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DOUCEK PETR ■ CHROUST GERHARD ■
OŠKRDAL VÁCLAV (EDITORS)

IDIMT-2014

Networking Societies - Cooperation and Conflict

22nd Interdisciplinary
Information Management Talks,
Sept. 10 - 12, 2014
Poděbrady, Czech Republic

SCHRIFTENREIHE
INFORMATIK

43



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Doucek Petr ■ Chroust Gerhard ■ Oškrdal Václav
(Editors)

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Networking Societies - Cooperation and Conflict
22nd Interdisciplinary Information Management Talks

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The Conference IDIMT-2014
took place September 10-12, 2014
In Poděbrady, Czech Republic

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Poděbrady - Janie Chroust 2014

Welcome to IDIMT 2014!

A hearty welcome to the 22nd IDIMT Conference!

We are happy to welcome you to the twenty-second IDIMT Conference. For various reasons we have changed the location again, also trying to improve each year. This year we are in a spa: a new experience for the participants of our conference. We hope that in this way we will stimulate both body and mind.

Looking into the audience I see the familiar faces of participants who loyally return year after year. We are a big family! This friendly atmosphere and the ample discussion time – many other conferences unfortunately lack these characteristics – are one of IDIMT's greatest assets.

The overall orientation of our conferences has not changed: it deals with current and future challenges in a world living from and dependent on Information and Communication Technology, but each year we can observe slight variations in interest and direction.

Looking back at the previous 21 conferences we observe a common trend from technology (especially software) to 'softer topics'. More and more the papers as well as discussions are concerned with the impacts and consequences (both positive and negative) of ICT on business, humans and society.

The first IDIMT conference (back in 1993!) discussed the transition of economies and social systems of differing political structure and the resulting necessary technical and managerial consequences. We then gradually advanced to considering the systemic aspects of a world dependent on Information Technology, also looking at the resulting challenges and problems. Soon economic topics attracted a growing interest of the participants, followed by contributions concerning sociological and ethical aspects. Reliability, vulnerability, disasters, and security followed as key topics. The influence of Social Media was taken up in the discussions last year.

This year's conference expands and diversifies the topics of last year, resulting in the following themes:

- Social Media
- Enterprise and Social Networking
- Disaster Management – Caring for Humans
- The Wisdom of Crowds
- Cloud computing: Risks and Chances
- Cashless Society
- ICT and Economy
- Corporate performance management

In my opinion the IDIMT-conferences act as a regional indicator of current trends in ICT. The headings of the individual sessions and the number of accepted papers reflect the current interest of participants. We sometimes even have to cancel a proposed session due to a lack of interest.

Hence the title of this year's conference: "Networking Societies - Cooperation and Conflict."

Employing a blind review process we have accepted 36 submitted papers and 7 invited papers, resulting in an acceptance rate of 66% of submitted papers. The authors come from 9 different countries (Austria, Belgium, Brazil, Czech Republic, Germany, Poland, Saudi Arabia, Slovakia, and Spain).

Each session is organized by a Session Chairperson. Traditionally a session starts with a keynote, the other papers providing additional points of view. The papers are followed by intense discussions. We believe that the intense discussions are one of the attractions of the IDIMT-Conferences, due to the interdisciplinary exchange of thoughts.

The preparation and realization of IDIMT 2014 would not have been possible without the support of many organizations and persons. Therefore we would like to thank:

- the Czech Internal Grant Agency (IGA) for Grant F4/8/2013 (IG409013),
- the University of Economics Prague and the Johannes Kepler University Linz, which as partner universities provide the organizational infrastructure.

Our further thanks go to:

- Petr Doucek for chairing the Organizing Committee, finding a new, attractive location for the conference and organizing a greatly appreciated evening event,
- Václav Oškrdal and Antonín Pavlíček who took over the work of arranging and assembling the selected papers into the proceedings, keeping contact with all involved parties, especially reminding the authors and performing all the other necessary administrative jobs,

- Lea Nedomová, Conference Secretary, for her support,
- all keynote speakers, speakers and contributors of papers,
- all Session Chairpersons for establishing contacts and soliciting contributors,
- all reviewers 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.

Looking forward to a successful and interesting conference!



Gerhard Chroust, July 2014

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**ČESKÁ
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Contents

Disaster Management – Caring for Humans

Prevention of Environmental Incidents Caused by Chemical Substances in the Czech Republic and its Information Aspects	13
Antonín Dvořák, Alena Hadrabová, Aleš Lisa	
Data Security Concerns of Future eCall Users	21
David Kubát, Petr Weinlich, Tereza Semerádová	
Critical Success Factors of the Recovery System at the Municipal Level of Disaster Management	29
Klára Antlová, Iva Hovorková, Tereza Semerádová	
Design of an Early Warning Mobile Application	37
Petr Weinlich, Tereza Semerádová, David Kubát	
The Use of Cryptography for Distribution of Information During Crisis Situations.....	45
Tomáš Žižka	

ICT and Economy

ICT and Economy	55
Petr Doucek, Jakub Fischer, Ota Novotný	
The Impact of ICT Growth on Households and Municipalities in the Czech NUTS-3 Regions: the Application of Cluster Analysis	63
Ondřej Šimpach, Jitka Langhamrová	
Towards an Ecosystem for Academic-Industrial Cooperation	71
Jan Ministr, Tomáš Pitner	
Measuring Performance of European ICT Sectors Using Output-Oriented DEA Models	79
Jan Mand'ák, Lea Nedomová	
Development of the Digital Forensics Laboratory Management System Using ISO 9001 and ISO/IEC 17025	87
Ondřej Hykš, Karel Koliš	
Applications of the Lean IT Principles – Comparison Study in Selected Czech and Polish Companies.....	95
Josef Basl, Michal Sasiadek	
Influence of Standards ISO 27000 Family on Digital Evidence Analysis.....	103
Jaromír Veber, Tomáš Klíma	

Cashless Society

- Mobile Wallets' Strategies towards Business Partners 115
Uschi Buchinger, Heritiana Ranaivoson, Pieter Ballon
- Cash Holdings Profitability Threshold Model 125
Rudolf Vohnout, Zora Říhová, Petr Břehovský

Social Media

- New and Social Media in Workplace 135
Antonín Pavlíček
- The Use of Social Media for Marketing Purposes by Czech Companies Doing Business in the Environment of Services on the Internet: A National Survey 145
Zdeněk Smutný
- Big Data and Legal Regulation 153
Richard Novák
- Social Media as a Tool of Tourism Destinations' Marketing Campaign 163
Alžbeta Királ'ová
- Social Media in Customer Relationship Management 173
Zuzana Šedivá, Michaela Müllerová
- Analyzing User Activity Based on RFM Models Complemented with Website Visits and Social Network Interactions 181
Pavel Jašek
- Privacy in the Information Society: How To Deal with its Ambiguity? 191
Tomáš Sigmund

The Wisdom of Crowds

- Communication, Information and Tasking with and of the Population in Case of Crisis and Disasters 205
Christian Kloyber, Markus Glanzer, Gerry Foitik, Georg Neubauer
- A Smart and Reliable Crowdsourcing Solution for Emergency and Crisis Management 213
Karina Villela, Kai Breiner, Claudia Nass, Manoel Mendonça, Vaninha Vieira
- Citizen-Centered Emergency Communication Systems: Emphasizing the Role of Individuals in Crisis Response 221
Tereza Semerádová, Petr Weinlich, David Kubát
- Detecting Events in Egypt Based on Geo-Referenced Tweets 229
Georg Neubauer, Hermann Huber, Bettina Jager, Armin Vogl

Enterprise and Social Networking

Towards Single e-Market.....	239
Radoslav Delina, Martin Kubačka, Peter Antal	
Internal Communication as a Neglected Part of ICT Management	249
Jana Holá, Jan Čapek	
What Do Czech ICT Students Think about Their Current and Future Jobs?	259
Kristýna Vltavská, Jakub Fischer	
Financial Sustainability of Digital Public Spaces	267
Michal Tkáč, Matej Hudák	
Analysis of the Possibilities of Improving an Online Reputation of Public Institutions	275
Peter Dorčák, František Pollák, Stanislav Szabo	
Smart Pre-Commercial Procurement Environment: Innovations Driven from the Demand Side ..	283
Martin Dujčák, Miroslava Packová, František Janke, Mojmír Prídavok	
Enabling Business Intelligence for SMEs Information System.....	293
Radek Němec, Jana Hančlová	

Corporate Performance Management

Performance Management and Measurement Research in the Czech Republic: 1993-2013	303
Jaroslav Wagner	
Professional Competence of Controllers in the Czech Republic: Research Empirical Study	313
Bohumil Král, Libuše Šoljaková	
An Empirical Investigation into CSR Reporting by the Largest Companies with their Seat in the Czech Republic	321
Petr Petera, Jaroslav Wagner, Markéta Boučková	
Architecture of the Reference Model for Cost Allocation and Profitability Management	331
Milos Maryška	
Business Strategy in Economic Crisis.....	339
Klára Antlová, Tomáš Langer, Jan Mrázek, Petr Rozmajzl	
CRM Performance Measurement Using AHP and CRM Scorecard	345
Hana Pechová, Markéta Zajarošová	

Cloud Computing: Risks and Chances

Cloud Computing: Risks and Chances.....	355
Michael Sonntag	
Information Assurance in Cloud Computing	365
Vlasta Svatá	

Cloud Security Problems Caused by Virtualization Technology Vulnerabilities and their Prevention	373
Rudolf Hörmanseder, Markus Jäger	
Risks and Auditing of Cloud Computing in Healthcare Facilities.....	385
Martin Potančok	
 The State of ICT – Its Trends and Development Both Economically and Technologically	
The State of ICT: Some Eco-Technological Aspects and Trends	395
Christian W. Loesch	
Statement of the Publication Ethics and Publication Malpractice	411
List of Authors	413

DISASTER MANAGEMENT – CARING FOR HUMANS

PREVENTION OF ENVIRONMENTAL INCIDENTS CAUSED BY CHEMICAL SUBSTANCES IN THE CZECH REPUBLIC AND ITS INFORMATION ASPECTS

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Keywords

Disaster, Pollution Incident, Information, Chemical Products

Abstract

This paper deals with the system of prevention of environmental incidents caused by chemical substances in the Czech Republic; major emphasis was put on the information aspects of this issue. An understanding of the roles of various stakeholders and an assessment of their access to relevant information are considered to be the most important factors for the prevention improvement. The aim of this paper is to identify weaknesses within the system, options enabling better access of stakeholders to relevant information as well as to improve mutual information exchange, with the aim to enhance environmental incidents prevention, which is currently underway in the Czech Republic.

1. Introduction

Emergencies with major negative impacts on human health and lives, property and ecosystems are an increasingly serious problem in the world today. Emergencies are understood to include (a) *natural disasters*, which occur out of natural causes independently of human action (windstorms, floods, volcanic eruptions, earthquakes). The prevention possibilities are limited with natural disasters. They concentrate mostly on monitoring of natural processes and building of an effective system of timely warning; (b) *environmental incidents* caused in relation to human activity. The risk of such incidents is increasing with growing production and other social activities, the possibilities and opportunities for their occurrence are expanding, and their potential danger for both the environment and human health is growing. As the studied topic is – in terms of scope and complexity – a complicated issue, this paper will focus only on one-off incidents caused by human or technique failures that have serious impacts on the environment, i.e. on environmental incidents. We will also limit ourselves in the discussion into the issue of environmental incidents prevention, and we will not, given the scale of this contribution, deal with the issue of already existing incidents solution.

Our paper focuses on emergencies caused by a single-instance human or technological failure with serious environmental impacts, known as environmental incidents. The most risky activities in the course of which an environmental incident can happen are currently seen to be:

- utilization of nuclear energy;
- handling of hazardous chemicals;
- handling of substances that may endanger the quality of groundwater and surface waters;
- handling of hazardous waste;
- handling of genetically modified substances and organisms (GMO).

In this paper, we will concentrate on *prevention of environmental incidents caused by selected dangerous chemical substances*.

The objective of the paper is to identify the deficits and major problems in ensuring this prevention, with focus on access to, and exchange of information, under the conditions defined by the current legal (institutional) system of the Czech Republic (the CR), and to suggest possible ways to improve these procedures. The major methodological approach applied is qualitative research, which serves best to gain the necessary information at this level of analysis.

The framework of the paper is the Czech Republic. According to Potužáková and Mildeová (2011), sustainability and social dimensions might be systematically considered also in the broad cross-border context, especially within the European Union. However, the international context and connections to transnational information systems and databases provide another dimension, which is to be the subject of other research. It does not look realistic to expect in this area such functionality, as the one provided for instance by the Schengen Information System.

2. Entities managing prevention of environmental incidents in the CR

Three principal entities contribute to prevention of incidents caused by hazardous chemicals:

- public administration authorities,
- operators of facilities that are potential sources of risk,
- the public.

Efficiency of management of environmental incident prevention requires an appropriate *division of responsibilities* and tasks among these involved entities and a *flow of necessary and good information among them*. Each of the entities plays a special role in the incident prevention process and has different information that has to utilize in order to succeed in ensuring incident prevention (Kreuz and Šauer, 2012). The exchange of information among the stakeholders involves collection, processing and dissemination of this information so that such situations can be tackled efficiently (Coombs and Holanday, 2010).

The general scheme of information provision in the CR (not only environment-relation information) is set in the way that companies provide public administration authorities with mandatory information about themselves and their activity (in the case they provide information directly to the public, it is based on voluntary decisions by firms and voluntary is also the scope and structure of the information provided). Public administration authorities are then required to provide the public with information, both acquired from companies and obtained by their own activities. Restriction of information provided to the public is possible, but reasons for such restriction have to be defined in advance (e.g., authorities will not disclose information that might threaten the national security, intellectual property protection, and other similar reasons).

Public authorities have a number of information systems from the environmental area to serve as a basis for their decisions. The Ministry of the Environment collects most of them in the Environmental Integrated Information System (EIIS). It is a set of information systems that relate to the environment, especially Register of Emissions and Air Pollution Sources [REZZO], Air Quality Information System [ISKO], extensive water management records, the Integrated Pollution Register [IPR], Waste Management Information System [WMIS] and more. These information systems are designed as separate entities, without direct reference to the common environment. Data managed in a unified information system EIIS are collected from external subjects, or are produced by the system operator. In addition to the usage of these information systems authorities also collect additional information about the risks from companies and, partially, from the public too. The principal advantage of the public administration authorities is that they can evaluate this information in the general context and connection across their jurisdiction (risk of domino effect, logistic issues, etc.). Public administration authorities are also responsible for providing the public with information. As for environmental incidents, this includes chiefly information related to resolving of incidents that have occurred, as well as information related to prevention (Skrbek, 2012). An information flow model describing the main flows is shown in Figure 1.

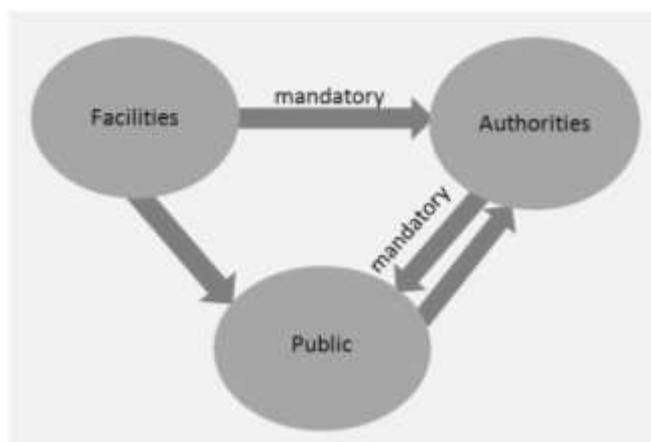


Figure 1: Information flow model

Operators of facilities in which hazardous substances are located have mostly information of a technical nature (what substances they have, in what quantities, how they are handled, where in the company the process takes place, etc.). For respectable companies that adhere to corporate social responsibility (CSR) principles, incident prevention is a part of their overall sustainable development strategy, including cooperation with public administration authorities and the public (Doucek, 2011). On the contrary, they do not have the same kind of information about other companies in their area.

The public, notably its part that involves itself in matters, plays an irreplaceable role. It comprises largely lay people, with a small proportion of professionally competent citizens (e.g., with a degree in natural sciences or chemistry). It is much more difficult for the public to access information on incident prevention than it is for the public administration of the corporate sphere. Public is reliant on what information is published by authorities (obligatory, based on law requirements, or voluntarily beyond this). Public may ask for the information available to the government, either in accordance with Act No. 123/1998 Coll. “The right to information on the environment”, or with Act No. 106/1999 Coll. “On free access to information”. Public approach to public administration information systems is limited or not possible at all. Thus, for each subject there is an information asymmetry, which complete removal cannot be assumed (Fiala and Šauer, 2011).

3. Current legal definition of incident prevention in the CR

Prevention of incidents caused by chemical substances is the only type defined by a separate act of law, namely *Act No. 59/2006 Coll. on the Prevention of Serious Incidents Caused by Hazardous Chemical Substances or Chemical Preparations (the Prevention of Serious Incidents Act)*. (In the Czech Republic there is also effective *Act No. 76/2002 Coll. "On integrated prevention"*, but its content and purpose relate to the prevention of environmental incidents only marginally. This Act mainly regulates the procedure for the issuance of integrated permits. These permits shall replace the existing sub-permits issued by several authorities by comprehensively assessed document that assures environmentally acceptable operation of the company).

Pursuant to the *Prevention of Incidents Act*, *operators of facilities and buildings* in which hazardous chemical substances are located are required to:

- collect information about what substances are handled in the facility (type and quantity);
- assess whether the situation is subject to the obligation to propose for themselves classification under Group A, Group B, or make a Report on Non-classification;
- elaborate a risk analysis pursuant to the requirements of the Act;
- based on pre-existing information, elaborate a draft Safety Program or a Safety Report and wait for the regional authority to approve these documents, or rework them based on its comments;
- ensure, in its buildings, unconditional adherence to all the requirements for safe handling of hazardous chemicals and implementation of the Safety Program or the Safety Report;
- upon any material change, inform the regional authority, modify and rework all the documentation and have it re-approved.

In order for these rules to be sufficiently effective in incident prevention, the facility operator has to have qualified and adequately competent staff or arrange external professional assistance.

Public administration authorities (regional authorities above all) have the following tasks in the process of preventing incidents caused by selected chemical substances:

- process operators' proposals for classification into Group A or B or non-classification. In such cases, they may decide on changes (in classification into groups, or classification of operators with smaller quantities of substances) by means of assessing the proposals in their context, while taking into account additional regional circumstances and a potential risk of a domino effect;
- examine the quality of the risk analysis submitted by the operators and request potential additions or reworking;
- examine the quality of draft Safety Programs or Safety Reports submitted by facility operators. In this phase, they shall cooperate with municipalities affected by the risk and, through them, identify any comments or objections from the public. After that, they shall approve the drafts or return them for additions or reworking;
- make the approved safety documentation accessible;
- cooperate on inspecting operators, as envisaged by the Act, with the Czech Environmental Inspectorate, Integrated Incident Prevention Inspectorate, and any other applicable public administration authorities.

In addition to authorities with executive powers, *other affected public administration authorities* may intervene in the process, which submit their position statements and formulate their requirements for the purposes of regional authorities' decision-making. The regional authority shall assess these comments and may make use of them in its decision-making. These authorities include mainly environmental protection ones as well as many others if their scope of activity is concerned by the incident risk.

The public are the third entity that is affected by prevention of incidents caused by chemical substances by law. The public have the right to be informed about the risks that concern it and that may affect the public's property, health or even lives. They should also have the right to influence decisions that are related to the risks.

The Serious Incident Prevention Act includes information of the public and assumes involvement of the public in decision-making:

- regional authorities are required to inform the public, via affected municipalities, about submitted draft Safety Programs and Safety Reports from operators of facilities where hazardous chemical substances are located. These drafts have to be posted for a prescribed period of time, and the public may familiarize themselves with them, make duplicates, copies or excerpts from them, and submit comments on them, which have to be in writing; currently, any other form (oral, telephone, email, etc.) is inadmissible. The public may express their comments also in another way than in writing, but authorities are not obliged to deal with this form of comments – particularly because of a lack of plausibility and shortage of evidence in any subsequent litigation.
- regional authorities have to organize public hearings to discuss these drafts in a form as prescribed by the law;
- when deciding about the draft documents, comments by the public have to be taken into account;
- approved documents, too, have to be made publicly accessible.

Even before the effect of this Act, there used to be a partial legal regulation focused on selected specific areas that required such regulation in the past. These were:

- military grounds and military facilities (regulated by Act No. 15/1993 Coll.);
- risks associated with ionizing radiation (regulated by Act No. 18/1997 Coll.);
- road, rail, air and waterborne transportation of selected hazardous chemical substances or chemical preparations outside buildings and facilities, including temporary reposition, loading and unloading in the course of the transfer (regulated by an array of legal standards regulating transport, such as Act No. 111/1994 Coll., Act No. 266/1994 Coll., Act No. 114/1995 Coll.);
- transportation of selected hazardous chemical substances and preparations in pipelines (including associated pumping, compression and transmission stations built outside buildings and facilities along the pipeline route (regulated by Act No. 458/2000 Coll.);
- mining for deposits of minerals in mines, quarries or boreholes (except surface buildings and facilities for chemical and thermal processing and refinement of minerals, storage and reposition of materials in settlement tanks) (regulated by Act No. 61/1988 Coll.);
- surveying and mining for minerals in the sea (practically non-existent in the CR);

- landfills (regulated by Act No. 185/2001 Coll.).

This means that prevention of incidents that can be caused by hazardous chemical substances in the CR is currently regulated differently depending on *which types of facilities contain such substances rather than on what types of substances they are*.

The list of such facilities and activities is extensive. Separate acts of law that are referred to in these special cases often do not include any detailed regulation and are accompanied by executive decrees or departmental regulations. The basic scheme of the preventive measures has to be similar and focuses on preventive actions of facility operators and actions of applicable authorities that approve and inspect their actions. However, the realistic options for public participation in these special legal standards are minimal or none. They are either older legal standards from times when information of the public and their participation in decision-making were not practiced, or they concern facilities in which different interests prevail and most of the information is classified (military facilities).

4. Public involvement in the prevention of environmental incidents

Involvement of the public in the environmental incident prevention process represents a separate issue. The lasting tradition in the CR is to exclude the public from decision-making on these matters rather than involve it. Neither business nor authorities have shown keen interest in the public being given information about what they are discussing together and what they are going to agree on. Both the actors are satisfied with this method of discussion and decision-making, because they have learnt to coexist together and are capable of influencing one another so that both parties are eventually happy with the outcome. The interest of the public and their effort to participate in the decision-making is disrupting this situation and complicating it. The most frequent argument for excluding the public is that they are not qualified enough, that they exaggerate the risks and concerns, and thus hinder development of business and economic growth. Contrary to that, the current trend which public administration bodies and business undersign at least formally is different. In line with its preamble, signatories to the Aarhus Convention (AC) acknowledge that the public have the right to be informed and to participate in decision-making on matters that concern them. It is ultimately the public who will feel the consequences of environmental incidents, either directly (health and lives, property) or indirectly (ecosystem damage and deteriorating living conditions; elimination of incident consequences is funded from public budgets as well). The Aarhus Convention says (and its signatories agree by signing it) that the public may contribute to better quality of decisions made, bring new stimuli and promote goals and ideas that neither businesses nor authorities have thought of.

In most cases, however, the public so far only have the right to be informed about what public administration authorities are discussing, and comment on that. The method in which the authorities publish the information does not stimulate the public interest very much at present. The legal standards assume various forms of mandatory publishing of information (on notice boards, on the Internet). The documentation is not published in full: only information where and when one can study it (at the authority offices, within their opening hours) is published. This does have a justification, because many of the documents are very extensive and cannot be published directly for capacity reasons, whether electronically or in the forms of tens to hundreds of pages posted on public notice boards. In practice, this means that interested public are discouraged by the effort that they would have to exert in order to obtain the information. Another fact that may discourage the public is that they are entitled to submit comments (written form is required to enable work with the precise wording), because the authorities are not (and cannot be) required to respect every

comment, but rather have to deal with them, even by way of rejecting them with a justification why they do so (Dvořák and Hadrabová, 2012).

5. Conclusion

Environmental incidents are always caused by some deficiency in handling hazardous substances. It may be due to the fact that the *rules for handling these substances are not strict enough and do not regulate risks properly*. In this case, the primary responsibility lies on the public authorities responsible to set appropriate rules. To set quality rules for the handling of hazardous substances requires adequate qualification of public administration officials or experts with whom they collaborate.

Since the advances in this areas are constant and new hazardous substances are invented all the time, the preliminary assessment principle has to be followed: it says that before a substance is permitted (registered), the potential risks associated with it have to be considered adequately and from all points of view, and that it must not be approved if these risks exceed the tolerable limits. Along with it, the precautionary principle has to be observed, whereby we should terminate or suspend, without undue delay, the use of substances that have passed the approval process in the past but whose potential risks have been proven later with new findings and experience. In such cases, regulation has to be quick without waiting for conclusive scientific affirmation or refutation of the concerns, because such affirmation may take many years and the damage may become much worse; polychlorinated biphenyls (PCB) are a typical example of where the precautionary principle was not applied and the damage has been enormous.

Environmental incidents may also happen due to *human error*, particularly insufficient discipline of staff at work and failure to adhere to regulations, or insufficient staff training and risk information. This area is chiefly the responsibility of operators of facilities in which the substances are handled. It is also partly the responsibility of public administration authorities, which may specify requirements for qualification, training and periodic testing for staff in contact with hazardous substances at work, and which check companies operations.

Another possible cause of incident may be *technical failure* (defect on the facility). This failure may occur either due to neglected mandatory maintenance and inspection of the facility (which is in fact again a case of human error), or due to causes that cannot be avoided in spite of all efforts (material fatigue, facility damage that cannot be detected with routine inspection, etc.). Again, the responsibility is primarily with facility operators but also public administration authorities (which set rules for operation, periodic inspections and repairs of facilities, and inspect the adherence to such rules).

The aim of this paper was to identify the strengths and weaknesses of prevention of environmental incidents in the Czech Republic and possibilities for improving the prevention of incidents, which is currently working in the Czech Republic. The main contribution of qualitative research we consider the identification of fundamental shortcomings that need to be removed.

It is necessary to examine, in which extent existing dissimilar legislation of the prevention, embodied in different legal norms that emerged over many years, is or is not a problem. At the same time, it is desirable to examine, if unification of legislation – or at least a modification of sub-rules to match the demands of today – would be necessary. It is also necessary to consider extending the possibilities of public participation in the prevention, particularly where this option does not yet exist or is insufficient. In this context, it is necessary to facilitate public access to the necessary information, especially to those available to government in its information systems.

Gradually, it is necessary to remove the fragmentation of the individual sub-systems in the Integrated Information System environment and adapt their content to the needs and ensuring the prevention of incidents. Given that information asymmetry among individual entities exists and cannot be expected to remove it, there may be the possibility of testing hypotheses or models of risk management by laboratory economic experiments. This would allow testing to detect any weak and strong points of prevention programs and improve their preparation and approval process.

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DATA SECURITY CONCERNS OF FUTURE ECALL USERS

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Keywords

eCall, Data Security, Information, WAZE, Position Tracking

Abstract

This paper presents results of research focused on fears and worries related to obligatory using eCall system in new cars since 2015. It also discusses some related topic, especially privacy concerns in case of using mobile devices for navigation and dependency of those worries on users' characteristics. It also monitors people's willingness to have eCall installed in older cars.

1. Introduction

In previous work (Kubát, 2013) a combination of already implemented solution and a new concept was introduced. One of the methods for forewarning in case of traffic problems is eCall and the other is a smart phone application, namely Waze. When presenting the idea I encountered many doubts about user data security and other personal data issues. So I decided to do a research about this topic and to find out, how people perceive the data security areas and how they feel about their possible misuse. This paper introduces results of the research.

2. eCall

Project co-funded by the European Union aims to the creation of 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 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)

A manual use of the system can be useful when a traffic accident is witnessed (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 about 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. The next disadvantage is a fact, that according to the system specification, it cannot locate the car before the emergency message is activated. It means that after activating the message, the system starts searching for satellites therefore a delay is inevitable.

There is also another point of view. This perspective takes in account the fact that although official places claim that there is no way how eCall could "spy" its users, there exists an official document named "Summary for citizens" that advises official places how to introduce eCall to citizens. In this document there is clearly stated that other advantages of the system are following:

- Less traffic jams caused by traffic accidents
- More effective control of traffic after traffic accidents
- The system could be used for other purposes – electronic road-toll, monitoring of dangerous wares, more modern models of insurance etc.
- Via this system automotive industry and telecommunication companies could provide new services.

This view tries to prove that implementing eCall will have next stages and their assertion will result in the real possibility of online tracking our vehicles. Unfortunately the document was withdrawn during working on this paper so the link is not valid. The original document is at disposal on an email of the authors of the paper.

3. WAZE method

WAZE is a free social GPS application featuring turn-by-turn navigation. It means that the driver is led through every crossroad. WAZE is supported by Android, iPhone, Symbian, Windows Mobile. WAZE differs from traditional GPS navigation software as it is a community-driven application and learns from users' driving times to provide routing and real-time traffic updates. It gathers map data and other information from users who use the service. Additionally, people can report accidents, traffic jams, speed traps, police patrols. It can also update roads, landmarks, house numbers, etc.

WAZE is available for download and use anywhere in the world, but while some countries have a full basemap, other countries still require users to record the roads and edit the maps. Currently WAZE has a complete base map in the United States, Canada, United Kingdom, France, Germany, Italy, Netherlands, Belgium, Israel, South Africa, Ecuador, Chile and Panama.

In addition to turn-by-turn voice navigation, real-time traffic, and other location-specific alerts, WAZE simultaneously sends anonymous information, including users' speed and location, back to its database to improve the service as a whole. This crowd sourcing allows the WAZE community to report navigation and mapping errors and traffic accidents simply by running the app while driving.

For the purpose of early warning we will deal only with the alerts. The routing and navigating is not important for this paper. WAZE can be used for warning in both cases – car accidents and traffic problems. It will inform other users the fastest way (compared to previously described methods). On the other hand, it has some disadvantages. A smartphone is necessary (OS: iPhone, Android, Windows Mobile or Blackberry) and a data plan is needed (to eliminate expenses for mobile data). But even with a data plan there are areas with no signal. In case of an accident there is a delay described in next chapter. And since it is a GPS application, signal from satellites is necessary.

A WAZE user has to be disciplined and not distract other users by sending useless messages just for obtaining more points in the WAZE system. Points serve for progress in WAZE user hierarchy. During the report of an event a driver is distracted too.

WAZE does not get information only from its users but from NTIC as well. The reverse flow of information is not possible at the moment. Reports from drivers are verified by other drivers but WAZE is still not reliable information source for NTIC. Of course, even a WAZE user has a duty to report the accident on line 112. In this case the other WAZE users are informed two times.

The idea is to allow information from WAZE report flow into NTIC which would then deal with it like with information from any other source. The data format of the information would have to be standardized. After the standardization the information could be processed flawlessly. It would ensure better awareness on the input. If the information is properly verified it could be processed by the Radio HELP system immediately without causing delay in NTIC. WAZE implementation would take effect in case of traffic problems that are not life-threatening. In those cases eCall is not activated and drivers are not obliged to inform NTIC about the problem.

Security issues of the application are equal to security issues of any other application that can send positional data. And using the application is a person's choice opposed to obligatory eCall.

4. Questionnaire

The questionnaire was created with emphasis on the fact that each respondent is different. Therefore the questionnaire was branched so we could get useful information even from a respondent who does not own a car or mobile device. For example if he or she does not use a mobile device for navigation, there was a question: "Why do you think other people find using mobile devices for navigation useful?"

For the best variety of respondents the questionnaire was disseminated many different ways. Via e-mail (friends and family members), facebook, idnes blog, car section on news server (garaz.autorevue.cz) and 1.9 % of questionnaires was filled directly on the server where the questionnaire was created. I avoided asking students because it would influence a diversity of results.

5. Composition of respondents

Total number of returned valid questionnaires was 210 from 250. 62,9 % were men and 37,1 women. Other respondents' characteristics are specified in tables 1, 2 and 3. Response rate cannot be figured out since this questionnaire was online. Therefore when a potential respondent decided not to attend the research, authors would not know it. All respondents were from the Czech Republic.

	number	percent
under 18 years	6	2,9%
18 - 25 years	53	25,2%
26 - 30 years	42	20,0%
31 - 35 years	40	19,0%
36 - 40 years	29	13,8%
41 - 45 years	14	6,7%
46 - 50 years	8	3,8%
51 - 60 years	12	5,7%
over 60 years	6	2,9%
total	210	100,0%

Table 1 Age of respondents

	number	percent
primary school	9	4,3%
skilled	11	5,2%
high school	92	43,8%
university	98	46,7%
total	210	100,0%

Table 2 Education

	number	percent
under 560 €	26	12,4%
570 – 930 €	51	24,3%
940 – 1300 €	50	23,8%
1310 – 1860 €	40	19,0%
over 1870 €	43	20,5%
total	210	100,0%

Table 3 Month family income

6. Evaluation:

6.1. Groups of users

In the first step basic groups of users were discovered. 74,3 % respondents own a car. 73,1 % car owners use smart phone and 68,4 %, e.g. 73 respondents smart phone owners use it for navigation. People who do not use it for navigation have following reasons: 58,3 % users have dedicated navigation, 13,9 % use paper maps, 25 % do not need a navigation and 2,8% have other reasons.

The question „Would you like to have eCall installed in your older car?“ had also interesting responses. 40,6% respondents would install it if it cost less than 150 €. 10,1 % would instal it if it cost less than 300 € and 52,2 % respondents would not install it at all.

6.2. Worries about eCall data misusing

In the next step the fear of data misuse when using eCall was evaluated. From total of 210 valid respondents 25,7 % was afraid of data misusing. One of aims of this paper was to find out what affects this privacy concerns. If it is gender, income of the family, age or education. Respondents were not told about possible misusing possibilities in advance and this was an open question (no possibilities were suggested).

Hypothesis claimed that there is no dependency of worries on observed property (age, income etc.). For finding out the dependency a Pearson contingency coefficient was used. The coefficient can reach values $0 \leq P < 1$, whereas value 1 can not be reached. Calculations showed that the dependency in all investigated characteristics is very low. The strongest dependency is on age and the weakest on gender. Hypothesis has been rejected.

$$P_{\text{age}} (0,254) > P_{\text{education}} (0,19) > P_{\text{income}} (0,125) > P_{\text{gender}} (0,039)$$

6.3. Privacy concerns of social network users

After comparing answers to questions: “Are you afraid of misusing your personal data while using smart phone for navigation?” and “Do you use social networks?” was found out that from 35 respondents who are afraid of misusing their personla data 26 use social networks. So the question is: How righteous are those worries? People may think that Facebook or Google+ are safe because these social networks are widespred. In the contrary, eCall and social navigation software are relatively new systems and people tend to believe that new things could be suspicious.

6.4. Categorising worries

For more detailed overview of respondents' worries there were implemented some open questions in the questionnaire. Among them was the question: “How could be data misused?” This question was answered by smart phone users and their replies are in the table 4.

worry	% of users
Position tracking	26.5 %
Marketing issues	23.5 %
Stealing money, property	17.6 %
Various ways	14.7 %
Voice monitoring	5.9 %
Identity theft	5.9 %
I don't know	2.9 %
Speeding tickets	2.9 %

Table 4 Categorising worries – smart phone users

From users' replies is easily readable that the position tracking is not the only issue. Misusing for marketing purposes or stealing money is a privacy concern of many users as well. Unfortunately there were not more respondents so the results are not very significant.

Next important question was: "Why are you afraid of implementing eCall since 2015?" There are two main groups of respondent that have similar replies. Replies are summarized in table 5. Some replies correspond with facts discussed above, eg. electronic road-toll is not only pointless fear but taking into account the official document it has some real outlines.

worry	% of users
Misusing with no detailed description (Big Brother, Czech law environment, distrust in state apparatus etc.)	34.6 %
Permanent position tracking	32.1 %
Various ways	4.9 %
Electronic road-toll, speeding tickets, travel orders ets	4.9 %
Other answer	4.9 %
Voice monitoring	3.7 %
What is obligatory, can be misused	3.7 %
Marketing issues	2.5 %
I don't know	2.5 %
Distrust of official information	2.5 %
Hacking a server with users data	1.2 %
Distrust of employees of the system	1.2 %
Minimal law protection	1.2 %

Table 5 Categorising worries about implementing eCall

7. Conclusion

There is no doubt that implementing new technologies can improve reaction time in case of emergency situation. But in the contrary, there are facts that are not officially communicated to public. And after evaluating the questionnaire it can be claimed that citizens are not unconcerned about their privacy. There are some ideas how to improve the safety. For example, to make eCall firmware open-source code. But the question is if this would be acceptable.

Interesting fact is that some people use social networks and their data are quite easily available but they are afraid of misusing data about their position. Certainly there is a different character of data but it still means that new technologies should be communicated honestly and carefully.

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CRITICAL SUCCESS FACTORS OF THE RECOVERY SYSTEM AT THE MUNICIPAL LEVEL OF DISASTER MANAGEMENT

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Key words

Critical Success Factors, Emergency Management, Restoring And Continuity Management

Abstract

The main purpose of this paper is to analyze the processes of information sharing on the municipal level with the aim to restore normality after a disaster occurs. The emergency management on the highest - national - level is thoroughly described in the National Emergency Plan while the factors such as education, culture, communication, and volunteerism influencing to a significant extent the “municipality level” are not managed and are organized ad hoc. On this lowest level, the representatives do not usually have the required managing skills and knowledge (they receive some education in this area but quite often they have no practical experience with large-scale leadership) which appears as problematic since they have to lead and coordinate numerous groups of citizens and volunteers. In this article the authors, via personal interviews with the municipality representatives, evaluate the critical factors of successful crises mitigation based on the experience of small towns with the emergency management implemented during the flash floods 2010 in the Liberec region. From historical events the critical success factors (CSF) could be achieved for emergency management.

1. Introduction

In the recent years we witnessed many emergencies resulting from natural extreme events, heavy traffic or blackouts. Many researchers are currently documenting and describing strategies and processes applied in such a situations in order to analyze and identify the factors that are necessary for successful and efficient problem solving. Similarly to the business environment, improvisation, adaptability and creativity represent the important aspects having impact on the chosen approaches to the coordination, collaboration and communication.

Emergency management is a multidisciplinary and multi-organizational event that necessitates cooperation across geographical and organizational boundaries. It requires coordination of human resources, technology, money, equipment while taking into consideration economical, cultural, educational, political and legal factors and the parameters of functions such as communication, coordination, information sharing, and decision making. According to Williams, Batho and Russell (2000, p.300) the primer objective of a disaster management is to restore normality as quickly as

possible. The response phase can be divided into three processes reflecting the timeline of the crisis: pre-event, crisis event and post event.

For each of these processes Ozceylan and Coskun, (2008, p.376) define the main factors of the emergency management model as: technological (effective warning system), cultural, socio-economic (transportation, industrialization, infrastructure), political (government, legislation), organisational (national emergency plan, coordination, administration) and risk factors (climate, geography). This problematic was already studied by many authors who identified different aspects that could be included among the CSF of emergency management at municipal level:

- Collaborative network (Williams, 2000, p.301),
- Agility, creativity, improvisation, adaptability and discipline (Harrald, 2006, p.121),
- Organisational flexibility, culture openness, effective coordination and collective response (Corbacioglu and Kapucu, 2006, p.220),
- Inter-organisational factors (Horan, Marich and Schooley, 2006, p.119),
- Clearly defined leadership roles, responsibility and authority (Dawes, Creswell, Cahan, 2004, p. 156),
- Infrastructure (Ozceylan and Coskun, 2008, p.376),
- Training (Williams, Batho and Russell 2000, p.300),
- Effective communication (Bardach, 2001, p.149),
- Preparedness (Skrbek, 2013, p.200),
- Political will (FEMA, 2006),
- Coordination, skills, knowledge, experience (Comfort, 1999, 134).

2. Research methodology

As it was already mentioned, the aim of this article is to analyse the problems during the crisis recovery phase on the municipality level. We organised a survey based on controlled interviews of the mayors from the municipalities in Liberec region that were in 2010 directly affected by the flash floods. Our aim was to investigate the greatest issues that appeared while performing the standard, prescribed procedures and to obtain personal opinion of these respondents on the changes that could be made in order to make the future emergency response more effective and all the aspects manageable in timely manner.

We were expecting that the results of this research will help us to more closely identify the CSF of the post-disaster processes enabling the return back to “normal” state. The critical success factor method that we choose, serves as a tool for identifying important elements of success Rockart (1979, p. 217) in the key areas of activity in which favourable results are absolutely necessary for a particular manager to reach his goals. The CSF method usually consists of five steps: 1) identification of the analyzed area, 2) collection of the data, 3) data analysis, 4) identification of the individual CSF, 5) analysis of the processes influencing the CSF.

Generally, each level of the organisational management has to concentrate on different CSF because the factors are dependent on the goals that the levels are supposed to achieve. Goals of the emergency management at the municipal level are defined by the directives and by the National

Emergency Plan. Whereas most of the procedures how to achieve the goals are described, the aspects that influence them are neglected. Among the numerous goals that need to be fulfilled we will concentrate on the priority ones that are: the human lives safety, the provision of the humanitarian aid and restoration of the elementary infrastructure. This paper does not deal with the secondary recovery activities which take place after the crisis subsides and most of the basic support systems are again functional.

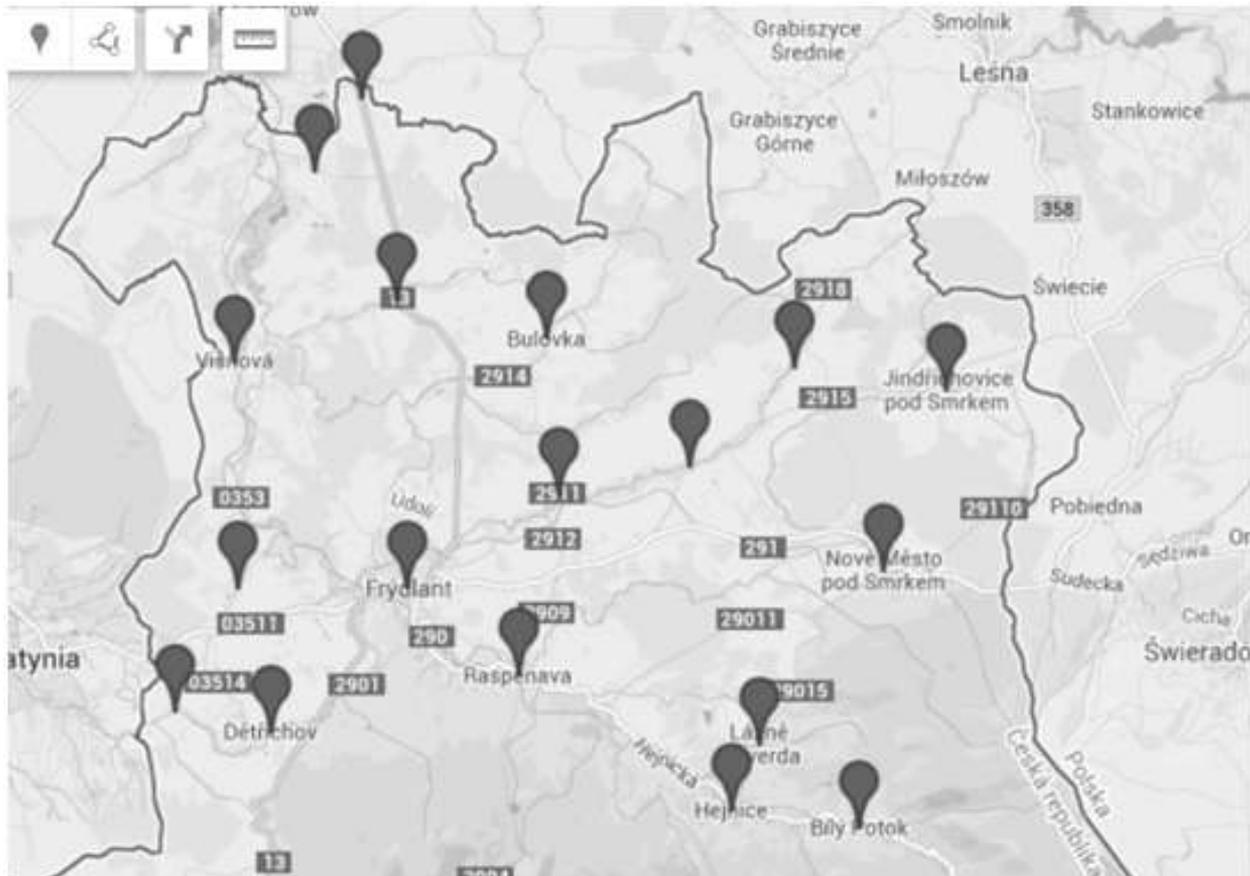


Figure 1: Villages at the affected area (source authors)

During our data collection, we interviewed 18 mayors (representatives) of the local villages and communities where the floods had the most serious consequences in the last years (see figure num. 1). Five of the questions were opened and the rest (12) were closed. The respondents were asked about the plans for emergency information sharing, strategies used for the coordination of volunteers during and after the crises situation and about possibilities of communication with the citizens in form of a feedback or about the existence of educational formations and courses in which the citizens could learn how to proceed in crisis situation. For the construction of the interview we used questions built on the emergency management model (see figure num. 2). This model presents all possible factors that can play an important role in the emergency management and that are therefore candidates to be classified as the critical success factors. At the end of the interview the respondents were asked to evaluate the importance of each factor on the scale form 1 (the less important) to 5 (the most important).

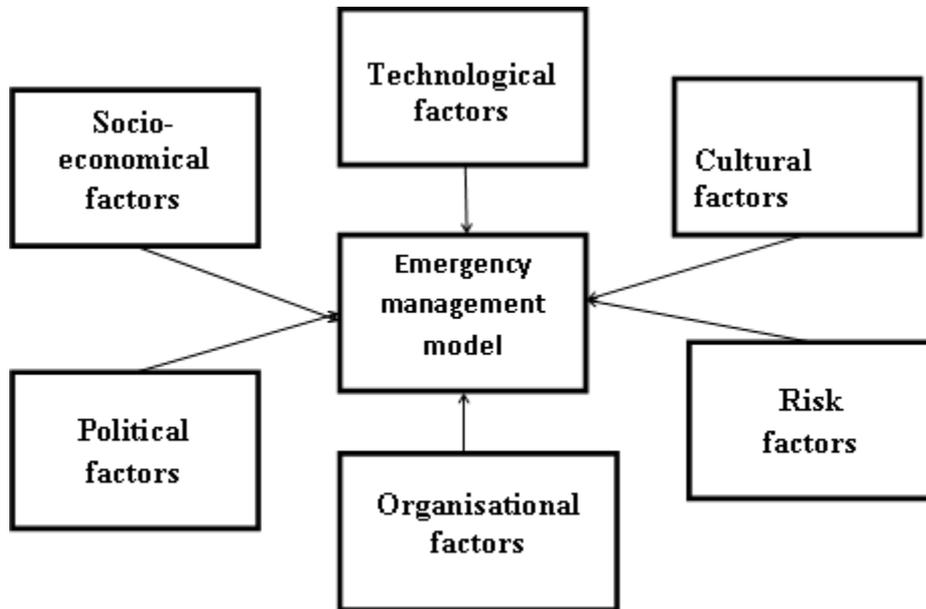


Figure 2: Emergency management model (Ozceylan and Coskun, 2008, p.379)

Crisis is a specific situation creating a new setting of conditions that is unfavourable and may become dangerous in many ways. The tendency is to get the setting back to the original (or improved) state. Based on our previous analysis of the current research and studies in this area we suppose that majority of the CSF will be dependent on the choice and functioning of the communication and information technologies. Contemporary society is referred to as the information society because, nowadays, almost everyone has a permanent connection to the internet (at work, during free time, or at home). It starts to be the main communication tool in all aspects of life. Some authors even call it the evernet (Geffroy, 2013, p.15). Despite all the advantages that these technologies offer, we think that they also represent a greatest source of technical or organizational problems. Via the identification of the CSF we equally hope to enlighten the role of ICT in emergency/crisis situation and their impact on the goal achievement at the municipality level that is managed by the local authorities.

3. Lessons learned from the flash floods 2010 in the Liberec region

In August 2010 the north of the Czech Republic was hit by heavy torrential rain that resulted into flash floods having severe and long-lasting consequences on the infrastructure and functioning of the affected regions. The floods struck primarily in the Liberec region and Ústí nad Labem which both had to declare a state of emergency. The situation required a rapid response and coordination of rescue and organizational units on many levels. In this case study we focus on the mobilization of individuals and material resources on the municipal level. During our research we interviewed the mayors or representatives of eighteen selected villages in order to obtain data concerning the problems that occurred during the crisis response and resilience phase.

The most problematic factor appears to be the coordination of citizens. Many of the answers mentioned the reluctance of many citizens to leave their homes and move to safety zones. “People usually underestimate the situation and the possible danger.” It was proven that some people do not believe there is an imminent danger or that the situation will become critical and life-threatening until they can experience it them-selves which may lead to complicated rescue operations. On the other hand, the respondents are convinced that if the citizens perceive the risk as valid, they are able

to promptly react. Indiscipline and curious citizens negatively influence also the organization of the humanitarian aid. Despite all these problems, only 20% of the villages that participated to our survey organize public educational sessions or trainings explaining the citizens how to behave in case of emergency. None of the municipalities have plans describing how to create, manage and utilize the network of volunteers as effective workforce. Collecting of the humanitarian aid by default takes place at the municipal office.

Significant issues appeared in early warning system as well (Skrbek, 2013, p.39). We discovered that certain municipalities have even incomplete informational infrastructure and very limited broadcasting possibilities that is why they need to, above all, rely on the help of Fire and Rescue services (FRS) who are equipped by a radio broadcasting device. The role of these services is amplified even more by the malfunctioning and “constantly overloaded mobile networks”. The FRS plays an important role also in informing elder citizens by visiting them in person. In addition his majority of villages provide critical information via profiles on social networks, official website of the municipality or via SMS.

With regard to crisis preparedness, all respondents confirmed that they have contingency plans and scenarios that are updated after every emergency situation the community had to recently face. However, only few of them have made the plans available to the public. Some of the answers likewise pointed out the lack of contact information on emergency services and uncertainty which protocol they should follow. Most of the respondents also recommended the organization of more trainings where the first responders and local authorities would become more familiar with the procedures and protocols that are necessary to follow.

4. Critical success factors of crisis management at the municipal level

The results of our local survey show that there are important shortcomings in all critical success factors listed by Ozceylan & Coskun (2008), that means the technological, cultural, socio-economic, political, and organisational and risk factors (fig. 2). The municipalities are not able to develop fully functioning collaborative networks of volunteers, rescue units and local authorities. Due to the low level of situational awareness and lack of knowledge about the prescribe procedures, the agents who participate in crisis response and resilience are confused, which considerably slows down the decision-making process and makes it impossible to react flexibly with regard to the changing environment. All these problems could be avoided by creating coordination plans with clearly defined roles and responsibilities including the help of groups of volunteers.

The factor that is cited by almost all the respondents is the effective communication. This factor can be without any doubts considered as fundamental since it has a high impact basically on all the others elements of a successful crisis management. If the communicational infrastructure does not answer the needs of reach, speed and quality, it will be very difficult to establish a stable information flow between all stakeholders. Although the municipalities in the Liberec region possess various means of emergency communication, there are still substantial problems with the reliability of the mentioned channels. The instability of mobile networks needs to be discussed with the service providers. Also local broadcasting services should undergo revision and be restored in places where they are malfunctioning or completely missing.

Serious deficiencies in communication were, as well, reflected in the incompetence to coordinate available knowledge and skills. The representatives of the local authorities included in our survey stated that, occasionally, they did not know who to contact in matter of additional humanitarian help or who they should turn to if they needed more emergency and rescue units. The authors of

this paper would like to draw attention primarily on the crisis education and culture that on the lowest, citizen, level seems to be inadequate. Lax and distrustful attitude toward warnings released by the local authorities and emergency services appears to be a common incident during crisis situations. Moreover, citizens usually disrespect recommendations given to them and remain in the endangered areas or interfere in the resilience operations because of their curiosity. In this case, intensified education could provide a solid background for development of a pro-active behaviour on part of the citizens and prevent similar complications.

5. Conclusion

Crisis situations produce conditions of great uncertainty and managing them successfully require the consideration of many factors which is not easy for the representatives of the small villages, who are usually just ordinary citizens and not the risk managers with long educational background. Therefore we concentrated on these problems and investigated the main critical success factors for emergency management as communication, using proper communication tools (Skrbek, 2013, p.200), recovering plans, educational disaster management in schools or companies and also the trust of the citizens. All the representatives on the lowest level are in a very close contact with the citizens and together with them they can avoid damage of health and property. During our research we come across many cases where some of the infrastructure damage has not been repaired till now. To ensure a better approach and behaviour in a disaster situation it is crucial to know what to do at each part of the crisis development. Some respondents answered, that they are not sure about some of the processes and contact information on the relevant emergency services. This area represents a big scope for improvement. First steps improving the preparation for possible upcoming crisis could be achieved by creating a network of cooperating villages and by organizing some educational courses for the citizens where they would learn about the basic instructions and safety measures and about the type (and location) of the central tolls for sharing information. In the future research, based on the knowledge gained in this survey we are planning to develop a viable communicational model improving the problems of the current situation.

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DESIGN OF AN EARLY WARNING MOBILE APPLICATION

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Keywords

Alert Messages, Application Design, Early Warning Systems, Mobile Devices

Abstract

Information technologies are increasingly gaining more importance in our lives. Thanks to the progress in this area, the targeting of critical information in nearly real time has been made possible. While the timely and transparent dissemination of information finds diverse applications in many areas, it is particularly emergency and disaster management where fast sharing of crisis-related data can help minimize the possible tragic consequences of life-threatening situations. This article proposes a possible method for the design and implementation of early warning mobile application in crisis situations. The authors firstly reflect on the desired functionality, secondly they outline the problems of input information and subsequent distribution based on spatial location data. A substantial part of this paper is also describing the individual steps taken during the design of the visual interface of the mobile application and to the explication of its impact on the perception of graphical and text-based information.

