (i.e., the suppliers, manufacturers, distributors, customers, etc.) based on material, data and financial flows (Harland 1998). The optimisation of such a network is therefore very complex problem. Generally, two types of supply network optimisation problems can be distinguished:

- network flows optimisation - the goal is to optimise the flows of goods/information/money through the network without changing its structure,
- network design or re-design: the goal is to find the best configuration of facilities and relationships in order to satisfy the goals and reduce the complexity of the network structure.

Concerning the measurement of network efficiency, several theoretical and practical issues were discussed. Four types of approaches can be identified (Allesina et al., 2010):

- Introductions and/or general studies. The whole problem of supply chain performance management and control is presented, and the complex features of a modern supply network are underlined, with a large set of supply chain performance indexes and software packages being introduced to support the decision making and mapping of the supply network (i.e. Huan et al., 2004; Tan and Platts, 2004).

- Statistical approaches. Analysis of the correlation between qualitative measurements of complexity and general network performance indexes (i.e. Milgate, 2001; Perona and Miragliotta, 2004).
- Entropic models. Mathematical models derived by the ‘entropy of information’ (developed during WWII for measuring and separating information codes, (Shannon and Weaver, 1948) that quantify the complexity of network and manufacturing systems (i.e. Frizelle and Woodcock, 1995; Calinescu et al., 1998; Sivadasan and Efstathiou, 2002).
- provide support to companies in a complex networks, populated by a great many actors. The authors, however, did not discuss the problem of complexity in the networks, but rather emphasised the need for studies on this important topic, justifying and validating the aims and objectives of the present research.

Mentioned works discusses the effectiveness of network according to material, financial or information flows. Other example of network performance evaluation, presented by Janke (2011), is based on the idea of market supply and demand equilibrium formation. The goal of such an optimisation is to ensure, the number of network participants is high enough to perform everyday business activities. In other words these measurements help answer the question, whether the network supply is “adequate” to the network “demand”. The brief concept of Janke’s (2011) indicator is described in following part. Later on, the practical issues connected to implementation of this proposed indicator will be discussed.

2. Network Performance Indicator - Adequacy of Network Supply

In this part, the basic concept of Janke’s (2011) business network performance indicator will be presented. Following text is therefore mainly based on mentioned work.

Adequacy of Network Supply Indicator refers to economic situation among networked companies. This indicator is therefore related to only network members and it describes the relations between network demand and network supply. The purpose of this indicator is to assess the network, whether the number of companies on network’s supply side is adequate to number of companies on network’s demand side.

To describe the network demand on the electronic business network the Request for Quotation (RFQ) was chosen. RFQ presents the request sent from buyer to supplier(s) to quote the price for the product, which is precisely defined. The RFQ therefore presents company’s interest to buy some product/service, what can be understood as demand. The other procurement requests – Request for Information and for Proposal) will not be utilized as demand indicators although they present companies’ interests to buy a product/service, as the procurement procedure ends with the RFQ.

Before presenting the proposed formula for the indicator calculation, the process of sending RFQ and possible reactions of supplier ought to be recalled. After company sends RFQ to specific potential supplier, what presents company’s interest to buy a product/service, supplier can response in following way (Janke, 2011):

1. supplier sends the price,
2. supplier does not send the price, with one of following reasons:
 - a. supplier does not produce or sell this product,

- b. supplier produces or sells this product but is not willing to answer because of various reasons,
- c. supplier missed incoming RFQ.

As missed incoming RFQ by supplier is considered to be rare due to various notifications which can be used in electronic business interfaces, excluding this option, the possible situations can be renamed in following way:

- possibility 1. presents *positive reply* for RFQ from supplier,
- and all possibilities 2. (*a, b, and c*) can be understood as *negative replies* for RFQ from supplier.

As RFQ presented the demand of company, positive reply for RFQ presents the supplier's supply. Aggregation of networked companies' individual demands/supplies for specific product/service equals to network demand/supply for this product/service. Dividing network supply by supply demand for specific product/service, the Adequacy of Supply Network is calculated (Janke, 2011).

$$ANSI = \frac{R^+_{RFQ}}{RFQ} \quad (1)$$

where

ANSI Adequacy of Network Supply Indicator,

R+RFQ the number of positive replies for RFQ received by companies for specific product/service during specific period of time,

RFQ the number of all RFQ sent by all the companies for specific product/service during specific period of time.

The value of the indicator is a part of interval from 0 to 1. If the value of ANSI is high, companies meet mainly positive replies for their RFQs sent, what means that network supply is adequate to network demand. On the other hand, if the value is close to 0 (or if it is becoming close to it), companies receive mostly negative reply which means that network supply is not adequate to network demand. The information whether business network needs more suppliers providing particular product, can be used by different actors on the network. Firstly, it can be useful information for business network "caretaker" (or manager) who can increase the efficiency of business network processes by inviting new external suppliers (not network members) of particular product or service. Secondly, external companies producing similar products/services to product/service, which are indicated as scarce by this indicator, might be interested to transform their production to produce this scarce product/service.

3. Practical aspects of ANSI deployment

3.1. Database

Procurement has been performing through electronic reverse auctions – dynamic procurement tool enabling competition among invited suppliers. The data collection has been provided in a raw format and it contained various information related to the electronic auctions performed.

3.2. Related database attributes

To fill the formula 1 with the numbers, the mapping of the indicator variables (R+RFQ, RFQ) with the database is essential. Variable RFQ presents the number of all RFQ sent by all the companies for specific product during specific period of time. In our example database, this number equals the total number of all invited companies to the electronic reverse auction for specific product during specific period of time. Concerning the table and cells, we can find such information by counting all the suppliers that have been invited to the auction.

Attribute name	Attribute description	Relation of this attribute to ANSI
DT_LOGIN	It contains date and time of the last supplier’s sign in to the electronic auction system	If this field is not empty, it indicates that the supplier not only signed up, but signed in to the auction, too.
DT_BID_CHNG	It contains date and time of the last supplier’s submitted bid	If this field is not empty, supplier submitted at least one bid in any of the auction rounds.
SEC_KEY	Database record storing information about the security key that has/has not been used by the supplier.	If the key has been applied, it indicates that the supplier did register for the auction.

Table 1 Description and usage of selected database attributes for ANSI purposes; Source: own table

R+RFQ presents the number of positive replies for RFQ received by companies for specific product during specific period of time. In our example database this number is presented by three different attributes: DT_LOGIN, DT_BID_CHNG and SEC_KEY. The description of these database attributes, as well as their application, can be found in Table 1.

Additionally, one more attribute has been considered during the evaluation period – USR_NM. This attribute stores the information about supplier’s user name that was provided by the supplier during the registration process. If this field is not empty, it indicates that the supplier has signed up, however supplier still does not have to submit a bid in. Although this attribute might be used for analyses as well, this data is considered to be highly sensitive by some companies, as it presents their supply chain. This was also the reason why one company did not provide us with this information. Therefore, for future ANSI calculations, this attribute might be missing in some databases and that is the reason why it will not be part of further analysis.

3.3. Adjusted indicator formula

Based on mapped attributes, the concept formula of ANSI needs to be rewritten in adjusted versions depending on the chosen database attribute:

$$adj_1ANSI = \frac{\sum_{i=1}^n DT_LOGIN \neq null_i}{\sum_{i=1}^n ALL_SUPP_i} \quad (2)$$

where

adj₁ANSI Adjusted Adequacy of Network Supply Indicator (1st variation),

$DT_LOGIN \neq null_i$ the sum of all the suppliers that logged in to comparison round of the i 'th auction,

ALL_SUPP_i the sum of all the suppliers that have been invited to the i 'th auction,

n the number of auctions.

$$adj_2ANSI = \frac{\sum_{i=1}^n DT_BID_CHNG \neq null_i}{\sum_{i=1}^n ALL_SUPP_i} \quad (3)$$

where

adj_2ANSI Adjusted Adequacy of Network Supply Indicator (2nd variation),

$DT_BID_CHNG \neq null_i$ the sum of all the suppliers that submitted at least one bid in the i 'th auction

ALL_SUPP_i the sum of all the suppliers that have been invited to the i 'th auction

n the number of auctions

$$adj_3ANSI = \frac{\sum_{i=1}^n SEC_KEY \neq null_i}{\sum_{i=1}^n ALL_SUPP_i} \quad (4)$$

where

adj_3ANSI Adjusted Adequacy of Network Supply Indicator (3rd variation),

$SEC_KEY \neq null_i$ the sum of all the suppliers that use the security key in the i 'th auction (in other words they did register for the auction),

ALL_SUPP_i the sum of all the suppliers that have been invited to the i 'th auction

n the number of auctions

3.4. Practical Example

In the following section, numerical examples of ANSI variations usage will be provided. All calculations are performed using the real business data describing electronic reverse auction selection procedures. The data were provided by two companies – public transport company and private energy company.

Both companies provided data from year 2008 to 2011 with the total number of 5018 auctions performed.