1. Introduction

In the Czech Republic, extreme natural events, power outages or other disasters are not as common as in other parts of the world, but when they occur, the consequences can reach tragic proportions. Obtaining appropriate and timely information plays a key role in mobilizing timely response and rescue of material resources, properties and even human lives (Skrbek, J. 2009). Today, the majority of the Czech population uses mobile phones on daily basis. According to CTO (Czech Telecommunication Office), at the end of 2013 there were 13,24 mil. active SIM cards. Mobile phones due to their number and coverage represent an important commercial article and for certain age categories they are considered to be a necessary social artefact or even a fashionable accessory. The Association of Mobile Network Operators (APMS) currently registers 3.7 mil people in the Czech Republic using mobile internet on their phones. We can also observe a rapidly expanding range of tablet users, for example last year the number was close to one million. With mobile technologies and the increasing coverage of the mobile Internet, the users can get to wanted information regardless of time or location of their action which could provide a significant advantage in situations when an immediate reaction is needed. As pioneer of this vision can be considered large insurance companies that follow the current trends and start to develop their own

mobile applications allowing the user to get information about weather forecast, or the updated information from mountain rescue services.

Every year, the number of smartphones among the users of mobile phones increases and will continue to grow in the years to come as well. These devices in addition to the standard features, such as making phone calls and SMS writing, offer the option to install mobile applications. It is exactly this functionality that could be the right step in crisis management (Kubat, Kviz, Skrbek, Zizka, 2012). At the moment, Czech government has no clear or coherent concept of crisis management. For many years, the investments in maintenance of the warning system, which is partly replaced by a system of public radio stations in towns and villages, are decreasing. Obviously, it is necessary to discuss the stability of the mobile network in case of an emergency and the period for which information could be distributed through the mobile network. These aspects are, of course, critical and the question still remains whether it is possible to strengthen the stability of mobile network through governmental support of private and commercial sphere and their mutual cooperation.

The authors of this paper, however, focus on the actual process of mobile application development, on its features and design. One of the key features is the targeting of send information to specific areas since it would be ineffective if the user of the application received information about event with no direct impact on him (for example a crisis situation of local character that goes far beyond regional borders of the user). Mobile applications should therefore really offer to the users only the information that directly affects them and that can help them protect themselves or their property (Skrbek, J. 2012). The large-format distribution of information without specific localization could quickly lead to a devaluation of functionality and timeliness of data provided by mobile application.

2. Design and implementation of a mobile application

The offer on the market of the mobile applications is today literally enormous. Everyday, many new applications appear, the number of ways how to utilize them in multiple areas is growing and in many cases, mobile phones applications have become a significant source of income. Most of these applications is, however, commercially oriented and developed with the purpose to entertain the user or to insure mediation of a commercial service or purchase. Creating a mobile application which main objective is to warn people in crisis situations is by its nature clearly a non-commercial project, that should be backed and supported by the government, a strong, financially secured patron or by joint collaboration of both. The financial demands of building and implementing such mobile application are certainly high, but it is clear that the benefits could far outweigh the embedded costs and capital investments.

The design and implementation of mobile application can be divided into individual sub-elements and steps: 1. Formulation of the requirements, 2. Analysis, 3. Proposition of the possible functionality and design, 4. Application programming, 5. Testing, 6. Distribution of the mobile application to the end user

2.1. Specification of the mobile application

Clear definition of the necessary objectives and requirements is one of the main pillars of the designing process of an early warning mobile application :

- What is the primary purpose?
- What input data will the application have available?

- How will these data be processed?
- How will the application distribute the output data to the users?

The primary purpose of such a mobile application can be specified as the protection of persons and property in the predefined emergency situations. No mobile application of this nature is not currently implemented in the Czech Republic and so far we are not aware of any governmental plans of providing similar public service to the public. The current state of early warning system in the Czech Republic cannot be describe as satisfactory. Warnings and alerts can usually be effectuated only by using the audio signals transmitted by local town broadcasting and the network of warning sirens. Information about the crisis distributed through standard channels of communication often reaches citizens that are not directly affected by the situation and does not get to people who need to be warned in timely manner.

The nature of processed input data play an important role. They should come from authorized agencies at governmental level. The application should be able to filter and use the data furnished by Fire and Rescue Services, Police, Emergency services and other critical organs. Nevertheless the security of critical input data and their protection against misuse still remain a great issue, since dissemination of false alarm messages could be part of a possible terrorist attack or represent a challenge for various hacking groups or individuals (Skrbek). A fraction of input data could also be gathered from the system eCall. This system, created as part of project run by the European Union, in case of an accident automatically opens a communication channel with the operator in the emergency center. This method is considered to be the quickest but the informational flow is enabled only in post-accident period and the implementation is still not completed (Kubat). The application proposed in this article would filter all the input data from defined sources and subsequently redistribute them to end users based on their location. Local distribution and data filtering would of course be automated by database processing. The relevant information would be distributed according to the geographical location of the application's user. The actional radius of the send data would differ with every type of warning (fire, terror, water, wind). The user would have the possibility to regulate the amount of details of the received message based on his own decision about its usefulness.

2.2. Defining functionality

Mobile application must provide an easy-to-use interface and the most natural and intuitive controlling possible. The interface of an early warning application must therefore be organizationally well-arranged and simple. The control features should be limited in number, divided according to standard layouts and large enough in order to facilitate the navigation and accelerate the speed of user's response. Nowadays, the market starts to be dominated by mobile phones with touch screen control which needs to be taken into account as well. The controlling of the application should be intuitive for all age groups of users, including the children and senior citizens.

2.3. Layout of the application

For textual information it is important to choose appropriate type and font style. It is preferable to use one, or at most two, sans-serif fonts that are, unlike serif fonts, more readable even at small sizes. It is not necessary to use many typefaces since there should not be much text information in the application for reasons of losing the easy readability and clarity. To display all needed text information two typefaces, regular and bold, should be sufficient. The selection of the minimum and maximum size for the font, the maximum length and the number of characters may also

influence the readability of distributed information. All types of emergency messages should be defined using a similar number of text characters which simplifies the subsequent automation of processing and visualization of text information in the mobile application.



Figure 1: Possible design of the mobile application (Authors)

The actual layout of the mobile application must again fulfil the above-mentioned characteristics - simplicity, orderliness, clarity of displayed information (Botzet, Skirmishes, Mark, 2013). It must allow a quick navigation in the application even for the users who work with the application for the first time. Individual distribution of graphical and textual information must be positioned in correspondence with certain developmental standards of displayed elements, whether it is a web interface or mobile application.

2.4. Design proposition

The system should distribute the currently required information using both, text and design appropriate visual tools (Hernandez, Viveros, Rubio, 2013). Thanks to the simplicity of graphic elements the user should easily recognize the importance of the notice and its main message. Four icons were designed for reporting the most frequent types of crisis situations: **fire, water, wind, terrorist attack**.



Figure 2: Proposed design of icons for selected crisis situations (Authors)

In terms of the visual and psychological perception of the application the choice of colors used play an important role. The researchers recommend involve natural human color perception, for example, use aggressive red color to indicate imminent danger. The use of different variations and shades of colors makes possible to visually distinguish and symbolize the distance from the impending danger. For example, the icon of fire would turn bright red if the mobile device (and thus the user) occur to a distance of 500 meters from the fire epicenter. With the increasing distance from the epicenter the shades of red (about two shades) would fade and after while change into orange mode representing more general and less threatening warning such as movement restrictions in danger zones, diverted traffic, etc.

When designing a mobile application it is necessary to consider two significant limitations. One of them is the resolution of the mobile device. Different smart phones have different resolutions. The resolution of touch screen mobile phones differs according to type and producer. It can range from 240 x 960 to 320px x 480px and more. The display resolution, its size and quality given by resolution per inch represent key attributes allowing the manufacturers positively reach potential customers which leads to their continuous innovation even for established models of mobile phones. Yet even minimal display surface provides an ample space for the creation of a clear graphic layout of a mobile application. Certainly, in the future, due to the improving resolution and rendering performance of cell phones, it will be possible to develop more complex and sophisticated design using simple animations.

Another important aspect are the graphical data demands and their impact on the device's processor and its graphical interface which can easily get overloaded. These factors therefore require to reduce the graphical files to the smallest size possible or to replace them by their equivalent using graphical styling and coding. To avoid the overloading of the device or of the distribution network, it is crucial that the size of all the data received by the application is minimal. Exactly this functionality of fast data transmission with local specification is one of the fundamental features of the proposed application.

2.5. Application programming and distribution to the end users

Currently, there are in the area of operating systems distribution three major manufacturers. These include, among other, the company of Apple with its iOS and its group of iPhones. As the largest player on the market for mobile phone devices is considered the company of SAMSUNG. The last of the major operating systems providers, is the transnational corporation Microsoft with the Windows operation system.

So far, on the market, ANDROID is the most represented operating system. The existence of various operation systems logically necessitates a different approach to the actual implementation of the mobile application. For each operation system there needs to be developed a different version of the application. After the successful testing, the next step is the distribution of the completed application to the users. Even in this stage, there are significant specifics of how to allow the users to get the mobile application. When distributing the Apple phones with the operational system iOS, the only option is to download the application from the official company iStore. The application itself, however, must first go through an approval and testing procedures, before it is considered as completed and approved for official distribution to potential users (Vávrů 2012). This, of course, can cause delays and require a longer period of time than usual to get from the design stage to final usage of the application.

The ANDROID operating system, unlike iOS, is fully open and it is possible to offer the tested and tuned application to users for direct download. Applications designed for the Windows operation system can be distributed via official portal windowsphone.com. When programming mobile applications it is important not to underestimate the security risks that are connected with the distribution of critical information. The whole system of which the mobile application will become part, must be adequately protected against external abuse. Ensuring such security involves reception of a coded transmission of output information and its subsequent decoding directly by the mobile application.

3. Already implemented similar mobile applications

It is possible to find few similar, already implemented, mobile applications whose main objective is to warn the user in life-threatening situations and help him to get through the evacuation a resiliencing process. American Red Cross created *Tornado application* that offers to its users step-by-step advice and instructions even in situation when there is no cell phone or internet signal available. The application launches an audible siren when the National Weather Service issues a tornado warning and informs the user after the warning is no longer valid. In addition, the users are provided with set of useful tools such as strobe light, flashlight or a map with location of safety and humanitarian aid shelters.

The Australian Early Warning Network assures similar functionalities. Registered members receive, based on their location, emergency alerts for severe thunderstorms, bushfires, floods or tropical cyclones and tsunamis. These alerts include emergency maps, instruction and even geo-tagged images and videos, all connected to social networks Facebook and Twitter. The Tsunami Alarm System operates on the same principles. The subscribers receive warnings on their mobile phones coming from many seismic measuring and tsunami warning stations all over the world. All the existing applications and systems using mobile devices ensure that the users can apply life-saving measures before the destructive event arrives.

4. Conclusion

In addition to mobile phones, it is possible to prepare similar application for the constantly growing groups of tablet users. This expansion would create new channels for informing the citizens and increase the chances that they will get the critical information in time via at least one of these channels (mobile or tablet). Duplication in similar cases are of course possible since some individuals own and use more devices at once, however it is more desirable to deliver one message multiple times than not deliver it at all or with a significant time delay. Implementation of the presented

mobile application focused on early and crisis warnings would certainly be accompanied by many problems: the stability and coverage of mobile and internet networks, structure of competences to provide crisis reports and information, automation of local targeting, financial support of the overall project implementation, the maintenance, hardware requirements and human resources necessary for successful implementation, etc. Another crucial issue, that should be addressed from the governmental level, is the privacy and security of the users who download the application. The whole system should fulfill the general requirements for security as for example the banking system but still remain simple and easy to use. The implementation of the security protocols is problem of technological nature. Despite the problems that may occur, it is evident that the implementation of the proposed application, or a similar one, could represent a great contribution to the currently existing warning system and help avoid the damages on human lives and properties.

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THE USE OF CRYPTOGRAPHY FOR DISTRIBUTION OF INFORMATION DURING CRISIS SITUATIONS

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Keywords

Broadcasting, Cryptography, Decryption, Emergency, Encryption, Information, RADIO-HELP.

Abstract

Using as a model situation a search for a wanted criminal inside an industrial building, this paper describes the implementation of an encryption algorithm in which the encryption method is based on the position of the recipient. The main objective of this contribution is to create a manageable model of a system that would allow to warn citizens about possible risks in targeted area and prevent them from entering the danger zone. The proposed model is designed as an extended part of an early warning system whose purpose is to inform the stakeholders during emergencies and help to eliminate the weakness of the already existing systems.

1. Introduction

The transmission of relevant information to affected stakeholders during natural and human-made extreme events and other type of critical situation has always been considered as a significant challenge. However, thanks to the continuous progress in the development of information technologies, multiple advanced tools that can become an asset in timely and locally-centered distribution are available. Despite these innovations, the recent events (floods in the Czech Republic in 2013, leakage of hazardous sludge from the aluminum processing plant in western Hungary in October 2010, etc.) proved that the distribution of vital information represents still a crucial problem since, during these situations, the communicational procedures turned out to be ineffective or failed completely (Fire Rescue Service of CR, 2013) (BBC, 2010).

Emergency can be defined as an event or a situation that appears in a border specific environment and that may be a result of many causes such as natural disasters, accidents, criminal activity, disease, threats to critical infrastructure, internal security and economy (Coombs, 2010). The most common examples of emergencies are floods, storms, fire outbreaks, traffic accidents, plane crashes and threats to public safety as a result of criminal or terrorist activity.

Even if we take in consideration the lessons learned from the past, the question how to effectively use available technology to ensure timely delivery of critical information in understandable form to affected individuals in targeted areas still remains unanswered. The aim of this paper is to outline possible methods of information dissemination in emergency situations that, additionally, require data encryption, so that they are readable only in a certain location/position. Ensuring safety during

criminal activity or terrorist attacks is one of the areas where the coding of information based on the position of the receiver could be extremely useful.

2. Defining model situation and basic requirements

2.1. Model situation

A nationwide wanted criminal is spotted inside the building, which belongs to a certain industrial company. The Czech Police coordinates the measures needed to be taken in order to secure safety within the area that is part of the company. Moreover, besides the internal safety ensuring process, another critical police task is to warn the citizens, who are approaching to, or who already are near the given industrial company, and advise them to avoid or leave the dangerous area. Therefore, it is necessary to define the message target area with regard to the industrial company (or in case of other type of emergency with regard to the epicenter) so that only people located in the nearby area around the company, and therefore aspiring to find themselves in imminent danger, would obtain the broadcasted police warning.

As the flow of information within the company is coordinated by the police, the possibility of confusing the company visitors inside the industrial resort with a transmitted message originally intended for another group must be eliminated since it could lead to panic and unwanted behavior. It is also important that messages distributed through chosen information channels will be kept unreadable and indecipherable for the criminals.

A graphical representation of such a model situation is shown in Figure 1. The area where the decrypted message (a clear warning) should be received is marked with cross pattern. The area of the industrial company and the circle with line pattern represent areas for which the message is encrypted. The location of the described, armed criminal is marked as icon figure that is larger than the other.

2.2. System requirements

The idea of transmitting encrypted information based on the receiver's location, does not necessitate the development of a completely new system, however the existing technological components and solutions will be integrated into new functional units.

The basic requirements are the following:

- Information must be available to everyone (citizens, visitors, etc.) who is inside the targeted area,
- The ability to encrypt information, based on geographic definition of the target area,
- Independence of the functionality of mobile networks and the Internet,
- The information provider must be a reputable source,
- Security and robustness of the system against abuse,
- The possibility of ongoing and continuous testing and verification of the defined functionality.

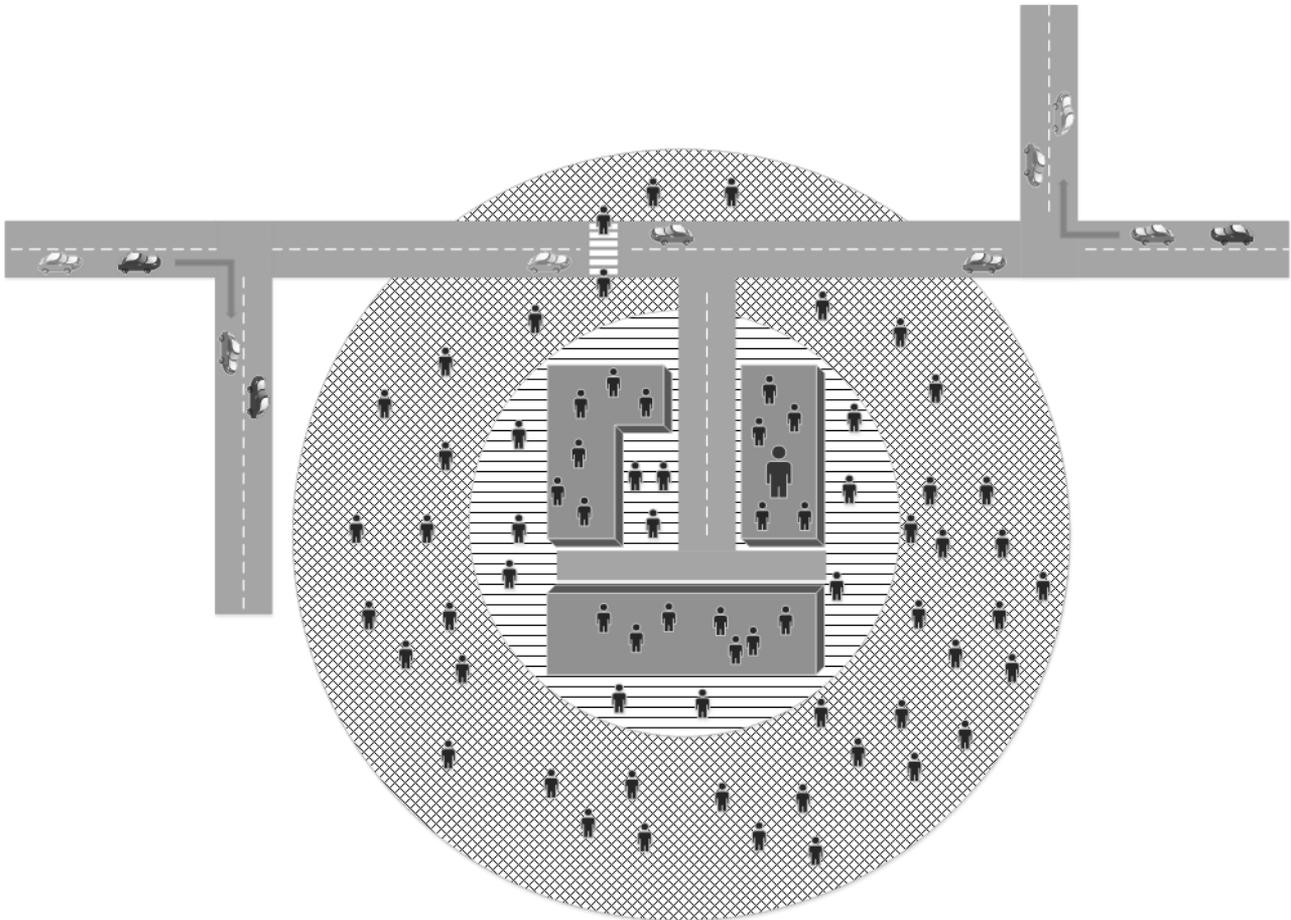


Figure 1: Graphical representation of the described model situation

3. Technical attributes of the encrypted positional broadcasting

The proposed model for encrypted positional broadcasting is conditioned by the use of a system called RADIO-HELP (Skrbek, 2011).

The aim of the current research team is to create a modern and innovative early warning system that would inform citizens in case of a crisis event e.g. criminal activity takes place within a specific area. More precisely, the methodology described in this paper will be based on the combination of two tested scientific tools. The first tool is the RADIO – HELP system, an innovative message broadcasting instrument that utilizes superposition of codes for forced receiving of radiobroadcasting signal.

The second tool that will be utilized as an additive feature to the above mentioned technology, with the ambition to create a design of a modern and innovative application, is the position based encryption/decryption algorithm. The location based encryption algorithmic procedure is also delineated and utilized by multiple researchers who have already developed and tested its functionality on mobile users.

Scott and Dening et al. (2003) proposed a data encryption algorithm called Geo-Encryption using the GPS. Its functionality was based on the traditional encryption system and communication protocol. For the sender, the message was encrypted according to the PVT (Position, Velocity, Time) of the receiver.

Furthermore, Liao et al. (2008) designed and implemented the Location – Dependent Data Encryption Algorithm (LDEA). The position based encryption concept was also inspired by a similar approach called Location Based Services (LBS) the importance of which was thoroughly analyzed and underlined by Mohapatra and Suma (2005).

Location Based Services can be classified into four categories (Mohapatra, 2005):

- Emergency services
- Information services
- Tracking services
- Entertainment services

Taking into consideration the emergency and information services categories and also the target operation of the functionality defined by the present paper, we can realize that a prospective encryption algorithm, dependent on the position of the mobile user can be derived from existing similar algorithmic approaches and used with the purpose of extending the RADIO-HELP functionality and so helping to prevent the undesired actions and behavior within a target area.

3.1. Description of radio-help system

Detailed components and principles of RADIO-HELP system are described in Skrbek (2009). The system is based on simultaneous applications of analogue broadcasting technology with superposition of digital content (HD RADIO or DRM) or full-digital broadcasts with the possibility of defining the positional coordinates via GPS (Skrbek, 2011). HD Radio technology (designed by iBiquity Digital Corporation) was selected in 2002 by the U.S. as a key technology for the digitization of radio broadcasting. Currently, this technology serves as a platform for 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 to identify areas of forced reception, i.e., where the broadcast is directed. The reception device in the target area is maintained in a standby mode. When it captures a broadcasted message at fixed frequency, the device starts to compare its location with GPS coordinates of the areas included in the broadcast. If a match is found, the device activates forced reception of the transmitted session. After the broadcasting session ends, the reception device switches itself back into the standby mode again. Subscribers of RADIO-HELP that are outside the defined zone are not disturbed and therefore are not mobilized by the warning broadcast sessions.

This principle allows the transmission of individual, independent sessions to more areas simultaneously. Long wave radio transmitters, which with new higher quality broadcasting channels gradually lose their utility, could also be used for the broadcast. In such a case, it would suffice to cover the whole Czech Republic just by one central long wave radio sender with superposed digital channels (Kubát, 2012).

Thanks to the favorable development of IT where circuits for the terrestrial broadcasting and GPS positioning are now installed in the majority of the new types of mobile phones, it should not be technically demanding to use it for purposes of positionally based broadcasting.

4. Basic attributes of the encrypted positional broadcasting

Location-based encryption or geo-encryption is an encryption method, in which encrypted text (ciphertext) can be decrypted only at a certain specific location. If someone tries to decrypt the message at another place the decryption process fails and reveals no details about the original information (Weinstock, 2006).

The proposed system, solving the model situation introduced in this paper, relies on the principle of early warning messages broadcasted to citizens within and outside a defined area, where for example, as it was stated above, the criminals and suspects are spotted by the police, and police actions against the latter is about to take place. The core characteristic of the transmitted messages is that they must be based on a position. As a consequence, the data sent inside the defined area where criminals are found in a certain moment, or where is the epicenter of other crisis situation, will differ from the data content which will receive the individuals who are at that time only nearby this area. In other words, the broadcasted warning message has to be sent as encrypted (i.e., ciphertext) when it is addressed to the citizens inside the target area and as a plain text or decrypted when it is addressed to the people outside the defined area.

It follows that the algorithmic approach which is related to the encryption/decryption procedure of the early warning messages should take the following steps: a) encryption of the broadcasted message and b) decryption of the message when i.e. the mobile user is found outside the region.

Multiple message encryption/decryption algorithmic approaches exist, such as the symmetric, asymmetric, hybrid and Geo-encryption (Scott, 2003). Figure 2 presents the geo-encryption algorithm, since it is an approach that takes into consideration the location of receiver, which is, as it was already mentioned, a core characteristic of the desired system. However, the final algorithmic encryption strategy that should be added to RADIO-HELP system in order to create a complete and universal solution to the problem, will be decided in further stages of the research.

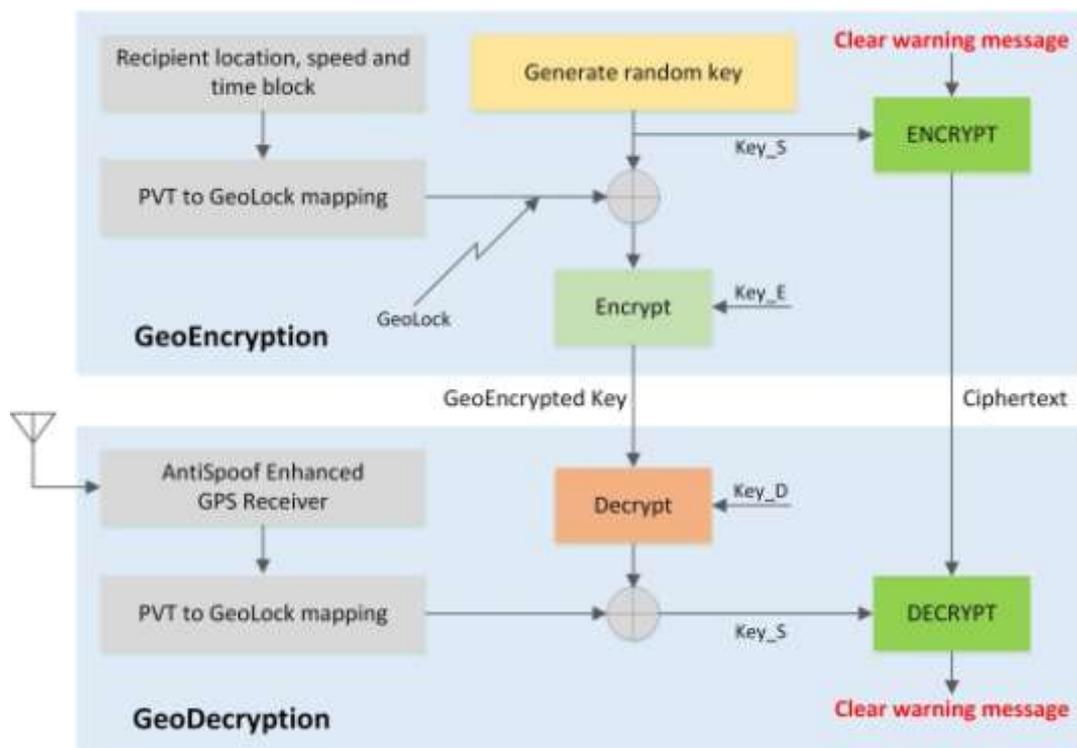


Figure 2: Geo-encryption Algorithm (Scott, 2003)

The system could be successfully implemented also in other emergency situations, not just in case terrorist or criminal attack. The aforementioned area can represent a shopping center, a bank, an industrial area, a park, a hospital or a public organization. When responsible authority receives information about the upcoming dangerous situation in the area the immediate action that should be taken according to our proposed model, in order to protect the lives of citizens and succeed in eliminating the danger to which they could be exposed. The exact transmitting procedure is described in more details below.

5. Proposed model of the message transmitting procedure

The final critical step of the system’s conceptual construction was specification of the flow of the early warning messages broadcasting process. If we use our model situation - as soon as the Police realizes the criminal’s presence (i.e., one of the buildings of the company) there should be an immediate broadcast of a warning message to the citizens who are at that moment inside the area (center) and at the same time an independent broadcast for those citizens who are outside the area so that they do not attempt to visit the defined territory. In the second case, the message is identified as an early warning protection message. The model of the activity and information flow with regard to the early warning message transmission is depicted in Figure 3. The transmission procedure is initiated by Message encryption. Consequently, the text of the warning message is formulated and then encrypted.

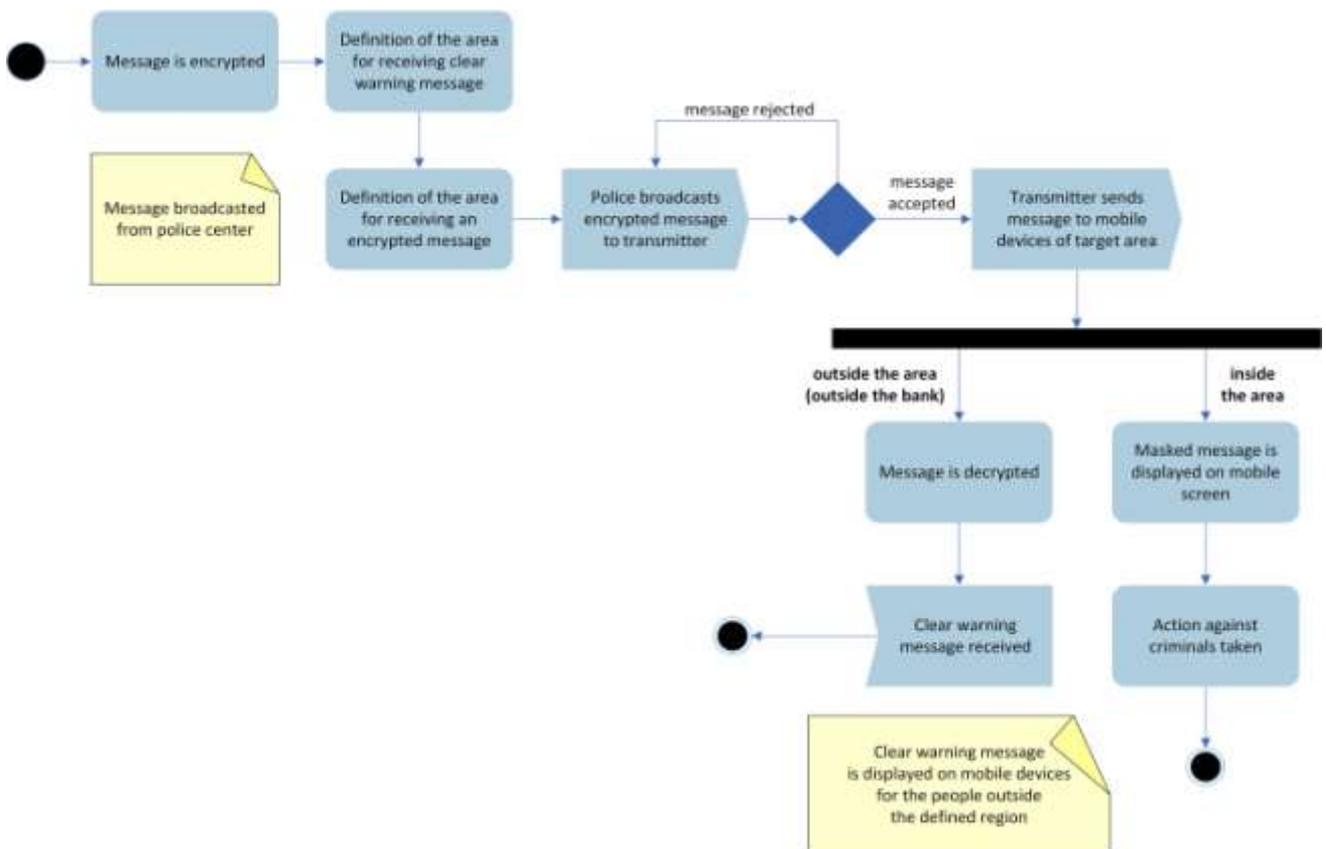


Figure 3: Activity Diagram of the Early Warning Message Transmission Model

The encryption is based on the definition of the target area of the warning message as well as on the special algorithm based on GPS coordinates related to this area.

The next step of the process is the transition of the encrypted message from the Police Operation Center (or other responsible authority, depends on the type of the emergency) to a special transmitter. If the transmitter receives the incoming message correctly, the same message will be sent at once to civilians' mobiles, radios, car radios and other possible devices in a form of a text. For the group of users located inside the target area the broadcasted message, thanks to encryption, will be displayed as an advertising text and it will not be understood by individuals for whom the message is irrelevant or not intended to (it is desirable that for example criminals do not understand the messages transmitted by the Police). Moreover, this form of text will help the authorities to take action without causing panic among citizens.

However, the message will be also addressed to a second group of people outside the defined area. In this case it will be decrypted and displayed in its original form as a clear warning text. As a result, the second group will be successfully and timely informed of the forthcoming danger and will avoid the specific area.

6. Conclusion

Positionally encrypted broadcasting system should be a future additional element to the existing concept of RADIO-HELP system, since it would significantly extend its functionality.

Throughout the creation of the model, among the core issues that were discussed as possible obstacles of the execution of the process during a real crisis situation, appeared the following topics: a) the limit or border between the region inside and outside of the target area and its definition, b) the type of the message sent to the individuals inside the area (encrypted) and outside the area (decrypted), because the message could be received by other non-targeted individuals (e.g. criminals that could as well try to escape), c) algorithmic encryption/decryption methodologies and finally, d) the technology utilized regarding the data transmission (medium of transition – transmitter, receiving devices, etc.).

The above stated topics are considered to be indispensable parts of the new functionality. The combination of RADIO-HELP system and a location based encryption algorithm would create an innovative and useful contribution in the area of location based emergency and information services.

Acknowledgement

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ICT AND ECONOMY

ICT AND ECONOMY

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Keywords

Impact of ICT on Economy, Measurement of ICT Impact, Spending for ICT, ICT Value Added, ICT Employment

Abstract

The aim of the paper is to underline the role of ICT in economy and to present trends in progress of ICT impact on economy. Paper analyzes key research outputs realized in European regions in last twenty years in this area; the Czech main research outputs are included as well. Selected key trends are then presented in this article – starting from share of employees in business sectors, to ICT spending in different countries, complex indicator of the importance of ICT for economics and value added.

1. Introduction

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 could be understood as multidimensional. ICT has an impact on economic growth, productivity, usefulness and efficiency from many different points of view.

In a prolonged period before the mid-1990s 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 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 transformation of the new technology into productivity increase. 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. European ICT-using sectors failed to achieve a similar development. However, the fact that ICT-using industries in Europe showed stable productivity

growth does not in itself preclude a positive differential impact of ICT. It may be the case that ICT-intensive sectors (ICT-intensity is usually 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) perform better in relationship 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 reduction of 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. 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.

Several macroeconomic investigations and systematic relatively longer period time research could be found for examples in articles by Sixta, Vltavska, Zbranek, (2011), Fischer, J. et al (2013a), (2013b) and Hanclova - for example (Hanclova, Doucek, 2012), (Capek, 2011). Their approaches are a little different because Fischer's outcomes are based on statistical research of national accounts data and Hanclova's approach prefers applying of econometric methods on macroeconomic data from EUKLEMS, Eurostat and World Bank databases. Other aspects of ICT improvement within Czech economy offers articles by Pavlicek (for example Oskrdal, Pavlicek, Hubacek, 2011) – accent on social networks and Smutny (2013) – these works are more oriented toward marketing aspects. Regional aspects of ICT impact on economy are also present for example in (Dorcak, Delina, 2011).

2. ICT Macroeconomics Trends

ICT generate different impacts on the whole economy. One of the most important of them is the number of jobs, respective the number employees working in ICT sector (ICT manufacturing, ICT services and ICT trading). The second dimension of direct influence on economy is represented by ICT spending. Complex indicator of ICT impact on economy can be presented the value added (VA).

2.1. Share of ICT Employment

The ICT sector contributes significant to total rate of employment, accounting for almost 15 million people in OECD countries in 2009, or almost 6 % of total OECD business sector employment (Figure 1).

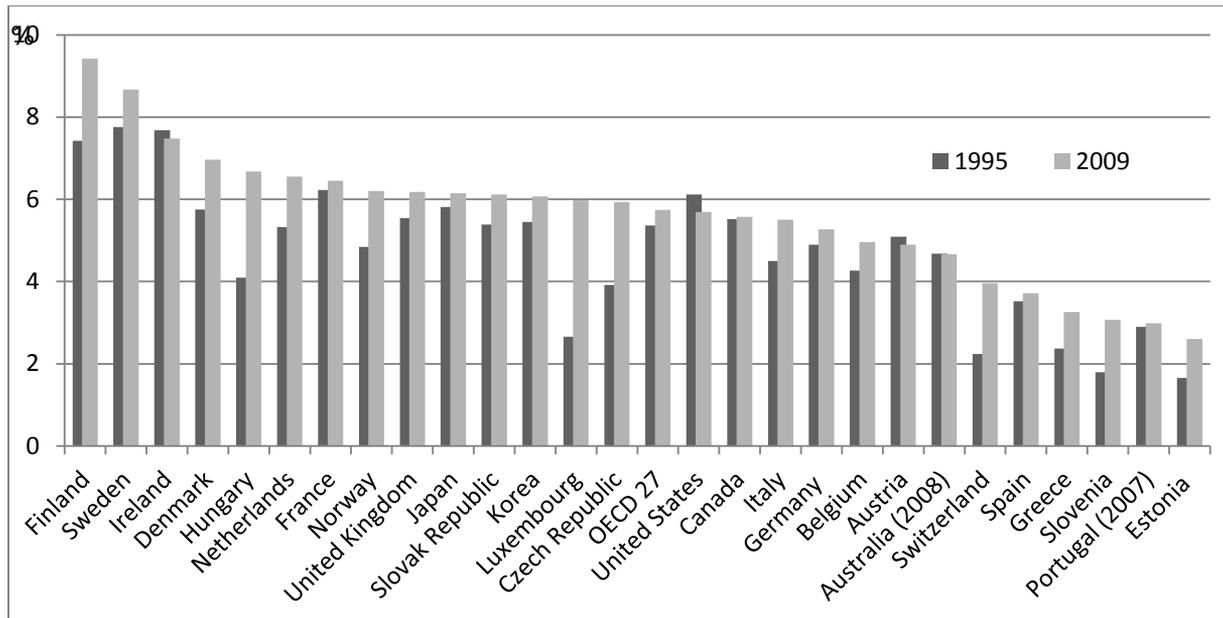


Figure 1 Share of ICT Employment in Business Sector Employment Source: (OECD, 2012)

Long term growth across the ICT sector was 0.8 % a year from 1995 to 2009, higher than total business employment growth. Finland and Sweden represented the largest shares of ICT employment in total business employment at over 8 %. Shares have increased remarkably over time especially for Finland (for 2.0 percent points). The same is true for (in decreasing order) Luxembourg (increase for 3.3 percent points), Hungary (increase for 2.6 percent points), the Czech Republic (increase for 2.0 percent points), Switzerland (increase for 1.8 percent points) and Norway (increase for 1.4 percent points), but on a lower absolute level - around 6 %.

ICT sector employment in the United States was accounted for more than 30 % of total OECD ICT sector employment in 2009. This was by far the largest share, followed by Japan (16 %) and Germany (9 %) (OECD, 2010). The share of employment in the ICT sector **declined** in countries such as **Austria** (for 0.2 percent points), **Ireland and the United States** (for 0.4 percent points), an indication of the increase in sourcing of manufacturing and services trade from non-OECD economies. In the United States, for example, the number of workers affected by mass layoffs in the ICT sector increased from the second half of 2008. In the second half of 2009, the number of affected workers reached a peak, with three times more ICT employees laid off than in June 2000. Nevertheless, employment in the ICT sector suffered less than during the dot.com collapse in 2001-03, when almost seven times more people were laid off than in June 2000. As was the case in the 2001-03 crisis, job cuts in 2009 **were deeper in ICT manufacturing than in ICT services** (OECD, 2012).

2.2. ICT Spending - World Wide

Total worldwide ICT spending is estimated to reach USD 4 406 billion in 2012, of which 58 % (USD 2 572 billion) belongs to communications services and equipment, 21 % (USD 910 billion)

to computer services, 12 % (USD 539 billion) to computer hardware and 9 % (USD 385 billion) to software.

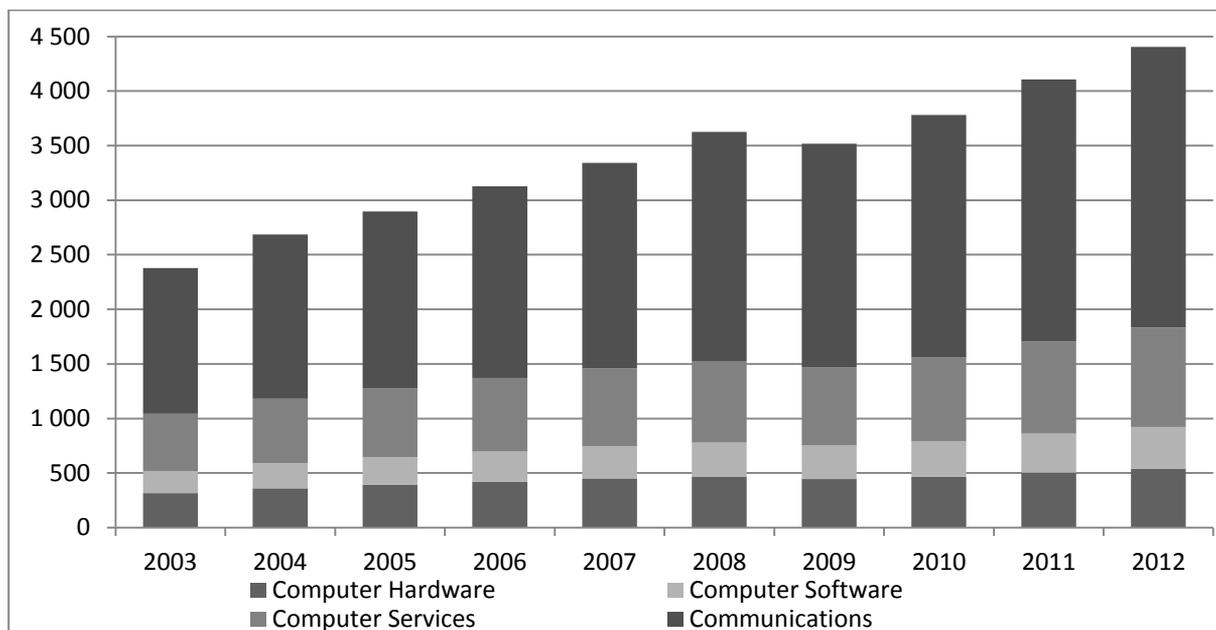


Figure 2 World Wide ICT Spending (mil USD , current prices) Source: (OECD, 2012)

From Figure 2 it is visible, that the biggest share of spending is focused on “Communications”, almost constant spending for “Hardware”, slow increase of the share of “Software” and “ICT services” in the period 2003 - 2012.

Only one macroeconomic remark – shares are counted in current prices, that means that thanks to the annual inflation spending for “Hardware” and “Software” is in fact decreasing.

2.3. ICT Spending – OECD Countries

“Communication services and equipment” in OECD countries accounts for half of total OECD ICT spending, followed by spending on “Computer services”, which accounts for 26 %. A somewhat larger share of total spending on “Computer services” suggests a structural shift to outsourcing of these business-related services, with a higher share in developed OECD countries (Denmark, France, Sweden, the United Kingdom and the United States). Greece, Mexico and the **Slovak Republic** have the highest share in “Communication services and equipment” spending (at around 80 %) (Figure 3). However, the share of “Hardware” and “ICT service” spending is well below average in Greece, Korea, Mexico, Poland, Portugal, the Slovak Republic and Turkey, because of lower business use of ICTs and the rapid growth of mobile and other consumer communication services. The **Czech Republic’s** spending structure is following „Hardware” -13 %, “Software” – 15 %, “Services” - 9 % and “Communications - 63 %). The structure of ICT spending is rather similar to spending in Austria, where the share for “Services” (17 %) is slightly higher and for “Communications” (54 %) slightly lower.

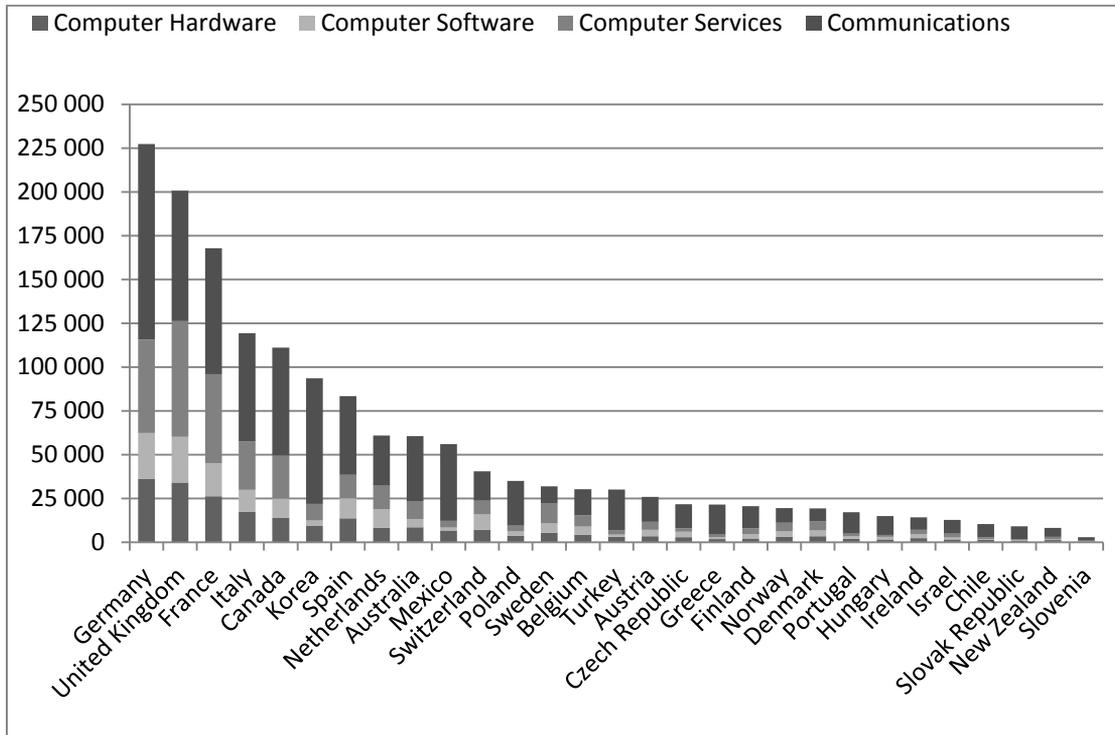


Figure 3 ICT Spending (mil USD , current prices) Source: (OECD, 2012)

The North American market remains the largest market for ICT spending, accounted for approximately 31 % of global spending in 2012. This is followed closely by the Asia-Pacific region and Europe, both accounted for 30 %. With the emergence of new high-growth, non-OECD markets (BRIC countries - Brazil, Russia, India and China) for ICT products and services, worldwide ICT spending increased by 7.1 % per year from 2003 through 2012 while OECD spending has increased annually 5.1 %. OECD countries are accounted for 72 % of the estimated global ICT spending (USD 3 154 billion) in 2012, down from 85 % in 2003 (OECD, 2010), (OECD, 2012).

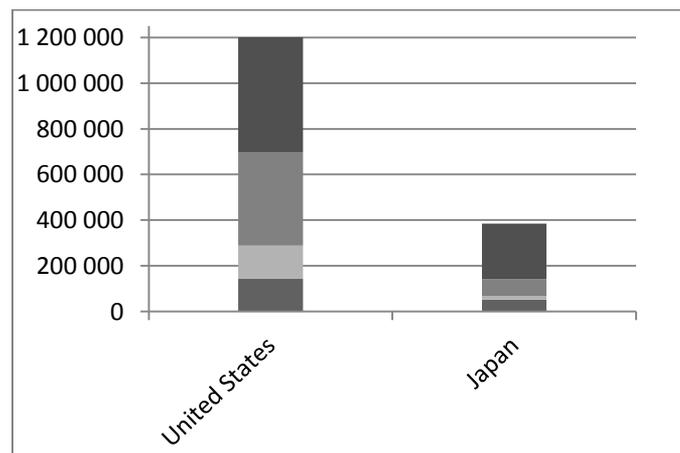


Figure 4 U.S. and Japan's ICT Spending (mil USD , Current Prices) Source: (OECD, 2012)

Comparison between Figure 3 and Figure 4 presents real chances for European countries to reach the same level in ICT penetration into the society as is in the United States and in Japan. ICT spending for example in the United States is 5.33 times higher than in Germany, but the population of the U.S. is only 3.72 times higher than the population of Germany.

2.4. Trends in ICT Spending

Following the noticeable **recession** in 2009, ICT spending is increasing most rapidly in **Africa, the Middle East, and Latin America, followed by Eastern Europe** (Fig. 5). In the Asia-Pacific region, Western Europe and North America, growth in spending is more subdued. In current prices, Japan and the United States are the OECD countries with slowest growth during this period.

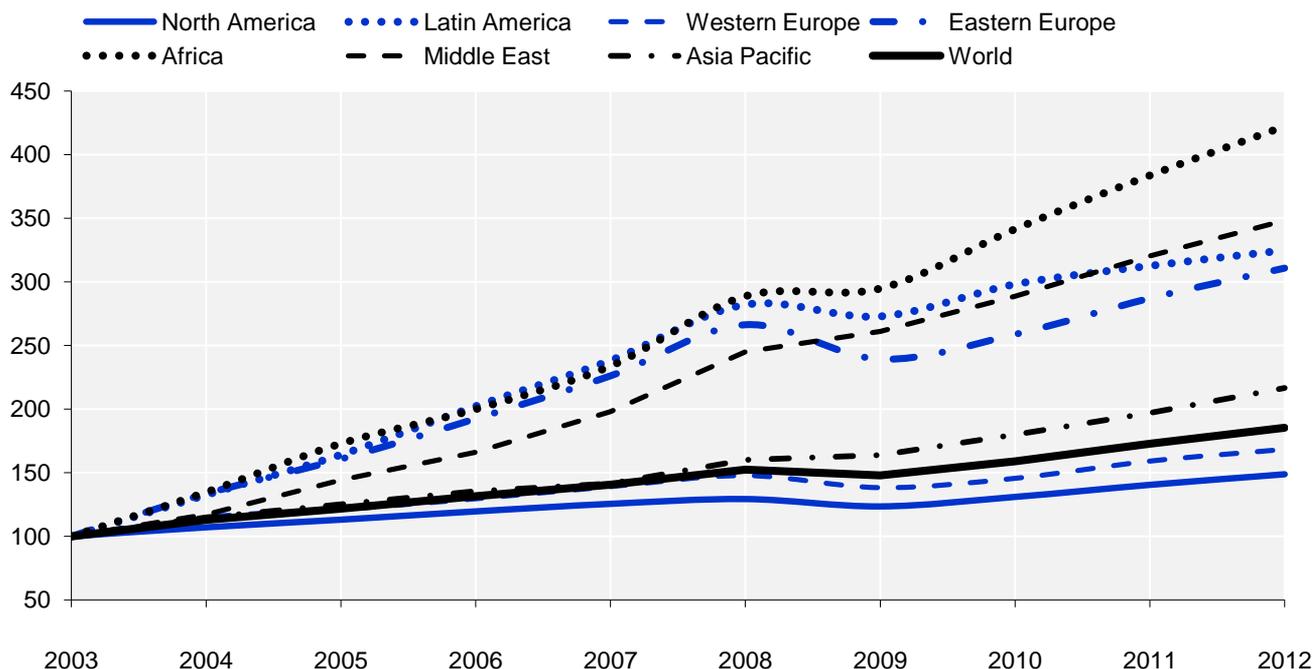


Figure 5 Trends in Spending (2003 = 100%) Source: (OECD, 2012)

Expected trends are very important, but what reflects the real importance of ICT for economy is the indicator of value added.

2.5. ICT Sector Value Added

Study of the value added generated by the ICT sector helps to underline the overall state of the sector and its importance for the whole economy. Value added is a key indicator that represents the incremental contribution added along the value chain by corporations. It is calculated by subtracting from revenues the cost of inputs purchased from other firms to create the product or service. Country-level data from the OECD show ICT value added as a proportion of **total business value added, as well as market trends**. The share of ICT value added as a proportion of total value added in the business sector has remained relatively stable during investigated period, showing a slight upward compound annual growth rate (CAGR) of 0.664 % over the presented years.

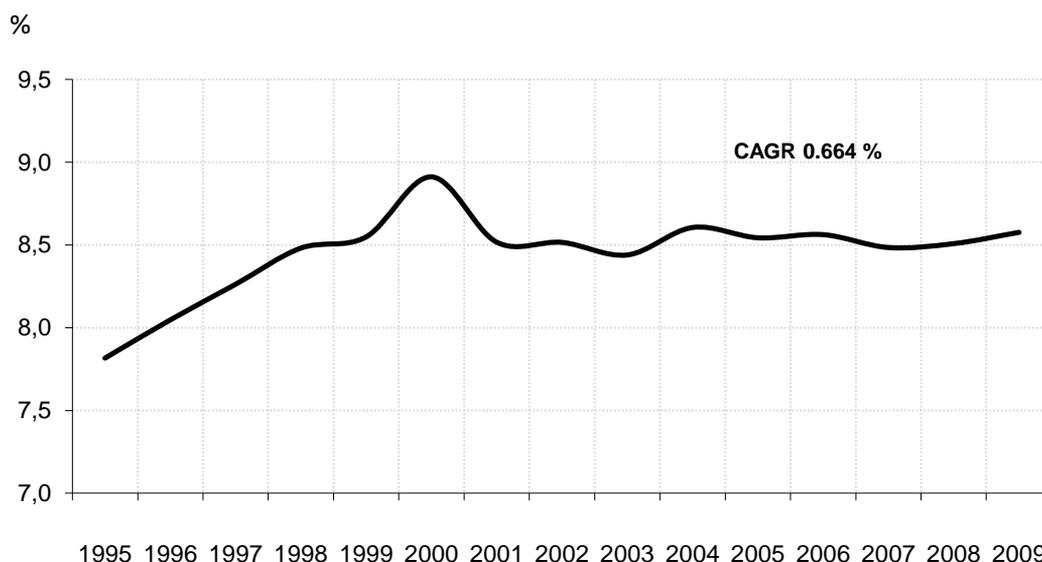


Figure 6 ICT Sector Value Added Proportion of Business Sector VA Source: (OECD, 2012)

In 2009, the share of value added attributed to the ICT sector was 8.6 %, up from 7.8% in 1995 (Figure 6). This trend indicates that output in the ICT sector is growing relatively to the rest of the economy (no faster, no slower), underlining the importance of the ICT sector overall. Recent economic downturns have buffeted ICT value added, but it has managed to grow year on year with the exception of brief episodes (2000, 2001) corresponding to the most difficult economic periods. Total ICT value added dipped briefly into negative growth in 2009. The ICT sector follows general trends in business sector value added, however, some ICT sector components are stable while others exhibit significant volatility.