Fiscal year	adj ₁ ANSI		adj ₂ ANSI		adj ₃ ANSI	
	Annual index	Annual change in %	Annual index	Annual change in %	Annual index	Annual change in %
2008	0,6516		0,7383		0,5487	
2009	0,8940	37,20%	0,9161	24,09%	0,7704	40,40%

2010	0,8939	-0,01%	0,9407	2,68%	0,7513	-2,49%
2011	0,9200	2,92%	0,9100	-3,26%	0,7500	-0,17%

Table 2 Overall ANSI results – public transport company; Source: own table

Fiscal year	adj ₁ ANSI		adj ₂ ANSI		adj ₃ ANSI	
	Annual index	Annual change in %	Annual index	Annual change in %	Annual index	Annual change in %
2008	0,1937		0,5141		0,3006	
2009	0,2833	46,25%	0,4898	-4,72%	0,2248	-25,22%
2010	0,2875	1,50%	0,5523	12,76%	0,2122	-5,59%
2011	0,3111	8,19%	0,4046	-26,75%	0,1932	-8,98%

Table 3 Overall ANSI results – private energy company; Source: own table

In tables 2 and 3, results for different variations of ANSI for all the procured products/services (not specifically for one product family as proposed in Janke, 2011) are provided for available years. As we can see, in both companies' cases although the values are quite different, the final trend in years is quite common. Both companies scored the lowest percents in the first year of using electronic reverse auctions with the exception of adj₂ANSI and adj₃ANSI of private energy company. Moreover, decrease seen from 2008 to 2009 in adj₂ANSI is negligible only -4,72%. For the rest of the cases, both great increase of the value of the index and convergence to the "reference" value can be seen. Lower scores in the first years of using electronic reverse auctions can be caused by discomfort perceived by invited suppliers. Normally, the decrease of suppliers' interest is observed, when the buying company forces them to compete in a "virtual room". This rule will probably be seen in most of the companies.

The difference between these two samples is vivid when the absolute values are contrasted - public transport company has adjusted ANSI variation 1 at the level of app. 92%, whereas private energy company scored app. 31%. This situation can be caused by various reasons, but mainly by difference in:

- industries they operate in,
- products and services that are being procured,
- financial situation,
- relationships with their suppliers.

Once the differences in ANSI between the two companies have been discussed, we focus on the results of the three versions of ANSI regardless of the type of the company. If the critical criterion for the evaluation of the ANSI indexes is the variance, the most suitable version of ANSI seems to be the adj₁ANSI. As we can see in the tables 1 and 2, adj₁ANSI is the most stable version of ANSI. In the case of public transport company after the first year increase of more than 37%, there is no change between 2009 and 2010 and only slight growth of 2,92% from 2010 to 2011. Similarly, in the private energy company's case after the strong increase in the first year, slight growth of 1,50% and 8,19% can be seen from 2009 to 2010 and between 2010 and 2011 subsequently.

The second approach is based on the assumption that the higher value of the ANSI is, the better. This theory considers original definition of the concept formula of ANSI, where any positive reply

should be taken into account. In this case, the most preferable variation of the formula would be adj_2ANSI as its values for public transport company range from 0,7383 in the first year and 0,9407 (maximum value between 2009 and 2011), while in case of private energy company values are significantly lower, but yet the highest comparing to the rest of the indicators, ranging from 0,4046 to 0,5523.

4. Conclusion

A modern business-to-business network provides brand new opportunities for further optimisation of company's internal processes. In 2011 Janke proposed an indicator of market supply and demand equilibrium formation. Adequacy of Network Supply Indicator uses concept of RFQ. Total number of RFQ presents the demand and positive reply for RFQ presents the supply.

In this paper, given electronic reverse auction system has been analyzed and relevant database attributes, for the purpose of the ANSI calculation, have been identified. The three approaches presented in this study prove that the ANSI formula is not only a theoretical concept hardly applying in the real business environment, but it is a result of a deep expertise of the procurement processes and namely electronic reverse auction systems.

Every variation of ANSI has its own strengths and weaknesses. As was mentioned in the practical example there are several approaches (e.g. lowest variability, highest average number of positive replies) that could be considered when deciding on the right formula.

Although the results of the practical example look promising, there are several limitations that have been identified:

- Different family products have not been considered, but general ANSI for all the products/services has been calculated instead.
- The level of product/service strategic importance (e.g. according to ABC analysis) has not been considered,
- Differences in industry sectors.
- Data pre-processing is a serious issue if the company procures thousands of products/services every year.

These limitations need to be overcome in the future if the concept is about to be implemented in the networked business environment.

Finally, one more thing needs to be considered - the values of ANSI are significant only when calculated for the whole network and for specific product/service family as proposed by Janke (2011). Suppliers' unwillingness to attend the electronic auction of particular company is not serious problem for the efficiency of the whole network. The problem occurs when there are not enough companies in the network and this lack is perceived by customers as this situation will result in the increase of prices in short-run. Therefore it is still to be seen, whether any variation of the ANSI is robust enough to answer the question: Is the network supply 'adequate' to the network 'demand'? But this question remains open for further research, as the aim of this paper was to map the proposed indicator concept with real database attributes and proposed first practical example on the set of auction data.

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TRUST IN ENTERPRISE NETWORKING: AN AGENT-BASED APPROACH

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Abstract

The presence of well-doing small and medium enterprises (SMEs) in the economy is considered to be one of the key elements of the sustainable economic growth. In today's economy, which is widely supported by the means of information and communication technologies, the enterprise networking problem is of particular interest. The key problem within this area is the trust among business partners. The paper presents a new approach to the analysis of trust relationship in the networked business environment. Based on the Schelling's segregation model, which is a well known agent-based model used in socio-economic research, a series of simulations is performed and analyzed in order to determine the evolution of business partnerships in function of the business partner's credibility.

1. Introduction

Sustainable economic growth is one of the key objectives of the European Union. Very important source of economic growth are small and medium enterprises (SMEs), which contribute to gross domestic product (GDP) and employment in market economies at crucial rate. The European Commission published in 2012 a study analyzing the important role small and medium sized enterprises play in EU economies (European Commission, 2012).

SMEs operate in a competitive environment of its region, country as well as internationally. In addition to competition, SMEs are also cooperating, creating the network (or cluster) of cooperating companies. With dynamic development of ICT and its use by SMEs, the possibilities of cooperation and networking of customer-supplier relationships are expanding. Business-to-business (B2B) networks are emerging with support of ICT tools to provide easier cooperation among companies. Thanks to development of electronic business and intense use of ICT, networking of SMEs is accelerating and SMEs can cooperate in wider geographical radius (Delina, 2011).

In SMEs networking process mutual trust between SMEs in given network is crucial. Trust is an important for effective and efficient collaboration of organizations. Every enterprise creates the network of trustworthy enterprises with whom it is willing to do business or collaborate. In the case of losing the trust in enterprise, it is excluded from the network. Network of trustworthy SMEs

represents a cluster cooperating subjects, while those untrustworthy are displaced out of cluster. Building of trust is a complex process dependent on number of parameters and factors, whose hierarchy can differ in every single SME. Trust can be based on historical good business relationship with given enterprise. Some experts recognize trust from the security point of view (Salam, A.F. et al., 2005). In case of electronic business on B2B level the trust in selling company is crucial for buying decision of a buying company, while sellers are not well known to the buyers in electronic environment (Lee, Turban, 2001). Famous political economist Francis Fukuyama (1995) acclaims the level of trust in society as far as a key aspect of economic growth and prosperity in given economy.

2. Network of SMEs and Trust

Trust is usually specified in terms of a relationship between a trustor and trustee. The trustee is the subject that trusts a target entity i.e. the entity that is trusted. Trust forms the basis for allowing a trustee to use or manipulate resources owned by a trustor or may influence a trustor's decision to use a service provided by a trustee. Based on the survey of Grandison and Sloman (Grandison, T., Sloman, 2000), trust, in the e-services context, is defined as: "the quantified belief by a trustor with respect to the competence, honesty, security and dependability of a trustee within a specified context". Also distrust is defined as: "the quantified belief by a trustor that a trustee is incompetent, dishonest, not secure or not dependable within a specified context".

Trust building process in network of SMEs can be considered in terms of topology in two types. First one assumes the existence of a central subject, which the participating SMEs trust to and they conduct their business through it. This central subject (web information sharing platform, e-marketplace, e-auction, etc.) creates and grants trust among the members of such group of SMEs. This model can be called a model of centralized trust. Building trust in this type of arrangement has been the subject of various articles and projects (Delina et al, 2007), (Guliano et al, 2007), (Mihok et al, 2008).

The second type of arrangement of the participating SMEs is network of the P2P type (peer-to-peer). This topology is composed of all subjects at the same level and rate their trustworthiness may depend on various factors. Elementary structure of the trust is a triangle of trust in which trust between two entities transfers further. This trust model can be called a model of distributed trust.

The focus of our contribution will be on the second type of arrangement SMEs in the business network. Using agent based modeling the emergence of so-called "clusters of trust" will be simulated.

3. Methodology

3.1. Agent-based modeling

Fully networked environment of SMEs represents a complex system because it contains a set of interacting enterprises which are maintaining business relationships with each other. Furthermore, these interactions change and evolve over time, i.e. the enterprise decides to change business partners because of the changes on the market. These characteristics of SMEs networked environment comply with the definition of complex adaptive systems (CAS) as described in the paper from Tesfatsion (2007).

For the purposes of CAS modeling, the agent-based approach can be used. This modeling technique gains on popularity in the last decades in the field of social and economic simulation. According to Farmer and Foley an *agent-based model* is “a computerized simulation of a number of decision-makers (agents) and institutions, which interact through prescribed rules” (Farmer and Foley, 2009). For the review of current state-of-the art in the field of agent-based modeling we recommend to consult the handbook edited by Tesfatsion and Judd (2006), paper written by Heath et al. (2009) or a discussion from Epstein (2008).

The agent-based models have been used for the modeling of trust relationships in different environments. Trust among different agents in supply chain is analyzed via agent-based approach in (Tykhonov et al., 2008). The effects of a trust mechanism on complex adaptive supply networks are treated in the paper by Kim (2009).

3.2. Schelling’s segregation model

American economist Thomas Schelling presented in his two papers (Schelling, 1969 & 1971) a very simple agent-based model of racial segregation in the USA. He studied the preferences of people regarding the willingness of having neighbors of the same color. His original model showed that even a slight preference for having the neighbors with the same color can lead towards a total segregation. This means that even people which are relatively tolerant regarding the preference of race will tend to live in the neighborhoods where there is a majority of inhabitants having the same color they have. At the beginning, Schelling’s segregation model has found its applications in the study of demographics and urban development, but later it has made an impact in social sciences and economics, too (Singh, 2009).

Despite the fact that the initial setup of this model depends of the spatial configuration of the individuals (agents), it has been demonstrated that Schelling’s model is a viable alternative also for the models where there is no strict geography-dependent configuration of entities. An example of such an application is the study of peer-to-peer computer networks presented in (Singh and Haar, 2004).

3.3. Experiment setup

In our research, we have opted for the Schelling’s segregation model in order to demonstrate the trust relationships among SMEs in networked environment. Every SME represents an agent which has its status towards other business partners (trustworthy or dubious). The main aim of the model is to demonstrate the interactions among enterprises and to analyze their preferences towards the cooperation with the business partners which cannot be trusted. The analogies between the components of Schelling’s model and our model for trust in enterprise networking are summarized in Table 1.

In order to be able to configure and perform the experiments, which are described in the next subsection, following assumptions had been made:

- The environment in which SMEs (agents) interact is *a world* represented by an $n \times n$ square matrix (or a grid). This world represents a simplified model of economy where the enterprises interact.
- Every cell in the grid can be either *vacant* or *occupied* (by an agent).
- The ratio between the number of occupied cells and total number of cells, referred as *population density*, is constant and set before the beginning of the experiment. It means that the number of SMEs in the economy is not changing within the simulation.

- There are two types of enterprises (agents): *trustworthy* and *dubious*. Furthermore, in this simplified model, we assume that enterprise status does not change over time.
- In the model the proportion of *trustworthy:dubious* enterprises is 50:50.
- The interactions of the agents are modeled in discrete time $t \in (1, 2, \dots, t_{total})$. The total number of iterations is denoted t_{total} .
- Every agent has perfect information about the trustworthiness, i.e. the type, of its partners who are modeled as neighbors of an agent.
- In our experiment we consider as neighbors of an agent (i.e. business partners) the agents within the Moore neighborhood of our agent (the agents at a Chebyshev distance of 1).
- The agent changes its business partners (it randomly relocates on the grid) if the threshold criterion of trustworthiness T is not met.
- The only two parameters, which are not fix, are the trust index T and the percentage of vacant cells v (Note that the real number of agents in the world N changes too, because it is a function of v).

Component	Schelling's segregation model	Our model of trust in enterprise networking
<i>World</i>	a city, a county, an urban area	an industry, a national economy
<i>Agent</i>	a person, a citizen, an inhabitant	an enterprise
<i>Key Characteristics</i>	race of a person (e.g. white or black)	credibility (trustworthy or dubious enterprise)

Table 1: Comparison of models

The description of the key model parameters, in accordance with aforementioned assumptions, is given in Table .

Notation	Parameter
n	Dimension of the world (n rows and n columns)
n^2	Maximal possible number of agents (enterprises)
v	Percentage of vacant cells
N	Real number of agents ($N=(1-v)*n^2$)
T	Trust index (i.e. number of neighbors that have the same status: either <i>trustworthy</i> or <i>dubious</i>). If we consider the Moore neighborhood, $T \in \{0, 1, \dots, 8\}$

Table 2: Parameters of the model

3.4. Simulation

The simulations and their analysis were performed in the open-source statistical programming tool *R Project for Statistical Computing* (R Development Core Team, 2011). For the purposes of the development of computing resources used in our analysis, the existing implementations of Schelling's model in R language, as well as the implementation in NetLogo software (Wilensky 1997 & 1999; Iozzi, 2008), were used. The outputs of the simulations are summarized in this subsection.

In order to determine the behavior of enterprises in an environment with mixed types of business partners, trustworthy and dubious, we have performed a set of experiments. We observed the interactions among respective agents, more specifically the modification of relationships based on different levels of credibility. Initial distribution of enterprises in the economy was randomly selected. After the initial setup, all agents assessed the quality of their business partners in every discrete time period t . Every enterprise E checked in its Moore neighborhood the number of enterprises with the same status as it had. If this number was lower than the requested level of trust index T , the enterprise E relocated in the grid (i.e., it had changed completely its business partners).

We have performed a set of four experiments with different values of T and ν . The configuration of each respective experiment is described in the Table . The setup of experiment B (the values of T and ν) corresponds to the original configuration used by Schelling in his works, initial setup of the other experiments is taken from Singh et al. (2009).|

Experiment	Dimensions ($n \times n$)	Trust index T	Percentage of vacant cells ν	Real number of agents N
A	100 x 100	3	10%	9 000
B	100 x 100	3	33%	6 667
C	100 x 100	4	2%	9 800
D	100 x 100	4	25%	7 500

Table 3: Experiments' initial configuration

The results of experiments in visual form can be observed in Figures 3-6. Grey color in the legend represents those enterprises which are considered being trustworthy, the white color is reserved for the dubious ones. All vacant spots are represented by black color.

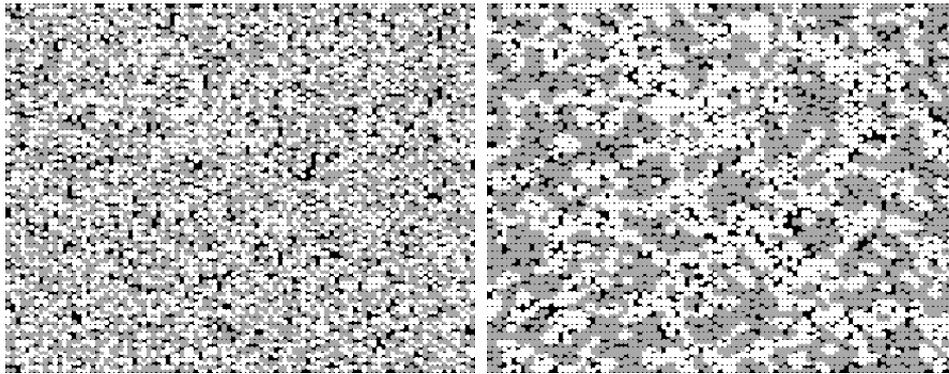


Figure 1: Experiment A ($T = 3$, $\nu = 10\%$) – initial situation (left), stable state (right)

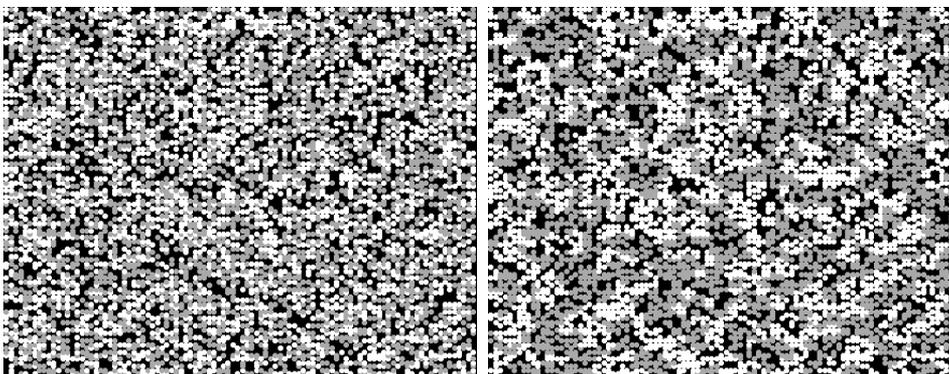


Figure 2: Experiment B ($T = 3$, $\nu = 33\%$) – initial situation (left), stable state (right)

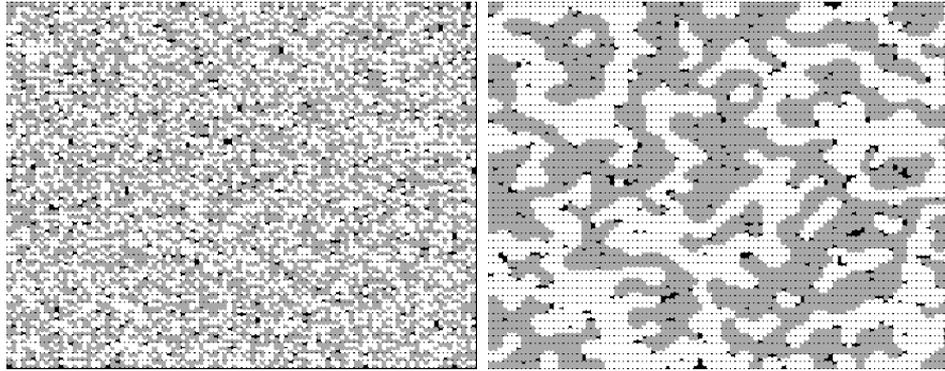


Figure 3: Experiment C ($T = 4$, $\nu = 2\%$) – initial situation (left), stable state (right)

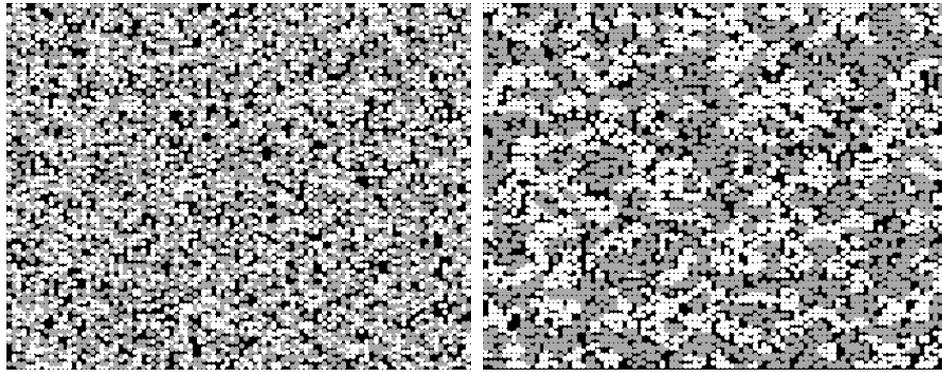


Figure 4: Experiment D ($T = 4$, $\nu = 25\%$) – initial situation (left), stable state (right)

In every experiment the stable state was achieved after finite number of iterations (i.e. relocations of business units in the grid). Because the initial configuration was set randomly, every experiment was repeated 10 times in order to determine average number of iterations. The results of simulations' runs are presented in Table .