3. Conclusion

The development of selected macroeconomics indicators (rate of employment in the comparison to all business, spending for ICT and value added) present increasing importance of ICT sector in the whole economy. Notable is increase in ICT spending in the United States and Japan in comparison to the rest of the OECD world. Positive is the trend in ICT spending in Africa – it increased 4.22 times in 2012 in comparison to the year 2003, followed by Middle East region (3.48) and Latin America (3.25).

What presents a little warning on the other hand is fact, that however spending is increasing, the value added remains almost the same since 2003 to 2012.

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THE IMPACT OF ICT GROWTH ON HOUSEHOLDS AND MUNICIPALITIES IN THE CZECH NUTS-3 REGIONS: THE APPLICATION OF CLUSTER ANALYSIS

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Keywords

ICT Growth, ICT Services, Households and Municipalities, NUTS-3 Regions, Cluster Analysis

Abstract

Czech economic situation has improved. We invest in human health, in education and human capital, in construction and infrastructure and as well in the development of information and communication technologies (ICT). Unfortunately, the ICT development is not equal in all regions of the Czech Republic. There are the regions in which the level of ICT services was already at a high level in the past, therefore the development was stagnating in recent years. On the other hand, there are also regions with low level of ICT services, where we can expect its increase. In this paper, we evaluate the development of selected ICT indicators in NUTS-3 regions of the Czech Republic. We utilize the cluster analysis and apply it on the latest available data from the Czech Statistical Office. We explain the reason of the identified changes and search for the explanation in cases when they did not occur. The findings are confronted with the economic statistics of the analysed regions. We particularly point out on the mutual relations among them.

1. Introduction

The quality of life of the population increases in almost all NUTS-3 regions of the Czech Republic, but the differences between them still remain (Fiala, Langhamrová, 2012). The Czech Republic is gradually starting to become an advanced economy (Maryška et al., 2012 or Basl, Doucek, 2013), which is according to the demographic statistics presented by increasing life expectancy, declining mortality rates, increasing average age and also by the minimum rate of infant mortality (Šimpach, Pechrová, 2013). With the respect to some evaluation criteria which uses Eurostat, we examine the situation in the NUTS-3 regions of the Czech Republic in the year 2012 (latest available data). We can show the statistics for individual regions in scatter-plots depending on GDP per capita in the regions. Capital City of Prague is always classified as the outlier, (because its GDP per capita is more than double than in other regions (Fiala, Langhamrová 2012)). We provide an evidence in the following graphs – see Fig. 1. It is apparent that some regions are in these statistics more than once at the end of the evaluation scale. However, it is not the rule with respect to the development and advancement in ICT that also affect the quality of human life (Maryška, Doucek, Novotný, 2012). It is evident that there will be regions in which the ICT services develop differently than in other

regions. We focus our attention on the selected statistics of ICT services, which are measured and published by the Czech Statistical Office (CZSO, section Statistics, Information Technologies).

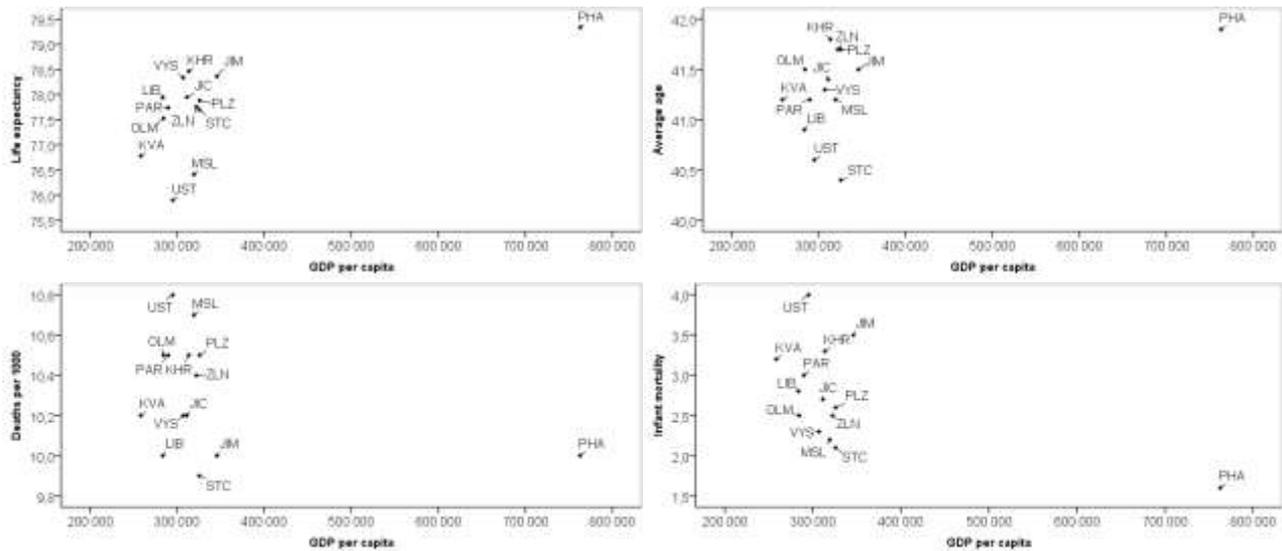


Figure 1: Quality of life in the Czech NUTS-3 regions in 2012. Data source: CZSO, authors' illustration

These services will cover the households and municipalities. Czech households are the most affected by ICT services such as “access to the PC” and “access to the internet”. In the Czech municipalities, which territorially belong to the particular NUTS-3 regions, there are various organizations, companies and authorities. Among the ICT services that the most important for the Czech municipalities (Kuncová, Doucek, 2013) belong the “Access to the internet in organizations” and the “Access to the electronic registry”. Especially the latter statistics has currently the great importance, because the electronic registry speeds up the administrative processes, saves the time and money and thus increase the efficiency and comfort of the people’s lives. In addition, there is the bridge between the households connected to the internet and the internet access in the organizations. In the context of regional comparisons there are also other two statistics important for municipalities. It is the availability of “high-speed internet in municipalities” and the managed “web pages of municipalities”. High speed internet connection becomes increasingly important for the population because the demand for quality internet services, web design and of course the quantity of transferred data increases (Basl, Pour, Šimková, 2008). Web pages of municipalities inform the population about the latest news and especially saving the time and money, because many administrative issues can be solved on-line and without waiting in the queue at the office. It is evident that the development of ICT services in the Czech Republic must have the economic impact both on the household and the municipalities (Maryška, Doucek, Novotný, 2012), (which belong to the relevant NUTS-3 regions).

The aim of this paper is to explore the development of these statistics of ICT services. We base our analysis on the latest available data, and on the similarity of the development of chosen statistics to cluster the NUTS-3 regions. We utilize two clustering techniques, one belonging to the most commonly used – Ward’s method (Ward, 1963), and the other belonging to the simplest group – the nearest neighbour (Gordon, 1999). From the obtained outputs there we may draw the conclusion about which regions developed similarly and which converged only recently. The outputs show that PHA (see the shortcuts of the CZSO) is not the outlier observations any more. Especially the regions, which are based on the evaluation of socio-economic statistics classified as developing had its potential for dynamic development of ICT services in the past. Regions, which were according to the socio-economic statistics classified as developed, have not such potential to grow in ICT

services and development. It is very probable that the future development of ICT services in former undeveloped regions will cause their more dynamic growth at present (Doucek, Novotný, Voříšek, 2009).

2. Materials and Methods

For the purpose of our analysis we use the data about the selected ICT services in the Czech NUTS-3 regions from CZSO database. Some data are available from 2005 to 2011 only, another from 2005 to 2012 (latest available). However, this issue does not matter, because the development of the individual regions is analysed partially, so the absence of the last observation do not have the effect of particular results (see Šimpach, 2013 for an example). For the Czech households we use the statistics about the percentage of households “*accessed to the PC*” by NUTS-3 regions (observations from 2005 to 2012) and the percentage of households “*accessed to the internet*” by NUTS-3 regions (observations from 2005 to 2012 as well). For the analysis of ICT development in the Czech municipalities we use the statistics about the percentage of “*organizations with the internet access*” and the percentage of “*organizations with access to the electronic registry*” by NUTS-3 regions (all have the observations from 2005 to 2011). In addition we consider the statistics about the percentage of municipalities “*connected to the high-speed internet*” and the percentage of municipalities “*with managed web pages*” by NUTS-3 regions (the observations from 2005 to 2011 as well). Using the software IBM SPSS Statistics 20 we apply two clustering methods using square Euclidean metrics (see e.g. Gordon, 1999)

$$\|a - b\|_2^2 = \sum_i a_i - b_i^2 \quad (1)$$

where a and b are any of two distances. This metric has a universal application in chosen clustering methods. The first method is Ward’s (the most frequently used). As noted by Mirkin (1996), this method is an agglomerative clustering method in which the dissimilarity between two clusters A and B is measured by the amount by which merging the two clusters into a single larger cluster would increase the average squared distance of a point to its cluster centroid:

$$d(A, B) = \sum_{x \in A, y \in B} \frac{d^2(x, y)}{|A| + |B|} = \sum_{x, y \in A} \frac{d^2(x, y)}{|A|} + \sum_{x, y \in B} \frac{d^2(x, y)}{|B|} \quad (2)$$

where $d(A, B)$ denotes the distance between the two clusters A and B . The second used clustering method is the nearest neighbour. It was selected because this method belongs to the simple algorithms (see e.g. Gordon, 1999) and its results are easy to interpret. As suggested by Murtagh (1983, p. 354), the nearest neighbour algorithm repeatedly follows a chain of clusters $A \rightarrow B \rightarrow C \rightarrow \dots$, where each cluster is the nearest neighbour of the previous one, until reaching a pair of clusters that are mutual the nearest neighbours. According to Bruynooghe (1977), a distance function d on clusters is defined to be reducible if, for every three clusters A, B and C in the greedy hierarchical clustering such that A and B are mutual the nearest neighbours:

$$d(A \cup B, C) \geq \min\{d(A, C), d(B, C)\} \quad (3)$$

All computed clusters are discussed and commented and on the basis of similarities of NUTS-3 regions there are made the conclusions regarding to their convergence in the field of ICT services.

3. Results and Discussion

Using the above mentioned methods there were calculated the clusters of NUTS-3 regions of the Czech Republic according to the development of ICT statistics in households. On the Fig. 2 we can see those clusters for the situation of Czech households with access to the PC and on the Fig. 3 is shown the situation of households with access to the internet. The results of both Ward's method and the nearest neighbour are in the case of households' access to the PC almost identical. The most of the regions except for LIB and VYS developed similarly during the analysed period. LIB and VYS recorded relatively high increase in the computer facilities during the last 7 years, (because these are the regions with medium age-old population structure, which had the potential for buying a PC). Therefore, these regions according to the both methods were farthest from each other. The other regions were equipped by PCs more and thus their relative increases were weaker.

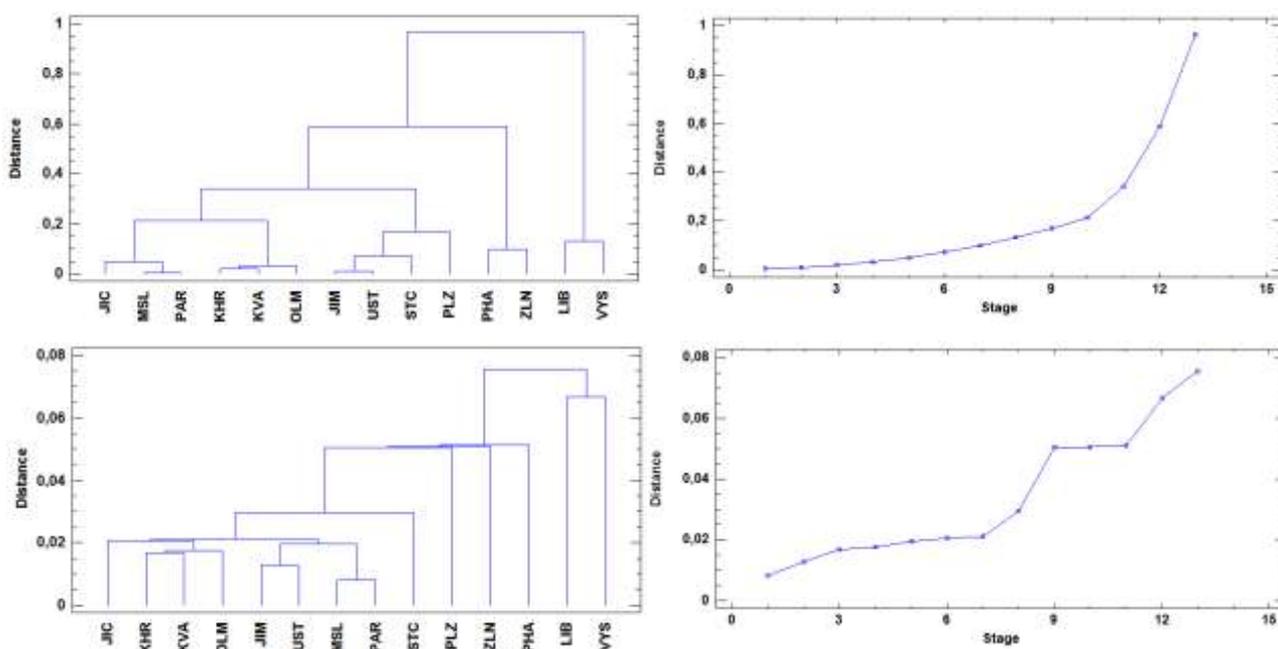


Figure 2: Households' access to PCs by NUTS-3 regions, Ward's (top) and nearest neighbour method (bottom).

Data source: CZSO, section Statistics, Information technologies. Authors' calculation

In the case of households connected to the internet is PHA region relatively outlier observations during the analysed years, because the facilities in PHA grew the fastest in compare to all considered regions, (it is currently nearly 70 %). According to the nearest neighbour method there were not identified the significant differences among the other regions. Ward's method (which is more sensitive in this case), divided the remaining regions into two similar clusters (JIC, VYS, MSL, LIB, PAR and STC) and (JIM, KVA, UST, OLM, PLZ, KHR and ZLN). Regions in the second cluster grew a little faster in the internet facilities. It may be caused due to the fact that these regions have relatively higher level of long term unemployment and during the period of economic crisis (mainly in 2008–2010) the statistics of internet facilities stagnated. We could observe the significant increase only in the last two years.

On the Fig. 4 there is shown the similarity of regions based on the development of access to the internet in organizations. PHA is again the outlying observation, but in this case it is a negative remote. There are huge number of organizations in PHA region, larger and smaller, but especially the smaller organization lack the access to the internet. The percentage of organizations with access to the internet developed from 51.7 % to 56.9 %. Regions KVA and MSL, which were clustered

together by both Ward's and the nearest neighbour method, recorded the evolution from 57.4 % to 71.7 % and from 59.5 % to 72.4 % respectively, which is a huge difference. It is due to the fact that there exist more organizations in these regions, where the access to the internet is a standard.

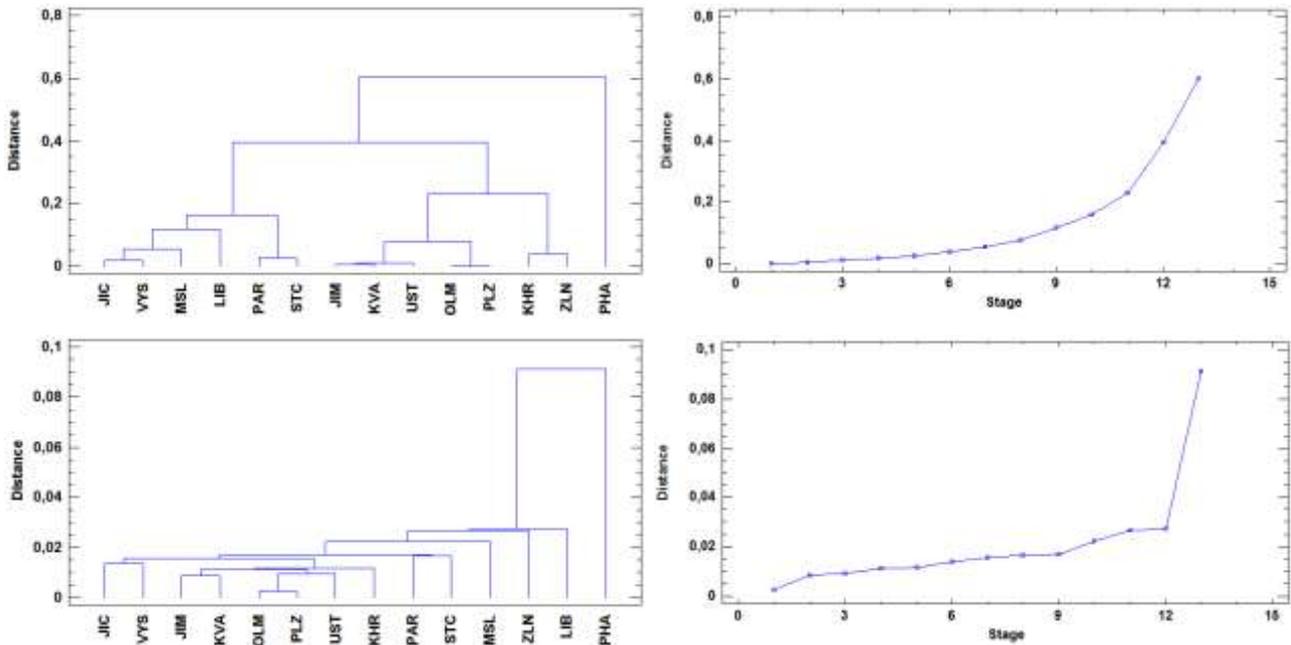


Figure 3: Households' access to the internet by NUTS-3 regions, Ward's (top) and nearest neighbour method (bottom). Data source: CZSO, section Statistics, Information technologies. Authors' calculation

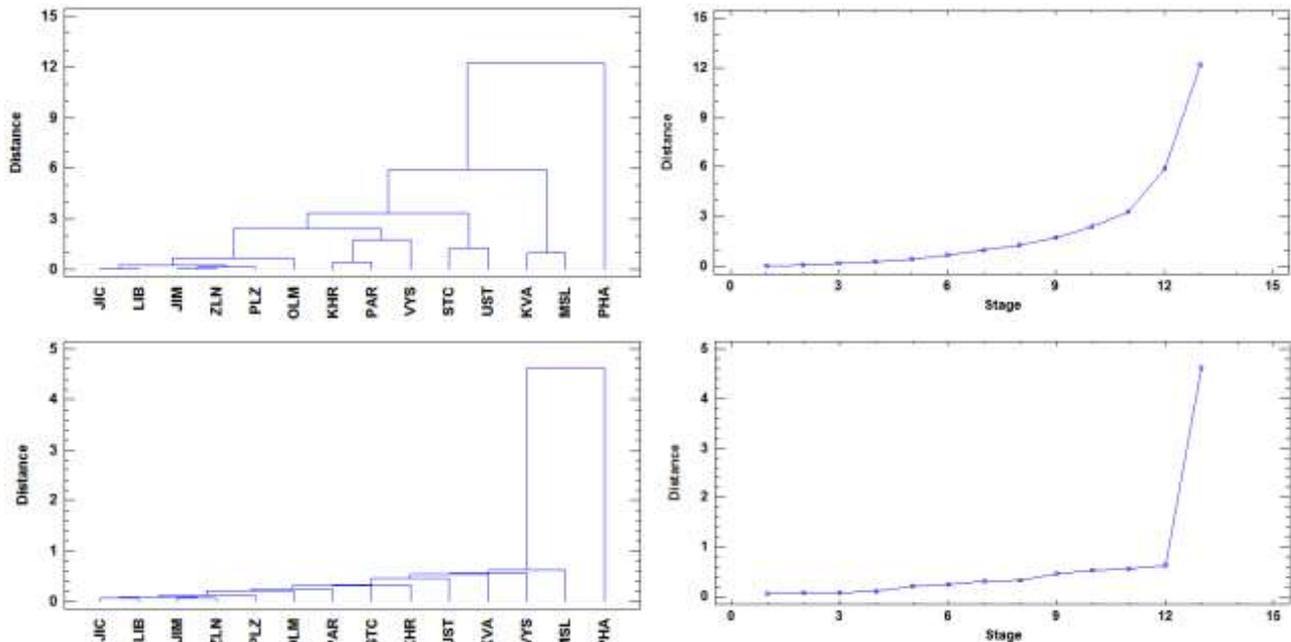


Figure 4: Access to the internet in organizations by NUTS-3 regions, Ward's (top) and nearest neighbour method (bottom). Data source: CZSO, section Statistics, Information technologies. Authors' calculation

Significant technological progress in the world of ICT are the electronic registry (see Fig. 5). Institutions in municipalities that offer the possibility of loading the documents through the electronic registry save the time and money for many people. Ward's method divided the regions

The Impact of ICT Growth on Households and Municipalities in the Czech NUTS-3 Regions: the Application of Cluster Analysis

into 3 clusters (JIC, PAR, KVA, LIB, UST and ZLN), (KHR, PLZ, OLM and PHA) and (JIM, MSL and VYS). These clusters are characterized by the properties of similar development of growth and decline.

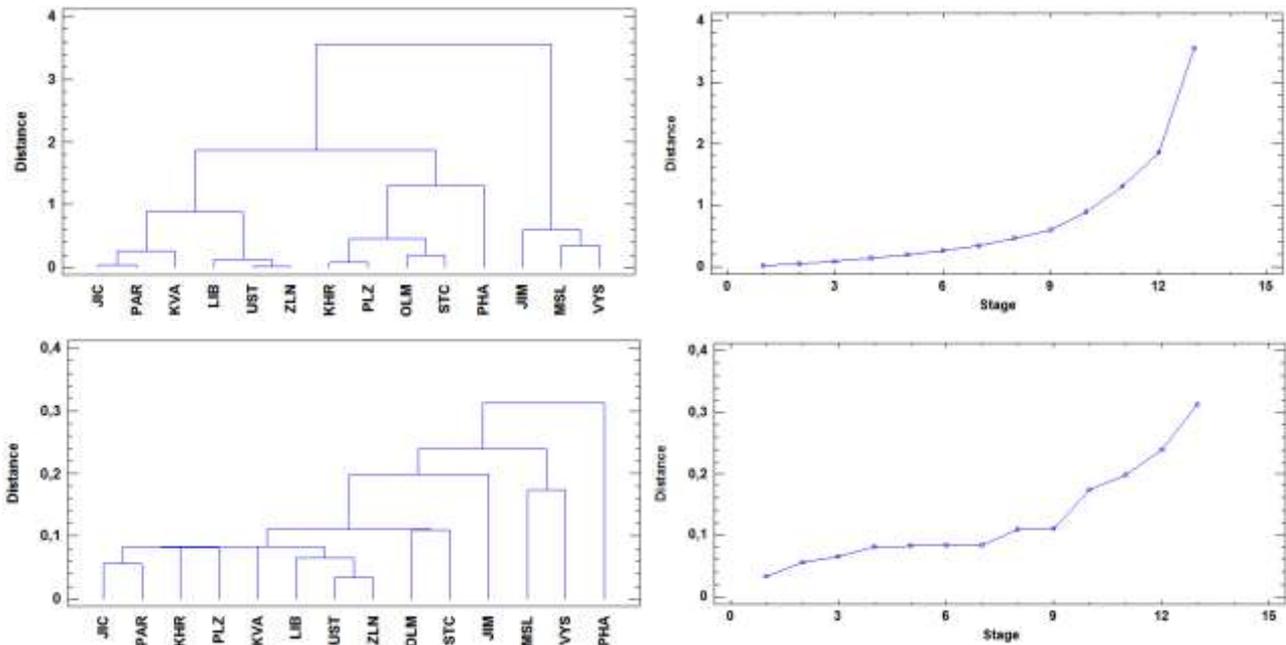


Figure 5: Access to the Electronic Registry by NUTS-3 regions, Ward's (top) and nearest neighbour method (bottom). Data source: CZSO, section Statistics, Information technologies. Authors' calculation

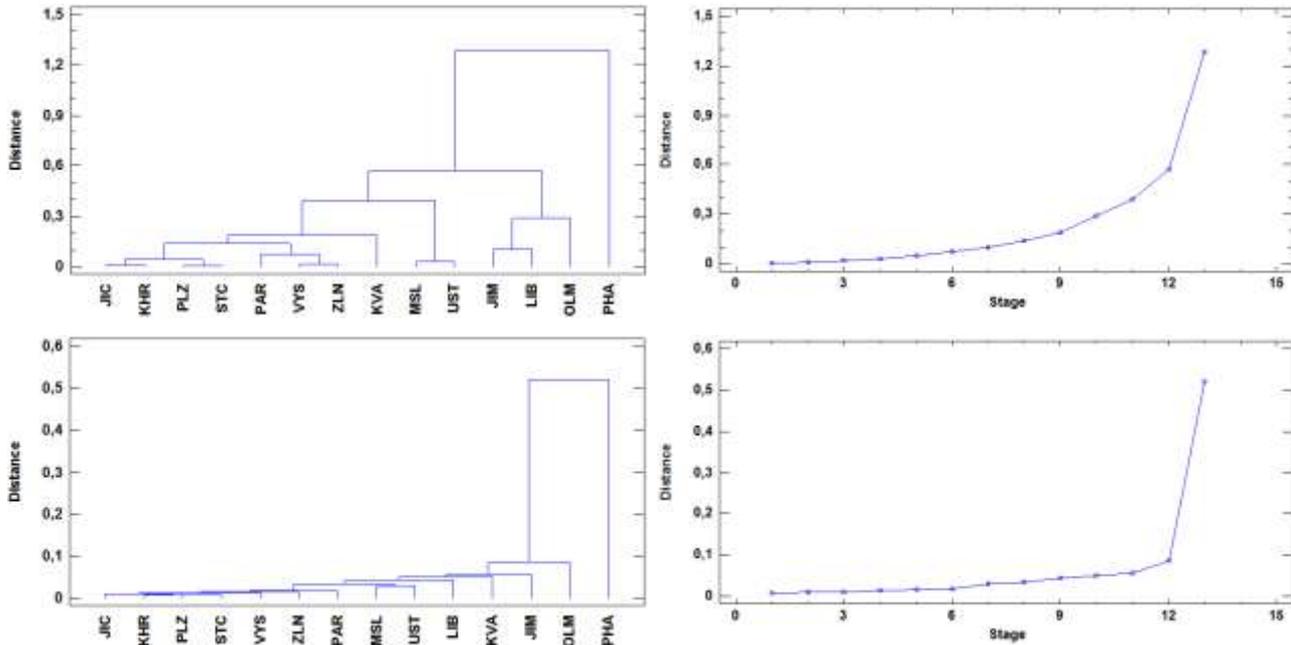


Figure 6: High speed internet in municipalities by NUTS-3 regions, Ward's (top) and nearest neighbour method (bottom). Data source: CZSO, section Statistics, Information technologies. Authors' calculation

Because the institutions were established and sometimes closed, the considered statistics have varied. The nearest neighbour method represents the growing statistic more, because it is the fact that the most developed regions according to statistics of electronic registry are JIM, MSL, VYS

and PHA. These regions belong to the most powerful in agriculture, industry and administration in the country.

The connection of municipalities to the high speed internet grew during the analysed period practically in all regions, (we can see the clusters of similarities of this development in Fig. 6). PHA region is the outlying observation, because there was the most significant increase noted. The current situation is on 94.8% level of high speed internet connections of the PHA's population. The other regions are in the range from 86.1 % to 93.4 %. Ward's method is more sensitive to changing the phases of growth and decline (e.g. the region MSL and UST), but it provides almost comparable results with the nearest neighbour method.

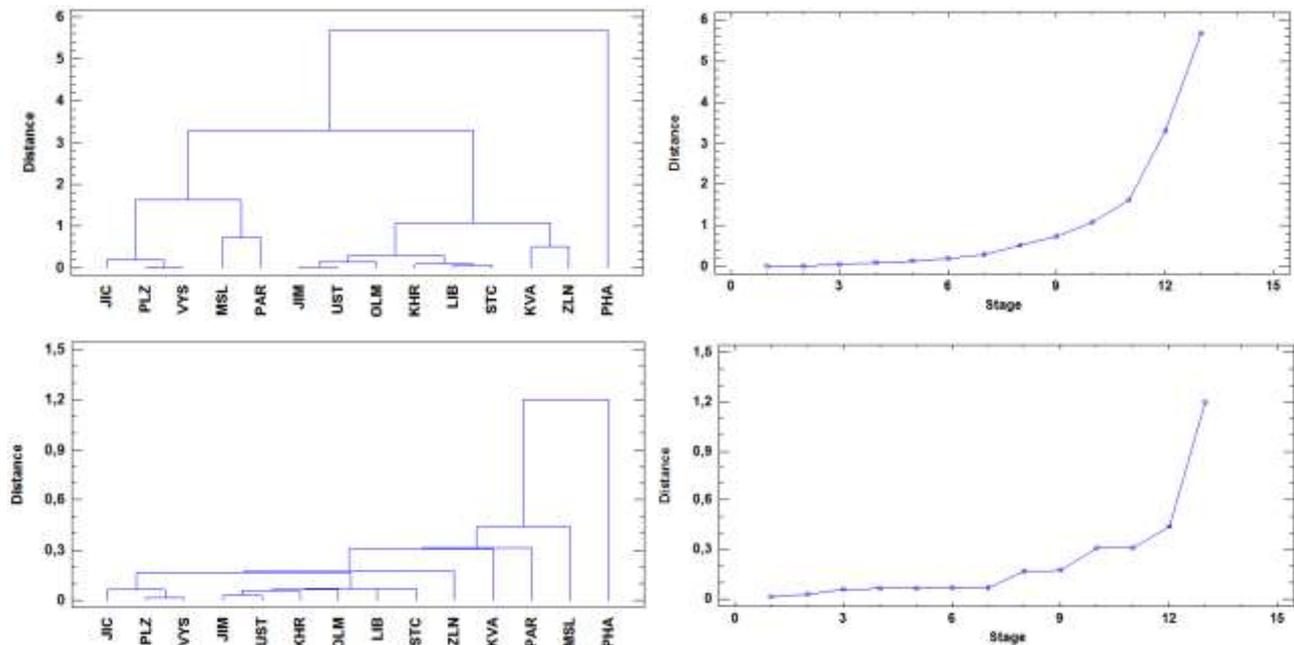


Figure 7: Web pages of municipalities by NUTS-3 regions, Ward's (top) and nearest neighbour method (bottom). Data source: CZSO, section Statistics, Information technologies. Authors' calculation

In the case of the web pages development we conclude that the PHA region almost did not change. The current level of managing web pages limits to 100 % (in 2005 the proportion was 93.1 %). The other regions have developed quite significantly. The greatest potential for the development had group of the regions (JIM, UST, OLM, KHR, LIB and STC – see Fig. 7). These are the regions included into the cluster both by Ward's and the nearest neighbour method. Their facilities increased from 71.3 % (in 2005) to almost 99.2 % (in 2011).

4. Conclusion

The aim of this paper was to evaluate the development of households and municipalities in the Czech NUTS-3 regions on the basis of selected statistics about the development of ICT services. This development based on the data from CZSO for period 2005–2012 (or 2005–2011), was evaluated by the similarity matrices. From the obtained results we can make an important conclusion that the Ward's method is more sensitive to changing the phases of growth with decline, so those regions which were included into the clusters based on Ward's method had undergone the similar alternating development. Regions which were mainly developing and their ICT level increased over time were better evaluated by the nearest neighbour method. When we see the

relationship between the results of both methods (e.g. in the case of high speed internet connection in municipalities), then the regions in the relevant clusters developed and grew similarly on the basis of analysed ICT statistics. It is important to note that the largest growth was recorded in regions which are classified according to Eurostat economic assessment as less developed regions. We can make a decision that the nearest neighbour method is more appropriate for the conditions of countries with stable growth potential and Ward's method for the countries with differently developed regions (such as the Czech Republic).

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TOWARDS AN ECOSYSTEM FOR ACADEMIC-INDUSTRIAL COOPERATION

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Academic-Industrial Cooperation, Science Park, Student-Centered Industrial Cooperation, Research and Development with Industry, Community-Driven Industrial Cooperation

Abstract

The paper presents an integrated view on creation an ecosystem for academic-industrial cooperation in the ICT sector under the conditions of the Czech business and higher education systems. It shows one case of a relatively long established system working at the Faculty of Informatics, Masaryk University, Czech Republic. It identifies the infrastructural, organizational, and other measures fostering academic-industrial cooperation there.

1. Introduction

Academic-industrial cooperation represents one of the key success factors for many sectors and regions worldwide. The situation in transition countries particularly in Europe differs due to missing tradition and different system of research and development at universities including other intellectual property rights legislation and rules. However, in the last decade, when Czech Republic together with its neighbors in Central Europe joined the European Union, we have witnessed an accelerated trend of activities supporting foreign investment involving ICT, fostering entrepreneurship, and EU-funded programs bringing the opportunity to build the infrastructural background to enable close collaboration between academia and industry.

The Czech Republic as a transition country exposes specific characteristics in academic-industrial cooperation that have been identified in (Pitner & Ministr, 2014). In this paper, we will identify and classify the measures fostering tight academic-industrial cooperation in the conditions of two established universities in the Czech republic – Masaryk University, Faculty of Informatics

and its CERIT Science Park oriented to companies from the ICT sector, and VŠB-Technical University of Ostrava also featuring its Science Park.

We will take a top-down approach primarily describing the infrastructural development then we focus on internal organizational structures for the support of academic-industrial cooperation. Then we will examine student-centered and individualized ways to support the cooperation. Subsequently, we will see how community-oriented and research-driven collaboration. Finally, we will show the measures to foster entrepreneurship among students.

2. Infrastructure for Cooperation

2.1. Science Parks

CERIT Science Park (CERIT-SP) is a strategic development project fostering IT-related academic-industrial cooperation at Masaryk University by providing office spaces for IT companies in close proximity to the Faculty of Informatics. Though it looks like a 100% win-win opportunity for companies and the university, attracting the right companies to rent office rooms having the right size in a reasonable time is not an easy task, since the situation is very complex. There are many factors to take into consideration for all players.

CERIT Science Park builds upon a tradition of academic-industrial cooperation at the Faculty of Informatics. The purpose is to provide a common shared environment for companies and research teams from the Faculty of Informatics in close proximity to the university. PhD students can act as both developers with innovative companies settled in the Science Park and at the same time do the research in collaboration with the rest of the team in the university – all in neighboring buildings. It will foster innovations in the companies, and bring interesting research problems back to the faculty. However, there are certain circumstances making the transformation of the vision into reality complicated (Motschnig et al, 2014).

One (not rare) problem occurs when the industrial cooperation “goes beyond the horizon” of local companies. This occurs quite frequently because for many top-level research teams the big multinational companies are natural partners in large EU research projects while most of the local companies are left out (Doucek, 2011). On the other hand, the local ones are more likely to join the Science Park for practical reasons – the park is not large enough to accommodate big companies. The big ones prefer to participate in R&D projects remotely, and in most cases the research team at the university is “just one of their research partners”, not a reason to move the company there. Therefore, there are excellent teams at the university having a long tradition of industrial cooperation and still, they cannot attract any company to the park thus missing the opportunity of a convenient cooperation with them in the co-locality. *Co-location* is just one out of several enabling factors (however important) for good collaboration.

For commercial institutions, commercial factors (naturally) tend to have priority. Taking this into account, shared visions including scientific and commercial facets need to be elaborated. Companies have to see the real benefit of coming closer to the students and researchers. In our opinion, companies (as well as universities) can profit from:

- the *research labs* working in the same or similar area;
- from the *participation on meetings* of the academic team where the company can influence the direction of the research, and finally;

- the chance to directly or indirectly *participate in the education* of potential future employees and build awareness of access to specialists in a given area.

Additional information upon large-scale strategic support of academic-industrial cooperation can be found in (Pitner, 2012).

3. Organizational Measures for Cooperation

The Faculty of Informatics at Masaryk University (FI MU) founded the Association of Industrial Partners in the beginning of 2007 (Faculty of Informatics, 2014). The basis of cooperation with a particular company is always a shared interest in a particular activity (Tvrdíková, 2013). Establishing a closer relationship is crucial for companies especially in areas where FI has a privileged position, at least in the national comparison (Hanclova & Ministr, 2013).

Cooperation with industry is a part of everyday life of Masaryk University in the field of research, development and teaching. Mutually beneficial cooperation creates necessary feedback for the business sector as a source of the innovation process. Developing mutual cooperation includes a variety of forms – closer links between research and industry, cooperation in the laboratories on projects of science and research, cooperation in teaching and creating fields of study and graduates' profile, internships for students, theses supervision, etc.

The Association of Industrial Partners (AIP) at the Faculty of Informatics is intended for companies interested in a long-term cooperation with FI. Cooperation within the AIP is based on a contractual basis in the following three levels:

- It is possible start with the category of the 1st level – *SME Partner*, a kind of focal point for small companies where the primary goal is to formally establish the partnership with FI MU. The partnership can eventually be limited to maintaining permanent contact with the university or the occasional call for topics of student theses.
- The 2nd level – *Partner* – can also serve larger companies for the initial contact establishment with the foreseen move to a higher level and initiation of a joint project, for example, with a prospect to obtain support from European funds, where the collaboration of academic research with industry is an important condition. The Partner has a dedicated point of contact between academics and participates in development projects with an involvement of several students, etc.
- Long-term common interest is the basis of the 3rd and the highest level of partnership - *Strategic Partner* category. The Strategic Partner has the opportunity to "be there" when the faculty discusses relevant issues of study or research.

Partners at all levels can take part in regular meetings with FI students and staff (organized in the final weeks of each term), where the partners are also informed about important developments and plans of FI. Partners can also be presented on the information points of the Association. At higher levels of cooperation individual additional promotion options are added.

Through all these means and activities cooperation of FI MU with companies becomes more cultivated than we knew it from elsewhere in recent times, e.g. in the form of some so-called job fairs or questionable diploma theses of students-employees. Joining the Association of Industrial Partners involves signing of a formal agreement with FI, and dedication of resources to cover the costs of common activities.

4. Student-driven Cooperation

The following patterns of academic-industrial cooperation are primarily oriented to students of particular study programs having business orientation. They include interims in companies, or support graduation thesis done in collaboration with companies. These patterns allow fostering academic-industrial cooperation on a relatively large scale.

4.1. Study Fields (programs)

Nowadays, we observe a decreasing ratio of obligatory courses in favor of optional ones within our study IT-targeted program. The trend started almost one and half decade ago, around the end of 90s with the European “Bologna system” boosting it by forcing the university education to be more transparent by clear separation of study stages and transferable credits EU-wide. FI MU was one of the first Czech academic institutions reflecting this in their study programs. Later in 2000s, the *Service Science, Management and Engineering* (SSME) program was launched as the first one not solely founded on the traditional combination of theoretical informatics and/or information technology. In several courses, explicit inclusion of *Person-centered Approach* has been introduced.

4.2. Wide Spectrum of Courses

During its evolution, FI MU has collected an ensemble of several hundreds of unique courses (around 400) given each year, which is likely the maximum reached at Central-European IT-teaching colleges so far. Together with the freedom of choice, this rich spectrum of courses makes the fundamentals of learning personalization at FI MU.

4.3. Interims

With the advent of new business-oriented study programs, namely the SSME at FI MU, a great portion of the student/learner time spent moves from in-class learning to interims in companies, being set up based on individual preferences in combination with business requirements and the influence of the study program profile defined by the university. This helps the student to understand the necessity of mutual understanding between individual vision and needs of the reality.

4.4. Courses by Industrial Partners

FI MU established its Association of Industrial Partners (AIP, www.fi.muni.cz/for_partners) in 2007 after a decade of mostly informal cooperation with companies. AIP focuses on long-term cooperation measured primarily by intensity of collaboration in co-supervising graduation (bachelor- and master-) theses with certain lower bounds for each category of the partnership. However, apart of theses supervision and research cooperation, teaching activities are a vital component of a working cooperation. Both parties can benefit: the company keeps in touch with the students, their potential employees; students are in contact with real-life experts. It works the best if the lecturers/tutors coming from the company have authentic experience from the university where the course takes place.

4.5. Courses with “Open” Content

The syllabi of obligatory courses at FI MU are under supervision, as they affect the profile of graduates. However, the flexibility is bigger for optional courses – the content can change from one year to another, it can even be partially adopted en passant during the semester if an interesting topic emerges. The flexibility makes it an instrument for further individualization of studies. It is a typical case that a student working on a master- or PhD- thesis in a lab presents his/her either intermediate or final results in the lab seminar while the audience can intercept, comment, and be inspired for their own work.

5. Cooperation Driven by Individual Work

After the era of massive university courses serving hundreds of students at lectures in the last decade as we have seen at most public schools in the Czech Republic during the boom of tertiary education, we now see a decrease in the number of enrolled students in almost all study programs. Reaching the top number of 396,000 students in 2010 (Czech Statistical Office, 2013), the number slowly decreased to 381,000 in 2012 and the trend will for long time be the same. As a reaction, the schools offer more specialized passages through the studies, many of them closely related to industry, including interims in companies, projects, graduation works in collaboration with companies, and recently also coaching.

5.1. Bachelor and Master Theses

The current legislation allows students to either select the topic of the thesis from the list provided by the faculty or propose their own one. Given this great level of freedom, the faculty either has to have enough supervisors willing to supervise topic brought in by the students or engage the collaborating companies to do so. It requires much broader grasp than the traditional model based on the topics proposed by the professors and selected by the students, and requires continuous education of practitioners from companies to be able to follow the (rather strict) academic rules for the theses, and an incremental growth of flexibility (Steinbring, Motschnig, & Pitner, 2013).

5.2. In-term Projects

These projects represent a lightweight enrichment of individualized elements in university education. The course featuring in-term project is an efficient way to combine frontal education (easy, cheap) and individual learning achieved during working on individual or team projects with a reasonable level of freedom, so usually the project is not composed by a fixed set of task but instead, its topic, technology is selected or created by the student(s) who participate in it.

5.3. Coaching

Coaching pushes the individualized learning to its maximum. It is completely individual and self-paced. The coach does not direct the coached person but helps him/her to find his/her own ways by discovering the inner potential (Ministr & Stevko, 2010). FI MU enriched its portfolio by coaching in 2013, starting the first round of coaching by identifying the initial set of potential coaches from both academia and industry and pre-training them.

6. Community-driven Cooperation

6.1. User Groups

A user group is usually a free community around a technology, many times just very loosely tight to the originating company of the technology. Recently, Java-, Google-, or Microsoft-, but also TeX- or Linux- User Groups represent at FI MU extra-curricular activities mostly driven by students themselves. The faculty helps with the rooms and ensures certain support of management and promotion. Local user group members or companies' representatives bring the content in. The attendance extremely varies depending on topic – famous names or hot topic, such as mobile development, attract dozens, even hundreds students for such event. The “brand name” of the particular user group helps to catch the primary attention of students but it does not work automatically – good content is always the key.

6.2. Contests

College learning should not be seen as limited to credit courses only. On the contrary, the school should encourage students to see themselves as learners who are responsible for their achievements. If we succeed in it, then less formal or informal learning experiences are equally important as completing credit courses. Various contest, focused e.g. on open-source software development or solving a given (authentic or synthetic) software development task, are an organic way to improve not only software development-related skills, but also communication competencies, and other personal qualities, such as reliability, patience, and endurance when confronted with real life of “social coding” representing the current mainstream paradigm for open-source development (Pochyla & Rozehnal, 2011). Another format of competitions is targeted at solving concrete problems emerging from the needs of industrial partners.

7. Research-driven Cooperation

7.1. Research with Industrial Partners

Research is undoubtedly one of the ultimate goals of academic-industrial cooperation as seen from the perspectives of both FI MU and VŠB-TU. However, it also brings another level of individualization of study passages for talented and motivated students wanting to skip the baseline of study requirements and do more (Vilamova, 2012). Participation in a research team involving an industrial partner brings several advantages. Primarily, the research problems authentically emerge from practice. Secondly, the participation means direct contact and collaboration with potential future employer with the chance to continue working on a similar problem further (Ministr, 2013).

7.2. Participation in Projects

Projects represent a similar way to involve gifted students in university activities, providing in even wider options than pure engagement in research. Students – project collaborators – can act not only as research assistants but also as junior managers or in administrative positions (Nemec & Zapletal, 2012). It allows them to broaden their competencies behind the standard curriculum, to establish closer contacts to local academics as well as project partners, frequently also coming from abroad.

7.3. Lab Interims

Lab Interims where the student is hosted by a research lab for a certain period are another way to confront the theoretical knowledge gained during specialized studies such as the *Service Science, Management, and Engineering* program with the practice in research teams. Such interims broaden the supply of individual learning option by enriching it with research dimension, and are in many cases closely tight to projects of industrial collaboration.

8. Cooperation Driven by Entrepreneurship

8.1. Courses Fostering Entrepreneurship

Such courses are a new (and in many sense unique) way to encourage students to run their own businesses. Since the demand for highly qualified IT stuff in Brno and CZ in general rises during the last years, it is not easy to think about taking the risk and establishing an own business instead of accepting a well-paid job e.g. in an international company. Despite this fact, FI MU together with partners like the South Moravian Innovation Centre run a course focusing on helping the students – potential young entrepreneurs with the first steps towards their own business and avoid usual mistakes and frustrations.

9. Vision

The above patterns and other measures that have been designed, introduced and tested throughout the last years, showed a significant role of the academic-industrial cooperation for both industry and academia that both recently facing a strengthening competition. Better classification together with identification of new ways can lead to improvements in the faculties' strategic goals and their management, and has the potential to inspire the other universities in the region and broader.

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MEASURING PERFORMANCE OF EUROPEAN ICT SECTORS USING OUTPUT-ORIENTED DEA MODELS

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Efficiency, ICT Sectors, European Union, Output-Oriented DEA Models

Abstract

The economic impact of information and communication technologies (ICT) has been already examined in many empirical studies and respected international economic organizations. An acceleration of productivity in the ICT sector is one of the channels through which ICT can affect economic growth (OECD, 2004). The purpose of this paper is to evaluate the efficiency of ICT sectors (manufacturing, trade, service) in 15 countries of EU during the period 1995-2007. Two output-oriented DEA models were used - model with constant returns to scale (CCR) and model assuming variable returns to scale (BCC). The obtained results based on the data from the EU KLEMS database provide evidence that Hungary, Ireland and France are countries where ICT sectors are the most efficient. A comparison of efficiency of three ICT sectors shows that ICT service sector is the most efficient sector while ICT manufacturing sector is the least efficient.

1. Introduction

At least in last twenty years, Information and Communication Technologies (ICT) are considered as a main economic driver in all fields. Economic growth is supported by extensive investments into ICT and ICT help to weak impacts of economic crises. According to the OECD (2004), three main channels can be identified through which ICT can affect potential growth rates:

1. an acceleration of productivity in the ICT sector themselves, and a growing size of ICT sectors in the economy;

2. capital deepening across the economy, driven by rapid investment in ICT equipment, and resulting in a boost to labour productivity;
3. widespread spillover effects on productivity arising from ICT.

Quiang et al. (2003) distinguishes also three processes of ICT influence on economic growth, which coincide with OECD (2004): (i) total factor productivity (TFP) growth in sectors producing ICT; (ii) capital deepening; (iii) total factor productivity growth through reorganization and ICT usage. The first process of ICT contribution to growth is a part of ICT revolution, which is driven by rapid technological progress (Quiang et al., 2003). The performance increases of new ICT products are equivalent to TFP growth in ICT producing sectors, which raise the average TFP growth of the whole economy. The second process - increase in the real capital stock per worker - raises the productivity of the existing capital stock and labour. Identifying the determinants influencing IT adoption is also very important (Hančlová et al., 2014). The third process is more difficult to characterise, because of its long-term effects. It is important to look at how technological advancements affect the entire economy rather than just focus on the benefits of improving productivity in one ICT sector. Hančlová and Doucek (2012) emphasize the fact, that ICT influence economy and its growth by direct production (ICT producing industries) and by indirect effects (ICT using industries). One of the indirect effects considered trust and trust building into the market economy (Delina, Drab, 2010). Technological changes across the whole economy affect TFP growth and demonstrate ICT's potential to stimulate productivity. Its increase and its sustainability is discussed for example in Basl and Doucek (2012). In this paper the first channel of ICT contribution to economic performance - productivity (efficiency) of ICT-producing sector - is analyzed. Pilat and Lee (2001) state that ICT sector only accounts for a small share of the economy, but make a large contribution to growth and productivity performance (Dorcak, Delina, 2011), because it experiences much more rapid volume growth than the remainder of the economy.

The goal of this paper is to measure and evaluate the efficiency of ICT sectors (ICT manufacturing sector, ICT service sector, ICT trade sector) in 15 EU countries within the period 1995 – 2007 using output-oriented DEA models.

The structure of the paper is as follows: In the first section the possibilities of ICT contribution to economic performance are described. In Section 2 the non-parametric Data Envelopment Analysis (DEA) method for evaluating the efficiency of ICT sectors and its two basic output-oriented models are presented. In the third section data sources and measures of output and inputs are characterized. The results of the efficiency analysis of ICT sectors using DEA models are summarized in Section 4 and the key results of the study are concluded in the last section.

2. Data envelopment analysis

Two basic models of DEA are applied to evaluate the efficiency of ICT sectors in 15 EU countries. DEA is data-oriented approach for assessing the performance of homogeneous *Decision-Making Units* (DMUs), which transform multiple inputs into multiple outputs. Important attribute of DEA is that it is multi-criteria decision making method based on mathematical programming. The efficiency score of a DMU can be generally expressed as follows (Cooper et al. 2007):

$$\frac{\text{weighted sum of outputs}}{\text{weighted sum of inputs}} = \frac{\sum_{i=1}^r u_i y_{iq}}{\sum_{j=1}^m v_j x_{jq}}, \quad (1)$$

where $v_j, j = 1, 2, \dots, m$ and $u_i, i = 1, 2, \dots, r$ are weights assigned to j -th output and i -th output, respectively.

The aim of the DEA method is to examine whether DMUs are efficient by assessing the size and quantity of the inputs consumed by the produced outputs. Effective DMUs are on the imaginary *production possibility frontier*, all other DMUs are inefficient. It is important to note that DEA is primarily a diagnostic tool and does not prescribe any strategy to improve the efficiency of DMUs (Coelli et al., 2005).

The first basic DEA model (CCR), which was introduced by Charnes, Cooper and Rhodes in 1978, assumes *constant returns to scale* (CRS). Returns to scale are considered to be constant if an increase in all inputs results in a proportional increase in all outputs. The CCR model was extended in 1984 by Banker, Charnes and Cooper and this model (BCC) considers *variable returns to scale* (VRS) - decreasing, increasing or constant. Returns to scale are considered to be variable if an increase in all inputs results in increase (decrease) in all outputs, which is higher (lower) than proportional. The assumption of VRS expresses the economic reality more realistically than CRS and thus can better identify more efficient units.

The ratio between the weighted sum of outputs and the weighted sum of inputs is the *coefficient of efficiency* (CE). In *input-oriented DEA models* the CEs equal to 1 for the efficient DMUs and CEs are less than 1 for the inefficient DMUs. In *output-oriented DEA models* the CEs equal to 1 for the efficient DMUs and CEs are greater than 1 for the inefficient DMUs. Using DEA it is also possible to compute the necessary improvements of inputs and outputs for the inefficient countries to become efficient. In this paper CCR and BCC output oriented models are used. These models contain radial variables ϕ_q , which indicate the required rate of increase of all outputs to achieve efficiency.

Assuming 3 ICT sectors in 15 countries, each with m inputs and r outputs, the relative efficiency score of a given ICT sector in country q is obtained by solving equations (2) - (6) and (7) - (11). Following models will be defined generally for multiple inputs and outputs (Jablonský, 2004). The *primary CCR output-oriented model* assuming CRS is defined as:

$$\text{minimize } g = \sum_j^m v_j x_{jq} \quad (2)$$

$$\text{subject to } \sum_i^r u_i y_{ik} \leq \sum_j^m v_j x_{jk}, k = 1, 2, \dots, n \quad (3)$$

$$\sum_i^r u_i y_{iq} = 1 \quad (4)$$

$$u_i \geq \varepsilon, i = 1, 2, \dots, r \quad (5)$$

$$v_j \geq \varepsilon, j = 1, 2, \dots, m \quad (6)$$

where g is the coefficient of efficiency of unit U_q , u_i are weights assigned to the i -th output, v_j are weights assigned to the j -th input, ε is the infinitesimal constant, x_{jk} is the value of the j -th input of unit U_k , x_{jq} is the value of the j -th input of unit U_q , y_{ik} is the value of the i -th output of

unit U_k , y_{iq} is the value of the i -th output of unit U_q , m represents inputs and r represents outputs.

The *primary BCC output-oriented model* assuming VRS is defined as:

$$\text{minimize } g = \sum_j^m v_j x_{jq} + v \quad (7)$$

$$\text{subject to } \sum_i^r u_i y_{ik} \leq \sum_j^m v_j x_{jk} + v, k = 1, 2, \dots, n \quad (8)$$

$$\sum_i^r u_i y_{iq} = 1 \quad (9)$$

$$u_i \geq \varepsilon, i = 1, 2, \dots, r \quad (10)$$

$$v_j \geq \varepsilon, j = 1, 2, \dots, m \quad (11)$$

v – free in sign

where v is a dual variable associated with the convexity condition $e^T \lambda = 1$. All variables in model (7) - (11) have the same meaning as in model (2) - (6).

In this study Microsoft Excel Add-in for solving Data Envelopment analysis DEA Frontier is used to evaluate the performance of ICT sectors.

3. Data, variables and ICT sectors definition

The data source applied in this study is the *EU KLEMS* database. The goal of the *EU KLEMS* Growth and Productivity Accounts is to support empirical and theoretical research of productivity in the European Union at the industry level. The big advantage of the *EU KLEMS* database is that it is based on analytical framework such as production functions and the theory of economic growth. This database includes measures of outputs (Gross Output, Gross Value Added) as well as various measures of inputs (Capital, Labour, Energy, Material or Service Inputs) since 1970. In this analysis data for the time period 1995-2007 are used because newer data up to 2010 are yet available for only a few countries.