Experiment	Minimum	1 st quartile	Median	Mean	3 rd quartile	Maximum
A	2310	2390	2399	2387	2408	2411
B	1883	1930	1953	1946	1957	1999
C	4239	4252	4269	4292	4316	4420
D	2703	2761	2778	2785	2811	2885

Table 4: Number of iterations needed to achieve stable state in every experiment

3.5. Results and discussion

For the purposes of this study, four different setups of Schelling's segregation model were used in order to analyze the behavior of enterprises in networked environment. By observing the results shown in Figures 3-6 (see subsection 0) we can conclude that in a heterogeneous business environment, where 50% of enterprises are trustworthy and 50% are dubious, a general equilibrium is formed over time. After finite number of time periods (see Table), we can observe the formation of the "clusters of trust". It means that the enterprises tend to find business partners which can be trusted. In the same time, the dubious businesses are isolated in groups, where they can maintain business operations only with other dubious companies. This isolation leads at the end to the downfall of this type of enterprises. In our setup, the used configuration can be considered as a form of market with a pretty high concurrence, which is modeled by the density of the model

world. The percentage of vacant spots varying from 2-33% does not leave a lot of possibilities for the enterprises to choose their business partners.

Furthermore, a very interesting conclusion can be formulated from these simulations. In accordance with Schelling's original findings, we can observe that the formation of trust clusters is present even in the situations when an enterprise has a relatively high tolerance to the cooperation with untrustworthy business partners. The level of trust index $T = 3$ can be interpreted, in our setup with only 8 business partners for each enterprise, as the situation in which an enterprise requires that only 37.5% ($3/8 = 0.375$) of its business partners are credible. The value of $T = 4$ represents the requirement of at least 50% trustworthy business partners. Therefore, we can conclude that the enterprises in networked environment have a strong willingness to do business with credible partners, despite the relatively high formal tolerance for the untrustworthy enterprises.

4. Conclusion

For the purposes of SMEs' networking the question of trust between business partners is crucial. In order to maintain a good financial health, every enterprise has to take in consideration the level of trust of its partners. Our model, based on the Schelling's segregation model, has shown that enterprises tend to cooperate with the partners who can be trusted. Furthermore, this result is observed even in the situations when an SME formally declares that it can support more than a half of its business partners to be dubious.

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POSTER SESSION

THE EXPECTED DEVELOPMENT OF THE GRADUATES OF INFORMATICS FIELDS

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Keywords

Students, Graduates, Informatics Fields, Population Projection

1. Introduction

One of the most important professions from the point of view of the competitive ability of the Czech Republic is still undoubtedly the profession of ICT workers (see, e.g. Doucek, 2011). Many of the jobs in this profession call for a tertiary education. The data on students of informatics fields were taken from the detailed database of the Institute for Information on Education (ÚIV, 2011),

2. Analysis of the past and prospects of the future development

The number of first-enrolled students in the bachelor's and five-year master's degree courses has almost doubled since 2001. At the same time there has been a continuing gradual decline in the number of students accepted for the five-year master's degree courses and an increase in the number of students enrolled first of all for the bachelor's course and later for the two-year follow-up master's degree course. Especially in the case of students of informatics fields the transition to the two-tier system of study is marked; The proportion of students of informatics fields at the bachelor level of study fluctuates around 10–15 %.

For implementation in practice it is understandably not so important how many students enrol, but rather the number of students who complete their courses, i.e. the number of graduates. While the average success rate (ratio of graduates to enrolled) of students in bachelor study in latest years is about 45 %, the success rate of bachelor students of informatics field was only about 33 %. More detailed analysis of the numbers of students and graduates can be found in Doucek et. al. (2012).

In recent years the number of students enrolled for bachelor's degree courses is almost as great as the number of 19-year-olds, which is the number of persons of the usual age for starting university studies. Although some of the students enrolled are certainly older and some students are enrolled in more than one university, this nevertheless confirms the fact that the possibility of university enrolment is highly accessible today.

Our projection of the future development of the number of students and graduates of informatics fields will be based on the assumption that since 2010 the number of students enrolled for bachelor's studies of informatics fields each year will be equal to 11.2 % of people at the age of 19

years. At the same time we shall suppose that the estimated success rate of these students will remain permanently at the level of 2009, i.e. at 33.1 %. The computation of the projection of graduates come from the population projection of the Czech Republic 2011, variant CZSO (Fiala, Langhamrová & Průša, 2011).

While at present the number of graduates is expected to reach 5 000, in the second half of this decade it can drop under the level of 3 500. In the twenties a repeated growth to about 4 500 is expected followed since the thirties by a permanent slow decline. Since the late forties, the annual number of graduates of informatics fields will be probably permanently lower than 3 500.

In 2010 the number of ICT experts in the Czech Republic has been slightly over 120 000. Only about 60 000 of them had completed tertiary education and the number of graduates in informatics fields among them was lower than 14 000. (See ČSÚ, 2012.) At the same time the total number of graduates in informatics in the period 2001–2009 was almost 35 000. But an important question is if the expected number of new graduates will be sufficient to cover the prospective increase of employees in ICT sector and to “replace” the retired (or died) ICT experts. The average annual increase of ICT experts in last five years was about 8 600 which is almost twice as high as the annual number of new graduates. It is of course possible that this increase will slow down in the future. On the other hand the ICT sector will probably need in the future higher proportion of tertiary educated people specialized in informatics fields than at present time.

3. Conclusions

Under the assumptions of the projection the annual number of graduates in informatics will drop from present value of 5 000 to the value about 3 500 with some fluctuations. The real development may probably of course be different. There arise many important questions concerning the future. Will the growth of the number of ICT experts be in the future as rapid as in the last five years? How many ICT experts will be needed in the Czech Republic for the future decades? And which proportion of them should have tertiary education in informatics fields? It will be probably higher than at present. Will the proportion of young people studying informatics remain at the present level? Or will it continue to grow? The other way how to increase the number of graduates is to attract students or graduates from abroad.

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ASPECTS OF SAFETY OF THE EDUCATION SYSTEM

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Keywords

Safety, Education Sphere, Pedagogical Cybernetics

Abstract

In this article, some questions concerning the safety of the educational system are considered. The safety of education is the compound part of general safety of the society and the state as a whole. The changes in the society lead to the forming of some serious contradictions in education, the necessity of solving those causes the origin of certain threats to the safety and integrity. These threats must be predictable and their sources should be successfully and timely revealed for the maintenance of the stable and effective development of the educational sphere.

1. Safety Education

The education system is a part of the general complex totality of social and economic relations in the state. One of the major questions for any country without dependence of level of social development is the safety in various branches (military, technical, technological, economic, financial, social, political, ecological, informative, etc.). The educational sphere is not an exception from the list resulted above (Maryska, Doucek, 2011).

As a rule, the state and society are actively forming the complete system of their general safety, and the safety of education, in the given context, can be considered as its certain component or subsystem. Changes in a society, in social, economic and political spheres, should cause the appropriate forms of an education system for bringing in conformity with the modern conditions and restrictions the functions of the integral educational environment, and also the aims of realization of these functions. In this connection the complex totality of serious contradictions appears between groups of the participants of the educational processes, operating subsystem of the education itself, and developing society.

In a society recently the tendency of the realization of activity starts to prevail, both as its separate members, and the whole social groups of citizens, directed on carrying out the process of the successful survival in the conditions of the aggressive and dynamic external environment. Objects of education of all patterns of ownership, as a matter of fact, today also are realizing their existence and functioning by means of struggle for a survival in the conditions of a rigid competition to establishments and the organizations similar to them, building their organizational, educational, economical, financial, social, informative, personnel, methodical, economic policy according to certain norms of behavior, which were generated on the international market of educational services.

2. Problem Formulation

In this article, we will analyze the education system as a whole, and its separate elements, and educational processes, occurring in these elements from the point of view of the system-cybernetic approach (Cancer, Mulej, 2008). The main elements of application of the system-cybernetic approach in educational management and its components were considered by us and formulated earlier. The given branch of knowledge has been defined by us, as «pedagogical cybernetics» for which a system of principles, laws, methods, technologies, algorithms and means of activity implementations on efficient management of objects of an education sphere are characteristic. From the point of view of the pedagogical cybernetics, separate elements of an education system, educational processes and educational sphere as a whole, represent complex dynamic social and economic systems. These objects are continuously under the influence of a great number of factors, as of external environment, aggressive by definition, and also direct operating influences of variety of organizational structures and the administrative institutions, aspiring to adapt their functioning for new conditions and the purposes.

3. Concept of Safety Education

The concept «safety» assumes obligatory presence of the term interfaced to it – «threat to safety» (Chroust, Ossimitz, 2011). Then, the effectively functioning system of safety of education sphere should, in a sense, well enough and successfully counterbalance the system of existing, planned, hypothetical threats. Besides, the safety as a whole will be defined much of the complex system of interests of some set of objects and of subjects of the certain sphere. In its turn, the conflict of interests in any area actually unequivocally defines the numerous likelihood processes of occurrence of corresponding sources of the threats, which negative action can be turned as directly on participants of such a conflict, and on the third party. In this sense, actually all participants of educational processes, and also a society as a whole are interested parties concerning timely revealing of a complex of threats, and their prediction (Jablotchnikov, 2009).

In our opinion, corresponding terms in education, first of all, there is a sense to consider from the point of view of the timely revealing and in the big share of probability of prediction of possible sources of such threats. Appearing of such threats, within the limits of the system-cybernetic approach, it is logical enough to interpret as complex likelihood events, the practical realization of which depends on degree of maintenance of balance between noted above subsystems. Numerical value of probability of occurrence of either threats is some dynamic function of time, the numerical parameters of which basically can be defined by means of standard methods of the theory of probability (Jablotchnikov, 2010).

Depending on a place of a possible finding and forecasting of corresponding sources of threats, generally they can be classified as internal and external in relation to an education sphere. The direction vector of actions of such kinds of threats will define structure and parameters of safety system as a whole, and also a complex and the program of adequate actions on its efficient management. Management efficiency will be defined also by invested financial assets in the general system of safety. Realization of functioning of safety system of education and its management may also be treated, as the effective management of risks in the course of maintenance of appropriate balance of the existing, planned and predicted threats, and also complex of actions for their indemnification.

First of all, it is necessary to define the content of concept «safety of education». Wide treatment of the content of term «safety of education», in our opinion, should include creation of set of certain

conditions of realization both generic and specific functions of protection of the important interests of the person, the separate social groups, society and the state as a whole in educational sphere.

The content of the term «safety of education» is connected with understanding of the dominant essence of specific functions of the general safety (reorganization, estimation of risks, control of situations, instructions, positions etc.) for realization of survival of the social and economic system as a whole. The given situation is often enough observed in administrative practice, including the educational sphere as well. The content of functions of protection is a realization of the complex of the organizational-legal, social, economic, technical, technological, administrative, structural, educational, financial, information and other actions, directed on forecasting, revealing, prevention and suppression of threats which can have negative influence on realization of functions of safety of an education system, in particular.

From the point of view of forecasting the occurrence or the real existence of external sources of threats, safety of education as a whole is formulated by us, as ability of the teaching and educational processes defined by their content, outlook, resources, conditions and restrictions, and also organizational, economic, financial, informative, industrial, administrative and other kinds of activity in the given sphere, to provide effective transfer of knowledge from present generation to future. Besides, it is necessary to provide the fullest satisfaction of set of requirements in educational sphere (Maryska et al, 2010). These processes should be realized irrespective of the real levels of quantity indicators and character of influence of external factors or existence of the certain reasons, as a guarantee of high degree of security of the vital interests of the person, separate groups of citizens, society and the state as a whole. The safety of education can also be defined as the degree of ability of the society and the state as the whole to provide the maintenance of the intellectual, humanitarian, scientific, technological, industrial and economical potentials of the certain country, as well as development of different creative collectives, scientific schools, which are able, in their turn, to create the necessary conditions of the realization of the state independence at the strategically important directions of the general evolution of totality of the social and economic relations.

4. Conclusions

Internal sources of threats of safety of educational system also can interfere with realization of resulted social function. The action of threats is directed basically on realization of internal processes of educational system for achievement of defined in advance purposes and to maintenance of parameters of the final result of its functioning. In this sense we can differentiate separate kinds of safety in an education sphere, namely: organizational, technological, structural, economic, financial, methodical, informative, social safety. The threats, at such approach, will be directed on decrease in efficiency of realization of processes of an exchange of system with the environment by all kinds of resources, energy, information and entropy. The success and efficiency of realization of managerial processes of safety of objects of educational sphere depends on ability of an internal operating subsystem to provide a reasonable correlation of dynamics of processes of the material resources' exchange and processes, which have the information nature. In this case, balance of dynamics of parameters of such exchange, instead of their numerical values plays the most important role. Safety of educational sphere is a new branch of a pedagogical science, the theoretical bases of which in actual fact are not developed. However, the importance and urgency of realization of similar scientific researches does not cause doubts.

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PROJECT-BASED APPROACH TO CONTINUOUS ORGANIZATIONS' IMPROVEMENT

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Keywords

Project Management, ITIL, Process Management, PMBOK, Strategic Planning Pyramid

1. Introduction

This article presents a basic insight into modern managerial practice to continuous organizations improvement, based on deployment of well-staged projects, aligned with organizational vision, mission and strategy as well as surrounding process environment.

2. The challenge of change vs. control

Projects and project management play an important role in many organizations. In her widely used PMBOK-based (PMBOK,2004) publication, Svozilová (2006) distinguished between two types of companies that use projects, namely:

- companies that generate most of their outputs via projects, or
- companies that apply project management to handle internal operations such as innovations' development, product research etc.

Such approach is based on the assumption that project management is an operational, tactical initiative that is best used for delivery of tangible products. However, projects can be also used to drive the continuous improvement and change in organization – which, historically, was considered as main task for process management. It is clear that such activities have to have a sound foundation, based on clear vertical (i.e. top down, vision-mision-strategy-process) as well as horizontal (i.e. continuos, process based) overview of organizational internal structures.

The top-down view can be based for example on the four level “strategic planning pyramid”, that was introduced by (Phillips, 2002). The four levels are as follows²⁵:

- Mission/Vision/Values – clarification of organization's main goals and purpose.
- Long range goals/Strategic initiatives – realization of the mission, vision and values, often broken down to the next level.

²⁵ Visualization of the pyramid and the later described process model is presented in the conference poster.

- Intermediate goals/Projects – non-routine tasks that are used to achieve specific goal.
- Activities – daily process-like operations.

The “strategic planning pyramid” is used as a “model of vision, communication, planning and decision-making throughout an organization; any proposed project is checked back to the model to ensure that it support the organization’s mission, vision, values, goals and strategy” (Phillips, 2002). Alignment of projects with strategic initiatives and the top-level intentions is the first prerequisite to keep projects under control and to be able to use them for long-term optimization, based on organization’s vision. But it is not sufficient – it is also necessary to ensure a good integration to the surrounding environment, both internal and towards the outside world.

Such integration can be provided by careful establishment of project management and projects in the internal process structure. This approach is in line with several generally accepted standards such as (ISO20000, 2005) and (ITUP, 2008); but these standards only provide valid recommendations, not universally usable guidelines. Incorporation of project management into the organizational process structure thus has to be based on careful ad hoc analysis, based both on the aforementioned best practices as well as on common sense and excellent consultation skills. In order to achieve the best results, allowing strategic usage of projects balanced with the day-to-day operations, the process interfaces of project management should be aimed towards:

- Strategic management process as the main long-term goals input
- Innovation and service improvement process as the main mid-term goals input
- Customer services and product delivery process in a bilateral I/O relation
- Subdelivery management process in a bilateral I/O relation
- Operations and maintenance process as the main output

Such process structure is in line with the traditional ITIL-based continuous improvement process, but puts focus on more aggressive, ad hoc initiatives presented by projects that allow to speed up the strategic change.

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ECONOMIC CONTEXT OF INFORMATION AND COMMUNICATIONS TECHNOLOGY DEVELOPMENT

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Keywords

Business cycle, Development, Gross Domestic Product (GDP), Information and Communication Technology (ICT), Innovation, Technological progress

1. Introduction

ICT development has been usually evaluated with technical indicator (Computing power, Memory capacity,...) and also economic indicators (ICT spending, Multifactor productivity,...). ICT spending/ GDP was found as proper indicator to reveal cycling trend of technological development according to innovation theory (Schumpeter, 1989). It describes innovations influence in technological progress and defines the progress stages in Juglar's cycles.

With reference to mentioned theory, qualitative innovations in ICT lead to the exchange of computing generations (Valenta, 2001). The ratio of ICT investments/ GDP in USA during last 60 years indicates three innovation (Juglar) cycles with 8-10 years innovation growth and 6-8 years digestion decline, which can reflect three generations of computing (Mainframe, Personal, Network). The extension of this trend predicts new generation of Smart computing since 2009 (Bartels, 2009).

The evaluation of mentioned innovation theory for ICT development was realized with measurement of ICT business cycles' dynamics in Czech Republic, Germany, China, India, Japan and Brazil for last 20 years.

2. Analysis

The analysis of ICT spending/ GDP ratio dependence in time was done for the examined countries. ICT investments consist in spending of private and government sector for computers hardware, communications equipment and commercial software. ICT spending was gathered from several sources (IDC, 2010; Gartner, 2010; Vertical Systems, 2010) in different structure and period. The inputs were integrated with the respect to identical items and their trend of continuation. It has monitored the dynamics of ICT sales, depending on its form (investment or services) and the major influence of global or local economy.

The result of ICT business cycles in Czech Republic, Germany, China, India, Japan, Brazil and USA in the expression of ICT Investments/GDP time dependence is showed at Figure 1.