Labour productivity for sector i and time t was selected as a measure of output and is defined as:

$$LP_{it} = \frac{GO_{it}}{H_EMP_{it}}, \quad (12)$$

where GO_{it} is gross output at current basic prices (in millions of Euros) and H_EMP_{it} is total hours worked by persons engaged (millions). ICT capital services per hour worked (*ICTH*) and non-ICT capital services per hour worked (*NICTH*) expressed in volume indices were chosen as measures of inputs. The definition of capital services is the following (OECD, 2004, p. 75): "Capital services refer to the flow of productive services provided by an asset that is employed in production. Capital services reflect a (physical) quantity, not to be confused with the value, or price concept of capital. Capital services are the appropriate measure of capital input in production analysis." O'Mahony and Timmer (2009) emphasize that in levels comparisons between countries

purchasing power parities (PPPs) are needed to adjust output and inputs for differences in relative price levels. The industry specific PPPs reflect differences in price levels across countries at a detailed industry level. The values of PPPs were obtained from the webpage of the EU KLEMS project. A comprehensive description of the data available in the EU KLEMS database is available in O'Mahony and Timmer (2009).

Data for this study were available for the following countries of EU: Austria (AUT), Belgium (BEL), Czech Republic (CZE), Germany (DEU), Denmark (DNK), Spain (ESP), Finland (FIN), France (FRA), United Kingdom (GBR), Hungary (HUN), Ireland (IRL), Italy (ITA), Netherlands (NLD), Slovenia (SVN) and Sweden (SWE). Definition of ICT industries was adopted by Hančlová and Doucek (2012) and is based on the industries included in the *EU KLEMS* database. In comparison with the study Hančlová and Doucek (2012) the *EU KLEMS* sector K72 Computer and related activities weren't included in the ICT service sector, because the data for ICT and non-ICT capital services are available only for the group of sectors K71-74 Renting of m&eq and other business activities. It should be noted that this classification is imprecise due to unavailability of necessary data. Definition of ICT sectors based on the EU KLEMS database is showed in Table 1.

Type of ICT sector	Code	EU KLEMS definition
ICT manufacturing	D30	Office, accounting and computing machinery
	D31	Electrical Machinery and apparatus
	D32	Radio, television and communication equipment
	D33	Medical, precision and optical instruments
ICT service	I64	POST AND TELECOMMUNICATIONS
ICT trade	G51	Wholesale trade and commission trade, except of motor vehicles and motorcycles

Table 1 Three types of ICT sectors

4. Optimization results

As mentioned in the previous sections, CCR and BCC models were used to evaluate the efficiency of ICT sectors in 15 countries of EU within time period 1995-2007. Average coefficients of efficiency in time were computed as geometric means, average coefficients of efficiency (CEs) across countries were computed as arithmetic means. Firstly, the graphical representation of the efficient frontier and production possibility set for the case of ICT trade sector and year 2005 is illustrated and then the optimization results for CCR and BCC models are summarized.

4.1. Graphical illustration

In our case each decision making unit (ICT sector) can be characterised by 2 inputs and 1 output. For graphical representation it is necessary to divide each input by output, so we get an amount of input, which is needful for production of one unit of output. Figure 1 shows graphical illustration of production possibility set and efficient frontier for ICT trade sectors in year 2005. From this figure it is obvious that efficient DMUs are ICT trade sectors in Italy, Slovenia and Hungary, other countries had in 2005 inefficient ICT trade sectors.

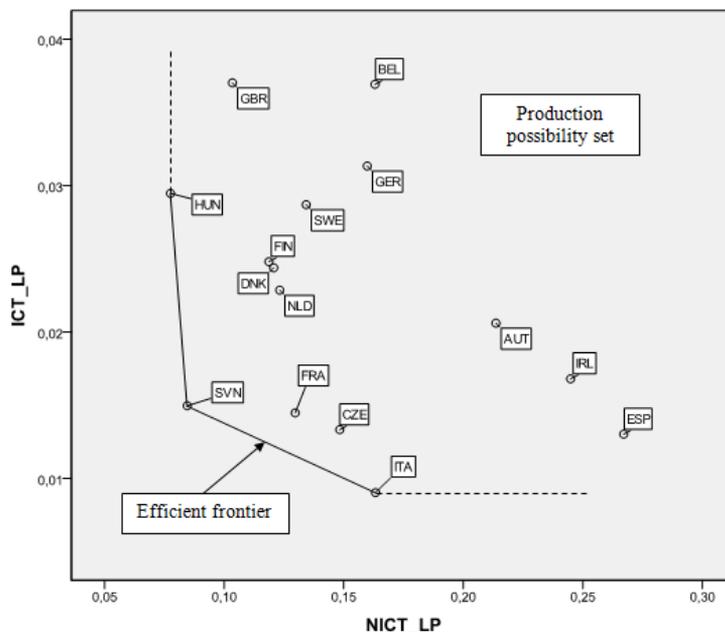


Figure 1 Efficient Frontier of ICT trade sector in 2005 - BCC model

4.2. Optimization results - CCR model

Firstly the optimization results for CCR model are listed. Table 2 shows three groups of EU countries according to their average CEs in the entire period. The countries were divided into groups using 33 and 66 percentiles, 15 countries are therefore divided into 3 groups of 5. The average CE ranges between 1.02 in the Hungary to 3.53 in Belgium. The group of countries, where ICT sectors are most efficient, consists of Hungary, Slovenia, Italy, Ireland and France.

1.02 < CE < 1.95	1.95 < CE < 2.89	2.89 < CE > 3.53
Hungary, Slovenia, Italy, Ireland, France	Netherlands, Czech Republic, Germany, Finland, Sweden	Spain, Denmark, Austria, United Kingdom, Belgium

Table 2 Three groups of countries according to their efficiency - CCR model

It is also interesting to compare which ICT sector is the most efficient. For this purpose an average efficiency scores of all countries in given ICT sector were calculated. In Table 3 there are average scores of efficiency, standard deviations (in parentheses) and rank of ICT sectors.

ICT sector	Average CE	Rank
manufacturing	2.974 (1.651)	3.
trade	2.233 (0.965)	2.
service	1.866 (0.757)	1.

Table 3 Average efficiency scores of ICT sectors - CCR model

The most efficient sector is ICT service sector with average coefficient of efficiency equal to 1.866, the second most efficient is ICT trade sector with average CE equal to 2.233 and ICT manufacturing sector is the least efficient (CE = 2.974).

4.3. Optimization results - BCC model

Table 4 shows three groups of EU countries obtained on the basis of the BCC model results. The average CE ranges from 1.03 in the Hungary to 1.80 in Belgium. From these results it is evident, that using BCC model the levels of efficiency are higher than in the case of CCR model. The group of most efficient countries consists of Hungary, France, Ireland, Finland and Netherlands. However, the difference between Netherlands (the most efficient group) and United Kingdom (the least efficient group) is small and equal to 0.1.

1.03 < CE < 1.15	1.15 < CE < 1.25	1.25 < CE < 1.80
Hungary, France, Ireland, Finland, Netherlands	Italy, Sweden, Belgium, Slovenia, Germany	United Kingdom, Denmark, Austria, Spain, Czech Republic

Table 4 Three groups of countries according to their efficiency - BCC model

Table 5 shows average CEs for ICT sectors computed by BCC model. The results are slightly different from the CCR model - ICT manufacturing sector is the most efficient sector with average CE equal to 1.195, ICT service sector is the second (CE = 1.279) and ICT trade sector is the least efficient with CE equal to 1.280. The average CEs in all three sectors are close to 1 and we can say that using BCC model all ICT sectors are classified as efficient.

ICT sector	Average CE	Rank
manufacturing	1.195 (0.220)	1.
trade	1.280 (0.292)	3.
service	1.279 (0.441)	2.

Table 5 Average efficiency scores of ICT sectors - BCC model

5. Conclusions

The results of optimization models for ICT manufacturing, ICT trade and ICT service sector in 15 EU countries during 1995-2007 can be summarized into following conclusions:

- The levels of efficiency of ICT sectors are on average higher in BCC models than they are in CCR models (average CE in CCR model = 2.435, average CE in BCC model = 1.265). Using BCC model higher number of evaluated DMUs is classified as efficient.
- The group of most efficient countries on the basis of the results of CCR model consists of *Hungary*, *Slovenia*, *Italy*, *Ireland* and *France*. These countries achieved average CEs between 1.02 (*Hungary*) and 1.95 (*France*).
- The group of most efficient countries on the basis of the results of BCC model consists of *Hungary*, *France*, *Ireland*, *Finland* and *Netherlands* with average CEs between 1.03 (*Hungary*) and 1.15 (*Netherlands*).
- CCR model identified ICT service sector as the most efficient with average CE equal to 1.866. This finding is consistent with the result of the study (Fischer et al., 2013).

- BCC model identified ICT manufacturing sector as the most efficient with average CE equal to 1.195. ICT service sector achieved average CE equal to 1.279 and the CE of ICT trade sector is almost the same as in ICT service sector (1.280)

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DEVELOPMENT OF THE DIGITAL FORENSICS LABORATORY MANAGEMENT SYSTEM USING ISO 9001 AND ISO/IEC 17025

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Keywords

ISO 9001, ISO/IEC 17025, Management Systems, Laboratory, Forensics

Abstract

For effective and efficient operation every organization needs to develop a management system that provides the basic framework for achieving it. Many organizations all over the world are using international management system standards as guidelines helping them to develop management system. For digital forensics laboratories there is no specific standard setting the requirements for developing such a system. This article will focus on international standards closely connected to management systems and dealing with specific needs of digital forensic laboratories and methodologies that can be used to further improvement of effectiveness and efficiency of management system

1. Introduction

Effectiveness and efficiency of an organization is always important question that has to be addressed by the top management. Like any other organization, digital forensics laboratory shall have a management system that ensures its efficient and effective operation. Given the focus of its activities, the organizations of this type have their own specifics, which the implemented management system has to respect and incorporate into its design. As an appropriate basis to design a management system seems to be the international standard ISO 9001:2008, which sets general requirements for management system with emphasis on quality of the product provided to the customer and international standard ISO/IEC 17025, that is the basis for the implementation of management systems in testing and calibration laboratories. Although these international standards are not designed especially for digital forensic laboratories, they can be useful for the first steps of designing the management system and their requirements can be modified and supplemented to meet specific needs of this type of organization.

It has to be noted that designing a management system based on the requirements of international standards has some limitations regarding achieving and improving the performance of the organization. Therefore, it is strongly recommended to implement other more advance methodologies to continually improve the performance of the organizations. Such methodologies are represented by approaches like the EFQM Excellence Model developed by the European

Foundation for Quality Management, methodology Six Sigma, developed by Motorola or Lean Management, which has been introduced by Toyota.

In this article we will focus on a comparison of the specific requirements of ISO 9001 and ISO/IEC 17025 and selection of requirements that should be applied to the management system of digital forensics laboratories and the implications of these requirements for the operation of digital forensics laboratories. Conclusion of the article will also focus on other options and approaches to improving the efficiency and effectiveness of the management of digital forensics laboratory and its operation.

2. International Standard ISO 9001 Quality Management Systems - Requirements

ISO 9001 is one of the most widely used international standards in the world with more than one million of certificates (ISO, 2012). This international standard provides the basic requirements for the management system of an organization and given its generic nature, it can be used by any organization (ISO, 2008).

Simplified structure of this international standard is shown in Table 2. Requirements of this standard can be also pictured from the process point of view, as shown in Figure 1.

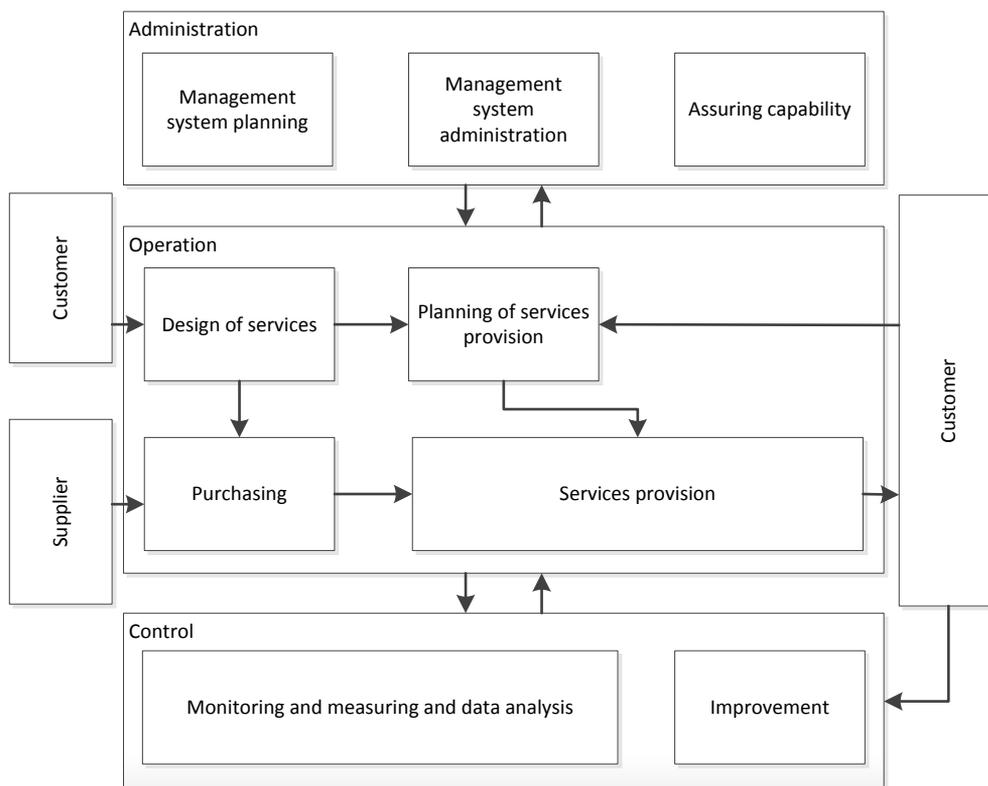


Figure 1 Process Structure of the Requirements of ISO 9001

In the process of designing management system for a digital forensics laboratory the requirements of ISO 9001 are fully applicable. With its emphasis on process approach and identification and fulfilment of customer requirements ISO 9001 forms ideal basis for the basic structure of a management system for digital forensics laboratories. The benefit of this standard can be found mainly in designing administration and control processes, which do not have as many specifics as

operational processes. Because of the specifics of activities realized in digital forensics laboratory, operational processes need more specific requirements, which are not included in ISO 9001.

3. International Standard ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories

Because ISO 9001 does not cover completely all activities realized in digital forensics laboratories, it is necessary to find other standard that will cover these specifics. There is no international standard drafted directly for management systems of digital forensic laboratories. Some requirements regarding specific activities are provided in ISO 27000 family of standards, but these requirements can be used only in designing processes closely connected to provision of services to customers, since they have no strong relation to management system.

The closest relation to a management system of digital forensics laboratory seems to have the international standard ISO/IEC 17025 (ISO, 2005). This standard has been drafted for testing and calibration laboratories, but some requirements are useful also for digital forensic laboratories and can supplement the requirements of ISO 9001 (Turman, 2009). Because of the different scope of ISO/IEC 17025, analysis of its requirements has been carried out to identify requirements useful for designing a management system for digital forensics laboratories. The results of this analysis are provided in Table 1.

Clause number	Clause title	Application
4	Management requirements	
4.1	Organization	Partly applicable
4.2	Management system	Fully applicable
4.3	Document control	Fully applicable
4.4	Review of requests, tenders and contracts	Fully applicable
4.5	Subcontracting of tests and calibrations	Fully applicable
4.6	Purchasing services and supplies	Fully applicable
4.7	Service to the customer	Fully applicable
4.8	Complaints and/or calibration work	Fully applicable
4.9	Control of nonconforming testing and/or calibration work	Fully applicable
4.10	Improvement	Fully applicable
4.11	Corrective action	Fully applicable
4.12	Preventive action	Fully applicable
4.13	Control of records	Fully applicable
4.14	Internal audits	Fully applicable
4.15	Management reviews	Fully applicable
5	Technical requirements	

Clause number	Clause title	Application
5.1	General	Fully applicable
5.2	Personnel	Fully applicable
5.3	Accommodation and environmental conditions	Not applicable
5.4	Test and calibration methods and method validation	Partly applicable
5.5	Equipment	Not applicable
5.6	Measurement traceability	Partly applicable
5.7	Sampling	Not applicable
5.8	Handling of tests and calibration items	Fully applicable
5.9	Assuring the quality of test and calibration results	Fully applicable
5.10	Reporting the results	Fully applicable

Table 1 Requirements of ISO/IEC 17025 and their application on a digital forensics laboratory

The requirements of ISO/IEC 17025 have been analysed regarding their suitability for digital forensics laboratories. The result of this analysis is a list of ISO/IEC 17025 requirements with indication regarding their applicability on digital forensics laboratory. Some of the clauses of the standard are completely excluded, some are applicable only partly. The reason for excluding some requirements or their parts is that they are closely connected to calibration activities, which are not carried out in digital forensic laboratory. Although the title of the clause 4.8 is Complaints and/or calibration work, the requirements of this clause are quite general and can be used in designing a process for handling complaints in digital forensics laboratory.

4. Comparison of the Requirements of ISO 9001 and ISO/IEC 17025

Because neither ISO 9001 nor ISO/IEC 17025 cover all aspects of management system of digital laboratory, the comparison of the requirements of these international standards has been made. The results of this comparison can be found in Table 2.

ISO 9001		ISO/IEC 17025	
Clause	Requirement	Clause	Coverage of the requirement
4.1	structure and scope of management system	4.1, 4.2	partly covered
4.2	quality manual, control of documents	4.2, 4.3, 4.12	fully covered
5.1	assuring top management commitment	4.1, 4.2, 4.15	fully covered
5.2	identification and fulfilment of	4.4	fully covered

ISO 9001		ISO/IEC 17025	
Clause	Requirement	Clause	Coverage of the requirement
	customer requirements		
5.3	quality policy	4.2	fully covered
5.4	setting goals and management system planning	4.2	fully covered
5.5	responsibility and authority, quality manager and internal communication	4.1, 4.2, 4.11	partly covered
5.6	management review	4.15	fully covered
6.1	provision of resources	4.4, 4.7, 4.10, 5.4, 5.10	fully covered
6.2	staff capability	4.1, 5.2, 5.5	fully covered
6.3	infrastructure capability	4.1, 4.6, 4.12, 5.3, 5.4, 5.5, 5.6, 5.8, 5.10	fully covered
6.4	working environment capability	5.3	fully covered
7.1	planning of services provision	4.1, 4.2, 5.1, 5.4, 5.9	fully covered
7.2	assuring fulfilment of customer requirements, communication with customer	4.4, 4.5, 4.7, 4.8, 5.4, 5.9, 5.10	fully covered
7.3	design of services	5.4, 5.9	partly covered
7.4	selection and evaluation of suppliers	4.6	fully covered
7.5	control of services provision, validation of processes, identification, preservation of product	4.1, 4.6, 4.12, 5.1, 5.2, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 5.10	partly covered
7.6	calibration and verification of measurement equipment	5.4, 5.5	fully covered
8.1	continual improvement	4.10, 5.4, 5.9	fully covered
8.2	monitoring and measurement, internal audit	4.5, 4.6, 4.9, 4.10, 4.11, 4.14, 5.5, 5.8, 5.9	partly covered
8.3	control of nonconforming services	4.9	fully covered
8.4	analysis of data	4.10, 5.9	fully covered
8.5	preventive and corrective actions	4.9, 4.10, 4.11, 4.12	fully covered

Table 2 Comparison of the Requirements of ISO 9001 and ISO/IEC 17025

Where ISO/IEC 17025 does not cover the whole scope of ISO 9001 requirements, these requirements have to be used instead. Where ISO/IEC 17025 fully covers the scope of ISO 9001, the requirements of ISO /IEC 17025 will be used in the process of designing a management system of a digital forensic laboratory.

The biggest gap between the requirements of ISO 9001 and ISO/IEC 17025 is in the requirements regarding the structure of an organization. Compared to ISO 9001, ISO/IEC 17025 does not require a structure based on processes. Given the specific activities of a digital forensics laboratory, the model combining process and project approach shall be developed to fulfil the requirements of ISO 9001. Other differences between these two international standards are minor.

Using the combination of the requirements of ISO 9001 and ISO/IEC 17025 will lead to the implementation of effective and efficient management system, which respects specifics of a digital forensic laboratory.

5. Methodologies for Further Improvement of a Management System

As mentioned above, international management system standards have limitations in improving the management systems performance. Therefore other methodologies have to be used to continually improve effectiveness and efficiency of a management system.

5.1. EFQM Excellence Model

Based on the experience from medical laboratories, one of the possibilities for further improvement of a laboratory management system is EFQM Excellence Model (Salas, 2006). This model has been developed by the European Foundation for Quality management as is focused on reaching higher maturity of management system in all its aspects. The model is based on self assessment and is able to identify aspects of a management system with the highest opportunity for improvement (EFQM, 2014).

5.2. Six Sigma

Six Sigma has been developed in the USA by Motorola. The focus of Six Sigma is on eliminating any sources of variations in the processes of an organization that are resulting to customer complaints. Implementation of this methodology can bring reduction of internal costs in processes and improvement of customer satisfaction (Shaffie, 2012).

5.3. Lean Management

Lean Management has been introduced by Toyota as Toyota Production System. This approach focuses on eliminating sources of wasting in the processes of an organization. Application of this approach results mainly in reduction of internal costs of processes and reducing the time needed to deliver a product to customer (Shaffie, 2012).

6. Discussion

The article has introduced the possibilities of using international standards in the process of development of a management system that will assure effective and efficient operation of a digital forensic laboratory. Because there is no specific standard for a management system of a digital

forensics laboratory, international standards ISO 9001 and ISO/IEC 17025 have been chosen as a basis for developing a management system.

ISO 9001 provides the most generic requirements for management systems and all requirements of this international standard should be covered by the specific management system. Because this standard does not address the specific activities carried out in a digital forensic laboratory, we have searched for other standard that is more suitable for such an organization.

The international standard with scope closely connected to the activities of digital forensic laboratory is ISO/IEC 17025. Although this standard is particularly designated for testing and calibration laboratories, some of the requirements are suitable also for digital forensics laboratories.

We have performed an analysis and comparison of the requirements of ISO 9001 and ISO/IEC 17025 resulting into a list of requirements that can be used to develop a management system for digital forensics laboratory.

Since we do not expect development of an international management system standard designated directly to digital forensic laboratories, the list of requirements identified in this article may be used to develop effective and efficient management system. Because of the limitations of international standards in improving management systems, organizations should also consider using other methodologies to continually improve their performance.

7. Conclusion

The article introduced the possible set of requirements that can be useful for developing effective and efficient management system for digital forensic laboratory. We focused on international standards ISO 9001 Quality management systems - Requirements and ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories which can be taken as a basis for the process of developing the management system. As it is not expected that specific international standard for digital forensic laboratories will be developed, the list of requirements combining ISO 9001 and ISO/IEC 17025 given in this article may be used instead of such specific standard. The article also introduces other possibilities for further improvement of a management system of digital forensic laboratory.

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Development of the Digital Forensics Laboratory Management System Using ISO 9001 and ISO/IEC 17025

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APPLICATIONS OF THE LEAN IT PRINCIPLES – COMPARISON STUDY IN SELECTED CZECH AND POLISH COMPANIES

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Abstract

The paper deals with the aspects of ICT innovation in sustainable development. It comes out of the lean principles applications in the IT area called lean IT. Lean IT seems to be important steps towards the higher effectiveness of ICT usage. Lean IT is an application of lean principles or rather industrial engineering principles in ICT. The article presents main results of survey done in selected Czech and Polish companies. They show the current status of the lean IT understanding, penetration in companies, expected benefits and known limits. The results of survey show the big potential for further penetration in companies and their ICT.

1. Introduction in lean principles and lean IT

1.1. Introduction into the Lean

Lean or Lean thinking is a methodology to manage a manufacturing company with a goal to avoid all wastes through the production while meeting customer requirements (Bell, 2012). Principles of Lean Manufacturing were put by W. Edwards Deming who taught new management methods in Japan in the early '50s (Deming, 1993). One of the most famous representatives of Lean is the Toyota firm with its TPS (Toyota Production System) . The most known persons of the development of the TPS is Taiichi Ohno. Just -In -Time, Kanban or Autonomation (Automation using people) belong among his major contributions.

Lean manufacturing is a shift from economies of scale to the economy of flow (Hanclova et al, 2012, Fischer et al., 2013). The lean principle mean systematic elimination of the waste – for instance idle time or material wastes in the production processes (Bell, Orzen, 2010). The

manufacturing with less waste products can be more efficient, faster and in smaller batches. This enables the company to quickly adapt to changing customer requirements. Quality is a desirable side effect of the lean production due to the fact that the production of defective parts or products is also a form of waste. Reduction of defects increases the quality and decreases costs. Lean is mainly about people. People are crucial element and the technology and automation play only a supporting role in lean manufacturing (Nedomova et al., 2013, Doucek, 2011, Hanclova 2012). There is necessary to change the corporate culture first to promote the participation in the innovation and improvement of each employee.

Process management is the second step then. The processes can be easily and continuously improve with the right corporate culture. It leads to reduced costs, to reduce time of new production and to better quality. Technology and automation has to be just the icing on the cake. Using technology to "bad" process is a waste of resources and time. The right effect can be expected only in the case if technology is used to automate debugged and efficient processes. Information technology (IT) can be such technology applied for lean principles (Basl et al., 2012).

1.2. IT supportive role of lean

IT can support the effort for lean management. On the other hand the management of the IT becoming also more and more focused on cost reduction at a time of frequent changes. The challenge for IT is the transparency of costs so as to achieve an increase in value added/cost reduction without the side effects of the damage trade. The role of IT is changing from a purely ancillary to the value-added factor. But this process still brings a lot of waste in the form of legacy infrastructure, fragmented processes and uneconomic practices. It is therefore necessary to manage the provision of services in order to reduce waste. Due to the fact that nowadays IT drives business processes, identification and elimination of waste are keys to the success of the business (Minter,2012).

Recent economic recession have shaken the foundations of many businesses, especially in the banking and financial sectors (Tinham, 2004). The threat of recession return emphasis the shift to cost reduction and conservative spending. Lean approach still does not necessarily mean progressive crossed out costs. Rather, IT managers are trying to explore principles similar to those of production to minimize waste, inefficiencies and costs. However, can principles originally intended for production also be used in the management of IT services and infrastructure?

1.3. Application of lean principles in IT – lean IT

A survey done by McKinsey & Company of 864 executives shows that 64 % of them currently deploying "lean IT". It means they apply at least some of the lean manufacturing techniques in area of information and information technology. Lean IT development began fifty years later then lean in production in the area of services support, marketing, design, sales and administration. The lean administration is the separate area of lean. Lean IT is therefore a relatively new phenomenon that is currently being explored and developed in various business sectors.

The usage of lean in IT is very wide. For instance it can be applied in the software development. Although all software products share some common basic characteristics, each project brings new technology, new people and new challenges. Apart from production, however, it still does the same thing over and over again. In response to this question methods and software project management (Scrum, Extreme Programming (XP), Feature Driven Development (FDD)) have been created to increase the chances of the company by providing a framework of best practices.

All of these above mentioned approaches have merit, but until we fully understand the reasons for their creation, we will not be able to adapt them sufficiently in specific situations. Lean IT provides the tools and methods that allow improve the existing processes of the state in which it is located (Maryska, Wagner, 2013).

1.4. Different understanding of Lean IT

If we translated literally Lean IT, we could interpret it as deployment tools and principles of lean manufacturing to IT infrastructure environment or manufacturing company providing IT services.

Although the principles of lean products with IT services seem incompatible at first moment, the opposite may be true. Due to different interpretations of the concept Lean IT can be understood on several levels:

- Lean IT in software companies is agile development,
- Lean IT in a production environment means using information technology effectively,
- Lean IT services - focus on the added value for a customer,
- Lean IT in IT services - cloud services, SaaS, IaaS and PaaS.

In all of these concepts, however, the Lean IT offers the following benefits:

- Elimination, straightening or automation of redundant processes (eg. paper billing, processes for communicating with authorities e -procurement, e -invoicing),
- Information about business at the right time, an overview of business performance data and response options during the current business,
- Increasing the effectiveness of inspections and straightening processes using applications to increase productivity and reduce costs for organizations,
- Better connection and response to customers, building relationships and adherence to requirements faster and better,
- Ensure that employees use computerization for continuous improvement in the organization, providing an environment to reduce downtime and unnecessary work, allowing the focus on value-adding activities.

1.5. Management of IT department

Idea to use the techniques of lean production was explored by some IT organizations. Very often, however, a lean approach is used only for application development and maintenance. Although many companies are still exploring the possibility of offshore development (development outsourcing in countries with low personnel costs), the cost of the development is still about 50 % of the total IT budget. When reducing the number of employees has also received a lot of companies to limit where further reductions significantly deteriorated competitiveness (Maryska, Wagner, 2012).

The introduction of Lean IT principles may at McKinsey & Company to increase the productivity of development and maintenance by up to 40 % while improving quality and speed. It is due to the analogy of the development department to the production line corresponding to each category of waste from the manufacturing plant category in development. I development includes many activities that should be automated and linked in order to reduce waste and improve production flow. The same reasoning must be applied in the field of IT operations services, as they can be, as

well as the development of applications, management of life-cycle services using techniques to improve the design, operation and transition services to support broader corporate strategy (Bell, 2012).

ITIL ® V3 promises knowledge of this, and many organizations are beginning to apply it (Doucek et al, 2013). Lean approach can complement management services such as ITIL, because they also focus on repetitive activities. And although Lean focuses on waste and its disposal, the objective of increasing productivity and improving quality through continuous improvement remains the same. Opportunity to apply lean principles can be achieved by many methods of IT management. Can be applied separately, but the integration increase their potential through synergy.

2. Lean IT survey in selected Czech and Polish companies

Applications of lean IT for the operation and deployment of the information technology (servers, notebook PCs, tablet, etc.) have been observed increasingly lately. Authors of this article decided to analyse the Lean IT trends how they are applied and used by companies. To make suitable comparison the survey was done partly in the selected Czech companies and partly in the selected Polish companies. To get similar and comparable results the group of external students of the University of Economy Prague (CZ) and the University of Zielona Gora (PL) were selected. The conditions for both groups were following:

- Students were at the similar faculties and the fields of studies.
- Students were in the final year of study,
- Students were from the wide variety of firms and their positions in these firms were also wide and representative,
- All students returned the filled form.

The survey represents the first pilot results. There were 18 students in the Czech group and 34 students in the Polish group.

The survey was done via form where students answered following questions:

Topic A: The application of lean IT principles in management of company:

Questions:

A.1 Does your company deal with lean topic?

A.2 Does your company deal with lean topics in the area of information technology (Lean IT)?

A.3 If the Lean IT is applied in your company and what is the meaning for your business?

A.4 Do you have a strategy for Lean IT in your company?

A.5 In which documents are explicitly expressed the needs to consider lean IT?

A.6 Who is responsible for lean IT in your company?

A.7 What is the relationship of employees to the lean IT?

Topic B: Application of Lean IT principles in the buying and operation of IT:

Questions:

B.1 Do you address issues of environmental impact when buying IT?

B.2 Do you address issues of environmental impact upon disposal of IT operations?

B.3 Do you know how much energy is consumed by IT in your company?

B.4 Do you know in which areas Lean IT is used and what plans you have to start using it in the future?

Topic C: The benefits and barriers to the implementation of Lean IT in your company:

Questions:

C.1 Which of the factors support the application of lean IT in your company?

C.2 Are indicators for the benefits of Lean IT applied in your business?

C.3 What are the benefits of using Lean IT specifically in your business?

C.4 Which factors have an impact on your business that do not apply the principles of Lean IT?

Topic D: The overall characteristics of the company:

Questions:

D.1 Which sector does your company operate?

D.2 How many employees work in your company?

D.3 Is your company with foreign participation?

D.4 What position within the company you work for?

2.1. Main results of Lean IT survey in selected Czech and Polish companies

The answers have brought an interesting overview of the current understanding and application of the lean IT topics among selected Czech and Polish companies. The following text shows the most interesting from them.

Answers for the topic A: The application of lean IT principles in management of company:

A.1 Does your company deal with lean topic?

The 50% of the Czech companies deal with the lean IT topic more than one year. On other hand majority of Polish firms (32%) answered that they have not met this topic yet. But the answers about the longer interests in this field were also among Polish companies often (27%).

A.2 Does your company deal with lean topics in the area of information technology (called Lean IT)?

Czech companies either deal with lean IT longer than one year (20%) or they currently make implementation of these principles (33%).

Polish companies more prefer answers that they have not meet these principles (30%).

A.3 If the Lean IT is applied in your company, what is the meaning for your business?

The both groups preferred answers that lean IT is only the meaning for gaining the other goals of company (Czech – 65%, Polish – 70%)

A.4 Does your company have a strategy for lean IT in your company?

Neither Czech (60%) nor Polish companies (58%) have special strategy for lean IT.

A.5 In which documents are explicitly expressed the needs to consider lean IT?

If there is lean IT mentioned it is mostly in business strategy in Czech companies (30%) and in IT strategy of Polish companies (32%).

A.6 Who is responsible for lean IT in your company?

Czech companies dedicated mostly the CIO as a responsible person (35%). Polish companies mostly have not thought about it yet (45%).

A.7 What is the relationship of employees to the lean IT? Employees in one half of the Czech companies (50%) know about lean IT principles. But majority Polish companies (68%) have employees have not met this topic.

Answers for the topic B: Application of Lean IT principles in the buying and operation of IT:

B.1 Do you address issues of environmental impact when buying IT?

Both groups of companies prefer IT producers who are environmental friendly (Czech – 45% and Polish 64%). There is very important that both groups also prefer equipment with lower electric energy consumption (Czech – 80% and Polish – 72%).

B.2 Do you address issues of environmental impact upon disposal of IT operations?

Both groups have a tendency for recycling IT equipment (Czech – 48%, Polish – 85%) or ecological liquidation (Czech – 100%, Polish – 42%).

B.3 Do you know how much energy need your company?

There is interesting that neither the Czech companies (50%) nor the Polish companies (70%) have information about energy consumption of their IT or they have not thought about it yet.

Answers for the topic C: The benefits and barriers to the implementation of Lean IT in your company:

C.1 Which of the factors support the application of lean IT in your company?

The three most important factors in selected Czech companies are – economic reasons (cost reduction (70%), vision of a company (60%) and creativity of employees (60%). The Polish companies prefer following three main reasons - economic reasons (cost reduction (82%), market needs (60%) and consumer expectations (65%).

C2 Are indicators for the benefits of lean IT applied in your business?

Czech companies mostly have lean IT metrics (40%) but they are not used regularly. On the other hand Polish companies mostly have no lean IT metrics (50%).

C.3 What are the benefits of using Lean IT specifically in your business? The main benefits were following and were also very similar in both group:

Czech companies – reduction of energy consumption (50%) and general cost reduction (50%).

Polish companies - reduction of energy consumption (85%) and general cost reduction (60%).

C.4 Which factors have an impact on your business that do not apply the principles of Lean IT?

The low level of knowledge about lean IT (Czech – 40% and Polish – 92%) is the most significant factor for both groups of companies.

3. Conclusion

The topic of lean IT seems to be a topic with high potential especially in time when the pressure on cost reduction and environment protection are growing. The first reason is the result of globalization and economic crisis. The second one is the fact that it is one of the important goals of the European strategy till 2020. The survey results show many similar aspects of lean IT penetration in the Czech and Polish companies (economic reasons for lean IT for instance). There are also differences on the other hand (implementation level seems to be higher in the Czech firms). There significant a low level of understanding and even low knowledge of lean IT topic in both countries. Authors believe that this paper could help to improve this situation.

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INFLUENCE OF STANDARDS ISO 27000 FAMILY ON DIGITAL EVIDENCE ANALYSIS

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Abstract

The investigation of digital evidence is focused on the acquisition and analysis of evidence that exist in digital form such investigation may be conducted either for the needs of the organization, or for the court law enforcement. Although, the need for digital evidence forensic investigation dates several decades back so the field is partly developed, standardization process always requires time. That is why even nowadays are being developed new ISO standards that will standardize practices and procedures related to digital evidence investigation. This article will focus on ISO standards that might significantly affect digital evidence analysis, we will introduce emerging ISO standards (ISO/IEC 27000 family) and we will find out whether and how those standards affect current procedures of digital evidence analysis.

1. Introduction

Notice that more and more information is nowadays stored in digital form. People are used to work with information in digital form using various devices to store digital data and to work with digital data. So even though we live and work in real world we also live and work in cyberspace (mentioned by (Sigmund, 2013)) or we may call it digital (or virtual) world. Let us emphasize that the existence of the cyberspace is a matter of the last few decades.

Potential incidents (including crime) may happen also in cyberspace. Even though the methods for investigating suspicious activities (incidents) are well established in the real world; the cyberspace is not that old, and thus incident investigation methods for it are still in development.

Consider that cyberspace and real world are tightly connected and not only people but also the critical infrastructure is connected to cyberspace and the real world (Schoitsch, 2013). This means considerable risks that come with crimes (incidents) in cyberspace. In such case we'd definitely need as much digital evidence as possible as soon as possible.

This is not the only reason why there are still in development procedures to ensure the security inside cyberspace. The ISO/IEC 27000 family is introducing the best practice in the field of computer security. Documents in ISO/IEC 27000 family also include (or are going to include)

documents focused on digital evidence investigation (digital evidence forensics investigation) those may play a role in standardization of digital incident investigations.

In this article we want to introduce especially important content of documents focused on digital analysis process. Possible practical impact of those documents on the work of digital evidence analysts, digital incident investigators as well as computer security experts.

2. Documents of ISO 27000 Focusing on Digital Evidence Investigation

Direct impact on digital evidence investigation will have five ISO/IEC 27000 family documents – almost all in development – pictured in Figure .

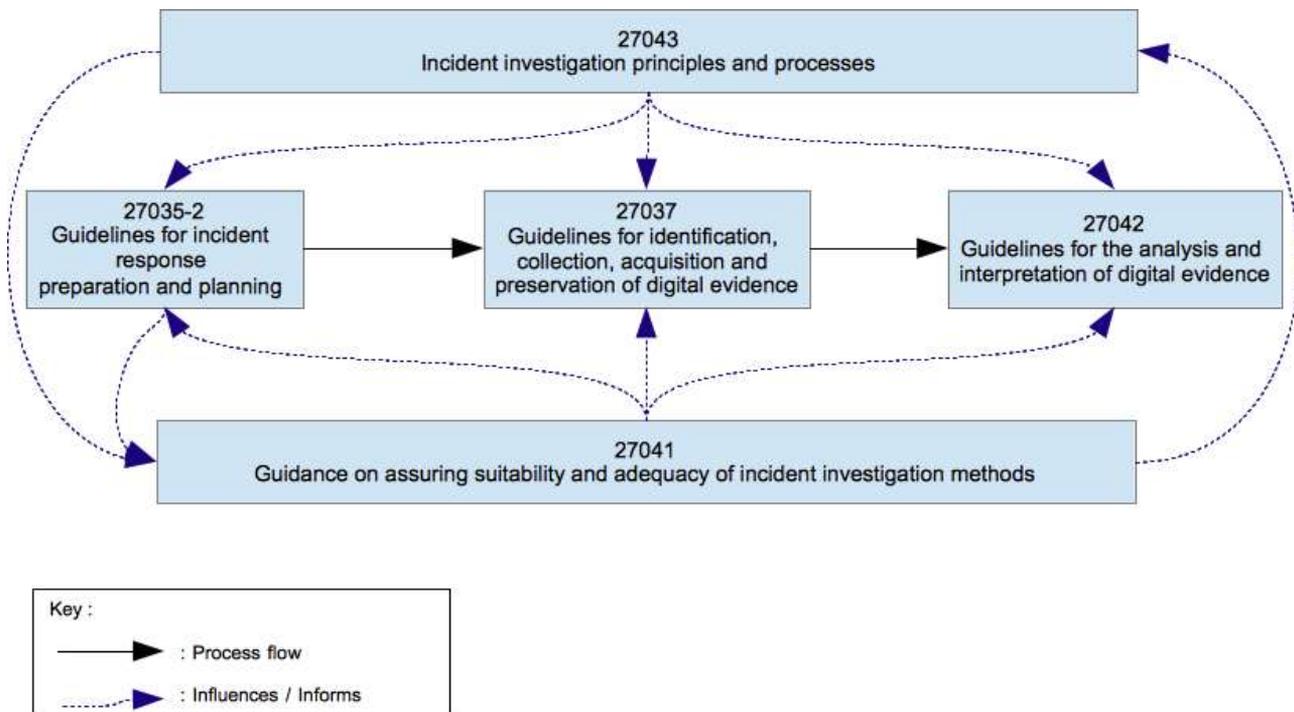


Figure 1 : ISO/IEC Documents for Digital Forensics Investigation – source (ISO, 2014c)

Document “ISO/IEC 27043 Incident investigation principles and processes” (ISO, 2014c) performs insight into the whole process of digital forensic investigation and also gives a general description of the whole process as the union of best practice in the field. Document was not yet officially released and is in FDIS (final draft International Standard) development phase. Document is planned to be published in 2014.

Document “ISO/IEC 27035-2 Guidelines for incident response preparation and planning” (ISO, 2013) focuses on the preparation for the detection of security incidents within the organization in order to detect incidents in time and collect all potential evidence about the incident. It is as a part of original ISO/IEC 27035:2011. Document is right now under development and is in WD (working draft) phase. Document is planned to be published in 2016.

Document “ISO/IEC 27037 Guidelines for identification, collection, acquisition and preservation of digital evidence” (ISO, 2012) is focused on the way the digital forensic evidence should be collected, how it should be transported and stored. Document has been published in 2012.

Document “ISO/IEC 27041 Guidance on assuring suitability and adequacy of incident investigation methods” (ISO, 2014a) is focused on digital forensics investigation methods – how to find adequate

method, how to ensure that method is reliable and how the chosen methods should be deployed in practice. Document is right now under development and is in DIS (draft International Standard) phase. Document is planned to be published in 2015.

Document “ISO/IEC 27042 Guidelines for the analysis and interpretation of digital evidence” (ISO, 2014b) is a kind of extension for ISO/IEC 17025:2005 and describes the specific needs that should be met for the digital evidence investigation. Document is right now under development and is in DIS phase. Document is planned to be published in 2015.

3. Impact of ISO 27000 Documents on Digital Evidence Analysis

ISO/IEC 27000 family understands digital evidence investigation as a set of processes. The action sequence (flow) of digital investigation as the ISO/IEC 27043 describe it is shown on **Chyba! Nenalezen zdroj odkazů.** The process consists of four parts:

- Readiness processes.
- Initialization processes.
- Acquisitive processes.
- Investigative processes.

Readiness processes are focused on pre-incident preparation. The importance of pre-incident preparation was well described on a specific example by (Sonntag, 2013). ISO/IEC 27000 family states that the collection of digital evidence is affected by system implementation (and setup); for example it is hard to collect any digital evidence if system is not logging events that happened inside system. This part of full digital investigation process will be addressed by ISO/IEC 27035-2 and will not be further described in this article because it is not directly affecting digital evidence analysis. The information system operator is responsible for realization of this part of digital investigation process.

Initialization processes are a set of activities connected to occurrence of an incident that might be investigated in future. It include detection of incident and first response to incident (for example disconnection of equipment from the data network). This part of full digital investigation process is addressed by ISO/IEC 27035-2 and ISO/IEC 27037 and will not be further described in this article because it is not directly affecting digital evidence analysis. The information system user and/or operator is usually responsible for realization of this part of digital investigation process.

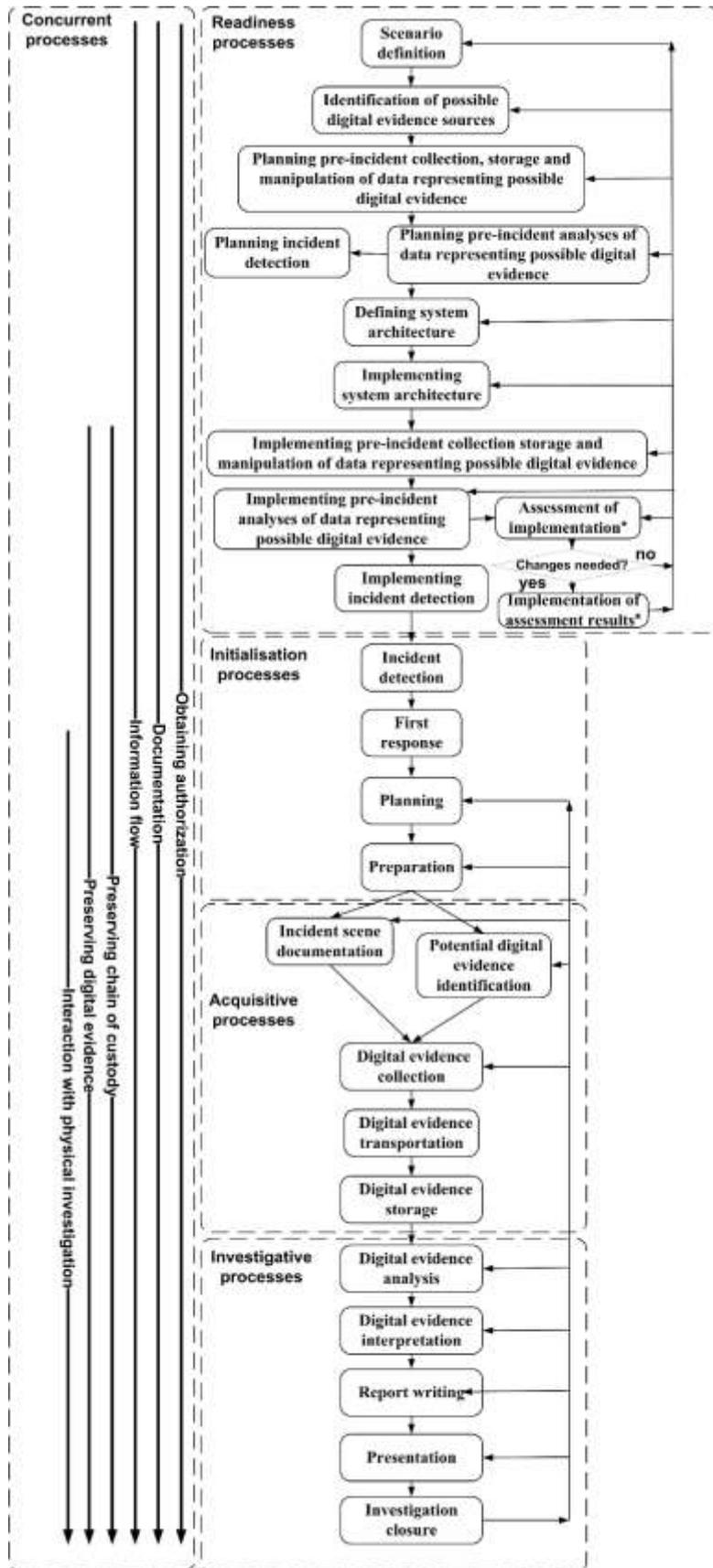


Figure 2: Digital Investigation Process Schema – source (ISO, 2014c)

Acquisitive processes are a set of activities that deal with acquisition of potential digital evidence. It consists of potential digital evidence identification, collection, transportation and storage. This part of full digital investigation process is addressed by ISO/IEC 27037 and will not be further described in this article because it is not directly affecting digital evidence analysis. However we are planning to introduce another article covering this issue. Digital evidence first responder (It may be either police investigator or employee involved in the investigation or third party investigator.) or digital evidence specialist (It may be either police investigation specialist or third party investigation specialist.) is supposed to realize this part of digital investigation process.

Investigative processes are a set of activities we want to further describe in this article. It is digital evidence analysis and follow-up activities such as interpretation of digital evidence, report writing and report presentation of the digital evidence investigation. This part of full digital investigation process is addressed by ISO/IEC 27042 and ISO/IEC 27041. Digital evidence analyst is responsible for realization of this part of digital investigation process.

ISO/IEC 27000 family also introduce concurrent processes (**Chyba! Nenalezen zdroj odkazů.**) that are supposed to ensure correct and incontrovertible digital investigation. Concurrent processes are covered in all the documents.

3.1. Digital Analysis Process

ISO/IEC 27042 may be considered an extension for ISO/IEC 17025:2005 (General requirements for the competence of testing and calibration laboratories). Even through ISO/IEC 17025 is not covering fully the needs of digital forensic laboratory (as described in (Hykš & Koliš, 2014)), ISO/IEC 27042 does not replace it; unfortunately it does not develop ISO/IEC 17025. ISO/IEC 27042 is describing only the *process* of digital evidence analysis and its needs (including best practice for process realization). So it may be used as a kind of supplement to ISO/IEC 17025 in laboratory.

ISO 27042 introduces two analytical models:

- static analysis and
- live analysis.

Static analysis should normally be carried out on a copy of the original potential digital evidence so analyst must make a copy (or get a copy) of digital evidence before he starts static analysis. Potential digital evidence will be inspected in raw form and interpreted through the use of appropriate processes (How to choose appropriate process is described in ISO/IEC 27041).

In certain cases it may be necessary or beneficial to examine a *live version* of the potential digital evidence in order to gain proper understanding (For example analysis of malicious software may require to run live version of software. Malware sometimes even refuses to activate itself (the core functions) when it detects that he has been migrated into virtual machine. Polymorphic or obfuscated software is often observed in live version inside virtual environment (sand box)). Still it is recommended to do *live analysis* on a copy of digital evidence; however when system can't be imaged or copied and it's still appropriate, or necessary, to examine that system investigator is supposed to do analysis on emulation of system or on real original hardware.

So even through ISO does recommend to use static analysis where possible it does not strictly requires to use only static analysis as some procedures described by (Bulbul, Yavuzcan, & Ozel, 2013; Huo & Guo, 2011) does not permit. In case the live analysis is employed there could be strong doubt about usability of this evidence for a court of law.

ISO/IEC 27042 and ISO/IEC 27043 also explains that analysis process contains not only analysis of evidence itself but also interpretation of analysis results, writing analysis report and the presentation of analysis results. Let's mention that there is not yet full harmonization between those two documents in this area yet (ISO/IEC 27042 does not mention existence and description of presentation process).

Interpretation involves fact finding, impact of analysis and validation of results. Also, there may be a need to prove accreditation fact regarding aspects of the investigation.

Reporting involves activities related to provision of written results of analysis. However, the report should meet certain requirements. The need for information (report should contain all information about investigation setup); need for clear understanding because wide audience (lawyers, judge...) should understand the results of the investigation.

The *presentation* of results is a process where the results of the investigation (and report) are presented to many kinds of stakeholders. The person conducting presentation should have insight to investigation (analysis) process in order to be able to answer specific questions.

Other parts of the ISO/IEC 27000 family now include a list of relatively well-known best practices in the field of digital evidence analysis, but it introduce a promising standard for the selection and development of digital investigation methods.

3.2. Selecting Methods for Digital Investigation

ISO/IEC 27041 introduce a standard for selection of suitable method for digital evidence analysis. Selecting the right method for digital evidence analysis may be complicated task for digital evidence analyst considering the fact that digital evidence analysis is often project like, the analysts should profit from having standardized approach to method selection.

The approach is based on PDCA model introduced in ISO 9001:2000 (it does not state newer ISO 9000:2008 version) and the method development/selection process flow is illustrated on Figure. ISO/IEC 27041 describes process not only for methods used during analysis but also other methods that might be used for investigation. New/selected method is described as a process because it may be continuously used for all similar activities once it is developed using standardized approach.

The process starts with *Requirements Capture and Analysis* part. In this process stage are method developers supposed to specify method needs and conditions (For example to get proper media image it is necessary to have media we want to make an image from and we also need permission to copy data from media.) to be able to ensure proper analysis. Stated requirements should be necessary, implementation-free, unambiguous, complete, singular and consistent with the remainder of the requirements in the set.

Process Design should take into account all method requirements (stated in previous step) and state what to do and how to do it while meeting all the requirements. Project/method designers should also consider possible risks arising from: tool (hardware; software) selection, investigator proficiency and experience, impact of process sequence on investigation.

Process Implementation leads to a clear step-by-step process documentation and specific tool selection. There may be more possible tools specified and in that case there should be guidance for an investigator how to select proper tool for his current task.

Process Verification (optional) provides an assurance, that a process or tool conforms a specification. Verification should check if the implementation of process meets the process design

and also whether the selected tools meet their specifications. Verification of tools may be performed by user, tool producer or third party.

Process Validation provides evidence, that the process produces correct outputs for the defined set of inputs. The validation process should also determine boundary conditions and error rates. Process/method validation may be realized as comprehensive validation (the check is done on all possible inputs), or as sufficient validation (the check is done against agreed requirements and conditions pertaining at the time of the investigation).

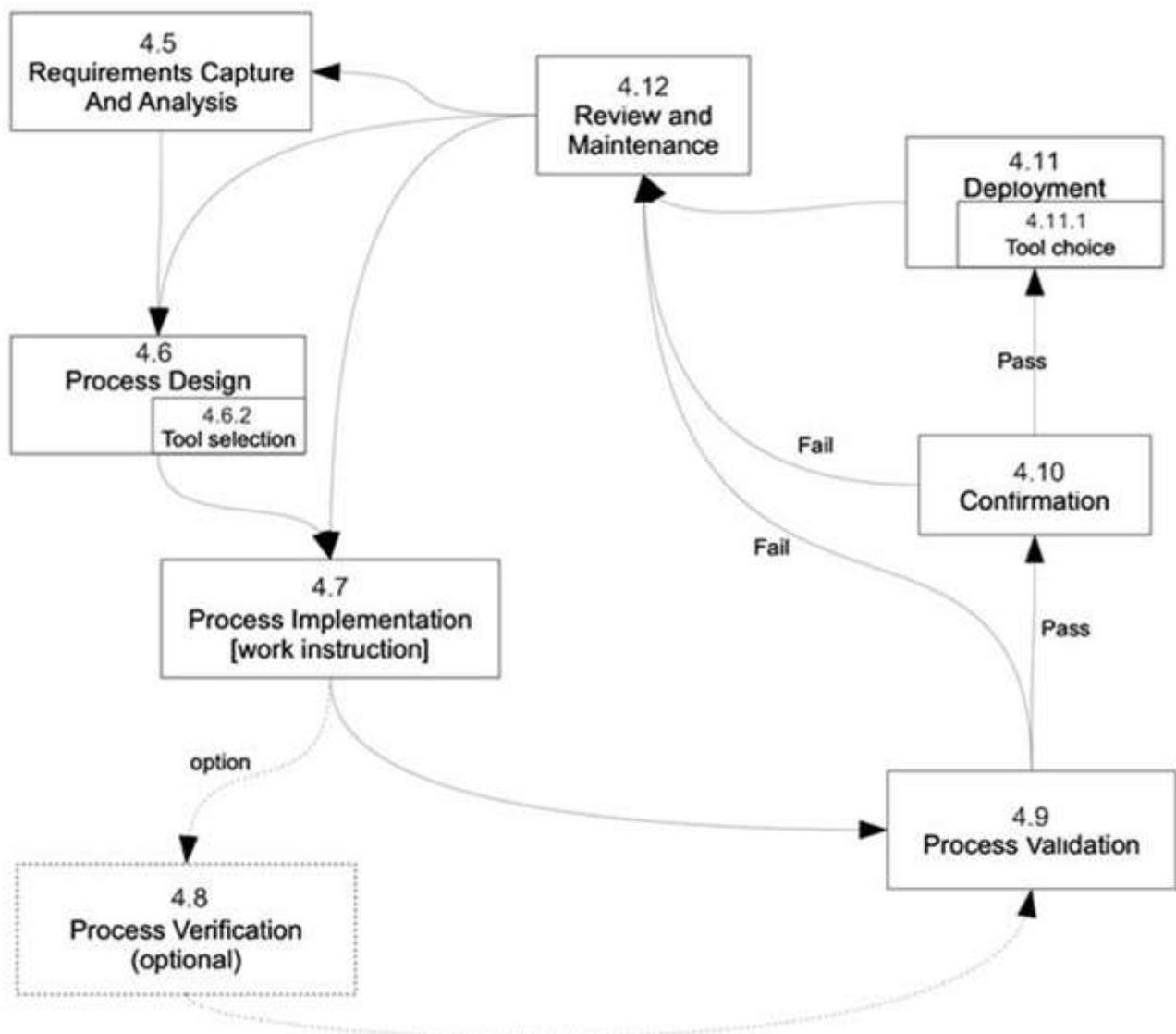


Figure 3: Digital Evidence Analysis Method Selection Schema – source (ISO, 2014a)

Confirmation is the final step before method deployment. Only validated processes are supposed to be confirmed and also the re-validation may be required once the process conditions have changed since last validation.

Deployment refers to use of new confirmed process during analysis. Investigator should record his tool choices (as those may differ from recommended tools in implementation step). Any problems arising in process deployment should be noted and notes provided as an input for process maintenance and review.

Maintenance and Review refers to reviewing the performance of process to identify any additional needs or possible problems (change of tools etc.). It may be even necessary to change requirements and conditions, process design and/or implementation. The revised process than must be validated and confirmed.

ISO/IEC 27041 also provides guidance to assurance during analysis process. The organization should validate preformed methods (processes used for examination must be validated) and people (investigators are competent, prepared for examinations, also tested that they are fit for purpose). Assurance may be done by organization itself or with help of third party.

4. Discussion

We have introduced all ISO/IEC 27000 family documents that might and probably will affect the future of digital evidence analysis. Not all documents that directly affect digital evidence analysis have been released as ISO standard; however even right now we may find out what impact it might have once they will be released.

We are expecting that document with *highest* impact will be ISO/IEC 27041 as it introduces standardization for method selection/development for digital evidence investigation thus provides a way to ensure more conclusive results of the investigation. Digital evidence investigation related to computer science that is rapidly evolving, thus the digital analysis is often rather a project than process. Analysts have to adapt existing procedures to new data media, new methods of data storage and also to growing storage capacity. Using the proposed procedures and recommendations should ensure proper development of reliable analysis methods.

Document ISO/IEC 27043 summarizes the whole process of digital investigations. Document maps the process as ISO standards describe it, and it also provides everyone a clear insight into issue of digital investigation. We expect that this document will not really affect current state of investigative/analysis methods (investigative process was already described this way before and is well known among in-field specialists) as it does not introduce any specific procedures or conditions. So the significance of this document is just for standard itself to make all parts of digital investigation framework well defined.

Although the ISO/IEC 27042 does introduce a set of best practices connected to digital evidence analysis, it is not yet unified methodology/procedures that would cover the whole process and/or introduce something valuable for digital evidence analysts (a large part of practices introduced in document is well known and also employed in common analyst practice). Unfortunately it does not (yet) interact with other existing standards that affects digital analysis like ISO/IEC 17025 or generally ISO 9000. So we expect that impact of document on digital evidence analysis practice at current state would be pretty low.

5. Conclusion

The article introduced current ISO/IEC 27000 family standardization efforts in the field of digital evidence investigation. In this article we focused mainly on digital evidence analysis that is covered by documents under development that are expected to be published in this or next year. We have found all the benefits of those newly formed standard and we also tried to analyze what impact they might have on the analysis of digital evidence in practice.

Even through the documents might still change we find it necessary to evaluate their potential for future of digital evidence analysis, as the number of digital incidents is still increasing while more and more people are working and entertaining themselves in our global and still growing cyberspace.

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CASHLESS SOCIETY

MOBILE WALLETS' STRATEGIES TOWARDS BUSINESS PARTNERS

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Abstract

Mobile Wallets innovate by allowing the convergence of services such as payment and loyalty schemes. However they have not been largely adopted so far, neither by the users nor by business partners. The paper focuses on the latter, i.e. it analyses how business partners are integrated in four Mobile Wallet Applications' (MWA) strategies: Key Ring, FidMe, Apple Passbook and Qustomer. It shows that MWAs act as platforms mediating between users and these business partners (here called third parties). MWA providers can reach at integrating in their network as many partners as possible (quantity of partners) and/or partners with a high brand value (quality of partners). Another important aspect of their strategy studied here are financial aspects. The paper shows that the studied MWA do not leverage loyalty points from partners, and discusses the consequences thereof.

1. Introduction

Mobile Payments and Wallets are nothing new. In 1997 a mobile phone was used for the first time to make a purchase: a soda from a vending machine (Ross, 2012). In spite of the promises, Mobile Wallets (MW) have not been able to revolutionise the payment market. The paper analyses one of the reasons and points out potential overcoming by considering MW as a platform that should leverage more on the two-sided markets where they are active.

A unique definition of what a Mobile Wallet is and what it (has to) contain, does not exist. It is rather an industry-driven movement towards multiple new services that a mobile device has to fulfil. These embrace, amongst others, payment facilitation such as NFC or other forms of financial transaction processing, storage of conventional money, loyalty cards and loyalty points, coupons or even medical records (Mallon, 2013). In 2013, comScore released the 'Digital Wallet Road Map 2013' that highlights the potentials and current adoption barriers of Digital Wallets. In their definition, a digital wallet stores "a virtual copy of the contents of a consumer's physical wallet to facilitate online or offline retail transactions" (comScore., 2013).

The comScore report acknowledges the low adoption of these concepts and makes several assumptions regarding the reasons, mainly focused on the user perspective. This can be the cluttered understanding of benefits of MW or the low awareness amongst users. Their suggestions to overcome these barriers anchor in awareness raising, communication of the benefits, foster availability and ease security concerns (ibid., 2013). On the other side, the 2013 Payment

Innovation Jury Report insists on the importance of payment innovation (Chaplin, 2013). The report, comparing payment solutions globally, reveals that payment innovation is of interest for many reasons and companies (Chaplin, 2013). In sum, traditional payment providers start competing with new industries and market entrants that provide novel solutions.

Many of these solutions however do not try to deploy the full potential of a probable MW. Instead, more narrow approaches are present on the market often in form of apps specialized on a few MW features. The results are Mobile Wallet Applications (MWA), e.g. PayPal's mobile payment app is based on the incorporation of credit or debit cards; FidMe allows to collect and use loyalty cards; CamCard processes business cards by linking the demographics of the cardholder to an imprint of the business card in the telephone book.

One motivation for such limited features might root in business model design choices. It allows the app provider to insert its app in a complex ecosystem tailored to particular customer segments, retailers of goods and services, and payment service providers. The app can then be positioned as the intermediate of two-sides markets (Hagiu, 2014) – and not as substituting to one actor of the ecosystem. In this position, an app actually represents a platform that intermediates a two-sided market often to generate revenue from one side. This is a crucial consideration, especially for a sector that mainly provides free services to users – like most mobile apps do (Gordon, 2013). In the work at hand, MWAs are studied that focus on the digitisation and management of loyalty programs. Actually Buchinger et al. (2013) show the purpose of traditional loyalty programs while their digitalization now allow (i) users to collect at one third party and to spend at another or at the platform; (ii) third parties to have some flexibility in terms of rewarding and redeeming loyalty points. The authors moreover show that such leverage may provide an additional revenue source (e.g. by charging third parties when they are rewarding loyalty points) and, more importantly, increases the lock-in of both sides of the market to the loyalty scheme.

In the remainder of the paper, Section 2 describes the methodology and conceptual framework, focusing on the concept of platform and how it applies to MWA. Section 3 describes and compares Value network and financial design choices for four cases of MW. Section 4 concludes and suggests ways for further research.

2. Business Modelling analysis of competing platforms

2.1. Case Studies

The section provides a detailed study of four cases of MWAs with platform characteristics, i.e. Key Ring, FidMe, Apple Passbook and Qustomer. They were selected based on their different strategies of how they realise the integration of MW functionalities, while they all allow to manage loyalty cards or points. The case study approach was chosen for its ability to describe “a contemporary phenomenon in its real-life context” (Yin, 1981 p.59) eligible for the economic analysis of MWAs. While different data collection methods can provide evidence; this paper combines findings mainly from observations and interviews. It thus addresses the objective to describe current procedures in the industrial field. Set-up as a cross-case analysis, examples can then be compared upon several factors. The authors follow the process of i) collecting data, ii) analyse cases separately, iii) make a cross-case analysis with deriving overall findings, iv) drawing conclusions (Eisenhardt, 1989).

2.2. The Business Model Design Matrix

This paper relies on the Business Model Design Matrix developed by Ballon (2007). Several business modelling methodologies have been developed in the last decade. (for a systematic analysis of business modelling methodologies, see Casier K. et al., 2014). The matrix described is used since it considers not only how value is generated (the *value proposition* towards the stakeholders; and *revenue generation*) but also how control is exercised (by the configuration of the *Value network* and through the *technological design*). Not all elements of the matrix are of equal relevance for the work at hand. The paper focuses on Value network and Financial model.

Beyond these design choices, for the work at hand, particularities of platforms need to be taken into consideration. Hagi (2014) addressed four strategic decisions that Multisided Platforms need to consider: i) the number of sides to bring on board; ii) design; iii) pricing structures; and iv) governance rules. The paper covers (i) and (iii). Regarding the first point, the authors suggest assessing not only the quantity but also the quality of incorporated partners (see Section 2.4). Thus a classification of third parties upon qualitative parameters can be derived that influences the strategic decisions of platforms. The pricing structure indicates how MWAs can be economically sustainable particularly if - and when - leveraging value of loyalty points circulating in the network.

2.3. Mobile Wallet Applications as Competing Platforms

MWAs are considered in this paper as multisided platforms, i.e. “technologies, products or services that create value primarily by enabling direct interactions between two or more customers or participant groups” (Hagi, 2014, p. 71). These groups are on one side customers and on the other side third parties. MWA compete to be adopted by both user groups. Such competition takes place in a context where there are positive network effects.

Operating on two-sided markets, platforms need to take into account the rate of adoption (i.e. “the relative speed with which an innovation is adopted by members of a social system”, Rogers, 1995, p. 23) for one side of the market to adopt an innovation and thus time for the side to grow to an attractive number. There may be “same-side” network effects, i.e. each new participant on one side of the market increases the value to join for other users of the same side. Such effects can be enforced by the platform e.g. by enabling interchange and networking between users. In addition, the weight of one side of the market can also define the attractiveness for the other side of the market (cross-side network effects) (Eisenmann et al., 2006). An innovation that is well adopted and has gained numerous adherents represents an asset for the platform with a certain control over this market side. Generally, on two-sided markets, a critical mass of users on one side provides a strong appeal for the other side to join (Rochet & Tirole, 2002) – even under paying conditions.

2.4. Influence Factors to Platforms’ Adoption

Each stakeholder group needs to be treated differently. The MWA operates as a platform on two-sided market where trade-offs between charging and subsidizing are crucial. In many cases one side of the market is subsidized while the other side is charged. The platform decides *how* to attract and subsidize one side and *which amount* to charge the other side for the privilege of granting access.

This trade-off can be broken down in two main objectives of the intermediating MWA, which can be directly linked to the platform’s Value network and Financial model: (i) attracting and incorporating both sides of the market, i.e. customers and third parties (Value network); (ii) generating revenues from one side of the market (here: third parties) by selling MWA services or –

studying mobile wallets who focus on the integration of loyalty programs – leveraging the value of loyalty points that circulate in the network (Financial model).

An important concept is *Referral Power*, i.e. the power that a strong customer basis gives a platform as an argument for addressing the other market side (here: incorporating third parties). This term will be used to express the power of the MWA, gained from possessing an adequate *quantity* of adopters of one side in order to attract the other side, i.e. cross-side network effects.

The other important concept is the one of *Brand Value*. Some stakeholders can be declared “marquee users” (Eisenmann et al., 2006; Parker & Van Alstyne, 2014), i.e. partners with an attractive profile and high *quality* for the other side of the market. These are companies with high brand equity. In this paper, we follow the definition of Keller, (1993), stating: “A brand is said to have positive (negative) customer-based brand equity when consumers react more (less) favorably to an element of the marketing mix for the brand than they do to the same marketing mix element when it is attributed to a fictitiously named or unnamed version of the product or service” (Keller, 1993, p. 1). Harnessing the brand equity of a well-perceived supplier and increasing the value for the other side of the market (here: customers) equally raise the value of the platform. Cooperation between platforms and marquee users can be established by exclusive agreements.

3. Implementation – Case Studies

The following chapter provides an analysis of four MWAs. They all position themselves in the middle of the loyalty points exchange stream between purveyors (i.e. third parties such as retailers and groceries) and their customers. Figure 1 illustrates the transformation from the traditional loyalty program to the intermediation of a MWA and thus creating a two-sided market.

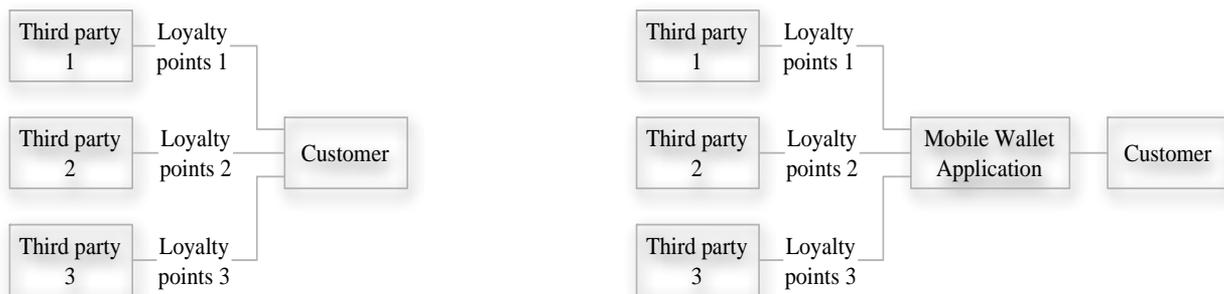


Figure 1: Traditional Loyalty Scheme (left) versus Loyalty schemes intermediated by MWAs (right)

While MWA generally provide their service for free to their users, they eventually follow (or prepare to follow) different strategies in leveraging third parties as a source of revenue. One possibility is to use the circulating loyalty points as a valuable asset.

3.1. Key Ring

Key Ring (www.keyringapp.com) is an iOS and Android app that enables its users to store and manage their loyalty cards, gain loyalty points, join new loyalty programs and receive mobile coupons. The main functionality is the scanning of barcodes of existing loyalty cards issued by third parties. The Key Ring app stores the digital imprint in the wallet. Discounts are automatically deducted when scanning the in-app-portrayed barcode at the checkout.

Three types of coupons are supported by Key Ring: (i) *exclusive coupons* when customers join a new loyalty program via Key Ring; (ii) *printable coupons* are a selection of offers that are not

exclusive to subscribers of a loyalty program but can only be accessed via the Key Ring app; (iii) *grocery coupons* are available for over 30 chains. Users actively select them and “clip” them to the respective digital card. The amount is deducted at the checkout. It can be assumed that cooperation is agreed between the retailers and Key Ring to set up exclusive coupons or grocery coupons. These might be agreed bilaterally on the basis of the assessment of added value for the retailer (additional sales channel to the customer base) and for the app (broader offer for their users). It applies however only to partnering third parties. In theory any card with a barcode can be stored/used. In March 2014, the application website claimed to support 13,000 brands and retailers, which leads us assuming some form of preceding verification of third parties’ loyalty cards. In this case customers need to register in advance for the retailers’ loyalty program and request a physical card.

In terms of *qualitative* cooperation, the agreements upon exclusive coupons and grocery coupons are relevant. In March 2014, the company stated that over 30 retailers were supported for grocery coupon, which feature the 5th (The Kroger Company) and 20th (Lowe’s) retailers of the 2012 *Global Powers of Retailing* report. This ranking is based on revenue figures, compared to other retail chains and companies worldwide (Farfan, 2012). The application does not support the circulation of loyalty points, nor does it provide its own loyalty points (to exchange) to the users.

3.2. FidMe

FidMe claims to be the mobile loyalty wallet leader in Europe (www.fidme.com) with 2.6 million users. The application is available on the Apple App Store, Google Play, Samsung Apps, Nokia Store, BlackBerry World and Windows Store as well as for Amazon Kindle and Windows 8. With FidMe, scanned loyalty cards are automatically stored in the MW. FidMe validates third parties’ loyalty cards, thus not every card can be scanned and added automatically by the user. The website of the company claims to support 4,200 retailers and over 10,500 local shops. If a user scans the card of a non-affiliated retailer, FidMe asks the user to report so that FidMe can validate the card.

These retailers eventually can sign up and create a retailer account, either a free – or a paid premium account. Via the dashboard, the retailer can create stamp cards (e.g., 5 stamps = 5 € off). In a next step, the app provides a printable QR code to the retailer for in-store placement. In operation, the receipt of a stamp on the card requires that the customer launch the FidMe application after paying and scan the aforementioned QR code. A stamp is added. FidMe mentions e.g. McDonalds, Quick, Subway, Pizza Hut or Marionnaud as partners (Bourgitteau-Guiard, 2013).

Apart from retailers’ loyalty points that can be earned through shopping, the app runs an own points program: pts FidMe. Points can be earned for adding cards, sponsorship, checks. FidMe foresees to exchange these points for rewards. At the time of research, it has not been concretized of how this is going to be configured in daily operation.

3.3. Apple Passbook

Besides the regular cards and coupons, Apple Passbook aims at housing e.g. movie tickets, gift cards or boarding passes. Different from an application, the ‘Passbook’ comes pre-installed on iPhone and iPod touch devices as part of the operating systems iOS 6 and 7. It then relies on incorporated third party, Passbook-enabled apps. Companies get support for the development of compatible apps. Users will typically need to have an account for the third party app the way they become a subscriber of a loyalty program at a grocery or retailer (Widder, 2013).

In February 2014, there were 38 apps optimized for Passbook in the US app store (26 in Belgium whereof 13 are applications from airlines). The latter is of particular interest for quality analysis: 7

of the airlines brands in the Passbook are in the list of the most valuable airline brands of 2013 (e.g. Lufthansa) released by skift.com, a portal specialized on travel news and information.

The relationship between Passbook and third parties is not clear. It can be assumed that at the moment the cooperation does not generate a revenue stream. The companies work together to improve the tool quality and functionality. Apple profits from respected companies that makes the Passbook more attractive (brand value). In return, companies profit from the link to the broad customer base of Apple and a positive reputation spill-over to this brand.

3.4. Qustomer

Qustomer (www.qustomer.be) is a Belgian company that aims to help merchants and retailers developing loyalty programs. Though a mobile application is available (iOS and Android), Qustomer has chosen to initially promote the physical card; probably because it is closer to the familiar way of collecting points and rewards.

Customers create a Qustomer profile online and opt for the virtual (mobile app) or physical (card) solution to collect points and rewards in-store from third parties. Participating retailers get equipped with a tablet and the software where they can create their loyalty concepts and define their own rewarding mechanism such as points, discounts or original rewards. Merchants decide which rewards they give for which amount of points. Both app and customer card have a unique QR code per customer that is scanned on a merchant's tablet. Following this, points are rewarded.

The concept has attracted approximately 240.000 users in 14 cities in Belgium since September 2012; and 370 third parties are revealed on the website in April 2014: restaurants, shops, boutiques, snack bars, etc. but no chains or multiple-outlet stores. Thus, not one particular partner can be singled out as the "top seller".

3.5. Comparison of Cases

The comparison of the case studies follows the classification into (i) Value network and (ii) Financial model. These parameters define crucial cornerstones of the applications' business models. A detailed itemization is shown in Table 1. Key Ring and Apple Passbook are both operating internationally, but, based on its partnership with third parties, Key Ring focuses strongly on the U.S. Apple on the contrary can leverage its global position to incorporate partners internationally. All are mobile apps, although the Passbook is a pre-installed application for iOS. Qustomer chose a parallel strategy by adding a physical card given the slow adoption of MWAs. By establishing this parallel strategy, they draw on long-known, established patterns from the users.

Regarding the *quantity* of the partners, Key Ring and FidMe are clearly ahead the others by incorporating more than 13.000 third parties using their potential to harness referral power. Different to Qustomer, the platform can include them (via the barcode) without their explicit consent and is thus suitable to expand their third party base more easily. Qustomer enters into bilateral agreements with all partners, requiring time and effort in developing this trusted relations. It only incorporates around 370 merchants but operates only in Belgium, which renders direct comparison difficult. On the other hand, Apple Passbook clearly does not aim at quantity of partners as an essential aim since it includes only 38 third party apps, even less in particular countries only.

In terms of *quality* of the partners, again FidMe seems to do better since it includes international brands as well as local merchants. Amongst them are internationally operating chains with high brand equity, prominent in - but not limited to - restaurants or beauty stores. Apple Passbook has in

particular incorporations with airlines, and thereunder internationally recognized brands. This is presumably attractive for frequent fliers taking mostly the same airline (alliance). Key Ring’s partnership strategy is remarkable for its focus on retail chains, mainly U.S. brands.

		Key Ring	FidMe	Apple Passbook	Qustomer
Characteristics & Execution	Mobile Wallet Focus	Loyalty Cards	Loyalty Cards, FidMe Points	Tickets, Boarding Passes, Loyalty Cards	Loyalty Cards, Loyalty Programs
	Business Operations	International; U.S.	Europe	International	Belgium
	Usage technique	Mobile App	Mobile App	iOS6 Mobile App	Card and Mobile App
	New technology to be implemented by third parties	Optional	Optional	Yes	Yes
Value network	Quantity of Partners	++ 13.000 retailers	++ 4.200 retailers, bar-code scan for 10.500; stamp cards not indicated	- 38 Third party apps in the U.S.; 26 in Belgium	+ 370 merchants in 14 Belgian cities
	Quality of Partners (leveraging high brand equity from partners)	+ Big U.S. retail chains Exclusive agreements with > 30 partners	++ Big intl. brands and local merchants	+ International airlines	- Local merchants
Financial Model	Income source	Third parties	Third parties	Software component	Third parties
	Leverage Partners’ Loyalty Points	No	No	No	No
	Own Loyalty Points	No	Yes	No	No

Table 1: Comparison of Case Studies

There is less diversity among the studied MWAs in terms of their Financial model. All provide their service for free to end-users. Third parties are then used as income source, e.g. FidMe provides a possibility to pay for a premium account with more functionalities. Passbook may stand as an exception here, being part of the pre-installed set of apps with iOS. Only FidMe provides their own loyalty points. However in FidMe’s case, these points have no use yet since they cannot be exchanged or spent. Finally, none of the studied MWAs leverage loyalty points from partners. By leveraging loyalty points that circulate in the network, platforms could potentially find a new income stream or increase value for themselves and other stakeholders (Buchinger et al., 2013).

4. Conclusion

The aim of the paper has been to analyse the business features of Mobile Wallet Applications (MWA). While the general question concerns the reasons for the - so far - limited adoption of MWs, the paper has analysed the strategies adopted by MWA providers towards third parties. To do so, it has focused on four cases: Key Ring, FidMe, Apple Passbook and Qustomer. These rely on the same concept since they allow customers to collect points for different brands and retailers but they differ in terms of positioning and partnerships.

An important finding is that these MWA do not leverage full potential of loyalty points. This has strategic implications in terms of their capacity to attract and lock-in third parties. On the customer side, MWAs allow to gather information about themselves as their retailer-preferences. MWAs have an interest in reinforcing their position as platforms mediating between customers and third parties, appearing as unavoidable bottlenecks, i.e. actors that give access to the most and the 'best' third parties; and that have an important number of users.

While the authors believe that MWA providers' strategies are one important aspect to overcome the limited adoption of MWs; the authors acknowledge that other barriers relate to the users' willingness to adopt such innovation, like legal constraints or limited functionalities. Further research is thus required to understand Mobile Wallets and their current limitations.

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CASH HOLDINGS PROFITABILITY THRESHOLD MODEL

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Cash, Cashless, Consumer, Fee, Merchant, Payment, Society

Abstract

The main question for merchants from the very beginning of cashless payments is if it is worth it to have the terminal to accept credit or debit cards. What is the amount of cash flow, which delimits the cash holdings to still be profitable? This paper tries to give answers to such questions by presenting a general profitability model, which will address defining the cash threshold amount.

1. Introduction

Over the course of history, there have been many different forms of payment systems, including barter, gold, and paper currency. After some time when trade became wider there was need for a trade mediator, which with all the goods could be evaluated. Money has been developed to uphold this and cash was it's essential form. In the mid-twentieth century, charge cards debuted and it was also the debut of a cashless way of payment. Today, we still pay with cash and checks, but certain payment cards are growing at a much faster rate than paper instruments. As new payment systems have been introduced, researchers have critically examined their costs from both a private and social perspective.

This paper wants to show that the inevitable shift toward a cashless society is beneficial, providing certain groups with clear benefits while not costing more to process in aggregate than traditional paper transactions. In brief the main objective is to prepare all the necessary steps for empirical examination of the move toward a cashless society including the benefits as well as the costs. The outcomes from this paper could be beneficial for people who are already part of a cashless society but primarily for those who are still afraid of electronic transactions and prefer cash-related payments.

There are plenty of economic literature titles concerning electronic payments, however not so many which focus on a consumer/retailer benefit analysis. One of the most essential works so far is the Garcia-Swartz (2006) paper. It mentions important aspects like costs related to each transaction type, which are analyzed in detail. The Andrew Ching, Fumiko Hayashi (2006) paper proves that people's decision about usage of a credit (debit) card is highly influenced by card issuers' reward programs. Finally this work shows that reward card transactions replace not only paper-based transactions but also non-reward card transactions. Most studies in the literature (Rochet and Tirole

2002, Hayashi 2006) rely on restrictive assumptions: consumers have a fixed demand for goods (irrelevant to their payment choices); merchants engage in a special form of imperfect competition (e.g., Hotelling); and there is no entry/exit of card issuers. Although that framework is handy to consider merchants' business stealing motive for accepting cards, it has ignored critical issues beyond those assumptions. Particularly, the pricing of payment does affect consumers' demand for goods; the entry and exit of card issuers are endogenous; and most important, interchange fees play a key role in network competition for attracting issuers.

It stands in contrast to much of the literature regarding payment devices, with the notable exceptions of Farrell (2006) and Rochet and Tirole (2006). In the more standard approach to modelling payment device markets in the two-sided market literature, as in Rochet and Tirole (2003), consumers and merchants derive benefits from their use of a particular payment device.

2. Definitions and Conceptual framework

A Cashless society: society that does not use cash. A theoretical society in which consumers purchase all goods and services by credit card or electronic funds transfer, without the use of cash. (*Cashless society*, 2014)

Merchant acquirer: An organization licensed as a member of Visa / MasterCard as an affiliated bank or bank/processor alliance that is in the business of processing credit card transactions for businesses (acceptors) and is always acquiring new merchants. (*Info Merchant*, 2012)

Interchange fees: fees paid by merchant-acquiring banks to cardholder-issuing banks are in place to cover the cost of converting a charge on a cardholder's card to a cash deposit to the merchant business checking account, including cost factors like billing services, ATM (cash machine) transaction etc. An interchange rate payable when the card is used that is high enough for the card issuing bank to make a profit provides financial incentives for banks to market, issue, and accept the credit risks of cardholders.

We can conclude research objectives: (a) to minimize the usage of the cash within the society (b) to point out how deeply reward card transactions can replace other payment methods and (c) to find out to what degree it is beneficial for merchants to accept card payments.

The conceptual framework for the propositional statements for this particular research problem will be presented. The decision making process of merchants and consumers to accept card payments is influenced by costs and benefits. The concepts comprehend items which compose costs and benefits and they are later variable and measurable. The concepts are: (a) card transactions rewards, (b) cash payment and handling costs, (c) card transaction proportional fee, (d) adaptive costs and (e) Providing the card service costs.

The approach requires examining the incremental transaction and posing the questions as: What are the costs and benefits of card transactions for each one of the parties involved? In order to properly address this question, we need to consider three issues. First, we need to take both parties into account (merchants and consumers). Payment instruments that are beneficial, for one of the actors may not be for society as a whole. Second, we need to carefully distinguish true resource costs from transfer payments. Third, we need to count both cost and benefits for all participants.

The approach will be strictly monetary-related orientation only, because it will not lead to misunderstanding the basic asymmetry between the economic roles of the consumer and the merchant.

3. Research model

From the theoretical basics of cashless payments we are able to prepare a research model, which can be understood in two perspectives - the customer's and the merchant's point of view. The following model doesn't only represent their mutual interactions, but moreover factors which influence their decision in the payment process. We need to setup initial environment characteristics: To simplify the model below we expect that identical merchants sell homogenous goods on the market. Also all consumers have access to cash and most of them also own credit cards.

- Card transactions rewards (related to Consumers only): Customers receive rewards for card transactions such as frequent flyer points, gift certificates, or cash back as an incentive to use the card. As a measurement variable we will use *Card transactions rewards - height*.
- Cash payment and handling costs (related to Consumer and Merchant): Cash payments and usage incur costs such as storage and safekeeping. Due to no-surcharge rules imposed by card networks.(such as theft); those for merchants include handling cash transactions (such as costs of labour, armored car, and bank fees, evokes costs for safe depository, misuse of the card is much lower than cash etc.). Another significant aspect is human factor elimination (e.g. costs for bad counting, earnings errors etc.). Generally, transactional costs with cash for consumers include costs of obtaining cash (such as ATM fees and time to go to the bank) and risks associated with cash. As a variable we will use *Cash payment and handling costs- amount*.
- Card transaction proportional fee (related to Consumer and Merchant): This is a fee which is charged for every card payment. Proportional means its true amount based on the payment amount. On the consumer side this could be zero. These costs are better known as interchange fees¹. A provider of the card charges the bank (and this bank charges the end-users of the transaction (Consumer & Merchant)). As a measurement variable we will use the *Card transaction proportional fee amount*.
- Adaptive costs (related to Consumer and Merchant): These costs include acquisition of fixed costs of renting card-processing equipment (e.g. payment terminal), credit (debit) card, fixed cost of maintaining a bank account balance or credit score etc. They are adaptive because they are related to adapting to the new technology (system). As a measurement variable we will use *adaptive costs - amount*.
- Provision of the card service costs (related to Consumer and Merchant): These costs are related to the card service on both sides of the contract. These are costs which end-users (Consumer & Merchant) have to pay to the bank which issued the card. On the consumer's side they could be zero. As a measurement variable we will use *Provision of the card service costs- amount*.

¹ The interchange fees in the US are among the highest in the world. In the UK, the Office of Fair Trading announced in 2005 its intention to regulate down MasterCard's credit card interchange fees as well as investigate Visa's. In the European Union, the European Commission pushed Visa International to agree to reduce its cross-border interchange fees on credit and debit transactions in 2002. In Australia, the Reserve Bank of Australia mandated a sizeable reduction of credit-card interchange fees in 2003 and is considering doing the same for debit transactions.

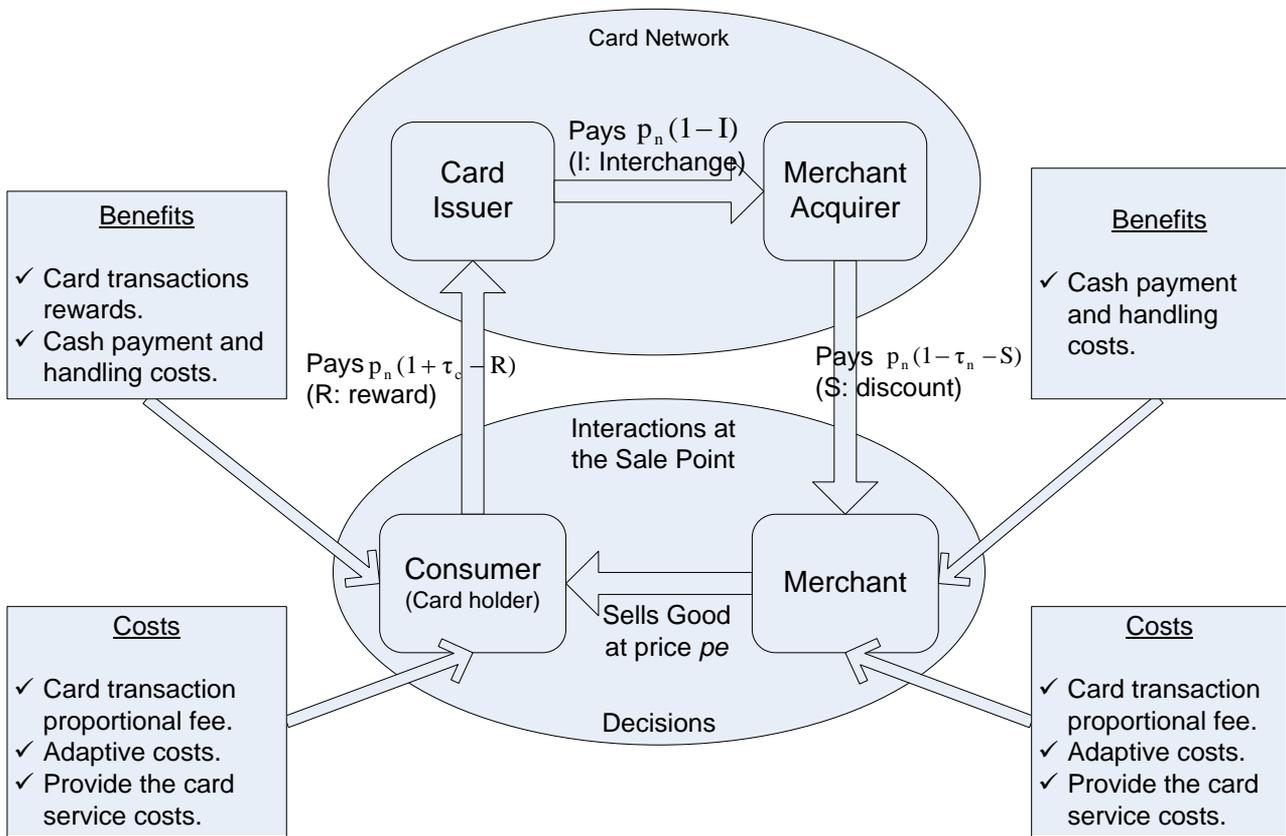


Figure 1: Research problem graphical model Source: [authors]

3.1. A Closer look

For basic understanding of the model we have to determinate benefits and costs related to the concerned parties. Let's say that C represents individual costs and B represents individual benefits. Then it has to hold true that:

$$\sum_n C < \sum_m B \quad (5-1)$$

In other words, overall benefits must be higher than overall costs. This holds true for both participating sides. A card transaction brings transactional benefits to both the card users and the merchants who accept those cards. One of the transactional benefits of cards is reducing transactional costs associated with cash transactions for both consumers and merchants.

To simplify the model we used cash-related costs as benefits of card-related payments. As I mention and explained in the previous chapter, we will consider only monetary-related aspects. When we use the appropriate variable(s) in the measurement section we should get a very good scope and understanding of the whole model. Non-monetary cash-related benefits and costs like anonymity, human factor elimination, risks etc. are highly related to monetary aspects and furthermore they are hardly measurable in practice.

The model assumes that there exists only one card network, which sets both merchant fees and the cardholder fee. The network sets a unique merchant fee in a given industry and a universal cardholder fee. Merchants are assumed to set the same price for cash users and card users. The network imposes the no-surcharge rule, which prohibits merchants from charging a higher price to

card users. Consumers are either cardholders or non-cardholders. Non-cardholders need to pay with cash all the time. On the other hand, cardholders can choose their payment method – either cash or a card. Consumers observe all the decisions the merchants made (card acceptance and new price) before they determine their payment methods, the merchants from which they make purchases.

In contrast to the consumer, the merchant's decision to adopt the card innovation involves both the merchant's and consumer's variable and fixed cost of adopting the card. This asymmetry in the consumer's and merchant's decision process is a key feature of the monetary approach to modeling payment card adoption. In the card network cloud the acquiring market is competitive and each acquirer receives a merchant discount rate S from merchants and pays an interchange rate I to card issuers. For simplicity in our analysis, we normalize merchant discount as an interchange fee to the issuers, i.e. $S = I$.

4. Measurement issues

Cash transactions rewards - height: Let us signify it as R . In many cases the rewards are in the form of bonus points to the bonus account. Those bonus points can be later spent in various ways. There are a few essential methods on how to calculate the reward bonus point amount, however for our case the most suitable is the following one:

$$R = p_n * f_b - \tau_c \quad (6-1)$$

Where:

p_nSold and charged price of the n -th good.

f_bBank reward percentage ($f_b \in <0;1>$ where 1 means 100 %).

τ_cFee for the card transaction.

Cash payment and handling costs amount: Let us signify it as τ_m . These costs are charged always when a merchant accepts cash (which is almost always with only a few exceptions). They are always (with minor exceptions) present on the consumer side if he operates with cash. The basic way how to illustrate this is with an example calculation of the final charged price:

$$p_n = \frac{P_0}{1 - \tau_m} \quad (6-2)$$

Where:

p_0Basic price of the particular good (i.e. purchase price + margin).

τ_mCash payment handling costs ($\tau_m \in <0;1>$ where 1 means 100%)

Card transaction proportional fee amount: Let us signify it as τ_n . Because in most cases there are no card transaction proportional fees charged to consumers (all costs are on the merchant's shoulders) we will exclude them from the following figure to simplify it:

$$\tau_n = p_n * (f_c + \tau_l) \quad (6-3)$$

Where:

p_nSold and charged price of the n -th good.

f_cPercentage charged by bank ($f_c \in <0;1>$ where 1 means 100 %).

τ_I Interchange fee rate for the card transaction ($\tau_I \in <0;1>$)

Adaptive costs amount: Let us signify it as k_m . Costs which are fixed per-period (one month, one year etc.). Those costs are independent of the card transactions, their count or charged amount. These costs are various from bank to bank and they depend on several factors, therefore it is very hard to measure it generally. For the card adoption it must be true that:

$$(P_n - \tau_n) > k_m \quad (6-4)$$

Provision of the card service costs amount: Let us signify it as S . They are strongly related to the costs which banks have with the merchant's (consumer's) card service provision. They are based on the charged amounts and frequency of the card transactions and time for which merchants (consumers) use the card service. In a competitive card service market where it is not feasible to assess an interchange fee, we have:

$$S = f_c \quad (6-5)$$

However we live in a world with interchange fees so:

$$S = p_n * h_b \quad \text{where} \quad h_b = p_a * p_f * p_t \quad (6-6)$$

Where:

p_nSold and charged price of the n -th good.

h_bPercentage charged by the bank ($h_b \in <0;1>$ where 1 means 100 %).

$p_{a,f,t}$Bank loyalty bonus coefficients (amount, frequency, time) ($p_x \in <0,01;0,2>$). Lower = better.

All the above presented variables contain characteristics of ratio scale. However sometimes the variable of R can also have properties of interval scale because in few approaches rewards are considered as negative card transaction proportional fees.

5. Data collection & sampling

Since the research problem fits in the macroeconomics sphere it is very difficult to have primary data collection. Even though we will be able to collect some primary data they will be irrelevant because we are able to involve only a small sample of society. Therefore the data will be inaccurate in the macroeconomics point of view and we cannot produce any trustworthy results.

Card transactions rewards- height: The rewards are offered by banks to their customers for credit card transactions. These rewards are often counted as bonus points, and for a particular amount of the bonus points you are able to choose some reward. The principle is simple – the more you use the card, the more bonus points you get. The ways how to obtain data on rewards offered by banks, as bonus point calculations, the sort of offered rewards etc. are from the secondary online resources (i.e. web sites of the banks) and from statistical reports, like annual reports. For measurement issues we will use financial related materials like economic papers, scientific research papers, reports and outcomes from macro economical on-line resources.

Cash payment and handling costs- amount: Because these costs relate to risks, theft etc., i.e. non-monetary aspects, the exact method is not easy to define. Significant criteria are consumer's income and merchant's sales. A certain part of the budget contains cash. For a larger cash amount more investments for cash storage, its securing etc. are necessary. For exact data of the cash handling

costs we have to search in scientific financial-oriented works, bank card payment research papers, related to merchants (e.g. when acquiring merchants for the card payment system) or retail stores for the prices (e.g. for safe-boxes).

Card transaction proportional fees and card service providing costs amounts: Sensitive information which are set in mutual agreement and they are mostly confidential. Exact values are not accessible to the public (of course exceptions can exist). The approximate known interval in which the percentage values flows is between 0,5 % and 2% of the transaction amount. Sometimes it could happen that card issuers like MasterCard or VISA publish their interchange fees. Resources where these values can be obtained from the bank's internal materials, mutual agreements between the merchant and his acquirer, and VISA and MasterCard internal documents, reports, annuals.

Adaptive costs amount: They are related on one side to the bank (account maintaining costs), on the other side to merchants (necessary essential costs for partial change to the cashless payments, e.g. safe-box elimination). To the previous participants we have to add retailers who sell card-processing equipment, computer equipment, software etc.).

6. Data analysis

By reason of much data collection from secondary data resources it is obvious that some quantitative statistic technique should be applied.

Adaptive costs, cash payment and handling costs amounts: Merchants decide not only their card acceptance strategy but also their prices. So in the beginning when merchants think about entering the business, they have to decide about the way of payment. So they will make an analysis of the available ways of payments and they will compare various multi-criteria decisions about which payment system they will accept. For this decision-making process the most suitable approach how to analyze costs vs. benefits are multi-criteria decision-making methods (MCDM). They enable a complex, integrated and logical framework that allows for interaction and interdependence among factors, and they enable consideration of different, more or less conflicting dimensions.

Card transaction proportional fees, card service providing cost amounts and card transactions rewards- height: The existing studies about the payment card market (Weiner and Wright (2005)) typically assume imperfect competition among merchants, e.g. hotel competition. Those models allow the merchants to behave strategically and consider the business stealing motive for adopting payment cards, but cannot easily keep track of market dynamics.

We consider a multi-period game and in each period, there are three stages: in stage 1 the network sets a merchant fee and a cardholder fee, in stage 2 the merchants decide whether to accept cards and their prices, and in stage 3 the consumers decide from which merchant they make purchases, which payment method they use, and how much they purchase.

Then outcomes of the changes in particular periods can be statistically worked up by Crude Rate² to produce results, and then we will see the ratio of the concerned parties who did accept card payments and who didn't. Then we can imagine how the card payment system within the whole society is effective in the new user's involvement.

² Crude rate is the ratio of the number of people in which the event of interest happens in a specified time period to the size of the population who may experience this event during the same time period. There are no adjustments made when a crude rate is given.

7. Conclusion

Societal benefits of using electronic money are obvious. The tracking and logging of all transactions is a very good way of minimizing illegality. On the other hand every good thing could be abused and cashless payments try to minimize potential security risks and makes the whole system more reliable. Using cash also has its own advantages. However, it will be more and more impractical in the future. Regulators claim that payment card systems charge “unjustifiably high” fees to merchants for payment cards while the banks issuing payment cards provide consumers with below-cost services and loyalty rewards and this occasionally prevents a cashless society boom.

Scientific contributions of this proposal will be (a) supposed arguments that will show the advantages of electronic transactions over cash transactions either for consumers and merchants,(b) report to society that the electronic payment system is ready for the card transactions increment (problem would not be the system but people) and (c) we will assume good documented indicators of the card payment system relations and influences in the whole system. The presented scheme can also be used to evaluate other economic problems.

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SOCIAL MEDIA

NEW AND SOCIAL MEDIA IN WORKPLACE

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Keywords

Social Networks, Social Media, New Media, Business, Workplace

Abstract

The paper aims at finding the effects of New & Social media NSM and Social networks sites (SNS) use in terms of productivity on the workplace. Theoretical part discusses advantages and disadvantages of NSM usage from the perspective of employers and employees. Different aspects are discussed: creativity, security, ethical problems, productivity, employee satisfaction and possible abuse. Practical part reveals the result of the employer survey on the use of NSM during the working hours. Survey was conducted in 20 companies from Czech Republic, India, Hungary, France and Austria. Results prove, that European companies are aware of NSM risks and benefits and have created rules and guidelines for employees, meanwhile Indian companies are still in the shadows. General conclusion of the paper is, that NSM are increasing communication, information flows, employees' awareness and motivation, and – to some extent – also productivity, but must be implemented wisely to avoid abuse and possible security risks.

1. Introduction

Let's begin with some numbers: Facebook officially admits (as of March 2013) 1.28 billion monthly active users (802 million daily) and 1.01 billion mobile monthly active users (609 million daily). 81 % of daily active users are from outside the U.S. and Canada. Facebook accounted for one in seven minutes spent online, on average 405 minutes were spent monthly on this social network, mobile access not included (Facebook, 2014). LinkedIn, in 2010 counting just little over 50 million users, is reaching nearly 300 million users nowadays. There are approximately 4 billion images on Flickr – the number of images doubled in the past three years. Wikipedia contains 14 million entries, 85,000 editors and 125,000 active users. Three years ago, Twitter had 75 million users, but only 15 million have used the service on a monthly basis. Today, reaching 1 billion registered accounts, 232 million people tweeting at least once a month. 60% of Twitter users access it from their smart phones.

Above mentioned numbers demonstrate, that social networks sites (SNS) and new & social media (NSM) have become part of our daily routine. They actually fulfil the need of human behavior to communicate and connect with people they know, meet people who share a common interest, collaborate, participate and share information and knowledge as well as gain knowledge (Golder, Wilkinson and Huberman, 2007).

However, NSM use in the workplace turns out to present a problem for employers – it is uneasy to control and harness. Should the use of NSM in the workplace be reduced to bare intranet-form of networking or should employees be allowed to log into their Facebook and Twitter accounts during working hours? Do benefits of allowing employees to use NSM during their working hours outweigh their interdiction? What strategy an employer should adopt when access to NSM is a working condition for a quarter of his taskforce?

Historically, such problem has already been experienced. Decades ago many employers feared the intrusion of the phone in the workplace that would enable employees to make work not-related phone calls during their working hours, then reducing their individual productivity. Many employers also feared the introduction of desktop computers saying that their employees would play computer games and be ineffective.

To tackle this topic, we should consider sociology, economics but also psychology. Some people are indeed more inclined to NSM usage than others. People who are more open to new experiences will use social media more frequently, people who are more emotionally stable will use social media less often, and people who are more extraverted will use social media more (Ehrenberg, Juckes, White, & Walsh, 2008). In addition, people with greater levels of neuroticism³ are more likely to engage into these kinds of virtual activities to seek support and company on virtual platforms (Ross et al., 2009). Specific psychological traits of employees affect their NSM usage during working hours and make them more or less inclined to develop addictive behavior. Possible addictive behavior results in a higher difficulty to express moral judgments since the ethical thinking is somehow impeded by addiction.

The ethical issue of NSM and the diverging views about how productivity is affected by NSM have largely been treated in the literature usually as separate questions. Indeed, the ethical debate (Sigmund, 2013) around NSM emerged from the impossibility to technically monitor the NSM use from the top. Business ethics is closely linked to social responsibility (Ferrell & Hirt, 2010). Employees have an individual responsibility and express individually value judgments when facing an ethical issue. Employees participate in building moral norms in a company – what is permitted or prohibited – and these moral norms are closely related to the values and ideals of the company. Employee may build their ethical judgment about NSM use on companies' ideals and values such as productivity and performance. This is how the productivity issue and the ethical debate could be drawn closer: "I consider social networking unethical during working hours because it does not fit the values of the company I have been hired in". Productivity could then be the reason why people do not use NSM at work. It has been a mistake of the recent literature not to consider the two aspects of this topic as two sides of the same coin.

This paper aims at finding the effects of NSM use in terms of productivity on the workplace – mainly from the side of employer – and his stance about the use of NSM during the working hours. The research question of this paper is: Is the use of NSM allowed during working hours and what does the employer think about the effect on the productivity of his employees?

³ By neuroticism we understand a fundamental personality trait in the study of psychology characterized by anxiety, moodiness, worry, envy, and jealousy.

2. Social networking in work

There are several studies conducted by researchers in this field, namely by team of Ethics Resource Center, (Bennett, 2010, Magnier-Watanabe et al., 2010, Russell and Stutz, 2014) which reveal more or less surprising connections between these two areas.

Social networking in the workplace became a crucial communication tool in many businesses. It provides a platform for creating communities based on similar interests, hobbies or knowledge. People can upload, share or spread information via messaging, chatting, video and file sharing or blogging. (Bennett, 2010) Despite the scepticism about distortion of the workers' attention, the use of new social media is a necessary way of catching up with modern trends of managing a business. Even the educational process should reflect new trends and development, so university alumni should already be aware of SNS and NSM (Doucek 2012). Employees need to be in touch with the outside world and have the immediate source of information. Still, some employers forbid going online from the company's computer network strictly; some just do not like seeing it in the workplace. It is almost impossible for an IT department to know every social networking website and to block access although many employees may theoretically and technically be forbidden to access SNS during their working hours. Therefore, the advice of the experts is: if you cannot beat them, join them. It can be converted into an extraordinary advantage only if you know how to use it.

Why do employees actually go online? They simply want to be in the picture. Bennett et al. (2010) explain in their paper the theory of personal control. Every worker needs to maintain the control over his/her physical as well as virtual working environment. In case a company controls data content in the intranets centrally, the employees feel tracked and bounded. They need to have the personal space to express themselves freely. They go online because of the false belief that "nobody is watching".

People also seek social gratification via NSM and one may wonder whether such social gratification seeking in the workplace is correlated to the level of self-esteem employees feel at work. Self-esteem responds to the need for self-realisation of every human being as underlined by Maslow. One may hypothesize that employee being criticized all day long in their workplace will tend to seek self-esteem throughout a virtual refuge, the NSM.

New social media deeply changed our societies by building virtual groups of people who share a similar passion for something that they know how to do, and who interact regularly in order to learn how to do it better. These communities are called "communities of practice", also known as "communities of interests". New social media (NSM) connect places and overcome distances. This is beneficial especially for a teamwork. It enables them to cooperate and coordinate their work more efficiently.

Productivity is often described as "the speed and accuracy of carrying out particular tasks". Productivity of a factory worker can be easily measured in total units produced in a workday whereas productivity is trickier to measure when it comes to occupations focusing on cognitive tasks. This paper focuses on this latter group of workers and the time spent by such employees to execute the job they were hired to do in order to produce the desired outcomes expected from the employee's job description.

2.1. Pros and Cons of using new social networks in the workplace

First of all, we have to differentiate between active and passive social networker. The passive social networker just reads what is going on, sometimes reacts, but never or rarely creates new

information. On the other hand, the active one contributes to the network, shares and develops the content. We will consider both of them, because both kinds of online activity carry potential benefits for the company, if only for a kind of dissipation of the worker. Accent should be put more on the active networkers, because their activities online can have significant impacts not only on their productivity, but also on the company's ethical culture, reputation or existence.

In the continually changing environment, people need to have the right information at the time when it happens. Intranet as an internal communication tool is not sufficient anymore, because it is not so flexible in changes. Contrary to this, NSM provide exactly what employees need. Moreover, it does not only give the information, but motivation, support, consultation, inspiration or new ideas as well. As Bennett et al. (2010) claim, the society has experienced a cultural shift from "information gathering" to "information participation".

The right usage of social network can strengthen company's image, perceived ethical culture or reputation. It is an essential part of modern marketing and promotion. According to the server Fastcompany.com, 93 % of companies are using social media for various purposes. (Cooper, 2013). 42 % added that especially Facebook has become a crucial tool for their competitiveness. (Noyes, 2014) To focus back on the worker perspective, social networking is useful for employees in almost every position in the firm. Salesperson can promote the product easily; the personnel clerk can check the candidates' profiles in the screening process (if it is ethical/legal or not); consultant can discuss the issues with the professional public. (Stoller, 2008) NSM and especially social networking sites (SNS) are therefore obvious assets for a company in terms of communication, marketing and recruitment process, but may be one of its major weaknesses as well.

If employers worry about NSM usage in the workplace, they actually express concerns about both the productivity and the real dangers brought about by NSM usage in terms of company. The main threats are leak of confidential information, misuse of information, harming of company's reputation or risk of catching a virus from the unsecure websites. (Smith, 2011) Indeed, in March 2011, a Nestlé employee who was managing content on the company's Facebook fan page displayed an aggressive behaviour by commenting violently on some negative remarks posted by some fans. By doing this, this employee did not abide the Nestlé principles of integrity and somehow tarnished the image of the Swiss company. Besides, employees might also vilify their own company via NSM or even leak confidential data. To this extent, use of NSM in the workplace by an unethical employee may jeopardise all the efforts by a company to meet fair competition.