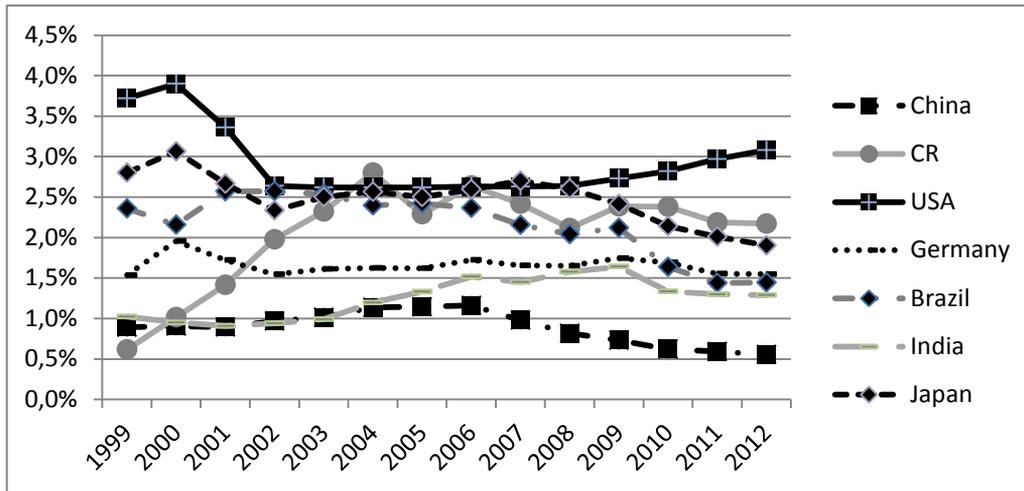


Figure 1: ICT Investment/ GDP in CR, Germany, China, India, Japan, Brazil and USA

3. Conclusion

Innovation theory was used to explain ICT development trend and predict next generation of computing. Its validity was confirmed with these findings:

- There are obvious Juglar's cycles in case of ICT investments, while no cycle encounters in case of ICT services.
- Global ICT development has dominant dependence over local economies' influence.
- Developed countries with higher market size (Germany, Japan) have the same business cycle dynamics as US market.
- Developed countries with lower market size (CR) have postponed digestion period, accompanied with synchronized innovation growth period with US market.
- Asian countries (China and India) have relatively high GDP growth, lower level of ICT investments/ GDP and its less cycling feature.

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Vertical systems (2010), Worldwide IT Spending 2010

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RESEARCH OF THE INFORMATION SECURITY IMPLEMENTATION LEVEL IN THE UNIVERSITY ENVIRONMENT

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Keywords

Information Security Management System, Security, ISO 17799, ISO 27000, IT Infrastructure Library, Public Sector, Universities.

1. Information Security in Commercial and Public sector

Nowadays the information represents the important asset and the companies should secure this potential source of their competitive advantage (Tvrđıková, 2010; Doucek, 2011). The security procedures should be developed and applied for ensuring the information security. These procedures should create the consistent system which is able to ensure or secure the most important company information – this system is known as Information Security Management System („ISMS“) (ČSN ISO/IEC 27000, 2006). There are several standards or methodologies which help to develop the good quality ISMS – especially ISO/IEC 27000 and IT Infrastructure Library (“ITIL”). These methodologies provide not only tools for security evaluation but also the recommendations for solution of security risks (Ministr, Fiala, Števkó, 2009). It is important to consider that the companies aren't only subjects which handle with the valuable information. The often neglected institutions are universities in spite of these institutions handle with valuable, important, sensitive and personnel information which are secured through internal instructions and acts or legal enactments (patents, results and reports of research projects, personnel information of employees and students, etc.).

2. Information Security Research Realization

2.1. Scope of the Research

The research which the authors decided to realize is focused on information security implementation level in the university environment. Also the part of research is the analysis of the key factors and threats which influence the number of security incidents and their impact in the colleges. In the range of the survey are the Czech and also the foreign universities (especially from Slovakia, Poland, Slovenia and Austria). Authors hope that at least two universities from each country will participate because the international comparison is one of the intended research result.

2.2. Information Security Research Focus

The investigation areas are derived from potential requirements of the university environment on the information security and information security specifications described in standards mentioned above:

- Evaluation of the Information Security Importance (from point of view of universities);
- Personal Resources for Information Security;
- Security Policy and Standards – level of implementation of information security standards;
- IT Service Continuity Management – preparation of the university for disasters;
- Outsourcing – outsourced IT services and their security;
- Internet – the implementation of methods for elimination risks;
- Personnel information and classified information protection.

2.3. Data Acquisition and Evaluation Method

The data will be acquired through the electronic questionnaire survey and pen and paper interview with particular university delegates. The data analysis will be realized according to methodologies included in set of standards ISO/IEC 27000 which will be used to characterize level of the information security on particular universities.

3. Conclusion

The information security in the public sector especially university environment isn't so frequently discussed in comparison with commercial sector. This is the reason why the authors have focused on the information security in the university environment. The results of the research will be compared with the results from commercial sector and it will be evaluated how different is information security level in commercial and university environment. Through this research authors don't want only to evaluate the current state but they want to propose the recommendation for increasing the security level in the university environment and they hope that this survey calls attention to information and its security as well.

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COMPARATIVE SURVEY OF STUDENTS' BEHAVIOR ON SOCIAL NETWORKS (IN CZECH PERSPECTIVE)

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Keywords

Social networks, Users, Survey

Abstract

Article presents results of sociological research focused on behaviour of students in the space of social networks (in Czech perspective). Questionnaires included 23 research questions, which had matrix structure for research comparison of utilization of seven different social networks: Facebook, Google+, Twitter, LinkedIn, Foursquare, Badoo and Latitude.

1. Introduction

Poster presents results of sociological research focused on behavior of students in the space of social networks (in Czech perspective). Online social networks systems (SNS) are after Wiki systems (Pavlicek, 2008, 2009) the second major invention of Web 2.0. SNS are very quickly changing the way how people communicate, entertain themselves, play and work, gather new information, communicate with old friends or meet new friends. The majority of people is thinking about possible utilization of social networks (Pavlicek, 2011). Students are still key users of social networks. This research came up with possible models of their behavior and points out possible future utilization of social networks. (Rosicky, 2006)

2. Research Approach

The main aim of the poster is to present the difference in behavior of high school students and university students. Research went ahead on at the University (UN) of Economics in Prague and at high school (HS) Heroldovy sady. Inquiry proceeds by form of questionnaires during December 2011 and January 2012. During that period were completed HS 108 and UN 307 questionnaires.

Research had aim to vindicate following hypotheses:

H1 – Users of social networks are aware of security threats

H2 – Social networks have become an essential part of our routine life

H3 – Social capital is increasing thanks to social networks

Questionnaire was targeting questions concerning activities on exquisite social networks, student habits, relation to advertisement, encounter with harmful content, security and sharing information. Respondents answered 23 research questions, which had matrix structure for research comparison of utilization of seven different social networks. It was concerned to social networks, which have the most users in Czech Republic. Research interviewed them about the Facebook, Google+, Twitter, LinkedIn, Foursquare, Badoo and Latitude. Every quoted network has its own specificity, in this regard on was focused the creation of questionnaire. Thanks complex conception and point of view to several networks a formbook questionnaire was used.

3. Key Findings

Research data have a huge potential for future analysis, which could utilize advanced statistical methods or data mining. In the Czech environment, the following key findings were identified:

- Outstanding difference is obvious by comprehension of security threats awareness on social networks between university and high school students. About 80 % of university students are aware of threats and also use security setting all over the social networks. In comparison only 60 % of high school students are considering this threat.
- There is obvious difference in time spent on Facebook among students. For example, 38 % of university students are 1-4 hours per day on Facebook, but for high school students it is 63 %. Only 26 % of university students spend on Facebook less than 1 hour per day, on the contrary, it is only 13 % of high school students.
- Classification of addiction on social networks could be found at the margin of spending on network minimally 5 hours per day. Through this margin we can classify 14 % of university students and 22 % of high school students are addicted. To the direct question about addiction respondents answered, that 16 % of university and 19 % of high school students felt that they were addicted.
- The connectivity to social networks is increasing by using smart phones. From university perspective it is 50 % of users who were using mobile phone for connection to social networks. Surprisingly, the number of social network mobile users is higher at the high school, where it reached nearly 70 % of students.
- Social networking is more connected with face-to-face communication at the high school than at the university.
- Almost 75 % of both students are indifferent to advertisement published on social networks, and the rest of students advertisements refuse.
- The best way how to reach social capital is to get in touch with the networks. In case of this research is the most suitable Facebook, where is concentrated 96% of university students and 96% of high school students

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AVAILABILITY OF USERS' PERSONAL DATA ON FACEBOOK

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Keywords

Privacy, Social Networks, Facebook

Abstract

Article describes the experiment on social networking service (SNS), in which authors measured the willingness of SNS users to share the private information over the network. Special applications were designed and distributed over SSN and its distribution measured. Also the acquired information were analysed, proving that a quarter of SNS users are careless about their private information.

1. Introduction

A social networking service (SNS) is an online service that focuses on facilitating the building (or projecting) of social networks or social relations among people who share interests, activities, backgrounds, or real-life connections. A social network service consists of a representation of each user (often a profile), his/her social links, and a variety of additional services. Facebook, Twitter, Google+ and LinkedIn are among the most popular these days, with number of users reaching up to a billion. The usage of SNS is very wide from SME (Antlova, 2011), HR (Pavlicek, 2010), education (Hanclova, 2011), (Doucek, 2009) to special situations (Skrbek, 2009).