Considering Facebook as one of the leading social network sites, every user has to take into consideration that the posts are more or less visible for all of its 1.31 billion active users worldwide. (Facebook, 2014) The information can be easily shared, copied, downloaded and stored for indefinite period of time if needed. The confident facts can be tracked and possibly misused by the third party. It is therefore highly recommended to think twice before posting any information relevant to a certain company. (Stoller, 2008)

2.2. Productivity of online active workers

According to the US staffing agency, one-third of workers use social media at work for at least one hour per day. Furthermore, the researcher Peter Mawson, believes that there is a significant loss of productivity from distraction in the workplace which has been estimated for a well-managed office as being approx. 70 minutes in a typical 8 hour shift. The danger is that usage of NSM in the workplace tends to increase this amount of lost productivity. Indeed, social networking has been linked with impatience, making individuals more self-centered, change of brain patterns and activity, and on top of all that, reduction of the average person's attention span from twelve minutes

to five in the last decade. NSM use has to be regulated but allowed, since one quarter of the panel selected by the US staffing agency stated they would not work for a company that would not allow them access to social media in the workplace.

Joe Nandhakumar, professor at the University of Warwick, led a study in the UK, Finland, and Germany among white-collar workers and came up with a conclusion: employees who used various types of social media and digital modes of communication were more creative and collaborative at work, and thus more productive. However, it has to be mentioned that these “various types of social media” were social media capabilities integrated into their enterprise systems. The development of new social media integrated to enterprise systems benefit to employees in terms of individual productivity. Nevertheless, the positive causality between NSM usage in the workplace and higher productivity is yet to be determined since many studies contradict each other. Microsoft itself conducted a study concluding that social media usage actually improved staff productivity while some other studies came to the opposite conclusion.

According to the research conducted by telecommunications corporation AT&T, the use of social media networks during working hours surprisingly increases productivity (Middleton, 2008). This results from the answers of 2,500 employees from 5 European countries. 65 % of the interviewees said that online activity had affected them or their colleagues positively in terms of productivity. 46 % added that they had gained new ideas or inspiration thanks to the social networks. 38 % found that social networking helped them to gain knowledge and resolve problems. 36 % then collected useful information about employees and customers.

As mentioned in the paper by Bennett et al. (2010), the productivity of the workers using social networks within the organization (or at least public social networks in interaction with their colleagues) can be boost mainly due to increased communication and cooperation with their co-workers. Moreover, when the employees share knowledge, they are actually using a collective intelligence. This interconnectedness is the main driving force for strategic focus, improvements and innovation, so the effectiveness of the team rises. (Magnier-Watanabe et al., 2010; Smith, 2011)

Social networking in its lighter form (keeping in contact with other colleagues) has different but also very important impacts. It makes employees feel like part of an organizational culture. It reduces social isolation especially during the time they are travelling and cannot be physically in the office. Communication therefore boosts team spirit. The employees do not feel alone in their office or help the newcomers to socialize in the company environment. Of course, it also depends on the kind of social network the employee is using. Some of them can really deliver new ideas to the old structures, but some on them are just detracting the workers without any benefits to efficiency.

Opposite to this is the situation, when an employee’s online activity is not connected with the other co-workers, suppliers, distributors, partners, clients, customers or other stakeholders. In this case there is surprisingly still something to improve the productivity of the worker. Social networks provide the employee with “brain breathers” as shown in the article by Sarah Winkler (2009). By reading the updates as well as browsing the web the mind gets a break and refreshes for further concentration. Moreover, workers connected to the social networks improve their social abilities thanks to regular contact with people. Consequently, they are better at communication with the partners or customers than their passive colleagues. Another positive fact which comes from Winkler’s research is that the workers who take regular breaks for checking the NSM are able to work until late evening hours.

On the other hand – the more social network accounts, the higher participation, the stronger is distraction. This is the point companies should be aware of and take appropriate steps to prevent NMS over-use. When abused, the social networks can easily become time killers in this context and the efficiency of the worker decreases. To avoid this, some kind of monitoring of the online activity would be reasonable, if it is permitted by the national legislation. The company can eventually check which website and for how long the employee visits. At any rate, the company's pursuit of information security has to be balanced with the employees' rights. (Russel and Stutz, 2014)

The employee should be aware of possible constant supervision and just behave “professionally” while being on the clock. Another problem arises in case the employee uses his/her own laptop, so the online activity is more difficult to track.

The company should also define the reasons for usage of the new social media explicitly. There should be a document dealing with the agenda of working on the internet and using of the electronic devices at the workplace. If permitted, a good point is having clear instructions specifically for social media as well. In order to be obeyed, the rules have to be effective and realistic at the same time. The company should be also ready for combating the rule-breaking by assessing the penalties and punishments. (Cox, 2009)

To sum up, the use of new social media leads to higher employee satisfaction, but not necessarily to employer satisfaction as well. The aim of the research was to find out what companies think about networking of their employees in the workplace and whether it is or is not leading to better productivity of the workers.

3. Research

Four leading service industry companies from 5 countries (Czech Republic, France, Germany, Hungary and India) were selected to study their stance on social network in workplace. Twenty different companies having different attitudes regarding the use of social media on the workplace have been analysed. The companies were approached by five involved students – native speakers – in their local language (Czech, French, German, Hungarian and English) to ensure higher level of cooperation. By using this approach a broad scope of research was guaranteed. As social media is a worldwide phenomenon it is important to use sources which were spread all over the planet settled in five differing social and cultural backgrounds.

3.1. List of surveyed companies

Czech Republic: ČSOB, Komerční banka, Česká pojišťovna, Kooperativa pojišťovna

France: CAP GEMINI, Sanofi, Axa, Orange

Germany: Allianz SE, Otto group, Bertelsmann SE & Co. KGaA, Deutsche Telekom AG

Hungary: Morgan Stanley, OTP bank, Citigroup,

India: Tata Consultancy Services, Infosys, Reliance Entertainment (Reliance Industries), Reserve Bank of India

3.2. Survey questions

The survey emphasized following 5 questions:

1. Does the company allow/tolerate employees to use new social media during working hours?

2. Does the company control which web sites their employees are using and how much time they spend there?
3. Does the company own internal communication network (e.g. an intranet discussion forum, or their own Facebook page)?
4. What does the company think about the use of FB/Twitter/LinkedIn at the workplace? How does it affect productivity of their employees?
5. Has the company created and imposed a code or documentation related to the use of Internet/NSM at the workplace?

By collecting information regarding these questions, we are able to provide a broad view on the topic by comparing the received data. This enables us to find a common result which proves our research ideas.

4. Results

Full detailed results of the survey will be published on IDIMT conference's website, due to limitations in the print, here are presented just summarized results.

Strict rules are applied by banks and insurance companies in Central Europe

Banks and insurance companies have the strictest rules about the use of social media in the workplace. In Hungarian, Czech and also in Indian banks, only the competent person can use social media during working hours, while respecting the values of the company. Most of the banks have Facebook page, LinkedIn profile or specially created websites for promoting their products, which are managed from the head offices. They put great emphasis on business ethics and ethical behaviour of their employees. Centrally managed internal control mechanisms are used for control of the workers.

Almost all of them use corporate intranet for internal communication. Use of websites like Facebook/Twitter are restricted, only employees, who use it for work purposes (marketing projects) or are in a high position in the company have the access to NSM.

Company owned communication devices cannot be used for private interests, or only allowed as long as company interests are not harmed by such behaviour. The misuse of company devices can lead to serious consequences for an employee, so they are obliged to act honest and in compliance with the applicable law system.

Use of social media can increase productivity of workers

We found out that the companies outside of financial sector (e.g Deutsche Telecom) have more relaxed rules about social media use. Regarding the use of company owned devices are considerably more generous too. They tolerate using social media platforms during working hours as long as it doesn't harm the company's values. It is also not prohibited to use the company owned devices for private purposes, so they are not supervised by any authority. According them the use of social media can affect productivity in a positive way, but any online "misbehaviour" should be fixed as soon as possible.

French companies put the biggest emphasis on the protection of their reputation

According to our research, French companies put the biggest emphasis on the fact that any publication on the internet can be accessible to a wide range of people, that's why employees are required to be very careful. Their social media policy is based mainly on their reputation and the

ethical conduct of their employees on NSM websites and SNS is strictly codified. The French managers pointed out to the latest example of American Airlines which posted an obscene picture on Twitter in response to a complaint by a customer, which harmed the company gravely. Based on their beliefs, strict rules and guidelines are necessary to make sure that things like this don't happen.

Lack of rules in Indian companies

The code of conduct in Indian companies is not fully adopted yet. A lot of companies don't have rules regarding the use of social media by their employees.

Only some multinational companies in the country are introducing their own code of conduct about social media. Tata, for example, encourages employees to use social media in their personal time, but puts emphasis on transparent and responsible use of the medium. This is how it tries to protect the interest of the company.

Some companies, like Infosys, are planning to introduce a social media policy plan, to enable them to take legal action against workers, who misuse confidential information.

5. Conclusion

This paper summarizes what effects the New Social Media have on an organisation and in which ways does it affect the productivity of the employees. Some companies allow the workers to use Social Media tools like Facebook or Twitter at the workplace and some do not. Some organisations make use of New Social Media as a source of knowledge transfer or as a marketing tool and others think it's just a waste of time which should not be encouraged among workers. The thinking also seems to differ amongst the eastern and the western cultures. After the research we came to the conclusion that the stance on using social media is decided according to the type of organisation and there should definitely be a set of defined guidelines. Need of guidelines or rules are kind of a given as people do have a tendency to abuse the Social Media in different ways, sometimes to express their anger, sometimes sadness and sometimes just carelessness. There have been cases when workers have been found sharing confidential data on social sites or posting something on behalf of the company without prior permission.

Productivity and New Social Media can complement each other or cross out each other, depending on an organisational policies. If there are no defined usage restrictions or monitoring, workers might just sit and chat or post all day long. Organisations should start making use of the Social Media as it is a powerful potential source for communication and therefore success. They can make some groups and encourage the workers to share the work matter through the social sphere. A social media code of conduct and formal training module should be a part of the employee curriculum. Further research can be conducted in this regard, more companies around the world can be studied and their stance on social media use can be judged. Also as new means of communication and media sharing are popping up, our research does need to be refreshed periodically.

The final judgement is: Social Media can be great advantages, if it is used properly. Many studies have concluded that NSM are helping to increase productivity and encourage active communication, if used it in the right way. It is the only medium which can bring about a revolution in the way we work and manage the organisations. People need to learn from mistakes made in the past and embrace this new wave of technology which truly is bringing about an organisational change.

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THE USE OF SOCIAL MEDIA FOR MARKETING PURPOSES BY CZECH COMPANIES DOING BUSINESS IN THE ENVIRONMENT OF SERVICES ON THE INTERNET: A NATIONAL SURVEY

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Keywords

Social Media, Companies, Marketing, Internet, Survey

Abstract

Social media are important tools for marketing activities in the environment of services on the internet. In the introductory section of this contribution, we aggregate and compare the outcomes of previous surveys focused on the use of social media by Czech companies. The following part presents original research on a sample of 4,584 Czech companies which do business in the environment of services on the internet. The survey particularly deals with the use of social media linked to a company's website with the purpose of enabling integrated marketing communication and creating synergy of interactions in this environment. The results presented here are interesting for companies when selecting an initial mix of social media, as they can choose communication tools relevant to their business and keep track of the use of these tools by their competitors. A general conclusion of this survey is that Czech companies doing business via internet use social media to a relatively small extent (compared to the USA, for instance) and therefore the effective use of social media for marketing purposes may still be considered a competitive advantage. Moreover 62 % of these companies don't use any social media (apart from a website with e-mail or contact form) for communication via internet.

1. Introduction

The phenomenon of social media and their impact on human communication options as well as commercial subjects is undeniable. A long-term trend in the field of applied research is the creation of methodologies and models which support management of marketing activities of commercial subjects on the internet, where a crucial role is played by communication through social media – see for example (Ungerma, Myslivcova, 2014; Dasilva et al., 2013). Social media also play an important role in other areas and approaches (which are) applied mainly to the market environment such as Competitive Intelligence (Molnar, Strelka, 2012), Marketing and Business Intelligence (Novotny, Jasek, 2013) or towards Information Management within a company (Doucek, Pavlicek, Nedomova, 2011). In addition to the practically oriented approaches, companies also need

information about their surroundings, for example about the penetration or use of social media in a particular segment in other companies. This information is especially suitable on the level of strategic management, where decisions are made about instruments that will be used for marketing purposes in the long-term, and also to determine whether these instruments bring a (competitive) advantage over the competitors – see also (Dorcak, Delina, 2011), or whether it is already an established standard of communication in a given area. After this broader overview of the competitive environment of the company, they approach to execution, i.e. to the actual activities (the use of best practices, mediaplan preparation) and their evaluation. In the course of evaluating the goals, including positive and negative impacts of the interaction of subjects – see (Gecti, Dastan, 2013; Smutny, Reznicek, Pavlicek, 2013; Zouharova, 2013), companies also compare their competitive position in the market segment. At this level, suitable sources of information for the management are externally provided statistics (e.g. companies Socialbakers or DeveloperAnalytics).

The broader view outlined above has also been the motivation for this contribution – to bring information about the use of social media by companies, with an emphasis on those that operate in the environment of services on the internet. In addition to the presentation of our own research results we will also use aggregate results of other surveys. The survey presented here provides a new insight into the current situation related to the effective use of selected social media by commercial subjects in the Czech Republic. Also in scientific sources there can be found similarly territorially and holistically focused surveys, although thematically different – e.g. Indonesia (Sarosa, 2012), Germany (Kruger et al., 2013), USA (Culnan, McHugh, Zubillaga, 2010), Pakistan (Khan, Bhatti, 2012).

In this section we will focus chiefly on two Czech surveys carried out in 2013. If we look at the currently available sources relating to the Czech Republic, we find that they mostly look at social media as a means of communication. This is a view taken also in the study (Michl, 2013) conducted on 1,624 Czech accounts on Google Analytics. An important conclusion of this study is the rapid increase in website visits coming from social networks, which is gradually catching up with organic traffic. Conversely, there is a decrease in the number of visits from catalogues. The study also compares the penetration of Facebook and Twitter into Czech society and attaches selected global trends.

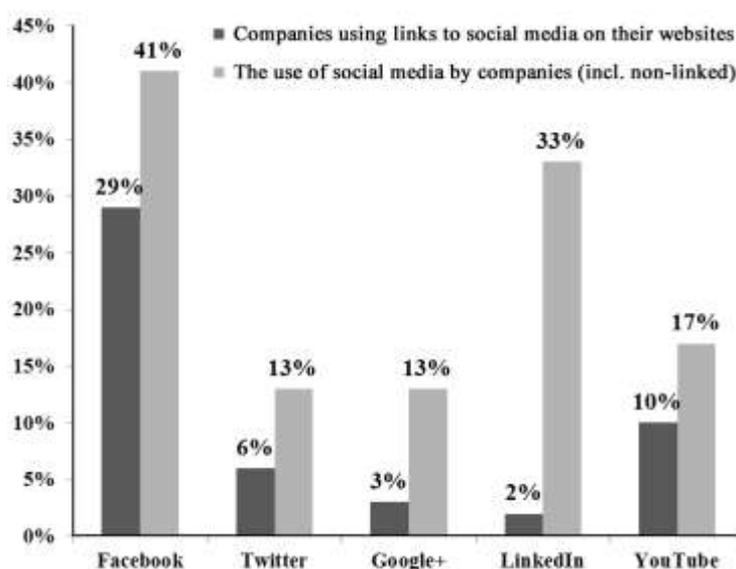


Figure 1: Aggregate results of surveys (Smutny et al., 2013; Filova, 2013) among companies in the Czech Top 100 chart in 2012 comparing (the absence of) linking of websites and social media.

The survey (Filova, 2013) which is relevant to this contribution deals with the use of five selected social media by commercial subjects listed in the "Czech Top 100" chart in 2012 (there are significantly different orientations of individual companies). This survey was in Figure 1 complemented by a survey published in (Smutny et al., 2013), which was carried out on the same sample of companies, but the views taken in these surveys vary. While the first one deals with the existence of a company profile in social media, the second view focuses on the integration of social media into a company's website (towards the concept of integrated marketing communication and its synergies). Based on this, we can say that there is still a large percentage of companies that focus more on the use of social media as individual tools, rather than on the concept of creating integrated marketing communication via the internet, with an emphasis on linking and supporting the interactions of subjects (people) in the internet-mediated environment. This difference in approach can be caused by a lack of competent experts in the field of social media towards their use in the commercial sector. This negative aspect is discernible already at the level of management and strategic planning and it spreads further to the organization of activities, which is shown also in the research of Altimeter Company (Solis, Li, 2013), which, however, was carried out in the USA.

Despite what has been mentioned, the survey presented below is original not only in its range within the Czech Republic, but also by its different approach, focusing not on the individual social media and the statistics describing their usage by humans or commercial subjects – as mentioned in (Michl, 2013). On the contrary, the survey is conducted from a select group of companies towards the use of social media and reflects the real situation in the segment. It provides much-needed information on the status of social media in a given segment, which aptly complement the strategic management of marketing activities.

2. Data Collection and Methodology

For the purpose of carrying out a survey in the Czech Republic among commercial subjects doing business in field of internet-mediated services, we examined the websites of 4,584 companies. We used the catalogues of companies listed on the portals of Seznam.cz and Centrum Holdings, where there are listed predominantly small and medium enterprises (SME) or self-employed individuals. The following overview shows the sections of catalogues that we were interested in, including the percentage of the total number of companies: eShops (18%), media agencies (23%), on-line services (31%), software companies (20%), web developers (8%). Data were collected manually by eighty students in their own project work during November and December 2013. The collected data were then cleared of redundancies.

The survey in question is a quantitative survey of the current state of use of selected social media by commercial subjects. Data were collected into excel sheets and then aggregated and processed by the author for the purposes of this article. For every corporate website we enquired whether there was a link (in the form of a direct URL link) between the company website and a selected social medium. As was shown in the paper (Smutny et al., 2013), in order to effectively communicate (or promote) in the environment of services on the internet, a company should integrate social media into the company's website at least at the level of a link. For this reason, we did not check whether there existed company profiles on the individual social media if the link was not listed on the website. This leads to certain limitations of the gathered data; on the other hand we obtained data of a different quality, such that represent the companies which have the potential to effectively communicate their message in the internet-mediated environment.

3. Results and Discussion

The basic survey results rounded to whole numbers are presented in Table 1. The diagonal highlights information about the proportional use of social media within the total sample of 4,584 companies. This table also shows the percentage of the combinations of two selected social media. The popular communications triple – the combination of social networking service, microblogging service and video hosting service (Facebook, Twitter, YouTube) – is used only by 3% of the companies. The available data also show that 62% of companies in the Czech Republic don't use any media for internet communication (apart from a website with e-mail or contact form).

	Facebook	Twitter	Google+	LinkedIn	YouTube	Blogs	Flickr	Pinterest
Facebook	28 %	—	—	—	—	—	—	—
Twitter	11 %	12 %	—	—	—	—	—	—
Google+	8 %	5 %	11 %	—	—	—	—	—
LinkedIn	6 %	4 %	3 %	8 %	—	—	—	—
YouTube	6 %	3 %	3 %	3 %	7 %	—	—	—
Blogs	2 %	2 %	1 %	1 %	1 %	4 %	—	—
Flickr	1 %	<1 %	1 %	1 %	1 %	<1 %	1 %	—
Pinterest	1 %	<1 %	<1 %	<1 %	<1 %	<1 %	<1 %	1 %

Table 1: The diagonal of the table shows the use of selected social media of Czech companies doing business in the environment of services on the internet. Furthermore, from the table can be read two selected combination of social media and their percentages.

It would be also useful to compare the results of our survey listed in Table 1 with the results of the 2013 survey carried out within the "Czech Top 100" chart in the Czech Republic and the "Fortune 500" chart in the USA (regardless of the type of business). This survey (Smutny et al., 2013) shows in the case of the Czech Republic similar result of Facebook integration at the level of websites (29% in Czech Top 100 versus 28% in this survey). In other social media that have been monitored (Twitter, YouTube, LinkedIn, Google+) the differences are greater, which is mainly due to the greater differences between the specialization of the individual companies (e.g. B2B, B2C, B2G), when it can be expected that companies doing business on the internet will do better. Compared to the USA we can find bigger differences, which determine the direction and the gap that Czech companies will try to fill in the field of communication regardless of the business type. In the case of the USA, Facebook is integrated in the websites of 74% of companies. In other monitored social media, the difference was more than tenfold in favour of USA companies. This implies that the competition between Czech companies in terms of using social media for active promotion is still low compared to the USA. Therefore, marketing activities through social media are still in the Czech context a competitive advantage compared with their penetration and use in Czech society – see (Michl, 2013).

For a closer look the data were further divided into four segments and submitted to the same analysis; the groups of software companies and web developers were merge due to their proximity. The results are shown in Figure 2, where we add the average values. We can find two distinctive counterparts. The first are On-line services (in catalogues also referred to as Internet services), that

consists of services provided over the internet (e.g. insurance mediation, cloud services) and among them can also be found the representatives of the other three groups. Compared with the other groups, they had the best percentage results on Facebook (38%), Twitter (17%), YouTube (12%), Blogs (6%), Flickr (3%), and Pinterest (2%). The second group are eShops, which had the worst results in the using of social media in Twitter (6%), YouTube (4%), LinkedIn (0%), Google+ (5%), Blogs (1%), Flickr (0%), and Pinterest (0%). This behaviour of eShops may have been caused by the fact, that many small eShops do not have the human resources to maintain a larger network of social media, and therefore focuses mainly on Facebook and advertising activities via search engines. It is interesting that companies in the field of software and web development have the best results with the professional social network LinkedIn (12%), and we can also find positive progress in the penetration of the relatively new social network Google+ (15%). Although it is not a significant difference from On-line services, if we compare it with the other two groups, we can say that it emphasizes the role of virtual life whether it is on a professional or a personal level in the social group of ICT experts. This is also reflected in the increased motivation of commercial subjects residing in the same virtual environments as their staff.

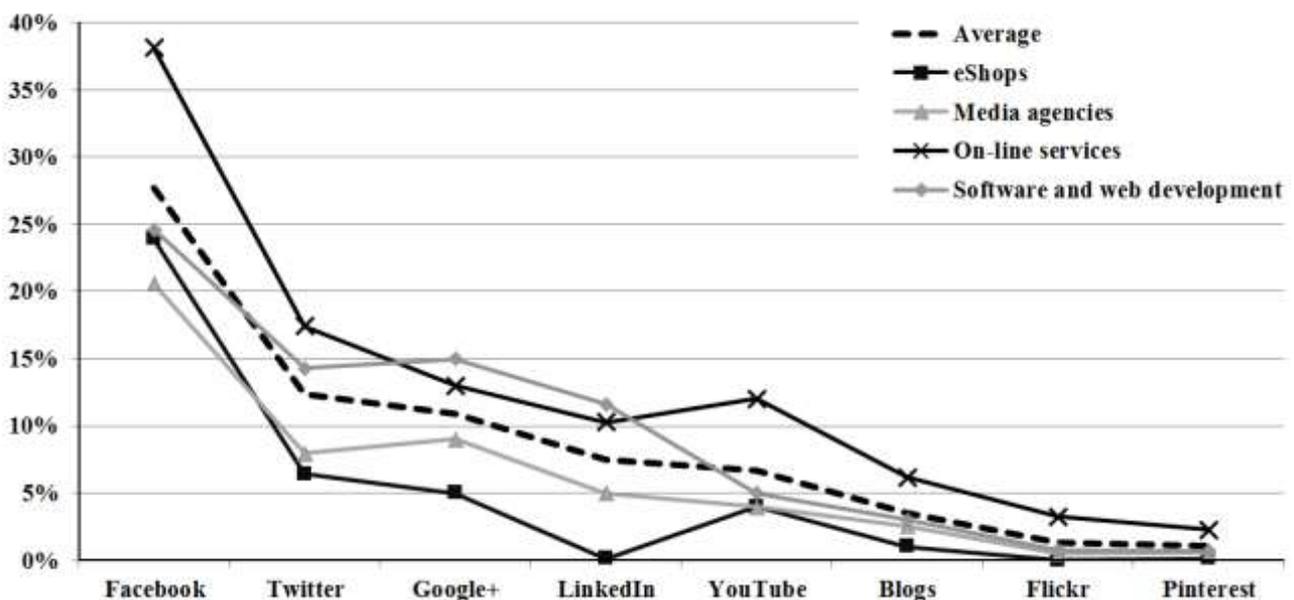


Figure 2: Percentage distribution of each social media in the four selected segments.

Apart from the results of selected social media, we were also interested in other kinds of communication popular with the general public. Their functions are now gradually integrated primarily into social networking, namely Voice over Internet Protocol (VoIP) and Instant Messaging (IM) clients, whose representatives are Skype and ICQ. Both remain in our survey above 4% of the total number of companies. In terms of individual segments, IM is used mostly by eShops (6%) and VoIP by software and web companies (6%). In contrast, there is the lowest use of IM (3%) and VoIP (3%) in media agencies.

4. Conclusion

The survey presented here is largely original compared to other surveys focused on the use of social media by commercial subjects. Its originality lies in the different perspective emphasizing the integrity of marketing communication and therefore also the linking of a company's website to social media and thus their at least basic integration. Websites are the primary reflection of the

company in virtual environment – see (Smutny et al., 2013), and therefore it is the central point around which the interaction of the subjects of the environment (in our view mainly people) revolves. The survey presented here reflects that and deals with only those social media that are effectively connected with websites.

- Based on the comparison of surveys (Filova, 2013) and (Smutny et al., 2013), there can be seen a large gap between the use of social media (profile creation and management) and its active connection within integrated marketing communication towards creating a synergistic effects at the level of interaction of the subjects of the environment. When compared to the state of companies in the USA, the competition level of the use of social media in the Czech Republic is lower.
- The presented survey based on a sample of 4,584 companies doing business in the environment of services on the internet reflects the low level of competition in the context of effective integrated communication in this area. The main summary of the results can be seen in Table 1 and Figure 2, where it is divided into four segments. Here we highlight just some general conclusions:
 - 62% of companies in the Czech Republic do not use for communication via internet (apart from a website with e-mail or contact form) any social media.
 - Means for rapid communication (VoIP and IM) are employed to the greatest extent by eShops and software and web companies, but their penetration is generally low.

Only in long run we can make new general conclusions on the use of online tools for communication purposes in Czech Republic. In the future it would be interesting to repeat this survey annually on a similar sample of companies. These results are interesting when choosing an initial mix of social media, when the company can choose the tools used and therefore relevant to their area of business. Although the social media are an important phenomenon of our time in terms of a marketing view of the online environment, because of their socio-economic impacts on society, this situation is not fully reflected at the level of companies operating in this environment (compared to the USA). For this reason, the effective involvement of this form of communication in an integrated marketing campaign for Czech companies still means a significant competitive advantage.

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BIG DATA AND LEGAL REGULATION

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Keywords

Big Data, Data Categorization, Data Collection, Data Protection Act, Legislation, Personal Data, Social Networks, Twitter

Abstract

The paper deals with the field of Big Data in relation to a research question of whether it is possible to collect data from different resources, analyze it and still be compliant with the principles of EU law and Czech legislation specifically. The paper is divided into two logical parts. First, an introduction to Big Data focusing on the social network of Twitter as one specific source of Big Data. In this case study the author shows the possibilities of what we can mine from this social network without approval of its users. In the second part an opinion of what is possible to do in the field of data gathering with respect to the principles of EU law and Czech legislation is formulated based on the provided legal analysis.

The conclusion of the paper is that although Big Data is a term that is not yet used in EU legislation, we should be aware of the fact that collecting data that may in any way lead to identification of a particular person is likely to violate law unless it is registered for such a purpose. Therefore only completely anonymous data keeps us safe while using search engines or developing applications for commercial use.

1. Big data introduction

This article will focus on the legal aspects of data collection and on the legal analysis in relation to the new type of data defined as Big Data. Before we approach this area in a more detailed way, we will cite one of the existing definitions of Big Data and its attributes as it seems to be a good place to start the following discussion.

“Big data in general is defined as high volume, velocity and variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision making” (Gartner, 2013).

1.1. Big data and social networks

When focusing on the legal aspects of Big Data collection and analysis in this article, we chose one specific data source called Big Data. We have decided to choose the social networks and Twitter as an example for the so called social mining done within this network.

Social networks and their further mining, analysis of the data and possible related ICT human capital is a topic that is well described by several authors (Ellison, 2007), (Pavliček, 2013) or (Doucek, 2009).

In this paper we focus not on the Social Network Analysis (SNA) that has already been widely described by other authors but rather on the legal aspects of data collection done based on the Twitter platform. We will pose the legal research questions and try to find their possible answers using an example of data gathering that authors carried out from Twitter with the help of external programmers in 2013 for the purpose of this article.

The data collection from Twitter is possible for developers through defined API (Application Programming Interface), through the use of programming rules that are officially published and described by Twitter on its website⁴ and further discussed in related communities of developers (Twitter, 2014).

For the purpose of this article we have defined the key words for data mining from Twitter with the purpose of gathering all data from Twitter users whose tweets contain the key words in Table 1 below. The purpose of such data collection could be Sentiment Analysis⁵ of Twitter users in relation to the defined key words representing interests of the specific company or its product. When defining the key words in Table 1 below we had in mind a telecommunication company GTS Czech, where the author works and which in 2013 launched the services of Mobile Virtual Network Operator (MVNO) that we try to monitor via Twitter.

ID	Key words
1	GTS virtuální operátor
2	virtuální operátor GTS
3	GTS MVNO
4	MVNO GTS
5	mobilní služby pro firmy
6	GTS mobilní služby
7	mobilní služby GTS
8	GTS Czech
9	GTS mobil
10	mobil GTS

Table 1 – Key words for data collection from Twitter (authors)

The results of such data collection carried out by the author with the help of external programmers in 2013 are shown in Table 2 below:

⁴ www.twitter.com

⁵ Sentiment Analysis (also known as opinion mining) refers to the use of natural language processing, text analysis and computational linguistics to identify and extract subjective information in source materials (Wikipedia)

ID	Key words	Tweet Message	User login	User name	Time
1	GTS virtuální operátor	Zajímavá nabídka ... Virtuál GTS startuje. Nejlevnější tarif stojí 35 korun bez daně - iDNES.cz - http://t.co/jZRR1kjHQs 	http://twitter.com/xelagem	Michal Novak	14.5.2013 15:21
2	GTS virtuální operátor	Virtuál GTS startuje. Nabízí neomezené tarify pro firmy a živnostníky. http://t.co/pCkDyXqplq 	http://twitter.com/emanprague	eMan	14.5.2013 11:06
3	GTS virtuální operátor	Virtuál GTS startuje. Nabízí neomezené tarify pro firmy a živnostníky. http://t.co/sgz1X6uCFr 	http://twitter.com/TomasCermak	Tomáš Čermák	14.5.2013 11:06
4	mobilní služby pro firmy	Operátor GTS Czech rozšiřuje své konvergentní portfolio pro firmy, spouští mobilní služby *** http://t.co/SUAigeoLSx 	http://twitter.com/feeditcz	FeedIT.cz	14.5.2013 17:18
5	GTS mobilní služby	pc-politika.cz - Články - technologie: Operátor GTS Czech spouští mobilní služby - http://t.co/IEjxvZwiLt 	http://twitter.com/szabog66	Gabriel Szabó	14.5.2013 19:23
6	GTS mobilní služby	Operátor GTS Czech rozšiřuje své konvergentní portfolio pro firmy, spouští mobilní služby *** http://t.co/SUAigeoLSx 	http://twitter.com/feeditcz	FeedIT.cz	14.5.2013 17:18
7	GTS Czech	RT @GTS_Czech : @GTS_Czech : Dnes jsme na tiskove konferenci představili konkretni konvergentni mobilni nabidku pro firmy - viz.16:54 <a ><a="" class="" href="http://3Ej">http://3Ej 	http://twitter.com/LadVach	Ladislav Vachutka	14.5.2013 19:27
8	GTS Czech	pc-politika.cz - Články - technologie: Operátor GTS Czech spouští mobilní služby - http://t.co/IEjxvZwiLt 	http://twitter.com/szabog66	Gabriel Szabó	14.5.2013 19:23
9	GTS Czech	@GTS_Czech : Dnes jsme na tiskove konferenci predstavili konkretni konvergentni mobilni nabidku pro firmy - viz.16:54 http://t.co/3w1pL3fkPZ 	http://twitter.com/GTS_Czech	GTS Czech	14.5.2013 19:04
10	GTS Czech	Operátor GTS Czech rozšiřuje své konvergentní portfolio pro firmy, spouští mobilní služby *** http://t.co/SUAigeoLSx 	http://twitter.com/feeditcz	FeedIT.cz	14.5.2013 17:18
...

Table 2 – Result of data collection from Twitter done in 2013

1.2. Research questions for legal analysis

As shown in Table 2, we are technically able to collect data from Twitter containing the key words but also the whole message and other attributes such as the names of Twitter users or time of placing the tweet. This brings us to the question of whether such collection and later analysis of users' messages is legal.

In the next chapter we focus on legal regulation in the European Union and especially in the Czech Republic and we defined the following research questions:

1. What is the framework for legal regulation in the Czech Republic and the European Union?
2. How can we gather and store data from available data resources and still be compliant with the aforementioned legal regulation?
3. How can we work with data from social networks and from Twitter specifically?

2. Legal Analysis

2.1. What is the framework for legal regulation in the European union and the Czech republic?

To understand if and how we may gather and store information from available data sources we have to take a closer look at the legal regulation of data handling.

Not all types of Big Data get the same level of legal protection. Some types of data might imply bigger risks to people than others. It is the personal data that is most likely to cause serious harm to persons in case of their misuse⁶. Therefore personal data and its handling also receive special

⁶ Serious personal data misuse capable of causing considerable harm is, for example, identity theft, misuse of passwords or other fraudulent behaviour on the Internet.

attention from the perspective of law as we further describe. From known previous research such as (Manyika, 2011) it is apparent that all sources of Big Data may contain personal data, so we believe that the understanding of how and in what way we may in this respect handle personal data is a matter of high importance.

Nonetheless, as law usually works *ex post* as a reaction to the social and economic situation of society⁷, an adoption of the appropriate legal regulation is always a matter of long-term social development. A persisting conflict between the right to information and the right to protection of personal data is not helping either⁸.

For a long time the opinion that the right to access to information and the opinion that simple protection of a person's privacy through private measures (such as civil action⁹) is sufficient has been prevailing. However, with rapidly developing technology, increasing access to the internet and growing production of high amounts of electronic data carrying information about individuals, the public interest on protection of persons against risks connected to possible misuse of such data was growing and legislators had to take action.

A good example of such a change in attitude is the adoption of the regulation of electronic commercials and unsolicited advertising messages. With an increasing number of messages sent via email the amount of advertising messages sent this way grew as well and became obtrusive for their recipients. Again, the right to spread information got into conflict with the right to privacy and legislators decided that there was a reasonable need for protection provided by public means, i.e. in the form of state intervention, and the adopted corresponding legislation¹⁰.

Nevertheless, Big Data as a special type of high volume and variable data requires a different attitude towards its technological handling and processing to personal data. Personal data may be easily recognised from other types of data and harm caused by their misuse is also easily imaginable. On the contrary, Big Data as a highly abstract term is not so easily comprehensible. It is very hard to imagine what this kind of data is and how it can be used or misused so we should speak rather about the content of Big Data than about its defining attributes such as volume, variety or velocity as this is a more important view from a legal regulation perspective. The aforementioned may be a reason why state authorities have not taken Big Data into account when interpreting current data protection legislation and why it is not reflected there, however personal data as sensitive content of Big Data are subject to legal regulation.

2.1.1. Legal regulation in the Czech Republic

The essential regulation of the person and privacy is given in the Charter on Fundamental Rights and Basic Freedoms (Charter on Fundamental Rights and Basic Freedoms, 1993). Article 10 (3) of

⁷ For more information about the legislative process see, for example, Gerloch (2001) or simple description of the term *Právo* (Law) at Wikipedia (Wikipedia, 2014, March 31).

⁸ See, for example, judgments of the Czech Constitutional Court IV. ÚS 154/97 of 9 February 1998 and IV. ÚS 146/04 of 4 April 2005.

⁹ In the Czech Republic the protection of a natural person and their privacy is currently secured by Section 81 and the following of Act No. 89/2012 Coll., Civil Code.

¹⁰ At first the regulation of advertisement was contained in the Act No. 40/1995 Coll., on Regulation of Advertising and on amending and supplementing Act No. 468/1991 Coll., on Radio and Television Broadcasts, as amended (namely the amendment done by the Act No. 138/2002 Coll.), but currently it can be found in the Act No. 480/2004 Coll., on Information Society Services and Amending Certain Acts, as amended.

the Charter states that everyone has the right to be protected from the unauthorized gathering, public revelation, or other misuse of his/her personal data.

This means that gathering of personal data may be either authorized or unauthorized. Authorization may be granted by a law (for purposes of its application) or by a particular person, in the form of his/her consent to the gathering of his/her personal data. Authorized gathering of personal data shall nonetheless be regulated by laws. In the Czech Republic such regulation is contained in the Data Protection Act (Data Protection Act, 2000).

The Data Protection Act provides protection to all kinds of data that allow someone to identify a particular natural person, namely on the basis of a number, code or one or more factors specific to his/her physical, physiological, psychical, economic, cultural or social identity¹¹. Under this definition, a name and surname, birth identification number, address or a telephone number of a natural person fall within the scope of personal data and therefore shall receive protection by the law.

The regulation of the Data Protection Act consists of the collection, processing and preservation of personal data. It also establishes the Czech national data protection authority, the Office for Personal Data Protection, responsible for the supervision of compliance with the Data Protection Act. It imposes some special obligations to those who collect (data controller¹²) or further process (data processor¹³) personal data.

The Data Protection Act contains special rules for transferring data abroad as well¹⁴. It distinguishes between EU Member States and third countries. Whereas transfer of data within the EU is unrestricted, transfer to the third countries is restricted and may be done only with the permission of the Office for Personal Data Protection or under special conditions set by Data Protection Act¹⁵. The European Commission however recognizes some places as safe havens¹⁶ for personal data such as the USA, Canada or Switzerland where the same level of data protection as in the EU is guaranteed and where no permission from the Member State Data Protection Authority is required.

¹¹ The full definition of the term personal data is given in Section 4 (a) of the Data Protection Act (Data Protection Act, 2000). See also footnote No. 5.

¹² A data controller is defined in Section 4 (j) of the Data Protection Act (Data Protection Act, 2000). According to this Section a data controller is any entity that determines the purpose and means of personal data processing, carries out such processing and is responsible for such processing. The controller may generally empower or charge a processor to process personal data.

¹³ A data processor is defined in Section 4 (k) of the Data Protection Act (Data Protection Act, 2000). According to this Section a data processor is any entity processing personal data pursuant to the Data Protection Act, on the basis of a special Act or authorisation by a controller.

¹⁴ For details please see Section 27 of the Data Protection Act (Data Protection Act, 2000).

¹⁵ Further specification of cases where the Office for Personal Data Protection does not require permission while transferring data abroad shall be found here: <http://www.uouu.cz/prehled-pripadu-predavani-osobnich-udaju-do-zahranici-u-nichz-neni-nutne-zadat-urad-o-povoleni/ds-1649/p1=1649>.

¹⁶ The safe haven privacy principles have been developed based on the Article 25 (2) of the Data Protection Directive by the European Commission, for example in its Decision 2000/520/EC of 26 July 2000 pursuant to Directive 95/46/EC of the European Parliament and of the Council on the adequacy of the protection provided by the safe harbor privacy principles and related frequently asked questions issued by the US Department of Commerce (notified under document number C (2000) 2441. Published in Official Journal L 215, 25/08/2000 P. 0007 – 0047.

Personal data gathered without authorization are protected by stronger measures – the unauthorized use of personal data is a crime under Section 180 of the Criminal Code (Criminal Code, 2009)¹⁷.

2.1.2. Legal regulation in the European Union

The European Union became aware of the dangers hidden in unregulated data gathering much earlier and in 1995 adopted the European Data Protection Directive (Data Protection Directive, 1995)¹⁸. The Directive came into effect on October 25, 1998 and the Czech Republic has implemented it in the Data Protection Act. The protection under the Data Protection Directive is again given to personal data only but it is broadly complemented by the practice of the European Court of Justice (ECJ).

The ECJ often revises or extends the impact of the Directive and adapts data protection to progress made in technological development. Apt examples are the ECJ rulings in the case C-101/01¹⁹ *Bodil Lindqvist v Åklagarkammaren i Jönköping* where the court, among other issues, dealt with the question of whether posting personal data on a website could be construed as transferring such data to a third country or the very recently decided case C-131/12²⁰ *Google Spain SL, Google Inc. v Agencia Española de Protección de Datos (AEDP), Mario Costeja González* where the ECJ ruled that “the activity of a search engine consisting of finding information published or placed on the internet by third parties, indexing it automatically, storing it temporarily and, finally, making it available to internet users according to a particular order of preference must be classified as processing of personal data within the meaning of the Directive when that information contains personal data and the operator of the search engine must be regarded as the controller in respect of that processing”. Although the ruling in this case applied to a company that has an EU establishment only, the substance of the decision is applicable in general – the Internet as well as search engines are not excluded from the scope of the EU data protection regulation.

Despite the fact that so far the ECJ has managed to decide just on the basis of the Data Protection Directive, the need for modification of the legislation with respect to the possibilities given by the Internet becomes increasingly apparent. Therefore the European Union has started working on new regulation covering all kinds of data and extending EU data protection rules to any data controller offering goods or services irrespective of whether connected to a payment or not and monitoring behavior of data subjects residing in the EU²¹. The work on the General Data Protection Regulation

¹⁷ The full name of the act is Act No. 40/2009 Coll., Criminal Code, as amended.

¹⁸ The full name of the directive is Directive 95/46/EC of the European Parliament and of the Council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data.

¹⁹ J. Klosek (Klosek, 2004, March 1) provided a useful summary of the case: “In this case the ECJ ruled that posting individuals' names and telephone numbers on a website constitutes the processing of personal data for the purposes of the Data Protection Directive and that website operators posting personal data online are not subject to the legal regime of the Directive governing the transfer of personal data unless (a) they actually send the personal information to Internet users who did not intentionally seek access to the web pages, or (b) the server infrastructure is located in a non-EU country”.

²⁰ Full ruling of the case has not been published yet but can be found online at <http://curia.europa.eu/juris/document/document.jsf?text=&docid=152065&pageIndex=0&doclang=EN&mode=lst&dir=&occ=first&part=1&cid=761388>

²¹ See Article 3 (1) and (2) of the proposal for a regulation of the European Parliament and of the Council on the protection of individuals with regard to the processing of personal data and on the free movement of such data (General Data Protection Regulation) (General Data Protection Regulation, 2012).

has taken more than two years and at the beginning of this year the General Data Protection Regulation was passed through the European Parliament²².

The European Union seems to be aware of the meaning and importance of Big Data though as shown in the recent preliminary opinion of the European Data Protection Supervisor (EDPS) on privacy and competitiveness in the age of Big Data (European Data Protection Supervisor, 2014), the EDPS raises this issue to the attention of other EU institutions and requires further investigation and discussion of this topic.

2.2. How can we gather and store data from available data resources and still be compliant with the aforementioned legal regulation?

Basically, it can be said that as far as we gather and store data that are anonymous, we are, from the Czech legal perspective, safe. The problem however arises when we collect data that can be attributable to a particular natural person and when such data are able to give us a means of identifying the person (e.g. first name and surname of the person). Such information as personal data is subject to the Data Protection Act and therefore must be secured within the rules given by this Act.

According to the Data Protection Act an entity that would like to gather, store or preserve data that may contain personal data has to register itself and the intended aim of gathering within the Office for Personal Data Protection²³ unless such gathering, storing or preserving is done under special legislation that imposes such an obligation²⁴. With respect to a general requirement that any kind of handling with personal data may be done with consent of the recipient only, the Data Protection Act also requires for data controllers to notify the recipient of personal data about the extent and aim of data gathering and about its further handling unless the recipient already knows such information.

Personal data may be collected by a data controller (or by a data processor who is however subordinated to a data controller) for specific, explicit and legitimate purposes only and for those purposes also processed. Further processing is not forbidden but it must be done in a way compatible with the original purposes in only such a way that is perceived as being in line with the law. That means that a data controller is allowed to further process personal data for a purpose different from the original purpose for which it was gathered but such processing needs to fall within the scale compatible with the original purpose which was disclosed to the recipient during the gathering.

Distinguishing between compatible and incompatible processing of personal data is not easy and recognition of the limit where the aim of data processing crosses the line of its original purpose of gathering is a very hard task even for those who apply data protection law, especially for the Office for Personal Data Protection. Moreover, the lag behind technological development is also apparent within the Office for Personal Data Protection's practice, where the lack of appropriate tools to find and punish entities that process data inconsistently with the original purpose for which it was gathered causes apparent obliviousness.

²² See Report on the proposal for a regulation of the European Parliament and of the Council on the protection of individuals with regard to the processing of personal data and on the free movement of such data (General Data Protection Regulation) (European Parliament, 2013).

²³ See Section 16 of the Data Protection Act (Data Protection Act, 2000).

²⁴ See Section 18 of the Data Protection Act (Data Protection Act, 2000). Act No. 89/2012 Coll., Civil Code, may serve as an example of such legislation where in the part devoted to insurance, the gathering of personal data is allowed in order to provide adequate insurance services.

This leads to a situation where entities that use secondary data processing (developers using Twitter API) may not even be aware of the fact that they are, by posting tweets through their search engines and gathering data among which personal data may be found, in that respect, violating the law.

2.3. How can we work with data from social networks and from Twitter specifically?

Twitter would be considered as a data collector under the Czech and European legislation and it should therefore overlook the tools provided to programmers and developers for data processing with respect to possible leaks of personal data.

Twitter is a US-based company and has no affiliate or business establishment in the Czech Republic therefore (with regard to the ECJ rulings) it is not a subject to either Data Protection Directive or Data Protection Act. However, as the United States are considered to be a safe haven in the sense of personal data protection, it should guarantee the same level of data protection as it is guaranteed by the Czech and European legislation. That means that there should be no leakage of personal data through the tools for developers.

However the fact that Twitter makes the tools for developers available does not transfer the responsibility from developers to Twitter itself. The aim of Twitter tools is to develop other commercial applications that interconnect Twitter users and share the information officially published by its users with their followers that are known to Twitter users. The intention of Twitter tools is not personal data leakage and there are individual developers who built the program code that could lead to personal data leakage. So if we collect the data in the Czech Republic as shown in Tables 3 and 4, it is not only Twitter but also we ourselves who should feel responsible based on the aforementioned Czech and European legislation.

3. Summary

The Big Data phenomenon is a good example of how technologies advanced legal regulation that usually follows with some delay. However, there always exist some principles in legislation that should be followed to avoid decisions of jurisdiction that can call the ICT enterprises, specialists and users to responsibility, even if the specific part of ICT tools or terminology is not yet known to the legislatives.

Big Data can be produced by people, machines or digital processes or even just through data processing and manipulation. Different ways of Big Data categorization could be defined but personal data can be found in almost every data source and could identify its users just from the context or thanks to a combination of multiple data sources.

The example of Twitter and the data collection possibilities that can be utilized through the social network with available ICT tools as discussed in this paper in the context of the legislative frameworks of the EU and the Czech Republic should give guidelines to ICT professionals on how to balance between technological capabilities and legal limits. The legal limit can be given either by explicit legal regulation such as the Data Protection Act and others or just by more general legal principles and court decisions as described in the LEGAL ANALYSIS chapter.

However, we should be aware of the fact that collecting data that may in any way lead to identification of a particular person is likely to violate the law unless it is registered for such a purpose. Therefore, only completely anonymous data keeps us safe while using search engines or developing applications for commercial and advertising use.

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SOCIAL MEDIA AS A TOOL OF TOURISM DESTINATIONS' MARKETING CAMPAIGN

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Abstract

The paper describes how changes in visitors' behavior influenced the tourism destinations marketing. It defines the tourism destinations; characterizes the tourism product and communications in tourism. The paper summarizes the main characteristics of postmodern tourism with implication to destination marketing and it deals with changes in visitors' behavior affecting the utilization of Internet and social media in destination marketing in order to influence the long tail of the market. The paper also shows best practices of using social media as a tool of tourism destinations' marketing campaigns.

1. Introduction

The development of tourism is conditioned by the existence of a suitable potential, which has a strong territorial dimension and is linked to the landscape system. Tourism destination is a natural entity which has in terms of tourism unique conditions and properties different from other destinations.

When deciding to buy, the potential visitor usually puts the choice of destination in the first place, followed by activities, attractions, accommodation and catering facilities. Potential visitors have a choice of many competing destinations and are not willing thoroughly extract information and waste time by shopping. Visitors are often willing to pay more for a quality product when it is easily accessible. Information is only useful if is correct (Chroust, 2013), can be found at the place where the visitor is looking for it, in the time when the visitor needs it and in the form the visitor will understand it.

The tourism product can be characterized as inherently intangible and inconsistent; its provision and consumption are inseparable, and it cannot be stored (McDonald, Frow, & Payne, 2012). Increased levels of emotional and irrational factors; emphasis on the word of mouth advertising; increasing demands on its uniqueness; importance of its image; importance of intermediaries; increased need for quality supporting materials; increasing use of information technologies; and special emphasis on communication skills of service providers binds to the purchase of tourism product. These characteristics indicate that visitors must be informed and motivated so that they began to be interested in the destination.

Communication with visitors is done through a variety of communication techniques using different tools. Social media as a tool of tourism marketing more and more convince destinations' marketers that they are an integral part of the marketing campaigns.

2. Changes in Visitors' Behavior

The mass tourism in the 20th century was characterized by largely non-differentiated products and services dependent on scale economies and mass consumption by undifferentiated tourists who were passive observers of events (Shaw and Williams, 2004).

Economy of scope, the systemic gains, market segmentation, and customized holiday are characteristics of the new tourism. According to some authors, new tourism is an aspect of postmodern society (Harvey, 1990; Rojek, 1995) that has produced a postmodern visitor in tourism – post tourist (Feifer, 1985).

The post-modern tourism is more individual, personalized, and value based. Individualism and postmodernism have contributed to creating fragmented and diversified supply and demand of tourism.

The post-modern visitor led destinations to a profound transformation of traditional tourism products, with a focus on “emotionalization” (Mikunda, 2004) of tourism.

At the end of the 20th century Michel Maffesoli had formulated the thesis of tribalization of the societies. According to Maffesoli (1991) the today society has strong tendencies to move in the direction of extreme individualization, but at the same time there are forces in the society that push it into social re-composition. He calls these tendencies tribalization, formation of new groups in the society.

Tribes are small and unstable organizations, which are kept together by the cohesion of common emotions and passions. Members of the post-modern tribes are often very different according to their sociological background, but their value systems are similar, and this links the members together. Internet makes possible for them to interact with each other, and they are able to organize common actions. These characteristics also fit most of the social media users.

By now, visitors do not trust advertising that focuses on the advantages and special features of the destinations. They are less susceptible to marketing than a visitor in the past. One-way communication, typical marketing tool for the past years, will not stand anymore. Visitors require a personalized approach, intelligent creative interactive, two-way communication and messages including empathy. They want to participate in the creation of tourism products, and want to buy based on relationships.

Social media can inspire visitors, support them by preliminary information search, comparison of destinations, decision making, travel planning, communication, engagement, information gathering, post-sharing and recollecting travel experiences. They enable to visitor not only to acquire tourism experience but also create it in both physical and virtual area. For destinations to remain competitive, one of the main challenges is thus to understand how to use social media for creating of successful, compelling and valuable tourism experiences (Buhalis & Neuhofer, 2014).

3. Internet, Social Media and the Tourism Destination Marketing

Technologies, information and reduction of borders have created a new form of destinations and tourism businesses which can benefit from the internet, international communications and market position (Flagestad & Hope, 2000).

Internet facilitates rapid dissemination of information across markets and creates demand for new products; it is the driving force in destinations' marketing.

Eighty-five percent people in the world have internet access, and the number of social media users around the globe has risen 18% in 2013. Nearly 25 % of people in the world now use social media. Africa (129%) and Asia (76%) showed the largest percentage increase in internet usage in 2013. By 2017, the number of social media users will raise to 2.55 billion (Table 1).

Social Network Users Around the Globe					
2013 (in million)					
North America	Western Europe	Central & Eastern Europe	Latin America	Asia & Pacific	Middle East & Africa
181	174	173	216	777	209
Estimated % increase 2011 - 2017					
25	46	63	114	146	191

Table 1 Social Network Users around the Globe; Source: Social Media Today (2013)

Destinations should accept that mobile devices are visitor's most important device; The number of mobile subscriptions jumped by 173 million in 2013, and the number of active mobile subscriptions around the world now equates to roughly 93% of the world's population (SDMW, 2014).

Facebook has over 60% penetrations of all internet users globally, YouTube 44%, Google+ at around 43% and Twitter at 35%. Twitter is the most used social media in the Middle East and Africa with 33% of users, Facebook leads in Latin America with 55% and in North America with 59% users. In Asia and Pacific 26% of 204 million users prefer G+; in Europe 18% from 48 million users are registered G+. From 7.49 million users in Middle East and Africa 31% prefer YouTube. The average time spent on social media worldwide is 5.2 hours (Komarketing, 2013).

Information is a competitive advantage in the global market. During its brief history, the web transformed itself from static web tools to digital publishing tool (one-to-many communication tool) to become a fully interactive platform for collaboration (a tool to support many-to-many communication). In terms of the demands on financial resources and know-how are entry barriers for destinations via the internet relatively low.

Internet, and especially social media, fundamentally changed the tourism destination and their interaction with visitors. Social media create opportunities for new, and strengthen existing relationships, it can increase general awareness of the destination. Social media is designed as an open space for communication, allowing visitors enhanced information search, and destinations better information delivery (Pavlíček, 2013).

The international financial crisis has forced destination to reduce advertising budgets. The management must find and apply new, creative and less expensive ways of communication with

visitors. Growing popularity of social media allows destinations take advantage of their potential as a marketing tool.

Marketing orientation of the destinations on the highly specialized products for niche markets, achieving success in the context of advances in communications technologies and social media is the focus on the long tail of the internet economy (Anderson, 2004).

Tourism destinations that want to specialize in the long tail use social media as a tool to build trust and a strong sense of identity (Fukuyama, 1995, Goodman, 2005). The instruments of social media include blogs, forums, user ratings and reviews, websites, podcasts (audio and video), collaborative websites such as like Wikipedia (Gillin, 2007; Lew, 2006). Destinations' visitors trust the opinions of family and friends more than others and are more cautious to approaches of traditional mass advertising market (Constantinides & Fountain, 2008).