Security of personal data on social networks is a very topical issue, since the privacy and personal information is considered extremely valuable for marketing and commerce. The issue of private data and their protection in the era of Web 2.0 was first mentioned with respect to wiki systems (Pavlíček, Rosický, 2009), however social networks make the issue even more pressing – they use recourses for the security and safety of users and their data (Rosicky, 2006). The main problem is that the users provide their data themselves often unconsciously. Once a user allows applications access to his profile, they could access all of his profile data. During our research (February-March 2012) we created Facebook applications and observed, what kind of user is likely to provide his personal data and what the data will include. Research was focused on the Czech language speaking Facebook population, 1607 users started the application, 431 of them (26,8 %) allowed the data gathering (262 unique users – 140 female, 122 male).

2. Acquired information

Here is the list of the information that were extracted from users' profile:

ID: Name: First name: Last name: Link to profile: Username: Birthday: Sex: Relationship status: (with name of the user and id), Religious Views: Political view: Timezone: Preset language: Languages: Hometown: Location: Bio: Employers: Education: Description: Likes: Last profile update

Among the most "valuable" have been (apart from personal data) the information from fields Description and Likes, which describe the user surprisingly well. See example:

Description:

- sports: Bowling, Snowboarding, Swimming, Golf (with list of users and IDs)
- favorite teams: Czech Republic men's national ice hockey team, Ferrari F1 Team, SK Sigma Olomouc
- favorite athletes: Lewis Hamilton, Tiger Woods, Jaromír Jágr
- inspirational people: Robert Kiyosaki, Larry R. Williams, Tomáš Nesnídal, Petr Podhajský,

Likes: MUSE , Curlies, Karin (MUSE), Nela (MUSE), Zapakatel.cz, Studio Sauna, Bejeweled Blitz, Stargate SG-1, Texas HoldEm Poker, Bud' dobrej etc. (note: this is the list of users likes)

This was just the example of some of the information that Facebook applications could download, when users allow access to their profile. In our research, we downloaded just a few items, though far more is possible.

3. Hypotheses

20 different data-harvesting applications were created. All of them were a basic quiz (5 questions) related to different topics: from cooking, names for children, banks, films, universities, cars, baby diapers, jobs, books, mobile phones, music, styles, paintings, sport, alcohol, vacation, sex, horoscope, geography and iPad. We collected users' personal data when they entered the quiz application.

The research tested following 3 hypotheses:

H1: Personal data are carelessly shared mostly by young an un-educated people.

This could be demonstrated by participation mostly by users aged 18-24 years and those with high school education or lesser.

The research shows that 38% of all users are 18-24 years old and 8% of all users are 25-34 years old as well as high school educated. This is only 46% of our participative users. Hypothesis H1 was not confirmed, the carelessness with personal data seems to be more universal, is not unique for mentioned group only.

H2: Users very openly share their very personal data.

This could be demonstrated by the fact, that majority of users publicize their relationship status (single, engaged, ...) on their personal profiles.

Collected data shows that 66% of all users post their relationship status on their profile. Hypotheses H2 is accepted.

H3: Two of the most attractive social themes are alcohol and sex.

We expected that alcohol and sex are prevalent in the 20% most successful quiz themes.

We partly accept the hypothesis H3, because only the alcohol-related topic the most successful topics, sex was not so successful (did not make it to the top 20%).

4. Conclusions

We have proven that the personal data could be extracted very easily form the un-aware users by simply requesting their consent. One quarter of users allowed such extraction. Such careless behaviour is not limited by a low education level (H1), and users tend to share very personal information indeed (H2). Seems that SNS users are already immune to the most flagrant spam topics, such as “free iPad, they are interested more in life-style topics – sports, cooking, holidays and alcohol (H3).

Another interesting findings were:

- The largest age group, which shares personal data, is aged from 18 to 24 years.
- Women are willing to share their data at a higher age than men (girls are more cautious, older women are more open).
- Majority of users (62%) show their education (27% university and 35% high school)
- Nearly half of users (48%) aged 25-34 show their employment on the profile.
- Very attractive topics for users are: alcohol, sports, vacation and cooking.
- 9% of users of the cooking application were over 65 years old.
- The fake application about possibility to win a New iPad does not attract many people.

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HISTORICAL RETROSPECTIVE ON 20 YEARS OF IDIMT

20 YEARS OF IDIMT - A HISTORY OF CONTINUITY AND CHANGE

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Keywords

History, IDIMT, chronology, conferences

Abstract

The IDIMT Conferences were started in 1993 as a joint project between the University of Economics Prague, represented by Petr Doucek from the Department of Systems Analysis, and the Johannes Kepler University Linz, represented by Gerhard Chroust from the Department of Systems Engineering and Automation. A small group of 14 participants met in a small hotel in the middle of Šumava (Bohemian Woods) in order to discuss 'Information Management' with respect to the intersection of technology and economy. Despite the small scale it was a great success and the participants decided to repeat this information interchange on a yearly basis.

This year, 2012, we are celebrating the 20th anniversary of the IDIMT Conferences. More than 50 participants are going to meet this year, presenting 40 papers. Over the last 20 year we have had well over 900 participants and 580 papers.

This historical review describes the growth from the initial meeting to today's well established conference. We indicate the improvements achieved each year, we discuss some of the milestones we have reached, and, last not least, we will give some personal accounts of our experience concerning organization and guidance of the conferences from 1993 to 2012. Many photos augment the report visually.

To simplify dissemination of this paper beyond the audience of this conference we are publishing it in a separate volume together with a digest of twelve presentations of technological progress held by Christian Loesch at the IDIMT conferences from 2000 to 2011.

20 Years of IDIMT – Looking Back

Editors: Petr Doucek, Gerhard Chroust,

University of Economics, Prague, Fac. of Informatics and Statistics,

Scientific and Research Paper, Sept 2012

Summary of the IDIMT Conferences 1993 –2012:

<i>Year</i>	<i>authors</i>	<i>papers</i>	<i>pages</i>	<i>editors</i>	<i>ISBN-No</i>	<i>Date of Conf</i>	<i>Location</i>
1993	14	14	151	G. Chroust, P. Doucek	3-902457-06-6	6.-8.10.	Kubova Hut'
1994	27	23	233	G. Chroust, P. Doucek	3-486-23147-2	9.-11.11.	Kubova Hut'
1995	33	25	228	G. Chroust, P. Doucek	3-486-23502-8	8.-10.10.	Kubova Hut'
1996	30	21	215	G. Chroust, P. Doucek	3-486-24033-1	16.-18.10.	Zadov
1997	35	30	320	S. Hofer, P. Doucek	3-486-24526-0	15.-17.10.	Zadov
1998	39	27	390	S. Hofer, M. Beneder	3-85320-955-6	21.-23.10.	Zadov
1999	46	34	424	S. Hofer, M. Beneder	3-85487-046-9	02.-03.9.	Zadov
2000	48	32	440	S. Hofer, M. Beneder	3-85487-153-8	20.-22.9.	Zadov
2001	45	29	397	C. Hofer, G. Chroust	3-85487-272-0	19.-21.9.	Zadov
2002	38	24	350	C. Hofer, G. Chroust	3-85487-424-3	11.-13.9.	Zadov
2003	38	24	310	C. Hofer, G. Chroust	3-85487-493-6	10.-12.9.	České Budějovice
2004	31	23	304	C. Hofer, G. Chroust	3-85487-665-3	15.-17.9.	České Budějovice
2005	30	22	313	Ch. Hoyer, G. Chroust	3-85487-835-4	14.-16.9.	České Budějovice
2006	45	29	364	Ch. Hoyer, G. Chroust	978-3-85499-049-9	13.-15.9	České Budějovice
2007	38	27	383	Ch. Hoyer, G. Chroust, P. Doucek	978-3-85499-256-1	12.-14.9	České Budějovice
2008	53	33	455	G. Chroust, P. Doucek, J. Klas	978-3-85499-448-0	10.-12.9	Jindřichův Hradec
2009	61	42	423	P. Doucek, G. Chroust, V. Oškrdal	978-3-85499-624-8	9.-11.9	Jindřichův Hradec
2010	62	42	397	P. Doucek, G. Chroust, V. Oškrdal	978-3-85499-760-3	8.-10.9	Jindřichův Hradec
2011	64	42	393	P. Doucek, G. Chroust, V. Oškrdal	978-3-85499-873-0	7.-9.10.9	Jindřichův Hradec
2012	69	46	395	P. Doucek, G. Chroust, V. Oškrdal	978-99033-022-7	12.-14.9	Jindřichův Hradec
	846	589	6885	SUMS			

THE IDIMT CONFERENCE SCIENTIFIC EVALUATION

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Keywords

IDIMT history, Thomson Reuters

Abstract

The history of the IDIMT conferences (Interdisciplinary Information Management Talks) started nineteen years ago in the beginning of the 90's. These meetings offered always a wide platform for students, scientists, lecturers and employees where they presented and discussed their experiences, opinions, ideas and visions in general informatics, information management, information and communication technology, information systems, sociology, philosophy, systems theory, sustainable development and other related topics. The still modern concept of interdisciplinarity is the big advantage of these annual meetings. This conference is indexed in Thomson Reuters scientific database since 2008. A short retrospective from the Thomson Reuters database is presented in this contribution.

1. A small look back to the past

Nowadays the IDIMT (Interdisciplinary Information Management Talks) conferences are a normal part of the calendar for a group of young and older scientists in majority from Middle Europe. The second week of each September became a period, when they meet in the Czech Republic to present here their results of annual surveys, information system improvement, research and development work, their opinions, new proposal and ideas.