According the study of Nelios Company, 38% of U.S. travellers and 64% of non-U.S. travellers use social media while travelling. One third of U.S. and one fourth of non-U.S. travelers frequently inform on the blog about their experiences (Nelios, 2013).

The internet plays a growing role also in the European travel sector. A majority of Europeans (53%) who took a holiday lasting at least five days used the internet to make their arrangements.

Online content is a primary source of travel information in Europe (Figure 1). It drives significant business, supporting 49% of all tourist arrivals in Europe, including search and reservation (Eurobarometer, 2012). The content on social media sites is generated by users, and hence their opinions are more credible to potential visitors. Ninety-two percent of visitors' trust word-of-mouth and recommendation from friends and family; online visitor reviews are the second most trusted form of advertising.

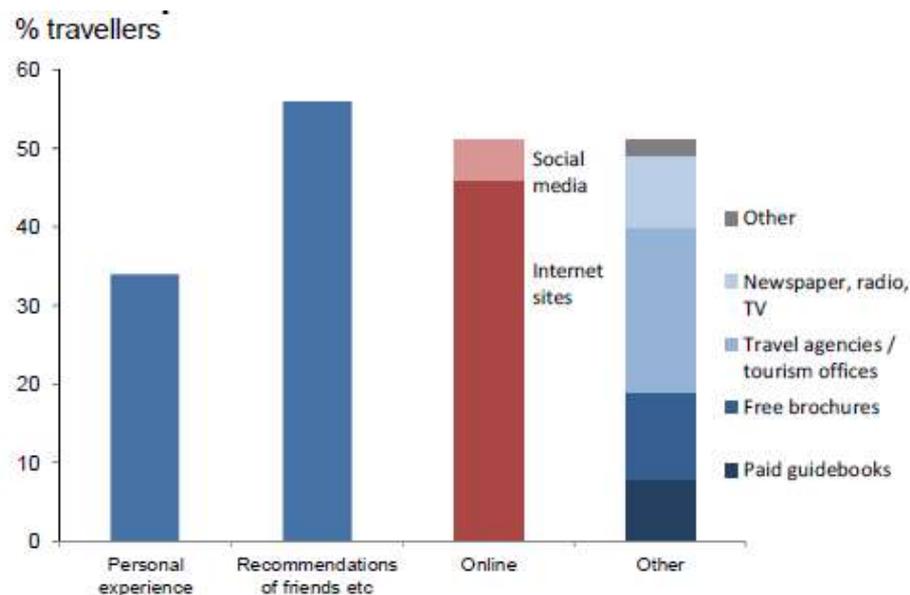


Figure 1 Most Important Sources of Travel Information; Source: Eurobarometer (2012)

The potential visitors look at an average of 3.6 online and 1.7 offline sources of information before deciding on the destination. They look at 3.2 brand generated, and 2.1 customer generated sources at this stage. When choosing the product, the potential visitor looks at 1.4 offline and 3.2 online information sources; 2.7 brand generated and 1.9 customer-generated information source at this stage. To be able to decide where to buy the product, the potential visitor looks at an average at 1.3

offline and 2.7 online information sources, and 2.4 brand generated and 1.6 customer-generated information sources (TNS, 2013).

According a survey *The State of the New Media 2012* (Mitchell & Rosenstiel, 2013), Facebook is a platform where mostly family and friends share information, on Twitter, people tend to get information from a broader mix of recommenders.

Utilization of social media in order to influence the long tail of the market is possible, for example, (Constantinides & Fountain, 2008) by listening to the market and joining the social networks, by creating user communities, or by creating business alliance.

Understanding multicultural differences is the first step for any destination trying truly to resonate with highly differentiated visitors. English is the number one language used on the internet (536.6 millions of user), followed by Chinese (444.9 millions of users), Spanish (153.3 millions of users), Japanese (99.1 millions of users), and Portuguese (82.5 millions of users). Diversity in the world of social media is an asset. Destinations must take into account the multicultural differences of their visitors and analyze what kinds of content are they consuming and sharing, why, where and how. Destinations' decision on social media must be based on knowledge what mediums and networks do their visitors use and trust.

4. Best Practices of Using Social Media as a Tool of Tourism Destinations' Internet Marketing Campaigns

Fifty-two percent of Facebook users said their friend's photos inspired their holiday plans. Forty percent of visitors post restaurant reviews on social media, 46% post hotel reviews. Post-vacation photos are posted by 76% of visitors and 55% of all Facebook users like pages specific to vacations. This information was not hidden to destinations that use social media as a tool of their marketing campaign.

The Tourism Queensland's (2009) campaign for the "*Best Job in the World*" (Picture 1) received an unprecedented amount of international publicity after the tourism board offered the winner A\$ 150,000 and a chance to be the "caretaker" of a paradisiacal island in the Great Barrier Reef. 34,000 applicants from 200 countries respond to an offer. The A\$ one million spent on the campaign, generated about A\$ 70 million in global publicity in the first month alone and A\$ 200 million overall. The advertising agency took three top awards that year for the campaign, and the BBC documentary about it was the most viewed program in the UK the week it aired.

Tourism Australia (2013) launched an A\$ four million campaign "*Six Best Jobs in the World*" (Picture 2) targeting the international youth market in 2013. The campaign introduced a global competition involving six of Australia's State and Territory Tourism Organisations - each offering their own unique "best job" as a winning prize. The successful applicant for each job will be paid a six-month salary of up to A\$ 100,000 including agreed living expenses. More than half a million expressions of interest have been submitted by nearly 300,000 individuals from 196 countries and more than 40,000 videos have been uploaded. The competition generated more than 1,000 media articles so far from around the world, and national TV news in more than a dozen countries. International television production companies had approached Tourism Australia with documentary proposals. Tourism Australia's 'australianworkingholiday' Facebook page get 4.1million plus fans. The working holidaymaker page has gained 100,000 new fans in a week, growing from 150,000 to 250,000.



Pic. 1 www.bestjob.australia.com



Pic. 2 www.bestjobs.australia.com

The e-campaign "*The Ultimate Thailand Explorers*" (Picture 3) was launched in 2009 (Citrinot, 2009). The competition was giving to five teams the opportunity to get a free six-day holiday and explore one of five of the Thailand's top destinations. The teams shared their experience on the web by uploading videos, pictures, stories on various community websites such as Facebook, Twitter or Youtube or through their own blog. Social media viewers could vote for the team providing the best experience of Thailand. The campaign aimed to bring back Thailand as a favorite destination for travelers. Applicants from 59 countries registered to participate in the competition. After only eight weeks, 248,000 people have registered, and almost 640,000 videos have been watched. The contest generated 576,000 articles on social media and 25 million views were recorded.

VisitScotland (2006) implemented in 2006 a successful e-campaign "*Date a Hot Scot*" (Picture 4), which called for single women around the world to vote for muscular Scot from selected websites www.dateahotscot.com. The photographs of twenty „hot“ Scots have been published on the websites, from which women had to choose "the hottest Scotsman." The winner was able to enjoy three nights in Edinburgh, including two meetings with "hot" Scots. Finally, more than 20,000 women voted for their favorite "Hot Scot."



Pic. 3 www.ultimateexplorers.com



Pic. 4 www.dateahotscot.com

The e-campaign "*All Things Tuscany*" launched by destination Tuscany aimed to attract visitors between 20-49 years. In the first phase, ten people who love Tuscany were selected and they had to report on the area for ten months. They created a blog; website; Twitter and Facebook fan page, Flickr page, YouTube channel, iPhone apps with geolocation and augmented reality. In the second phase articles, photos, news, and videos were published through all these channels. In the third phase competition, and quizzes were created, they managed social interaction with people and dramatically increased the buzz around Tuscany, awareness of the destination and preference. The

awareness of the destination has increased by 11% in the target market, and visits in Tuscany have increased by 7% (InToscana, 2013).

The Spanish Tourism Board launched the “*I need Spain*” campaign with the aim to make people love Spain and give travelers reasons why they need Spain. Spain in this campaign focuses on the emotions and social media storytelling. The campaign is 100% user generated, amassing thousands of stories, more than 18.500 shared pictures and more than 190.000 people who declared they "need" Spain (Caballero, 2013).



Pic. 5 www.allthingstuscan.com



Pic. 6 www.tourspain.es

Currently other successful social media campaigns are launched, e.g. in Bratislava (Slovakia), and Thailand. “*Discover Bratislava Region*” (BSK, 2014) which combines social media and geocaching – visitors (main focus on families) should find the hidden 300 treasures in the region of Slovakia.

The campaign “*Thailand Extreme Makeover*” was launched by Tourism Authority of Thailand to promote the destination as a centre of medical tourism. Tourists from all over the world are invited to join a “reality-type” contest in which the selected contestants undergo makeovers including various cosmetic surgery procedures (TAT, 2014).

5. Conclusions

Interactive marketing communication is based on caring for the individual visitor and building a relationship with him/her. Communication through a variety of communication techniques using social media as a marketing tool allows destinations take advantage of their potential.

Based on the presented best practices it can be stated that to remain competitive destinations should use social media. In preparation for the social media campaign, the destination should focus on content, creativity and performance. The most frequently claimed objectives of the social media campaigns can be summed up as follows: (1) increasing awareness of the destination (Italy, Australia, Spain, Thailand, Scotland); (2) global publicity (Australia, Scotland); (3) strengthening the destination image as a favorite destination (Thailand, Spain); (4) targeting specific market (Australia, Italy, Thailand, Slovakia).

In most of the campaign presented some similarities can be found: (1) the campaign takes the form of a competition for applicants (Scotland, Australia, Thailand, Italy); (2) to register, the applicants are asked to send their videos to the contest web page or generate videos during the competition (Australia, Thailand, Italy); (3) the prize is a dream vacation/job/remake in a process known from the television reality show (Australia, Thailand, Scotland); (4) the winner will share his/her experiences during his/her stay and/or after the return home on social media, blogs, etc. and will act

as an ambassador for the destination; (5) using emotions to promote destinations (Scotland, Australia, Thailand, Spain, Italy).

Although launching a successful user-generated content campaign in tourism seems easy, in fact, it is a complicated task. It can be recommended that the destinations wishing to launch a social media campaign allocate enough resources for planning, production and promotion, and they promote the campaign on-line and off-line, using advertising and strong public relations. Implementation of innovative creativity, a novel approach that uses a different tone of voice and in-depth understanding of social media to create a web buzz is the next condition for conducting a successful campaign. Offering useful information on the destination in all stages of visitor's decision making process (before, during and after visit), monitoring and managing online conversations about the destination, creating a visitor relationship and support services together with identifying and connecting with destination's ambassadors worldwide are the preconditions for visitor loyalty. Continuous monitoring and assessing of all components of the campaign enable destinations to implement corrections if needed.

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SOCIAL MEDIA IN CUSTOMER RELATIONSHIP MANAGEMENT

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CRM, Social CRM, Social Media, Marketing, Customer, Company

Abstract

The paper is focused on the use of social media in customer relationship management applications. In the introductory section describes the basic terms and relationships in CRM and social CRM. They mentioned a significant change in the concept of social CRM. The second part is characterized by social media and their application in the CRM architecture. The third part of the text presents results of research focused on the use of CRM and social CRM in enterprises in the Czech Republic.

1. Introduction

With the development of the Internet began to apply new approaches to developing its content. End users started with the coming of web.2.0 tools (such as forums, blogs, shared media, etc.) to create the web content. Users began to use an Internet content not only as individuals, but also cooperatively. The phenomenon of social media has emerged. It is the logical outcome of the possibilities offered by social media.

Social networks are one of the fastest information sources. Almost everyone is currently connected to some of the social networks. According Brynley-Jones (2012), over five years, it is expected that sales through social media will reach \$ 30 billion. 15% of people aged 16-24 prefer to interact with customer support by using social media. Well-designed implementations of social applications aim to make it easier for people to get their work done. According to Henschen was in 2012 over 845 million Facebook users, 152 million of them were U.S. residents, which is almost one half of its population. (Henschen, 2012). It is therefore not surprising that companies focused on the area of B2C (Business-to-Customer) tried to exploit this potential, which provides them with social networks. Companies that communicate with a large number of customers (such as banks, insurance companies, shopping centers, telecommunications, etc.) use these social media to support the management of internal and external processes. Social media have opened for business the space for new forms of communication and collaboration with customers, new approaches to their clients and finally, the necessity to monitor data outside the enterprise.

And so development came to the use of social media in applications of information systems, particularly in the area of customer relationship management. A traditional CRM solution was

supplemented not only by new communication channels, but also by a completely new approach to solving customer-oriented processes in the company, which led to a totally sharp change in a business strategy and a corporate culture. Originally, this new approach was to be called by the term CRM 2.0. Currently these solutions are called social CRM or SCR. As the acronym SCR is also used the different meaning as Supply Chain Risk Management, the text will continue to use the term Social CRM.

2. Understanding CRM and social CRM

The role of the social CRM is often mentioned in information sources from different perspectives. To better understand the difference between CRM and social CRM solution, it is necessary to mention the main characteristics and definitions of these two expressions. By Greenberg (2009b) CRM is "a philosophy and a business strategy, supported by a system and a technology, designed to improve human interactions in a business environment." He mentioned also the fact that CRM is continuing business initiative that demands a dynamic, ongoing strategy of customer engagement. CRM can be perceived as a cross-functional strategic approach concerned with creating improved shareholder value through the development of appropriate relationships with key customers and customer segments. (Payne & Frow, 2013). Dohnal (2002, p.18) draws attention to the fact that "CRM includes staff, business processes and technology, IS/ICT to maximize customer loyalty and consequently the profitability of the company's part of the corporate strategy and as such becomes part of the corporate culture."

CRM is a methodology primarily transformed into corporate strategy, which is applied to a set of "customer" process, whose goal is to make profitable relationship with the customer. (Tomášková & Vass, 2006). Role of information technology in the target CRM concept is defined primarily as a support and automation of the whole CRM process.

CRM process can be spread into several activities. Operational CRM is used to automate customer-oriented processes. This applies, for example, sales automation, marketing and customer service. Analytical CRM involves the collection, storage, organization, analysis, representation and use of data that was obtained operational activities of the company. Cooperation CRM includes use of services and infrastructure to allow interact between the company itself and all available distribution channels. This part should ensure interaction between customers and companies. (Payne, 2006, p 23). This process view also reflects a methodological approach the concept of CRM. CRM process starts with a knowledge of customers (data warehouse), through detailed analysis of their needs and behavioral patterns transforms data into information (business intelligence & analytical CRM) and subsequently allows the use of such information for efficient and personalized interactions with customers (operational CRM) all distribution and communication channels (collaborative CRM). (Tomášková & Vass, 2006).

Summarizing the above mentioned definitions of CRM, it can be stated that the main goal of CRM is to create a better relationship with the customer using the Internet and the resulting new ways of interacting with the customer. The aim is also to improve communication with the customer and in particular its coordination within the company.

Social CRM is also interpreted from different perspectives. The concept of social CRM by Fauscette (2009) presents tools and processes that encourage better, more effective customer interaction and leverage the collective intelligence of the broader customer community with the intended result of increasing intimacy between an organization and its prospects and customers. *"This is done in a way that empowers the customer, makes the interaction more of a Web 2.0*

experience and allows the customer to interact when, how and where they choose. The tools themselves are user driven, collaborative and social in design, promote interaction and focus on user driven innovation. They may include linkages to public social networking environments as well as private company owned systems."

Social CRM adds a whole new dimension to the traditional view of customer relationship management. The focus is absolutely on people and not technology. It's about joining the ongoing conversations customers and perspectives are already engaged in — not trying to control them. It's about using any tool available that will allow to meaningfully engage with more people like them. (Leary, 2008). Social CRM is a philosophy and a business strategy, supported by a technology platform, business rules, workflow, processes & social characteristics, designed to engage the customer in a collaborative active conversation (for example: Greenberg, 2009; Magierski, 2008).

To summarize the previous definitions of social CRM, then we come to the fact that social CRM provides new impulses for corporate culture, internal processes and employee behavior within the company. Social media and resources affect management processes and customer relationships. Social media tools and Web.2.0 bring more activity to the company from customers, which must be reflected by the internal processes of the organization. While CRM focuses mainly on maintaining the loyalty of current clients, a social CRM also try to reach new potential customers. What are the major differences between CRM and SCRM?

As already mentioned, changes apply to the whole concept of CRM - from a strategic point of view, process, commercial, technological, and organizational application and is reflected in the process of operational, analytical and collaborative CRM.

Greenberg (2007) defines these essential characteristics of social CRM:

- Customer strategy is a business strategy,
- The relationship between the organization and the customer is a collaboration,
- Business is targeted at environments and experiences that attract customers,
- Marketing services is focused on building relationships with customers, through discussions and monitoring conversations,
- Technologies are focused on the social aspects of customer interaction.

CRM helps companies build a relationship with the customer that is trying to shape his views, he tries to offer products and services that will satisfy him and for example in the form of targeted marketing actions or campaigns. It uses the tools primarily supporting sales, marketing and customer service.

Unlike CRM, social CRM understands the customer as a partner who will help him to create and offer better services and products. Customers expect that companies will respond almost immediately and according to the preferences of the customer. Thanks to social networks, customers share their experiences with millions of other people through the Internet. The customer is involved throughout the life cycle of a product or service - from its development to its distribution. Social CRM is a corporate strategy than just set of tools. Engage customers in business process and create a relationship with him based on two-way conversations with customers.

3. Social Media and their Usage in Enterprise

In the context of the social CRM they are often mentioned only social networks. Social CRM uses all types of media that support the customer communication in a community. Social media also include discussion forums, blogs and microblogs, message boxes, shared multimedia and websites with content generated by users.

It is important to mention basic features of social media strongly influence their use in social CRM: topicality, public editing, social validation and content sharing. In particular, the possibility of mass edits (eg. used in blog posts or reviews in the forums), contributes to the rapid distribution of information, news. This can be an advantage and a disadvantage. An uncaught wrong customer's thinking about the product and the lack of a quick company's response to that information may lead to a fatal decline of product sales. The same applies to other feature - social validation. Content sharing is a common form of distribution of innovations. Announcement of a new product or a video presentation with the new product features are usually distributed via social networks or shared media (eg. Flickr), where can be shared with a huge number of potential customers.

Architecture of the CRM and social CRM can be addressed differently with regard to the specific capabilities of the organization. Some models are based on the priority strategic view of the business of the company. An example of such an approach is the model by Buchanan (2010) shown in Fig. 1.

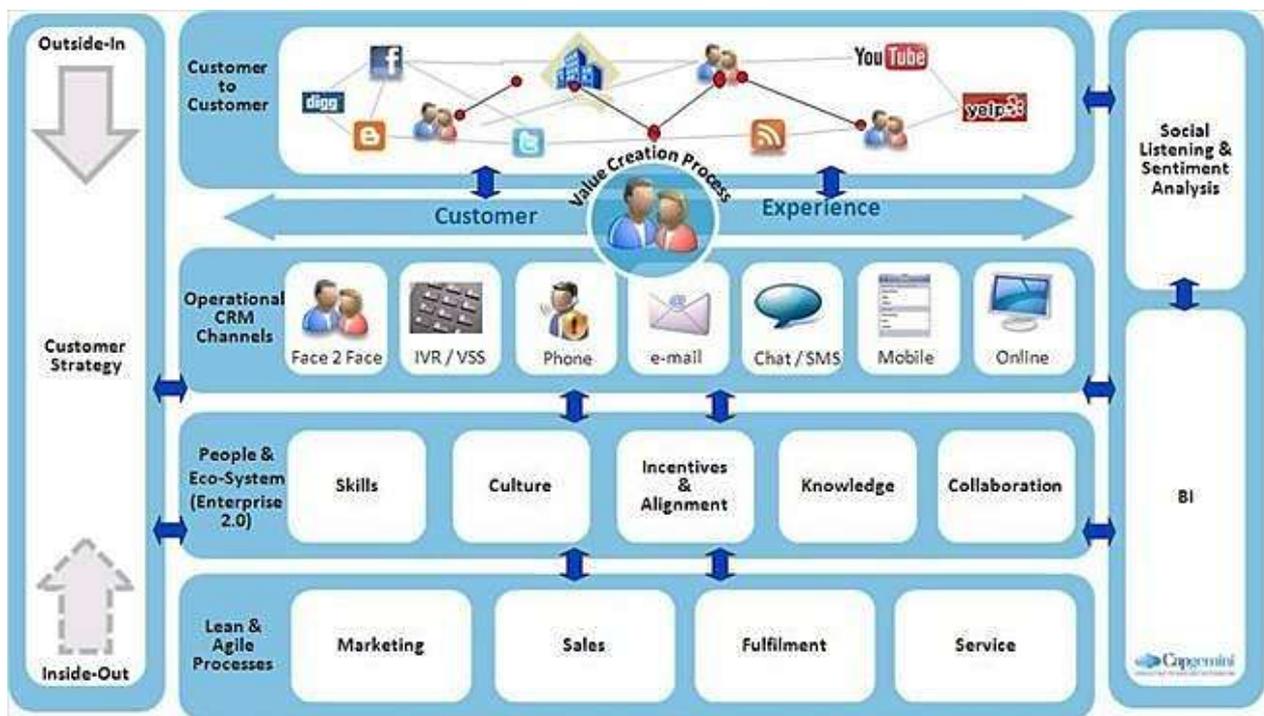


Figure 1 Architecture of Social CRM (Source: Buchanan, 2010)

The first layer, called *Strategic Strategy*, is the basic layer in the model concept, supported by people, processes and technology. There are connected other layers. The *Customer to Customer* layer mediates links between organizations, social media, customers, and between customers themselves. In this layer, customers read reviews, contribute in discussion forums, share media, etc. This layer has a social character. Layer *Operational CRM* supports traditional operating Channels CRM with maintaining internal channels of communication in the company. The layer *People & Ecosystem* Buchanan considers the crucial of the whole model and explains it as follows: "While

your competition is focusing on tools, you should do something else and focus on people. You probably have a greater impact on customers than any tool that you can buy." This idea reflects the nature of social CRM. Social CRM is a way of thinking and a change of strategy than just a deployment and use of social CRM tools. The *Lean & Agile Processes* layer covers all business processes such as marketing, sales support, customer services, etc., ie. customer-oriented processes, both internal and external.

An entirely different approach is a model presented by Michael Fasceutte (2011) that solves the layer in relation to the kind of communication and supported services. This model is more technologically oriented in relation to the Buchanan's model.

Another solution offers the model by Esteban Kolsky containing two layers of social business rules. (Kolsky, 2009). One layer defines business rules that society sets for interacting with customers and for controlling communication with other stakeholders. The second layer is used to set the rules for the channels. This layer determines how channels will interact and perform and what will happen with the obtained data. Feedback management is by Kolsky the most important component of social CRM. This component covers interactions with customers and generally all communities. Other components are identical to the CRM solution.

In conclusion, the construction of social CRM tools is always a reflection of the corporate culture and strategy. Just deployment of tools for social media is clearly not sufficient for a successful social CRM solutions. All components of an information system must work together. Data coming into the company from customers, as well as data monitored outside the company, must be further processed in the required quality and time. Otherwise social CRM processes will not bring a needed added value.

4. Companies in the Czech Republic and their Awareness of social CRM

In the above text there were issues outlined CRM and social CRM - basic concepts, relationships and goals of solving this area. How are these concepts and issues of CRM solutions used in organizations in the Czech Republic? One part of our research in the field of social CRM has been conducting the survey, which was to map the situation in Czech enterprises. We were interested whether enterprises implemented CRM applications and whether they use social media in the CRM.

The survey was approached by representatives of businesses in the country. Questionnaires were distributed both in electronic form and on paper. Based on the questionnaire, we would like to confirm or refute whether firms use some social media, whether there is a link between the business area and implementation CRM or a social CRM. sure all employees know what is CRM, respectively. SCRM and that is most often used by medium-sized and large companies. On this basis, the result following three hypotheses:

H1: At least half of the surveyed companies in their business uses some social medium.

H2: There is a link between the business areas and whether CRM or SCRM use.

H3: The use of SCRM in companies depends on the size of the company.

Survey was carried out in March 2014, and 91 questionnaires has been processed.

According to a company size there was a balanced representation of companies: 23% of micro-firms (under 10 employees), 18% of small companies (under 200 employees), 27% of medium-sized enterprises (under 500 employees) and 32% of large companies (over 500 employees).

In the questionnaire, respondents were asked which type of CRM use - operational, analytical and collaborative. Responses to this question were fairly evenly balanced, the most companies use a cooperative CRM (38%). 31% of surveyed companies use an operational and an analytical CRM.

The most frequently reported purpose use social CRM belonged use as a trade promotion (43%) and marketing purposes (37%) and its use as a distribution channel (20%) when social media can be used to offer and subsequent sale of products or services.

The question of whether firms are using social media, the answer was balanced: 55% of companies use social media, 45% of businesses does not use social media. Further the survey shows that the most commonly used social media are social networks (see Figure 2):

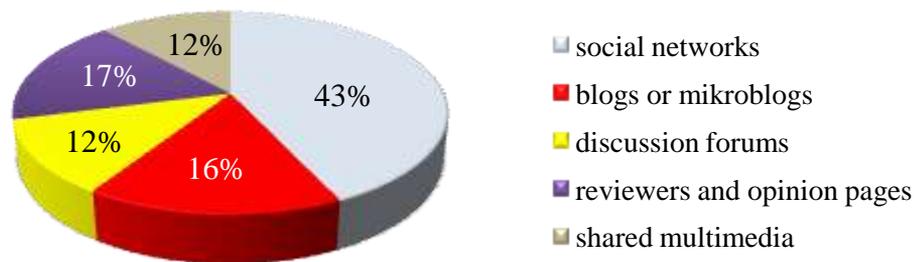


Figure 2 Social media types used in companies (Source: own survey)

In addition, we were interested whether companies use social CRM and if not, whether they consider its solution in information system of the company (see Fig. 3):

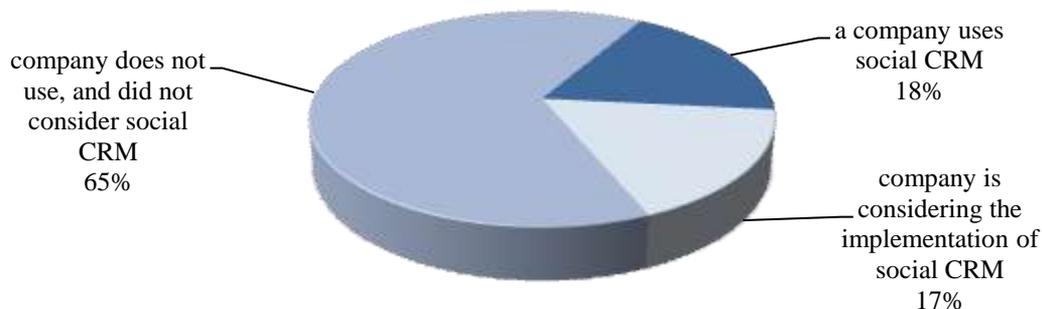


Figure 3 Use social CRM in enterprises (Source: own survey)

Figure 3 is confirmed by the fact that the vast majority of companies (82%) still do not use social CRM and the vast majority of them (65%) does not consider its implementation. The survey shows that the focus of companies using social CRM is in area of information technology, telecommunications, services and trade. It was important to find out why companies do not use or consider implementation of a social CRM.

The most common reason for not using social CRM in companies was presented mainly due to insufficient interest on the part of management (52%), the nature of the companies (17%), a lack of knowledge about SCRm in companies and a lack of knowledge about its possible benefits (17%). Among other reasons for non-use was the fact that companies doing business in the field of B2B, therefore these tools have a little meaning from their point of interest. Only one respondent stated as the reason for not using social CRM possibility of challenging solutions integration social media and CRM tools in information system.

The survey also confirmed the hypothesis that social CRM, like a traditional CRM, is mainly used in large enterprises. 50% of companies that use a social CRM are large companies (see Fig 4):

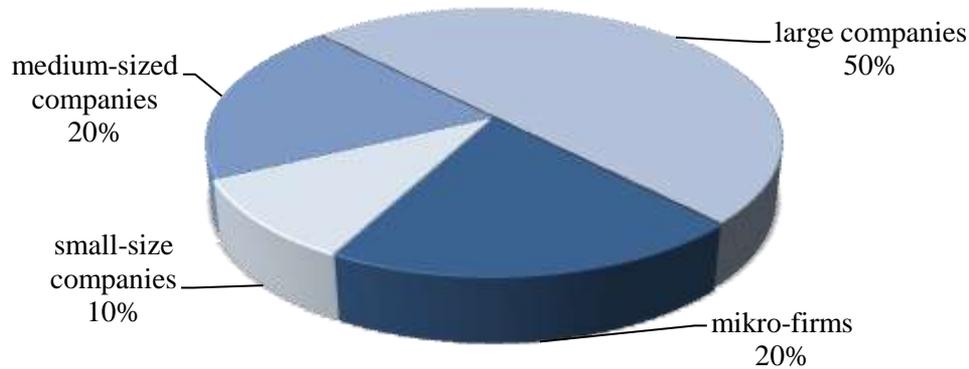


Figure 4 Usage of social CRM by a company size (Source: own survey)

5. Conclusion

Based on the survey results were then evaluated the hypothesis set with the following statement:

H1: At least half of the surveyed companies in your business uses any social media. **CONFIRMED**

H2: There is a link between the business areas and whether CRM or Social CRM use. **UNCONFIRMED**

H3: The use of SCRM in companies depends on the size of the company. **CONFIRMED**

The survey shows that 55% of companies use of social media in their business. The most frequently reported are mainly social media networks, review and opinion pages, and blogs. For most companies, this means managing these social media by its own means as evidenced by the fact that SCRM tools used by only 18% of firms.

The paper summarized aspects of using of social media in CRM applications. The paper pointed out that CRM and social CRM is not just the use of social networks in the enterprise. It is a completely new approach to solving customer-oriented processes in the company. Customer strategy becomes a business strategy. Social CRM is not only the management of social networking, but strong integration of social media, their monitoring and management of other social media in the context in connection with business processes.

Acknowledgement

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Social Media in Customer Relationship Management

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ANALYZING USER ACTIVITY BASED ON RFM MODELS COMPLEMENTED WITH WEBSITE VISITS AND SOCIAL NETWORK INTERACTIONS

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Keywords

RFM Analysis, Customer Segmentation, Social Media

Abstract

Analyzing customer's behavior based on Recency-Frequency-Monetary value (RFM) modelling serves well both for customer segmentation purposes and for its predictive ability to hit customers with high probability of repurchase. This paper presents an innovative approach to extend data sources for RFM modelling apart from purchase data only to using website visits and social network interactions as factors of valuable customer activities that help to leverage the predictive power of a model. A comparison of transactional and enhanced model with visit-level data was conducted in order to demonstrate useful additional information. The paper outlines and discusses an incorporation of data sources about individual customer interactions on Facebook and Twitter into RFM analysis.

1. Introduction

(Birant, 2011) followed on work by (Bult & Wansbeek, 1995) and described RFM Analysis as a marketing technique used for analyzing customer behavior such as how recently a customer has purchased (recency), how often the customer purchases (frequency), and how much the customer spends (monetary). It is a useful method to improve customer segmentation by dividing customers into various groups for future personalization services and to identify customers who are more likely to respond to promotions.

(Miglautsch, 2000) points out that the purpose of RFM is to provide a simple framework for quantifying customer behavior and that RFM is a superior method for selecting customers. The traditional approach to RFM Analysis as described by (Bult & Wansbeek, 1995) and with practical implementations in R software by (Ohri, 2012) and (Han, 2013) consists of dividing data into intervals of five breaks for every RFM component. This simplicity of quintiles is useful for visualization and practical application. Miglautsch also offers a form of weighting of R, F and M scores together.

Very little literature has explored different sources of customer interactions that can be valuable for RFM analysis. (Li, Lin, & Lai, 2010) combine opinion-mining techniques and adaptive RFM

models to develop a framework to evaluate the influential capability of online reviewers and recommend appropriate ones to support word-of-mouth marketing. This paper aims to use similar approach as (Aggelis & Christodoulakis, 2005) that used RFM scoring for active e-banking users and also continues the previous work of (Novotny & Jasek, 2013) where indirect links to future behavioral measures of Customer Lifetime Value were proposed, with great focus on website interactions. Linking and integrating social media to company website is an important issue. (Smutny, Reznicek, Kalina, & Galba, 2013) state that only by using a proactive approach to identify user interaction, company will be able to reallocate its resources adequately and effectively manage marketing not only in the internet environment. This gives great motivation of integrating data from all possible sources of customer interactions together.

This paper compares two quantitative models of RFM analysis using transactional and visit-level data from the website. The author expects that visit data can update the information whether customer is “alive” in terms of engagement with company. As it proves that enhancement of transactional data is useful and adds value to the RFM analysis, several practical steps towards individual customer data from social networks Facebook and Twitter are described and analyzed in more detail.

1.1. Methodology

The paper used anonymized quantitative purchase and website visits data from a Czech online retailer obtained with permission. More information about the dataset is described in part 1.2. The dataset was divided into two parts of transactional data only and enhanced data with website visits tied to an individual customer. On each of this subsets a quasibinomial logistic regression model was constructed with the goal of estimating probability of purchasing given RFM characteristics of a customer. The model family was selected accordingly to (Han, 2013). In order to build the models, these subsets were divided into training and validation parts of same length. Proposed cut-off date for this 50/50 model validation is December 15, 2012.

As RFM repurchase probability presents an obstacle in hard to visualize 4-dimensional dataset, this paper followed an approach by (Han, 2013) that plots relationships between Repurchase Rate and each RFM component individually. Three submodels of same family (quasibinomial logit) were used to support such relationship visualization of Buy ~ Recency, Buy ~ Frequency, and Buy ~ Monetary value. Apart from that, two quasibinomial logit models of Buy ~ Recency + Frequency + Monetary value were built and compared.

1.2. Sample dataset description

For the purpose of this paper real-world data from a Czech online retailer was used. The business sells fashion primarily for mid-aged women and regularly twice a year changes a large portion of product catalogue in order to match summer and winter season. According to the customer base classification done by (Fader & Hardie, 2009, p. 63), this dataset has non-contractual relationship with customers and continuous opportunities for transactions.

This historical log contained 77 289 logged-in visits to the e-commerce website and 33 613 online purchases made by 29 589 different customers from the time period of September 1, 2011 to March 31, 2014 (134 weeks in total). The data source was Google Analytics. The data was anonymized and none of attributes could be used to link pro personally identifiable information.

Table 1 exposes an example of this dataset for one specific customer. Customers are often visiting the website without intention to purchase and it can be seen that purchases vary with quantity and amount of goods sold.

Date	Client ID	Visits	Transactions	Amount (CZK)	Quantity
2011-11-02	22862	1	0	0	0
2011-11-17	22862	1	2	1 540	10
2011-11-26	22862	1	1	434	4
2011-11-30	22862	1	0	0	0
2012-05-05	22862	1	1	1 120	5

Table 1. Data for online visits and purchases. Source: Sample dataset, filtered for a specific customer.

Unfortunately, the sample dataset does not include data from social networks. There were two reasons of not obtaining such data: 1) the company itself doesn't operate any Facebook page or Twitter profile, 2) due to the demographical characteristics of the target group only a tiny fraction of customers are supposed to actively use social networks.

2. Comparing RFM models

This chapter describes two quasibinomial logit models based on RFM metrics. Formal model comparison is done later in part 2.3.

2.1. RFM with transactional data

The work of (Han, 2013) includes implementation of RFM analysis in R software with all necessary calculations to calculate recency from last purchase date until now and to sum up customer frequency of interactions and her profit or revenue in past. Although scatter plot seems to be a good way to shed some light on the distribution of the data, for more explanative reasons also individual models were constructed.

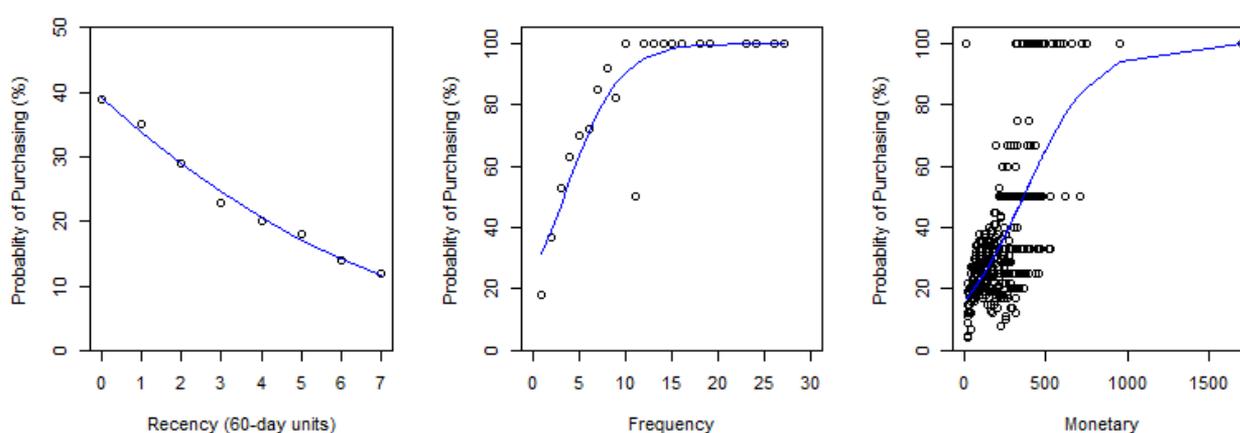


Figure 1. Visual interpretation of RFM components for transactional data. Each figure plots actual data and quasibinomial logit model for $\text{Buy} \sim \text{Recency}$, Frequency , Monetary . Source: Author, based on sample dataset, computed with R software.

Figure 1 shows a scatter plot of RFM components and its probability of repurchasing and quasibinomial logit models for every RFM component. Details of coefficients and their significance are listed in Table 2. Figure 1 clearly shows strong relationship of Recency to Probability of repurchasing with natural interpretation of customers recently active within last three months to

have twice as high probability of purchasing as customers with last order a year ago. This negative relationship would also be expected in a model with visit-level data described later in part 2.2. The role of Frequency is evident: customers with high number of transactions (with frequency higher than 10 transactions) seem to be very loyal as their probability of repurchasing is greater than 80 %. Yet the company should be worried about new acquired customers with only 18 % probability of repurchasing.

	Recency model		Frequency model		Monetary value model	
Coefficients	Estimate	Standard Error	Estimate	Standard Error	Estimate	Standard Error
Intercept	-0.4439	0.0303 ***	-1.1235	0.5180 __*	-1.6716	0.0851 ***
Recency	-0.2263	0.0083 ***	X	X	X	X
Frequency	X	X	0.3368	0.0772 ***	X	X
Monetary	X	X	X	X	0.0046	0.0003 ***

Table 2. Estimated coefficients of quasibinomial logit models for Buy ~ Recency, Frequency, Monetary.

Coefficient estimates are significant at the 0.1% level (marked as *) and 5% level (marked as __*). Source: Author, based on sample dataset with transactional data, computed with R software.**

2.2. RFM Model enhanced with visit-level data

As an additional step, individual customer-level website visit data can be added, as seen within Table 1. Customer identification is achievable by current logged-in session information or by setting up long-term browser cookie that identifies future visits of a customer.

One can expect that visit data can update the information whether customer is “alive” in terms of engagement with company. The model parameters are shown in Table 3. Changes between such data (shown on Figure 1 and Figure 2) are better explained in part 2.3 of this paper.

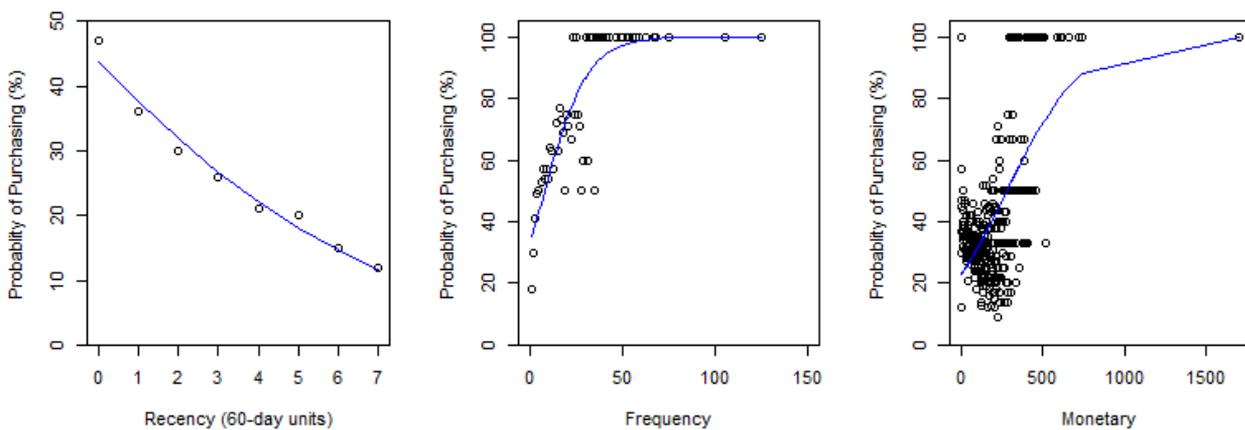


Figure 2. Visual interpretation of RFM components for visit-level data. Each figure plots actual data and quasibinomial logit model for Buy ~ Recency, Frequency, Monetary. Source: Author, based on sample dataset, computed with R software.

	Recency model		Frequency model		Monetary value model	
Coefficients	Estimate	Standard Error	Estimate	Standard Error	Estimate	Standard Error
Intercept	-0.2510	0.0588 _**	-0.7026	0.2392 _**	-1.2228	0.0777 ***
Recency	-0.2514	0.0162 ***	X	X	X	X
Frequency	X	X	0.0861	0.0115 ***	X	X
Monetary	X	X	X	X	0.0043	0.0003 ***

Table 3. Estimated coefficients of quasibinomial logit models for Buy ~ Recency, Frequency, Monetary.

Coefficient estimates are significant at the 0.1% level (marked as ***) and 1% level (marked as _**). Source: Author, based on sample dataset with visit-level data, computed with R software.

2.3. Model Comparison

Coefficients and other statistics of studied models have to be discussed. Table 4 shows important metrics for each model and Figure 3 clearly indicates the difference between models.

	Transactional model		Visit-level model	
Coefficient	Estimate	Standard Error	Estimate	Standard Error
Intercept	-1.6768	0.0647 ***	-0.7066	0.0537 ***
Recency	-0.1500	0.0107 ***	-0.2148	0.0100 ***
Frequency	0.5915	0.0247 ***	0.1719	0.0091 ***
Monetary	0.0009	0.0003 ***	0.0011	0.0003 ***

Table 4. Comparison of coefficients and other statistics for two studied models. Quasibinomial logit model for Buy ~ Recency + Frequency + Monetary. All coefficient estimates are significant at the 0.1% level (marked as *). Source: Author, based on sample dataset, computed with R software.**

Negative values for Recency were as expected in part 2.1. Very interesting difference can be seen in terms of Frequency: visit-level model weakens the marginal importance of this coefficient by 70%.

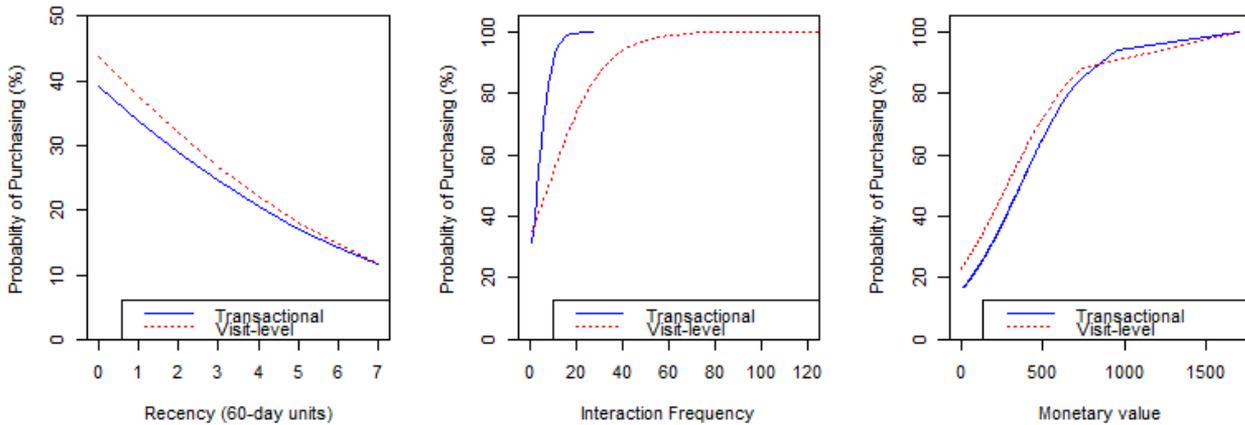


Figure 3. Visual comparison of RFM probabilities when using transactional and visit-level models based on three quasibinomial logit models for Buy ~ Recency, Frequency, Monetary. Source: Author, based on sample dataset, computed with R software.

The role of Monetary value is very doubtful in overall result: the estimate 0.0011 would mean that high value purchase of 1700 would add just 1.87% into resulting probability of repurchase.

3. Towards Enhancing RFM Models with Social Network Data

Similarly to the shift from transactional data to incorporating “internal” data from company’s owned channels, the focus will now be placed into adding “external” channels data as well. These include customer activities on social networks which may or may not be managed by a company. Also, demographic, interest and personal data about specific customers could be retrieved as well. According to (Pavlicek & Pechar, 2012), such personal data is easily available by careless social media users.

In the scope of this paper the author outlines possible ways to enhance RFM analysis with interaction data from two largely known social networks Facebook and Twitter. Such data could be used in a similar way as data from website visits.

3.1. Facebook

In case of Facebook the interest is on customer interactions for specific content a brand publishes. Graph API described in (Facebook, Inc., 2014) offers the */likes* edge for post nodes and */comments* edge for comment replies to a post. Also, */posts* edge for a specific Facebook page returns published posts, so all data retrieval can be done programmatically.

An output array represents each of the people who liked the object, specifying user with application-specific ID of this person’s user account and full name. An example of HTTP/1.1 GET request on host *graph.facebook.com* can be */661704773864624/likes*. The output contains following data field:

```
{ "data": [ { "id": "10201427875893354", "name": "Alice Placeholder" },
  { "id": "10202251797591562", "name": "Bob Placeholder" } ] }
```

This list of customer identifiers can be tied with internal CRM records of a customer. A possible implementation is outlined in Table 3. The relationship between Internal Customer ID and Facebook User ID is supposed to be 1:1, but one user can like or comment multiple posts.

Internal Customer ID	Facebook User ID	Post ID	Liked?
123	10201427875893354	661704773864624	1

Table 5. Structure of data retrieved and processed from Facebook API. Source: Author

3.2. Twitter

In case of Twitter the focus is on customer's interactions with a specific content a brand publishes or when a customer mentions a brand. For the former one, Twitter's API (Twitter Inc., 2014) doesn't allow direct requests as Facebook does, so a developer has to work with the list of 20 most recent Tweets favorite by a specific user. An example of an authenticated HTTP/1.1 GET request on host *api.twitter.com* can be */1.1/favorites/list.json?user_id=14979466*, where *user_id* value is a specific Twitter user identifier. The output contains following data fields (some other were omitted for simplicity):

```
[ { "created_at": "Fri May 02 06:51:28 +0000 2014", "id": 462122180470640640,
  "retweet_count": 2, "favorite_count": 5,
  "favorited": true, "retweeted": false, } ]
```

Although outlined implementation would require additional development, the final output shown in Table 4 demonstrates the desired data structure. The relationship between Internal Customer ID and Twitter User ID is supposed to be 1:1 – yet one should consider possible multiple Twitter accounts for a customer in specific situations, e.g. director of a company who tweets both by her personal account and by her company's account. Favorites and Retweets would be linked to Twitter User ID with an obvious 1:N relationship.

Internal Customer ID	Twitter User ID	Tweet ID	Favorited?	Retweeted?
123	14979466	661704773864624	1	0

Table 6. Structure of data retrieved and processed from Twitter API. Source: Author

3.3. User Profile Matching

Integration of customer-level data from social networks relies on one important assumption that customer can be accurately identified by 1:1 relations between internal and external user identifiers. This topic was largely studied by different authors, such as (Malhotra, Totti, Wagner, Kumaraguru, & Almeida, 2012), (Paridhi, Ponnurangam, & Anupam, 2013) or (Raad, Chbeir, & Dipanda, 2010).

The work of Paridhi et al. found 39% Facebook identities to a studied group of Twitter users. An algorithm by Anshu et al. matched profiles with 64% accuracy, gaining impressive 98% of accuracy, 99% of precision and 96% of recall using the most promising set of features.

Methodologies for user profile matching are outside the scope of this paper, but it is clearly evident that automated processing of user profiles is highly reliable and with regards to the privacy and legal requirements can be used to tie internal and external customer data.

4. Conclusion

The paper outlined possible ways of enhancing traditional RFM Analysis with additional data that demonstrate customer's activity and engagement with the company's marketing channels. An anonymized data sample from one Czech online retailer was analyzed to support this theory.

Studied comparison of transactional and visit-level data on data sample showed that Recency calculated from visit-level data shows higher probability of repurchasing, meanwhile Frequency calculated from both interactions of transactions and visits doesn't always show that a customer would have higher probability of repurchasing in case of her frequent visits to a website.

Because such enhancement of RFM Analysis proved to be valuable, in part 3 additional data sources as Facebook and Twitter were discussed. Information retrieval of customer interactions can be done automatically using API. Such data integration raised important issue of user profile matching. The data could be treated in the same manner as with website visits: enhancing RFM model with new interactions to better understand long-term purchase behavior of a customer. A combined log of customer purchases, visits to website, comments, likes favorites and retweets would thus serve in a model for probability to repurchase. Unfortunately, this enhancement could not be done with the sample dataset.

As a future work, further exploration of social network data and proposal of new links between customer multi-channel engagement and Customer Lifetime Value are needed. Also, the social network data described in part 3 should be used in a practical case study of RFM analysis.

Acknowledgment

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PRIVACY IN THE INFORMATION SOCIETY: HOW TO DEAL WITH ITS AMBIGUITY?

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Keywords

Privacy, Information Ethics, Relativism, Dogmatism, Pluralism

Abstract

This article deals with the concept of information privacy, describes its content, various points of view from which it is addressed in the literature and tries to find a solution for various, sometimes contradictory understandings of it. The suggested solution should be the metatheoretical pluralism which has an old tradition both in the western and eastern culture. It will be shown it is a possible, but not final solution for all ethical controversies.

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1. Introduction

The information society with its stress on information production, analysis, processing, storing and availability by means of various technologies has put us in a new situation concerning privacy. We are facing many modifications of the privacy concept. Some say the concept of privacy is changing, other think it is violated and some even say it is disappearing completely.

That people's attitude towards privacy is changing can be illustrated on the talk about transparent society, data-exhibitionism, transparent assessments in many areas of the environment (see e.g. Šauer et al., 2012) etc. Above all the young generation yields its private information to the companies and public institution carelessly. It should be therefore analysed what people think about this concept and how its understanding has changed. Many researches have shown that people have worries about their privacy and above all internet is considered a dangerous medium if privacy is concerned.

ICT contribute in many aspects to the privacy tensions. One of them is the personalization-privacy paradox. It consists in the relation between personalization and privacy – in order to provide personalized services the technology must have some information on its users and the information on them is in this way made public. Providers of ICT personalized services often exploit the personal information. This issue dominantly concerns smartphone users as mobile phone users are especially tied to their phones. And in return for personalization phone software providers get interesting information which can be used for marketing purposes. Smart phone users then legitimately express concern about privacy (Accenture, 2012). The concern for privacy is however

a complicated issue. People express concern for it, but are willing to abandon it to some extent in return for services. (Sutanto, 2013) The technical measures providing anonymity are usually very complicated and codes of conducts of providers as well.

What is however threatening the ethical character of the society is the careless approach of the young generation. We have carried out a research at our University of Economics in Prague which has shown that students are interested in information ethics, but interest in legal and technical aspects prevail. On the other hand they are mostly careless in submitting their personal information on the internet and don't care about the terms of contract of many services provided on the internet. Theoretically they know the risks, but their absorption by the internet is too intensive. The current situation in the area of internet privacy may be characterised as chaotic and the users very often don't understand neither know who and how processes their data, for what purpose and what he can learn about them. The bigger players like companies or institutions are in a better position, but they are affected by the chaotic character as well. We are dependent on ICT which has wide consequences (see e.g. Mildeová, Brixí, 2011). That is why I would like to analyse the concept of information privacy, search for its definition and look for ways how to deal with its contradicting understanding.

2. Information ethics

Information privacy is part of information ethics. Already in the 80s Mason (1986) expressed concern for four areas of information ethics. His typology became popular as PAPA (privacy, accuracy, property, and accessibility). Privacy is important for both individuals and companies. Madden et al (2007) report that 85% of adults consider privacy very important and Deloitte (2007) found out that 85% companies experienced a privacy breaking in previous year.

2.1. Privacy

Privacy in the area of information ethics may be characterized by the question "What information about one's self or one's associations must a person reveal to others, under what conditions and with what safeguards?" (Mason, 1986, 1). That question is related to the question what information can people keep to themselves. Privacy is threatened by the massive use of IT which can get (e.g. by surveillance), process and store big volumes of information. Another factor which contributes to the breaking of privacy is the increasing importance information has in our society where advantage is obtained when the information is timely, accurate and nobody else has access to it. Surveillance, industrial espionage, big data analysis all these phenomena are related to the privacy breaking. The problem with privacy is that its breaking is usually unnoticed. The affected subject needn't know he is directly spied, but also the fact that combination of various data together may reveal a lot about the subject is often not realised by the subject. So buying and merging of disparate databases reveals a lot of new information. Even though the subject may be willing to provide some information to disparate database, he would never agree to provide all complex information to one subject as it would know too much about him. Another problem is related to the errors in the databases. The subject needn't know information is erroneous or not correct and it may cause unexpected consequences. In addition to that the costs and efforts to correct the information may be high.

Mason's view is reflected in recent literature, too. E.g. Tavani and Moore (2001) mention the restricted access to personal information. Another views on privacy (e.g. Collste, 2008) stress the control over the circulation of information concerning the subject. I think these views are

interrelated and mutually compatible. Restricted access to personal information includes the fact that the person has control over it and can grant access to other users.