Annually present conference participants many contributions at this conference under the title of "Interdisciplinary Information Management Talks" (IDIMT) since October 1993 (Chroust, 2007). This conference is known under the acronym "IDIMT" on five continents in the world. We find plenty of conferences all around the world, but what is the main advantage, according to my opinion, and the benefit of this small but smart meeting? (Doucek, 2006), (Doucek, 2007)

1. At the meeting regularly person from different countries of central Europe (usually from Austria, Czech Republic, Germany, Slovak Republic, Slovenia and Hungary) take part.
2. Knowledge and experience background of each group of participants is a little bit different. It contents from the more technical orientation of Austrian and German participants on one part of the spectrum to some regular Czech participants focusing on philosophy and human aspects of information and communication technology (ICT) improvement; financial management (Slovak participants); and on complex interpretation of the world with accents

on ethics and responsibility (Slovenian participants) this feature of interdisciplinarity offers ideal conditions for know-how interchange and for a large field for discussions,

3. The scope of presented contributions, information, ideas, opinions and knowledge is wide – from technical oriented contributions through contributions focused especially on human aspects of ICT and on philosophical aspects of ICT impacts on society to managerial aspects of ICT and informatics management and modeling, not to forget the systemic aspects.
4. The specialization of the participants as well as their age and practical experience are different, so those participants provide a wide scope of presented opinions and ideas; from young, dynamic and self-confident PhD students to wise and more “conservative” professors.
5. There are also presented and discussed different concepts of the education process.
6. Discussion, formal as well as informal, is an integral part of the conferences; we provide enough time to discuss all aspects of presented contributions.
7. The orientation of the conference program is annually up-dated such that new and leading edge themes are included into conference topics.
8. From the beginning, we had proceedings of the IDIMT conference. Now on the average we have more than 40 papers totaling some 400 pages per conference in last three years. They show a proud record of our conferences (Figure. 1) (Thomson Reuters, 2012).

The IDIMT conference became, not important in what location, an ideal platform for scientific work results presentation especially by young and/or younger colleagues and PhD. students.

2. The Thompson Reuters History

New scientific history has been started since 2009, when the proceeding book of IDIMT conference was included into the American scientific database Web of Science (CPCI-S – Conference Proceeding Citation Index- Science) operated by Thomson Reuters. This indexation brought with it new dimension to the conference, because contributions presented on this conference are accepted by Ministry of Education, Youth and Sports of the Czech Republic as output of research and development work. Because Thomson Reuters requires also demonstrate the history of the conference, we added proceeding books from last five years to this apply. The final effect is that all IDIMT proceeding books are included into this world known scientific database since 2004. Number of published items of the IDIMT conference is presented on Figure 1.

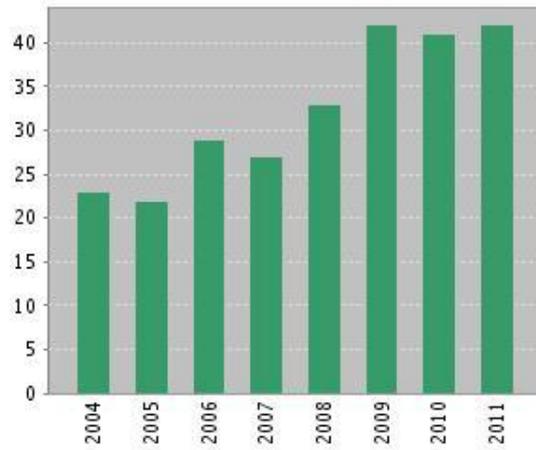


Figure 1. IDIMT - Published Items – Indexed in Thomson Reuters (Thomson Reuters, 2012)

Another information about the IDIMT contributions is the impact of them on scientific community. This fact is measured by number of citations in Thomson Reuters database. Figure 2 contents number of citations of IDIMT contributions in each year since 2005.

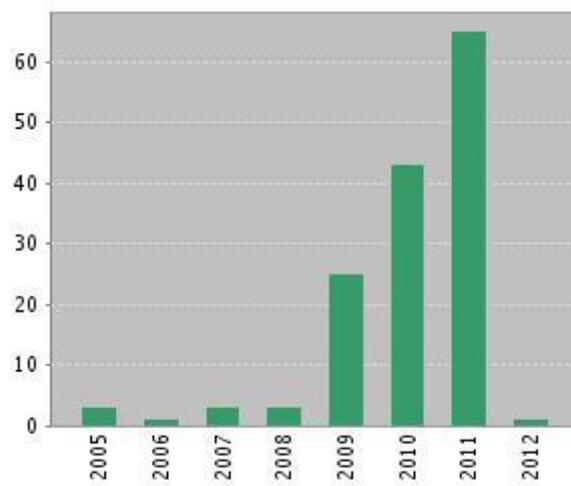


Figure 2. IDIMT Citations – In Thomson Reuters (Thomson Reuters, 2012)

Summary of Figures 1 and 2 is presented in following Table 1.

Published Items	259
Sum of the Times Cited	144
Citing Articles	67
Average Citations per Item	0.56
h-index (Hirsch citation index)	5

Table 1. IDIMT Statistics In Thomson Reuters (Thomson Reuters, 2012)

Another statistics is about the number of contributions, where are participants as main authors or co-authors. This statistics is visible in Table 2.

Surname and Name	Number of Contributions
MULEJ Matjaž	20
DOUCEK Petr	12
CANCER Vesna	10
CHROUST Gerhard	10
GROSS Tom	9
KLOCKNER Konrad	8
SONNTAG Michael	8
SIGMUND Tomáš	7
FISCHER Jakub	6
PAVLICEK Antonín	6
ROSICKY Antonín	6
DELINA Radoslav	5

Table 2. Contributors on IDIMT (Thomson Reuters, 2012)

Other participants with less than five contributions since 2004 are not included into this Table 2. The variety of participated countries is also large. The majority of contributions is of course from Middle European countries. However, sometimes are coming to the event persons from other parts of the world.

Country	Number of Contributions
CZECH REPUBLIC	71
GERMANY	24
SLOVENIA	24
AUSTRIA	20
SLOVAKIA	12
HUNGARY	5
FRANCE	3
IRELAND	3
CANADA	2
DENMARK	2
TAIWAN	2

USA	2
FINLAND	1
POLAND	1
THAILAND	1
UKRAINE	1
VIETNAM	1

Table 3. Contributions Per Country (Thomson Reuters, 2012)

Other interesting view on IDIMT activities and contributions can be seen from the point of view of scientific area. All of our contributions were merged by Thomson Reuters staff into the “box” “Management” and more than one-half into “Business”.

Scientific Area	Number of Contributions
MANAGEMENT	259
COMPUTER SCIENCE INFORMATION SYSTEMS	217
BUSINESS	148
COMPUTER SCIENCE INTERDISCIPLINARY APPLICATIONS	110
INFORMATION SCIENCE LIBRARY SCIENCE	106
COMPUTER SCIENCE THEORY METHODS	84
ECONOMICS	69
COMPUTER SCIENCE SOFTWARE ENGINEERING	29
EDUCATION EDUCATIONAL RESEARCH	29

Table 4. Contributions Per Scientific Areas (Thomson Reuters, 2012)

The implication of the Table 4 is that Information Management related topics are partially related to computer science and information system, partially to business but all is management.

3. Hot New

The hot new of this year is our attempt to index this conference in SCOPUS database.

4. Final Thanks

We would like to express here great thanks to all members of organizing and program committees and to all participants. My thanks also to all founders of the IDIMT conference and especially to Gerhard Chroust, Jan Ehleman and Leo Vodacek, that you started this small but smart conference and we also thank you for your vitality, the inspired wisdom of life.

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20 YEARS OF IDIMT – ICT TRENDS AND SCENARIOS AS REFLECTED AT IDIMT

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The continuous string of contributions to this subject offers the special prospect to review and analyse previously emerging trends and developments of ICT and Microelectronic in the light of the actual situation. We will revisit scenarios of past years and pursue the fascinating opportunity to balance the promises of the once newly emerging trends and ideas to their realization and impact, both as success story as well as failures, impasses or ideas that never made it to the world market.

- 2011 ICT Trends, Scenarios in Microelectronics and their Impact
- 2010 Some Eco-Technological Aspects of the Future of Information Technology
- 2009 Technological Outlook: The Future of Information Technology
- 2008 Technological Forecasts in Perspective
- 2007 15 Years moving in Fascinating Scenarios
- 2006 Do we need a new Information Technology?
- 2005 Future Trends and Scenarios of Information Technology
- 2004 Information Technology: From Trends to Horizons
- 2003 Trends in Information Technology
- 2002 Safety, Security and Privacy in IS/ IT
- 2001 Trends in Business, Technology, and R & D
- 2000 Ethics, Enforcement and Information Technology

Reviewing success and failure of once praised achievements in today's light, the shifting priorities both scientifically and economically, as well as emerging phenomena (as e.g. organic electronics, nanotechnology, MtM, Non Volatile Memory, Photonics) may help to gain some insight into the future, and the interaction of science and economics.

The full text of this presentation at IDIMT 2012, together with an outlook on future scenarios has been published in:

20 Years of IDIMT – Looking Back

Editors: Petr Doucek, Gerhard Chroust,

University of Economics, Prague, Fac. of Informatics and Statistics,

Scientific and Research Paper, Sept 2012

It is also available on the IDIMT Homepage (www.idimt.org)

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IDIMT's Publication Ethics and Publication Malpractice Statement is based, in large part, on the guidelines and standards developed by the Committee on Publication Ethics (COPE).

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Authors must certify that the manuscript has not previously been published elsewhere.

Authors must certify that the manuscript is not currently being considered for publication elsewhere.

Authors must notify us of any conflicts of interest.

Authors must identify all sources used in the creation of their manuscript.

Authors must report any errors they discover in their manuscript.

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Reviewers must keep information pertaining to the manuscript confidential.

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