2.2. Accuracy

The second aspect of information ethics is according to Mason (1986) called accuracy. It can be characterized by the question “Who is responsible for the authenticity, fidelity and accuracy of information?” (Mason, 1986, p.1) Misinformation can bring about unpleasant consequences when official authorities use it or when other subjects, e.g. business partners, colleagues, family members etc use it. As many people may publicize almost any information which becomes available to the public, the occurrence of inaccurate information is quite often. That is valid for many advisers, experts and even computer programmes that make inaccurate predictions. Nowadays people are overwhelmed with information, but their problem is to find out which information is reliable and accurate and which is not. Another ethical and very often legal issue relates to the fact that it is not clear who is responsible for the decisions made by software or by people using the software (Altschuller, 2004).

2.3. Property

Property of information is also a hot topic today. Mason (1986) characterized it as “Who owns information? What are the just and fair prices for its exchange?” Intellectual property rights do also belong into this sphere. It may very demanding to produce the information, but its reproduction and distribution may be very easy. Moreover the original especially in its digital form will be unaffected by the reproduction. That is why information must be protected as it is easily available through communication channels. Its means of protection are more complicated than is the case with tangible property. Moreover it is difficult to identify the cases of information misuse and to reveal the offender. The easy reproducibility of the content of information, the character of knowledge and also of information as something that is communal and the democratic character of our society has led to a tension between the definition of information property rights and the practice. This area contains also many unclear cases which are difficult to solve. It is not easy to decide between the conflicts of privacy protection and rights of the public to be informed, it is not clear who owns the information and knowledge inserted in the expert systems, the definition of privacy and its breaking is not unanimously settled, the responsibility for the control over the use of information is in conflict with privacy etc. Khalil, Seleim, 2012 concentrate on the copyright issues regarding the software products. They consider the following questions ethically controversial: Who owns information? Who owns the channels of distribution and how should they be regulated? How is compensation determined?

2.4. Accessibility

Mason (1986) summarized the content of that aspect in the question “What information does a person or an organization have a right or a privilege to obtain, under what conditions and with what safeguards?” Access to information is a precondition for literacy and provides people with the opportunity to find their place in the market and the society as such. However the access is dependent on the computer, computer skills and internet connection which is not available to everyone. Previous literacy is also an advantage in information acquiring and analysing. That is why those with the advantage get more and more and those handicapped get less and less. To give all as equal starting point as possible we should help the disadvantaged. Handicapped may be even regular users in favour of big companies which have more tricks how to outsmart them. Security,

which includes confidentiality, integrity, consistency, and controlling access to resources, is considered accessibility-related issue (Khalil, Seleim, 2012).

Mason's characteristics of the area has proven to be quite accurate as it is with small modifications used up till now. Let's now turn to information privacy, its concepts and dealing with its ambiguity.

3. Information privacy definition

Even though Mason provided us with a definition of privacy, it still remains not very precise.

A definition of information privacy has been suggested already in 1967 by Westin as the ability of the individual to control when, how and to what extent his personal information is communicated to others. Personalization requires collecting and processing a huge amount of personal information and as users of blogs, social networks and internet discussions provide a lot of information on themselves online, their personal information becomes vulnerable. Trials against popular websites for breaking the privacy rules or the recent decision of the European court of justice which has led to the implementation of the right to be forgotten by Google are proofs of the increased concern for privacy in society.

Up till now we don't have a detailed enough definition of privacy. „Privacy [...] is a concept in disarray. Nobody can articulate what it means.“ (Solove 2008, p. 1.) This idea articulates the situation where it is difficult to find a unanimous definition of privacy. There are some general concepts reaching the antique tradition, privacy is often understood in its relation to its counterpart public sphere, but a clear-cut definition is still missing. Roughly speaking we may characterize privacy as a sphere where only a limited group of people selected by the subject has approach and may get information on the subject. Public sphere on the other hand is a sphere where everybody or at least some not approved by the subject have approach to the subject's information, but this definition is too general to solve all problems we are facing.

Belanger and Crossler (2011) researched the concept of information privacy and found out that “issues surrounding privacy are myriad and varied in nature” and “information privacy research has been student-based and USA-centric with limited generalizability”. (Belanger, Crossler, 2011, p. 1018). That however doesn't mean that there is no definition of privacy, every culture and to a great extent every individual has some understanding of it. Let's look at some models of information privacy.

Regarding internet privacy concern Hong and Tong, 2013 studied many scientific sources to internet privacy and developed a multilevel model consisting of two second-order factors of interaction management and information management, and six first-order factors (i.e., collection, secondary usage, errors, improper access, control, and awareness). Interaction management includes collection, secondary usage and control whereas Information management consists of errors, improper access and awareness. The interaction management component describes how an individual manages his or her interaction with others, while the information management component describes how an individual manages his or her personal information. Collection is the degree to which a person is concerned about the amount of individual-specific data possessed by websites (Malhotra et al. 2004). Secondary usage is the degree to which a person is concerned that personal information is collected by websites for one purpose but is used for another, secondary purpose without authorization from the individual (Smith et al. 1996). Errors is the degree to which a person is concerned that protections against deliberate and accidental errors in personal data collected by websites are inadequate (Smith et al. 1996). Improper access is the degree to which a person is concerned that personal information held by websites is readily available to people not

properly authorized to view or work with the data (Smith et al. 1996). Control is the degree to which a person is concerned that he/she does not have adequate control over his/her personal information held by websites (Malhotra et al. 2004). Awareness is the degree to which a person is concerned about his/her awareness of information privacy practices by websites (Malhotra et al. 2004).

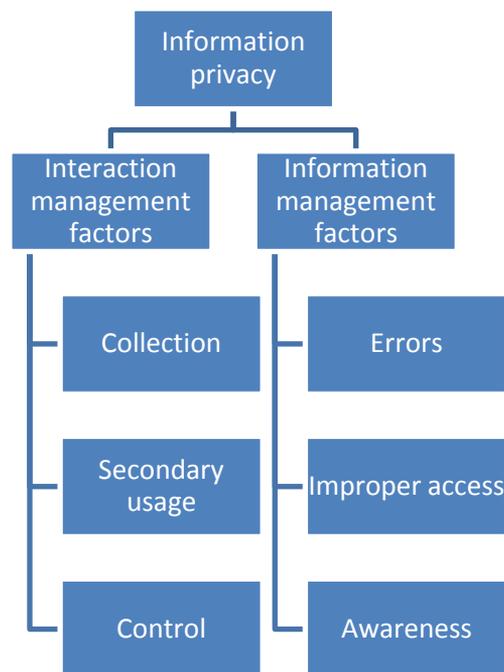


Figure 1: Aspects of information privacy (Hong & Tong, 2013)

As for the definitions of privacy Skinner et al. (2006) suggest that most interpretations of the concept of privacy refer to a human right, but within different contexts. Based on that Clarke (1999) identified four dimensions of privacy:

- privacy of a person,
- personal behaviour privacy,
- personal communication privacy, and
- personal data privacy.

As a lot of data traffic is digitalized, personal communication privacy and data privacy can be merged into the notion of information privacy. (Bélanger, 2011). With the spreading of ICT, information can be collected, aggregated, and analyzed at a faster pace and in larger volume than ever (Malhotra et al. 2004). Data can be collected without individuals' awareness (Bélanger and Hiller 2006). Nowadays a big problems relates to secondary uses of one's personal information (Bélanger et al. 2002). Secondary use means practice of using data for other purposes than those for which they were originally collected. Smith et al. (1996) identified 4 dimensions of information privacy: collection, unauthorized secondary use, improper access, and errors. Another taxonomy includes information collection, information processing, information dissemination, and invasion (Solove 2006).

4. Studies on information privacy

Belanger (2011, p. 1020) identified after his literature review the following aspects of information privacy: trust, culture, security, economics of information privacy, surveillance, personalization, risk, marketing, and control, among others. An additional topic area is the tools and technologies for information privacy.

Another interesting question relates to people's attitudes to privacy. One of these findings is that the concern for information privacy no longer influences the willingness to disclose personal information (Belanger, 2011, p. 1021). As people are told fair information treatment will be used to deal with their information, their concern for information privacy is small enough that they will provide personal information online (Culnan and Armstrong, 1999).

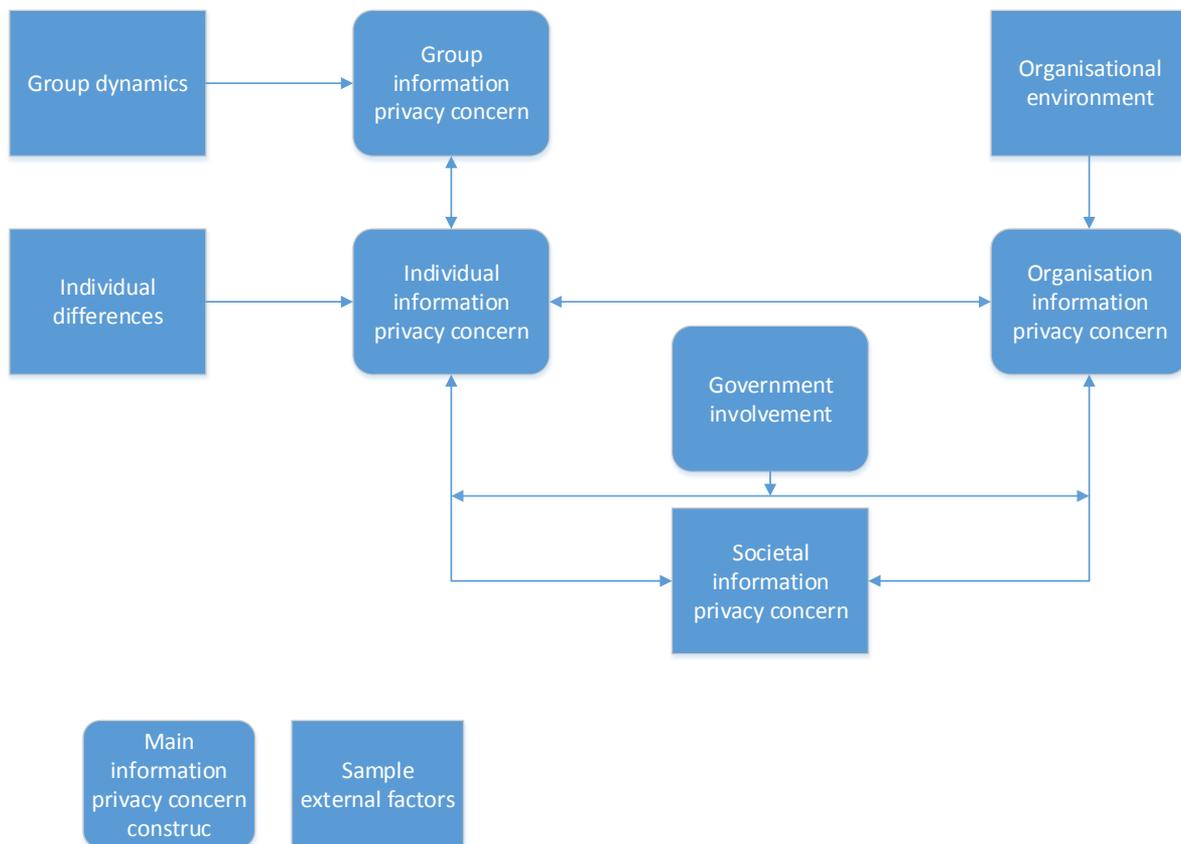


Figure 2: Influences on Information privacy (Bélanger & Crosley, 2011)

Belanger and Crosley, 2011 performed an analysis of the literature content on privacy. They differentiated in connection with Gregor (2006) between 5 theory types:

- Analyzing (Describe the state of information privacy or the need for information privacy research),
- Explaining (Explain what is occurring but do not provide testable predictions),
- Predicting (Provide testable predictions without well-developed causal relationships),
- Explaining and predicting (Explain what is occurring and provide testable predictions with causal explanations), and

- Design (Specifically design a tool for providing information privacy or a framework to evaluate such tools and action).

Their findings show majority of information privacy research has mainly focused on explaining and predicting theoretical contributions, followed by analytical theoretical contributions as a second major category. They have also found out that very few articles provide design and action contributions. That shows how complicated and complex the issue of information privacy is. The definitions of privacy are still quite general and the identified factors are very similar. They just specify the general concept of limited or controlled access to one's personal information without providing the details and limits. We now understand more what aspects information privacy has, but don't know the varieties of various understandings of these concepts, limits and details. We may even conclude that its concept is not only different for different cultures, but that it is changing. That is what L. Floridi stressed in his ontological conception.

5. Floridi's ontological conception of privacy

An interesting approach towards information privacy was developed by L. Floridi (2005). Its advantage consists in the fact that it focuses on the qualitatively new aspects information privacy has in our society. According to many theories ICTs make problems with information privacy worse because of their increased processing capacities, their speed, quantity and quality of data they can collect, record and manage. Theories based on these postulates however forget that ICTs not only worsen the situation, but also have potential for privacy increase and for its change. ICTs reformulate information privacy. Floridi also provides some illustrative examples: many transactions like banking or booking are carried out remotely, the amount of anonymous interactions grows, digital information is volatile and fragile, digital data can be encrypted. ICT allow for both increase and decrease of information privacy. But also the informational environment has changed. Floridi defines information privacy as a function of the ontological friction (forces that oppose the information flow in the infosphere). As ICT transport information they are the most influential factors affecting information privacy. Factors affecting the friction can be changes in the environment or changes in the affected actors or their behavior. Old non-digital ICTs like printing, masmedia etc. tended to reduce the friction in the society because they enhance and augment the agents embedded in it. The digital ICT create new environment or as Floridi puts it they "re-ontologize it". Floridi distinguishes five fundamental trends in the re-ontologization of information privacy:

- Digitalization of informational environment,
- Homogenization of the processor and the processed (digital content is processed by the digital tools),
- Evolution of digital agents (people equipped with notebooks, cameras and smartphones which can freely and effectively operate in the new environment),
- Informatization of interactions,
- Mutuation of old agents into digital agents.

5.1. Privacy in the re-ontologized infosphere

The friction in the infosphere is importantly affected by the technological innovations and social developments. Old ICT enhance friction and augmentation of agents and decreases information

privacy whereas digital ICT not only decreases or increases information privacy, but also changes our understanding of it. The ontological understanding of information privacy may explain the enhancement of information privacy (control and protection of personal data – encryption, anonymization, password – protection, warning systems, control and recording of the use of information etc.). It also enables the decrease of anonymity in public sphere which increased at the end of 19th century.

5.2. Reductionist and ownership interpretation of information privacy

Regarding information privacy the reductionist interpretation and the ownership interpretation are quite popular. The reductionist interpretation deduces the value of information privacy from the unpleasant consequences caused by its breach. Breaking information privacy means breaking human dignity. The ownership interpretation says that information privacy must be respected as it is part of person's right to bodily security and property and every person has the right to own his information from birth to death.

The first reductionist approach is consequentialist, the second is based on the natural rights argument. Both see information privacy breaking as intrusion into a sphere which should be controlled by the subject and kept private. None of these theories is however satisfactory. The consequentialist theory is to some extent correct, but may be in conflict with social interests and welfare. The protection against and investigation of crimes may require breaking the privacy in higher interests. The interpretation based on natural rights has problems with unwilling transport of information to someone (e.g. unwilling hearing of someone's conversation where no information ownership seems to be violated), information privacy in public contexts (e.g. someone accesses a public space and can't expect privacy keeping, like if someone buys newspapers in the street can't expect that nobody would notice that), and the last problem consists in the virtual character of information (someone's information is not lost if somebody else gets it).

None of these two theories recognizes the ontological change the new ICT brought to the sphere of information privacy. In this context Floridi (2005) supports the individual responsibility for information privacy where an individual constitutes its informational identity. The right to information privacy can be understood as a "right to personal immunity from unknown, undesired or unintentional changes in one's own identity as an informational entity, either actively - collecting, storing, reproducing, manipulating etc. one's information amounts now to stages in cloning and breeding someone's personal identity – or passively – as breaching one's informational privacy may now consist in forcing someone to acquire unwanted data, thus altering her or his nature as an informational entity without consent." (Floridi, 2005, p. 195) This definition deals with the difficulties of both theories identified above. There is no difference between one's informational sphere and one's personal identity. We can say "I am my information". Another consequence is that if someone's personal identity is stolen, there is another person (the thief) whose identity has been enhanced. It shows how the industrial conception of information has changed.

6. Dealing with different perspectives

Floridi's ontological conception of privacy doesn't however tell us how to deal with the conflicting conceptions of privacy. Privacy is undoubtedly influenced by the social norms, including ethical norms, which are not unanimous and harmonious. Not only in the area of privacy, but in the whole sphere of ethics we have to come to terms with the differences between various values, approaches, claims etc.

What attitude towards the conflicting privacy concepts should we adopt? First of all we should understand them and then look for a solution.

There are three possible solutions. The first one is dogmatism. Dogmatism believes there are universally valid ethical norms that are known to a person or a society and it has the right to push them through and implement them. Other perspectives are wrong. It is very tempting to adopt such an approach especially if information constitutes our identity. The result is however intolerance and conflict.

The second option is pluralistic relativity. This perspective breaks down the dogmatic approach of ethnocentrism. However relativism is limited. In the global village we live in there is a need for common norms we could use when encountering members of other cultural contexts. And the second limit of relativism is that it doesn't tell us what to do and how to behave except for a type of fascist enforcement of one's authority.

6.1. Metatheoretical pluralism

Based on Ess's (2006) article I'd like to suggest an approach based on metatheoretical understanding of various concepts and looking for a shared concept allowing bridging the various perspectives. I'd like to analyse some concepts of metatheoretical pluralism which may be helpful in finding an approach not reducing differences, but allowing their interconnection as various perspectives at one topic which are not incompatible as they are just analogical perspectives at one topic. Through this way of thinking the various concepts of privacy may be possibly kept without much conflict. Ess (2006) compares ethical pluralism to Aristotle's explanation of "to on" (being) which is said in many (pluralistic) ways.

Metatheoretical pluralism must be differentiated from the so called *modus vivendi* pluralism which is actually similar to relativism because it resigns to any common ground. Such an approach is hard to be found in reality as the encounter of various ethical stands requires a solution. In the case of *modus vivendi* pluralism force must be used in order to calm down the differences. (In ethical relativism force is used to resolve the differences.) Lawrence Hinman suggests a robust pluralism which hopes for compatibility even though compatibility is not a necessary requirement. There are also stronger forms of pluralism, like the one proposed by J. Rawls who tried to find a set of shared ethical rules that all thinking people would accept. The ability of this pluralism to include all different norms is however limited (see e.g. Madsen and Strong). Madsen and Strong have found an even stronger form of pluralism in the work of Ch. Taylor. His conception gives up the requirement of opinion identity and insists on complementarity of opinions where differences lead to the enrichment of all participants. Harmony between different opinions is based on positive engagement of participants and leads to expansion of the horizon of agents. The difference of the other is preserved, not reduced.

Ess (2006) identified a still more robust pluralism in the work of Plato and Aristotle which allows distinctive ways of bridging the differences. Plato says in the *Republic* that singular ideas allow for diverse instantiations and applications in the material world. This may serve as a third way between the extremes of pluralism and relativism. The interpretations remain different, but they remain connected through their origin or reference. This pluralism is allied with *phronesis* (practical wisdom - prudence different from theoretical wisdom – *episteme* and craftsmanship – *techne*). Practical judgement allows different conclusions in diverse contexts where common general principles are applied. It overcomes the only potentiality of Hinman's simple pluralism and erasure of differences in Rawls' theory. Interpretative pluralism allows a strong connection between ideas, but the irreducible differences are kept. The interpretative pluralism Ess identified in the roots of

both Western and Eastern philosophy and culture has two advantages: it has bigger potential to include differences than pluralisms that rely on compatibility. Second its basis on harmony may become a bridge between various cultures and traditions. Ess presents two examples related to the discussed topic of information privacy. The first one is the informed consent and internet research ethics. There is a difference between the USA and Norway regarding the informed consent when recording in public spaces. In USA there is no expectation of privacy in public spaces and no consent is in contrast to Norway required. While expectations are different both sides agree that the expectations are the starting point for the judgments. Another example relates to the different basis for privacy in Eastern and Western countries. In Western countries privacy is based on the dignity and autonomy of the individual person whereas in the Eastern countries privacy is limited by the interests of the state and is more collective than individual good. Both areas however agree on the importance of privacy for the development of commerce. We can see three realizations of one concept in three areas.

The drawback of this theory however is that it supports understanding of various concepts, but doesn't tell how to bridge the differences. The conflict doesn't always consist in ignorance and not-understanding of the common ground. Nonetheless the understanding may be the first step of the solution.

7. Conclusion

Information privacy is a complex issue with many aspects. We should treat it as a changing concept with many varieties. To understand it we should approach it from the ontological side and to deal with its complexity we should adopt the metatheoretical stand.

Privacy affects our daily life and that is why our task as IT researchers is to inform and draw attention of the wide public to the ethical issues and to educate students in these aspects of IT use.

Teaching ethics has an ethical and practical dimension. The ethical dimension consists in the fact that it is good to teach ethics and raise good students and citizens. The practical one consists in the fact that IT specialists and IT users will face ethical dilemmas as they enter and influence pluralistic world where many often conflicting ethical perspectives prevail. ICT affects above all the privacy sphere. To understand the ethical concepts and to solve their conflicts is both a practical and a theoretical task.

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THE WISDOM OF CROWDS

COMMUNICATION, INFORMATION AND TASKING WITH AND OF THE POPULATION IN CASE OF CRISIS AND DISASTERS

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Abstract

Existing approaches to communication with the population in case of disaster are focused on alerting and providing basic information using public media. A consistent communication concept beyond the early warning phase taking into account information needs and capabilities of the population is still lacking. This article describes a conceptual approach to link provision of information to the organisation and mobilisation of sectors of the population to enhance the level of preparedness and enable a more coordinated response.

1. Introduction

Communication with the population in case of disasters was long time confined to uni-directional strategies for mass notification in case of an upcoming hazard or existing emergency situation. In this case early warning aiming at alerting a group of individuals is delivered with sirens, route-alerting with loudspeakers on vehicles or using mass media.

These communication channels differ in the degree of information they can transport. Acoustic alerting is restricted to a small number of tone variations whose meaning is not naturally given, but must be acquired and regularly trained to interpret it rightly. Therefore mass alerting is augmented with information by additional alerts through media (radio, TV, internet, social media).

When using bi-and multi directional communication channels disaster managers have the possibility of getting feedback from the recipient of the initial information. This can range from a simple confirmation of receipt up to receiving more detailed information on the (perceived) situation alerted persons might be in. Bi-directionality is the case for face-to-face mass alerting strategies but also technologically supported communication approaches such as telephone (landline, mobile), text message and social media such as Facebook or Twitter.

When it comes to communication with the population, going further than merely improving strategies for early warning and mass notification is important for three reasons:

- Besides the pure warning of an approaching hazard or incurred emergency, people want to know more about it and how to react. This is why social media has an important impact on the interaction with the population.
- The more information people receive prior to the occurrence of a disaster the more prepared they will be to help themselves and others– in short the more resilient they will be.
- Affected population does not only need but can also feedback information which in turn may increase the early awareness of disaster managers. The alerted (and emotionalized) but not affected population is often willing to help and constitutes a relevant resource that needs to be informed, organized and tasked so it becomes an additional asset to the response and not an obstruction.

This article will describe the challenges these three points pose to disaster managers and suggest an overarching approach targeting all three dimensions.

2. Challenges for disaster management and crises communication

When coming to the communication with the population disaster managers face several challenges:

2.1. People perceive risks differently than disaster managers

People don't share the risk priorities of disaster managers. Worldwide evidence gathered especially through community-level risk assessments done by NGOs such as the Red Cross indicate that local population has a very distinct risk perception and is little concerned with Disaster Risk Reduction (Cannon 2008).

In addition, especially in high-income countries even when people are made aware of the possibility of arising catastrophes, they tend to rely on the functioning of the response system and also imply that existing infrastructures will continue to function.

2.2. Population as consumers

It is the daily business of responders to be best prepared to respond to the population's needs and include the worst case into their emergency planning strategies. At the same time the population may perceive the proper functioning and the robustness of the services as given. This may even be reinforced actively by media strategies putting forward the increased response capacities of authorities and response organisations. For example, much of the dissemination activities of EU projects in the realm of disaster prevention and management are aiming at communicating the positive outcomes of their doing. The downside of this very legitimate and essential doing is that this may reinforce the consumers' role of the population leading to an increased vulnerability in case of major disasters.

2.3. Citizen's need for information and participation

When people finally conclude that they are at risk (by perceiving a risk or being told by authorities or the media) they are more likely to take proactive action. Empiric evidence suggests that people take action when they think they are at risk implementing the most appropriate actions they know (Lindell et al 2006). It is therefore important that official warning messages include recommended

protective actions when the disaster strikes and raise the awareness and preparedness of the population before the occurrence of disasters.

The least effective communication strategy is withholding information – the best strategy for disaster managers is communication. Alerted but not affected population will strive to get additional information on the hazard, especially when they are emotionalised by mass media coverage, and some will even act and try to help. Experiences from the 2013 floods in Austria and Germany support this thesis as social media groups formed rapidly gathering several thousand followers grasping to know more about the flood situation, posting pictures of the floods and even trying to organize citizen-to-citizen help largely independently and often uncoordinated with the response.

2.4. Organising and mobilising the population

The phenomenon of non-affected citizens, alerted and emotionalised by mass media, wanting to converge to the disaster site to help, is known in the disaster management community under the term “spontaneous volunteering”. Spontaneous volunteers (sometimes referred to as convergent or un-affiliated volunteers) are individuals or groups that spontaneously offer their help in the aftermath of a disaster or an emergency. They may arrive unsolicited at the scene, have not been specially recruited and are not affiliated to the existing emergency management system (Governor’s Office of Emergency Services California 2001). For a response system not prepared to deal with spontaneous volunteering this willingness to help may be perceived as a possible burden and may stress the system generating additional workload (registration, sheltering, food, equipment) on the one hand and disappointed volunteers on the other hand, in case their willingness can’t be utilized at all or not accordingly to their skills (Fernandez 2006). Therefore there are some existing approaches on how to deal with the issue of spontaneous volunteers and make the citizens’ willingness to help an utilizable asset for assisting the response.

2.5. There is no such thing as the crowd

Finally disaster managers face the challenge that communication strategies may picture the population (or the “crowd”) as uniform receivers of information in case of disaster and concentrate solely on the technical dimension. Disaster managers must be aware that they are communicating with multi-fragmented active stakeholders. Societies in general and especially in urban settings are very heterogeneous in terms of language, gender, nationality, ethnicity, religion, class, socio-economic background, etc. This applies to that what is commonly depicted as cultural diversity but encompasses also intra-cultural differences (Antweiler 2003) that are often overlooked and help to explain why a German baker might have much more in common with a Chilean baker than with a German mathematician (Interkulturelle Kompetenz Online 2004). Thus communication strategies must better match their target groups taking into account different social and cultural norms, language proficiency levels, physiological and psychological handicaps, etc. For quite some time communication does not need the physical presence of people any more why the boundaries of intercommunication are no longer physical or technical but more economic and political (Antweiler 2012). And with 6 billion worldwide mobile phone subscriptions and over 2 billion mobile broadband internet subscriptions (IFRC 2013) will be taking a back seat leaving political influence as one major factor for communication, which is to be considered for planning disaster communication.

3. Going further than information

As described above communication with the population is a multidimensional process not confined to the immediate aftermath of a disaster but is a continuous process involving the various stakeholders in disaster management that has to be already incorporated in to preparedness planning of authorities, response organizations and the media. What is still lacking are interactive tools to get into a continuous communication relationship with the population for preparedness, early warning and response phase as well as guidelines for how to use the information for best reaching the different societal target groups.

3.1. Pre-crisis communication: building up resilience

Increasing resilience must be included into disaster management processes. Subsequently disaster communication strategies must not be confined to crises communication for the immediate response but must include the preparedness phase for informing and actively including the population to increase their resilience. Crises communication must therefore be embedded into broader research and resilience management processes. It is clearly not purely a technological issue. Technology can facilitate the doing of disaster managers but is not the solution, and even more striking – it may not even be an available tool in a disaster situation, in case of complex disasters with cascading effects. This would be the case with long lasting power outages, which would leave parts of the infrastructure for interaction with the population not available at all or partially unavailable. Both the population has to learn to improve their resilience as well the first responders and crises managers have to learn to communicate adequately in such situations and to use their remaining resources most efficiently. It needs not to be an enduring power outage, which may influence the crises communication: there may be disparities between urban and rural areas in the access to communication infrastructures, such as broadband internet. Thus, relying on few and largely technically assisted solutions may be problematic.

3.2. Building resilience and keeping track with technical development

The technological development is dramatically changing the former unidirectional relationship between disaster managers - the sender of the message - and the population – the receiver of the message. Not only there are additional communication channels such as social media, but also with a multi-fragmented population using various and different communication channels disaster managers must not rely on only one or more communication channels but nowadays disaster warnings must be issued using a large variety of available mediums. Disaster managers must thus keep constantly track with technological advance and put emphasis on newer communication channels when it comes to preparing and including as well as alerting the population. Additionally technological evolution, such as the development of bi- and multi-directional communication channels such as social media may eventually offer new possibilities: with multi-directional communication means it is nowadays possible for disaster managers to receive immediate feedback from the population which could be included into the information management process.

3.3. Interaction with the population

One approach to interact with the population in case of crises and catastrophes is crowd tasking. Crowd tasking can be applied to involve volunteers in all phases of crises management. Example given, the Austrian Red Cross is currently developing such a tool in order to enable organised

volunteers to contribute to the Red Cross activities on a regular basis (Neubauer et al 2013). Multiple basic processes are imperative for such solutions, comprising:

- community building, registration of volunteers and data maintenance
- definition of tasks, selection of qualified volunteers
- crowd task execution
- analysis of the contribution of the crowds and visualisation

3.4. Trustworthiness and media literacy

An issue connected with the provision of information is its trustworthiness. Are there communication channels more trustworthy than others? How to deal as disaster managers with social media? Can disaster managers get reliable information from the crowd?

On the bottom of these three questions is one common aspect: trust. People must have trust in the public authority issuing the alert or communicating with them. Other sources of information may be the mass media and personal networks. Trust may also influence the communication habits as well as the communication channels people prefer to use (MSB 2013)

With social media the role of the authorities as main providers of alerts or information for situational assessment starts to get more and more contested and changes towards information from multiple actors and sources. This implication has another dimension for the response system– the one of media and information literacy. The population needs to have the capacities to interpret the information they receive, so they can filter wrong or misleading information from other information such as the one of the authorities. Initiatives such as the Media and Information Literacy campaign run by UNESCO aim at increasing population's media literacy.

This adds to other literacy discussions for disaster management that addresses more the language proficiency issues of communication. The results of a content analysis of general disaster preparedness websites undertaken in 2008 indicated that the information on these websites was quite difficult to read and that there was need for easier to read and visually adapted content (Friedman et al. 2008). This criticism of disaster preparedness material applies to the communication of preparedness measures in general, as many resources are electronic versions of printed guidelines. Regarding information – the content – what to communicate is quite stable and there is a common understanding on preparedness measures, guidelines and tips. The means – the how to communicate differs and may be the key to a better-prepared community, which is to be evolved together between disaster management professionals and media experts.

3.5. Going further than informing – good practise on organising and mobilising the population

A good practice example for the pre-disaster organisation of spontaneous volunteers is the "Team Österreich" initiative by Austrian Red Cross together with Austrian public broadcasting station Hitradio Ö3. People willing to help in case of disaster are approached beforehand, they register in a self-administered database, enter their capabilities and type of help they are willing to provide and finally in case of disaster they are alerted by means of SMS to assist the response with supporting tasks. The success of this initiative, which started in 2007 and rapidly gathered around 30.000 people living in Austria willing to help others, is largely based on the nature of the disaster manager – media partnership. The Austrian Red Cross acts as the fiduciary of these resources that are made available to the responding authorities and organisations. Hitradio Ö3- the public radio station on

the other side, is part of the team. Thus stories about “Team Österreich” are seen as editorial content, not as advertising airtime to be sold.

Moreover, such an existing initiative of registered and motivated volunteers can be a good host platform for technologically supported tools for interaction, such as the crowd tasking concept briefly described above, providing possibilities to retrieve more reliable data from better known online volunteers.

4. Discussion and Conclusions

Disaster managers will have to be highly flexible in the future. First they will have to keep adapting to fast changing technical realities and societal transitions. Technology will keep evolving and population will keep communicating – assisted by technology, but using a variety of communication means. Crises communication will have to include all possible communication channels and put more emphasis on how to reach out to prepare the population to help themselves and others. The population itself is not uniform but heterogeneous, why factors as language proficiency, ethnicity, gender, religion, socio-economic background among others have to be taken into account. At the same time information may not be enough for the non-affected but informed and emotionalised sectors of the population. Therefore concepts and online tools to manage spontaneous volunteers and mobilise willingness to help (spontaneous volunteer management, crowd tasking) are the logical continuation of information.

Hence, disaster communication as it is understood here is not only about transferring information from a sender (authorities) to the population but is a multi-dimensional relationship between response system, content to be transported, media and media channels as well as various target groups. Furthermore this relationship is not restricted to response phase but encompasses the preparedness phase to raise awareness on risks and prepare people to respond and assist the response.

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A SMART AND RELIABLE CROWDSOURCING SOLUTION FOR EMERGENCY AND CRISIS MANAGEMENT

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Abstract

The RESCUER project aims at developing an interoperable information system that will support emergency and crisis management command centers in quickly handling emergencies and managing crises based on reliable and intelligent analysis of crowdsourcing information mashed up with open data. Two application scenarios will be especially investigated and supported: (1) incidents in industrial areas such as chemical parks, and (2) incidents at large-scale events such as the upcoming sport events in Brazil, namely the Football World Cup and Olympic Games. This paper presents the scientific objectives of the RESCUER project and its concept, as well as describes its components and respective related work.

1. Introduction

Emergencies are defined as critical situations caused by incidents, natural or man-made, that require measures to be taken immediately to reduce their adverse consequences to life and property (DHA, 1992, DHS, 2008). While emergency handling or management is the planning and establishment of organizational and procedural conditions to support the fastest possible conversion of a critical situation that has occurred into a normal situation (BMI, 2011), crisis management involves: (1) *evaluating the severity* of possible adverse consequences of a critical situation, (2) *coordinating* the required measures for avoiding, controlling and/or mitigating those adverse consequences, as well as (3) establishing a strategy for *communication* with the parties that should be informed.

Partners of the RESCUER project are developing a smart and interoperable information system for supporting emergency and crisis management. Its focus is on incidents in industrial areas and during large-scale events, but the resulting platform can also be used to deal with critical situations in other contexts, as the challenges are mainly the same.

The RESCUER project has five scientific objectives: (1) targeted interaction with the crowd at the place of the incident but appropriate in terms of risk exposure, (2) (semi-)automatic fusion, aggregation and analysis of multimedia data provided by the crowd, (3) optimized aggregation of intuitive metaphors for visualization and manipulation of information, (4) customized communication of the incident and its consequences targeted to the audience, and (5) ad-hoc communication between people in the crowd.

In Section 2, we discuss research work related to our objectives. In Section 3, we present the solutions that we have been developing for achieving those objectives. Section 4 summarizes the next steps planned in the context of the project.

2. Related work

This section presents previous research work that is relevant to the RESCUER project. They support the work on the four research areas of the project, namely crowdsourcing information using mobile technologies, data fusion and analysis, software solutions for command centers, and ad-hoc communication between mobile devices at the incident place.

2.1. Crowdsourcing information using mobile technologies

There have been several initiatives and projects in which emergency and crisis management, in particular natural disaster management, was supported by crowdsourcing information. The Ushahidi crisis map platform (Heinzelmann and Waters, 2010, Gao et al, 2011, Ushahidi, 2012) and the Sahana disaster management system (Sahana Software Foundation, 2012, Weaver and Boyle, 2012) provide a key value for their users through the incorporation of various communication channels (e.g., e-mail, Twitter, or GoogleTalk) and connection of short statements with geographic coordinates. However, these two systems mainly deal with textual messages and 1,000 volunteers worked in assigning preliminary geo-location to incoming messages in the earthquake in Haiti in 2010 (Heinzelmann and Waters, 2010). Regarding the usage of mobile technologies for providing crowdsourcing information, several platforms (e.g., mCrows, mClerk, MobileWorks, or txteagle) allow for ubiquitous sensing and data processing, and they often focus on social aspects. However, they enable mobile users only to post and work on sensor-related crowdsourcing tasks that are not time-critical. Therefore they are not appropriate for supporting decision making in the context of emergency and crisis management (Gao et al., 2011).

2.2. Data fusion and analysis

Many solutions have been proposed that deal with crowd event analysis in video sequences. They focus on analyzing the scene motion for extracting anomalous behaviors. In (Blash et al., 2006) and (Krausz and Bauckhage, 2011), a system is proposed that analyze crowd disaster videos using on optical flow algorithms, mostly applied to images shot by static surveillance cameras. Zhan et al. (2008) offer not only a survey of different computer vision techniques, but also crowd models from sociological and physiological approaches, suggesting that a combination of different models might provide intelligent systems with capabilities to understand crowd behaviors automatically. In addition, images also offer relevant information about crowd situation as, for example, visual

information about an isolated emergency inside the big event, which might related to concrete people needing help or crowd density measurement (Krausz and Bauckhage, 2011).

Fire in industrial areas is a scenario that has also been analyzed. Many techniques have been proposed in recent years, some of them use color information (Phillips et al., 2002) or motion information with the aim to locate fire more accurately. Additional features are used in (Borges and Izquierdo, 2010) and (Liu et al., 2010), which are randomness of area size and spatial distribution. Concerning fire detection, there are solutions that focus on smoke detection or on gas leaks as supporting methods (Yuan, 2008, Toreyin et al., 2005).

2.3. Software solutions for command and control centers

During an emergency, command centers must deal with several requests coming from sources in a crowd. An approach used to deal with requests and responses visualization and management is to provide a crisis map (Meissner et al., 2006, Ostrovskii, 2007) using the heat map technique. In such a map, nodes represent requests. The map is the central point for the operational forces to take actions, share information, and coordinate with each other. GIS (Geographical Information Systems) and WebGIS techniques are useful to manage spatial data regarding locations, routes and objects (Ostrovskii, 2007, Walle and Turoff, 2008). Dashboards are used to support visualizing metrics and statistics regarding the requests and responses (Ostrovskii, 2007), so that emergency managers can use drill-down capabilities to access details on different types of requests, their responses, the organizations that are assigned to them, and the responsible team members.

A big challenge in a command center is to filter the information that should be available and to provide it at the right time to the right people (Engelbrecht et al., 2011). In addition, according to Zook et al. (2010), crowd-sourced information needs to be presented appropriately to maximize its use by the responders. However, responders have different information needs depending on their area of work, and thus different strategies are required in different circumstances to maximize the information usefulness. It is necessary to find out how to best present crowd-sourced information to fill knowledge gaps outside formal assessments. Furthermore, several organizations are often involved in the handling of an emergency situation and each organization has its own emergency management plan (e.g. Andrienko and Andrienko, 2007), which includes procedures and responses in case of disasters or crisis. In this sense, we must investigate what is necessary for coordinating resources and information from different organizations.

2.4. Ad-hoc Communication

Ad-hoc networking is a flourishing research area. A specific subfield relevant to the work planned in the project is that of Mobile Ad-Hoc Networking (MANET). In both areas there exists a tremendous amount of research on topics ranging from routing through adaptation and self-configuration, energy consumption optimization to location services (Basagni et al., 2004, Perkins, 2008).

Given the importance of maintaining communication in an emergency situation on the one hand, and the increasingly wide spread of WiFi and Bluetooth enabled mobile devices in the public on the other hand, several research groups have recently started looking at using such technology for disaster and emergency management. In (Jang et al., 2009) the concrete example of post-earthquake environment was examined looking not just at mobile phones but at any WiFi enabled devices. The specific context of smartphones has been investigated for example in (Brownlee and Liang, 2011), while the notion of using MANET networking in conjunction with participatory sensing is described by Jang et al. (2009). On a more theoretical level, Newport et al. (2004) examined

propagation and signal quality issues related to MANET-based communications with different technologies.

3. Solution

The proposed solution can make the work of the command center and the operational forces in emergency situations more efficient and effective. It will not only quickly provide contextual information about the situation through the collection, combination, and aggregation of crowdsourcing information, but also support official and accurate announcement of emergencies to the affected community and to the general public. The concept of the RESCUER system is illustrated in Figure 1 and explained below.

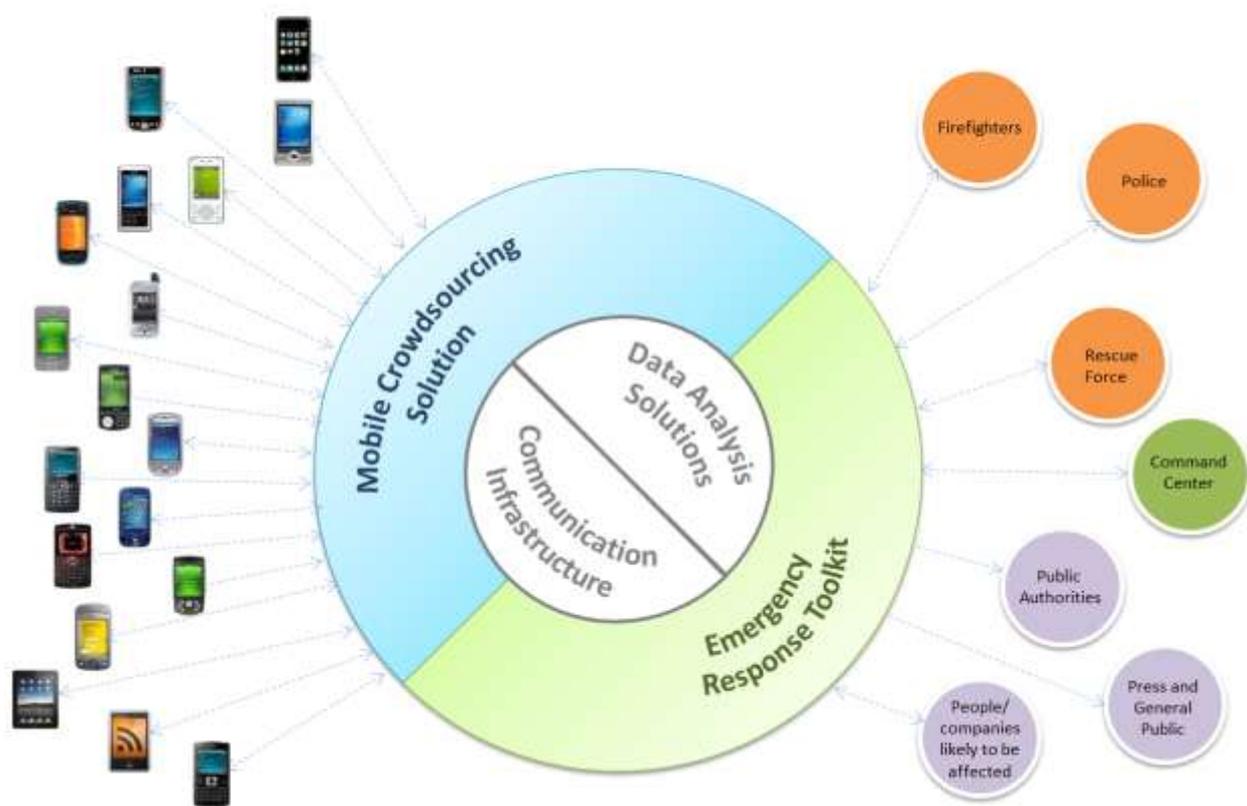


Figure 1: Conceptual overview of RESCUER

3.1. Mobile Crowdsourcing Solution

As there are a lot of aspects requiring people’s attention in emergency situations (Nass et al., 2014), a key challenge is the identification of appropriate interaction concepts not only to *avoid user’s cognitive overload* but also to *engage people* in using the Mobile Crowdsourcing Solution.

Two types of information can be gathered from people carrying mobile devices at the place of an emergency situation: (1) information that can be extracted from mobile devices without user interaction with those devices, e.g., GPS position, movement speed, movement trail, or number of devices at a specific location, and (2) information to be provided by users through the explicit interaction with their mobile devices, e.g., videos, text messages, and photos.

Therefore, our strategy is composed of three different modes of information gathering: *fully-automatic* information gathering, *semi-automatic* information gathering, and information gathering based on *full interaction* (Nass et al., 2014). Figure 2 presents the relation between stress and human cognitive capabilities, and the respective information gathering modes supported by our mobile solution.



Figure 2: Stress, cognitive capabilities and interaction strategy (Nass et al., 2014)

3.2. Data Analysis Solution

Our Data Analysis Solutions take care of: (1) fusing similar data coming from different eyewitnesses, and (2) analyzing photos, videos, and text messages in order to extract information such as the type of incident, the position and dimensions of the affected area, people density, surrounding sources of further danger, evacuation routes, and possible approach routes for the formal responders (operational forces' staff assigned to go to the incident place). This component is also in charge of assuring the smooth exchange of data among the operational forces and between the operational forces and the command center.

The challenge in this project comes from doing multimedia data analyses in a timely manner while using noisy sources of information (mobile devices in uncontrolled scenarios) and other aggregated data such as video location and textual descriptions. Our approach uses the JDL/DFG (Joint Directors of Laboratories/Data Fusion Group) data fusion model as an initial base (Blash et al., 2006). The aim is to detect related material based on location as well as semantic similarity of content.

3.3. Emergency Response Toolkit

Members of a command center will use our Emergency Response Toolkit to: (1) get contextual information about the emergency, (2) ask eyewitnesses and formal responders for relevant missing information, (3) give instructions to eyewitnesses, formal responders, and potentially affected people or companies, and (4) communicate the emergency to the press, public authorities, and the general public in a context-aware way. First, the command center will be able to quickly classify the emergency according to severity, assess the current risks, and take the most appropriate measures for the specific critical situation at hand, which includes sending the formal responders to the place of the emergency. The Emergency Response Toolkit will avoid information overload, by providing the members of the command center with information that really matters, when it is required, and according to the member's profile. Visualization techniques appropriate for emergency and crisis management will be used in this step. Second, the command center will be able to avoid panic and its bad consequences, by providing information to people according to their specific location and in the way they need to know to assure their safety and/or comfort. Through the usage of tablets, members of the command center should be able to leave their place and still provide and receive information from the command center.

3.4. Communication Infrastructure

The general idea is to design an intelligent communication protocol that optimizes spectrum usage and energy consumption. For example, assuming high crowd density, only a small fraction of devices is needed to ensure message transmission. Devices can start and stop participating in the routing of messages and alternate in taking the roles of *access point* or *connected node*. This will ensure that there will be no excessive drain on individual batteries and no spectrum congestion.

The basis for the communication infrastructure will be a mobile application installed on the devices of some members of the crowd. In order to distribute the application within the crowd, each device already having the application must first act as an access point, while devices trying to install it are configured as connected nodes. The connected nodes can install the application as soon as it is available.

4. Summary and Next Steps

This paper presented the solutions that are being developed in context of the RESCUER project. The novelty of the RESCUER project is:

- Eyewitnesses and first responders will be able to provide information using interaction schemes and interfaces specifically developed to be used under stress and time pressure.
- The process of extracting relevant information for the command center from the information received from the crowd and from the information stored in the databases of the operational forces will be automated as much as possible.
- Situational awareness and cognitive load will be balanced.
- Information will be made available to the public according to the relevance.
- People will be able to exchange and forward data even when the mobile phone based communication (including data transmission) breaks down.

The different solutions presented in this paper will be evaluated in both scenarios: emergency and crisis management in industrial areas and for large-scale events. The Mobile Crowdsourcing Solution and the Emergency Response Toolkit are going to undergo an early evaluation in the context of the Football World Cup 2014. The main focus of this evaluation will be the usability and the user experience provided by those components. Live evaluations related to complete system are planned for later on.

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CITIZEN-CENTERED EMERGENCY COMMUNICATION SYSTEMS: EMPHASIZING THE ROLE OF INDIVIDUALS IN CRISIS RESPONSE

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Abstract

Effective and fast distribution of information to stakeholders during an unstable and dangerous situation represents both: a critical factor of a successful crisis response and also one of the greatest challenges. The rise of new communication technologies, such as Web 2.0 applications and mobile phone communications, and the increasing ability of the population to use them on daily basis, have created new possibilities how to globally engage citizens in a short period of time and how to establish emergency communication system allowing two-way sharing of messages across all levels of the organizational hierarchy. This paper focuses mainly on the dissemination of critical information to the lowest level of the hierarchy during selected extreme events and, based on the analysis of these events, proposes a citizen-centered model of an emergency communication system.

1. Introduction

Increasing frequency of the catastrophic events and the limited response capacity of the governmental agencies in the past few decades confirmed the necessity of developing and implementing an early warning and recovery system ensuring timely information delivery and agile adaptive responses. In order to share critical information effectively, the responsible governmental and local authorities need to mobilize all the necessary resources in time-acceptable manner which can be very financially and organizationally challenging (Chatfield, Scholl & Brajawidagda, 2013). Achieving a crisis resolution usually requires involvement of many private and public entities from different levels of the organizational hierarchy. Too complicated processes of gathering and distributing information among these many levels can result in notable time delays and misunderstandings. In the field of emergency information systems, most of the research is focused on the notification techniques and technologies while the broader, communication, perspective is often neglected. The communication approach presupposes existence of an infrastructure enabling the informational flow to be transmitted in both ways and thus allowing all the stakeholders, including individuals in the affected areas, to participate in the disaster management. The role of individuals in the creation and provision of public services has recently significantly grown.

Whitaker (1980) in his public administration theory on citizen co-production distinguishes three types of citizen contribution: the individuals may (1) request new public services from the government, (2) negotiate changes, or (3) cooperate with the governmental agencies in executing some of them. All three types are considered to be very beneficial. In this paper we study the communicational requirements of large-scale emergency situations that an optimal information system should fulfill with respect to Whitaker's citizen co-production theory.

2. Effective sharing of information during the crisis cycle

According to Haddow (Haddow, Bullock, Coppola, 2010) an effective communication strategy should control and adjust the information flow in conformity with the current phase of the crisis developmental cycle. During the first stage, mitigation, information is released with the aim of reducing loss of lives and property in possible future events by implementing new optimized strategies and technologies as preventive measures. In preparedness phase, the communicated messages are supposed to educate the public in procedures and evacuation plans for use when a disaster occurs. The response stage consists in providing notifications, warnings and reports about the current development of the situation. The main goal of information in the recovery phase, which starts right after the immediate threat has been eliminated, is to explain the individuals affected by an extreme event how to get back to normal state or how to subscribe for a disaster relief (Skrbek, 2009).

The major objective of the communication strategy should not be a mere sharing of information, but, above all, the creation of so-called situational awareness (SA). The SA theory distinguishes three consecutive levels of cognition that can be described as (1) perceiving the changes in the surrounding environment, (2) understanding the new settings, and (3) having the ability to predict how these selected elements will react in the future. In order for the actors to cooperate in crisis solving the SA needs to be shared to some extent. This sharing takes usually form of written or spoken messages transmitted between individuals and communities (Endsley et al., 2003). Narratives are considered to be one of the most effective ways of knowledge distribution in social systems. They make possible the transformation of individual experience of every single agent into a general framework of causally interdependent events creating together a comprehensive overview of the whole, more complex, situation (Reitsma, 2010).

As stated in Luukkala et al. (2014) information systems used in state of emergency should provide the possibility of two-way communication allowing the participants to send and receive narratives from both, lower and upper levels of the hierarchy. A great part of the situational awareness is also based on space-related data and information. The location of the affected areas and the orientation in time chronology of events, are considered to be necessary factors in decision-making processes. In achieving the highest possible level of the SA, visualization plays also an important role. From this point of view Geographical Information Systems can be recognized as a powerful tool since they are mostly based on map reference background. Systems designed to mediate the emergency cross-communication of messages using variety of communication technologies linked into one unified network are commonly referred to as emergency communication systems (ECS) and they usually include emergency early notification systems as integral part. The establishment of functional ECS facilitates the communication between rescue units, the people in affected areas and the decision makers (Manoj, 2007).

3. Communicational problems that appeared during Hurricane Katrina, SARS outbreak and Tsunami 2004

The ability to react as fast as possible during crisis response depends directly on the timely identification of the crisis outset and subsequent notification of the authorities about the danger. In 2003, before the SARS outbreak in Hong Kong, thanks to early alerts of possible pneumonia outbreak sent by World Health Organization, the Singaporean Ministry of Health recognized the signals as important threats and issued a public warning containing a list of symptoms and instructions how to behave in such a situation (Leidner et al., 2009). On the other hand, in the case of New Orleans hurricane (2005) the public early warning systems have failed. Although the scientific research provided very exact description of the risks that the city was about to face in terms of hurricanes, and despite the fact that the messages sent to the government and the public satisfied the criteria of detectability, easy visibility and decodability, there was no mention about the steps that should be taken to avoid or reduce the potential losses. Due to the uncertainty and vagueness of language used in pre-Katrina evacuation warnings, the audience was confused and did not consider the leaving as mandatory. The development of situational awareness was not sufficiently supported by motivational and instructional messages urging the people to act with enough caution and vigilance (Elder et al., 2007).

The credibility of information sources appears to be another critical factor in emergency communication. According to Seeger et al. (2006) communication strategy should be based on personalized messages that correspond to the audience's cultural and social background. Building public trust helps mitigate the crisis response strategy more effectively, gain the stakeholder's commitment and convince him to follow the orders given by the key decision makers. The individuals who find themselves in the threatened regions represent the lowest level of the organizational hierarchy. Generally, they do not dispose of information about the global development of the crisis, however they do have the most current data about the local situation.

After the crisis breaks out, it is necessary to proceed quickly, because the longer the government looks for a solution, the greater is the risk that the situation is going to grow unmanageable. Therefore agile mobilization of human and material resources becomes a crucial process in crisis response stage. The approach to mobilization of people and technologies may differ. For example, in response to the SARS epidemic, the priority was put on mobilization of human resources, while the technological ones were not used until almost a month of activity. In the Tsunami response, the authorities found the preferential mobilization of systems and technologies more effective (Leinder et al., 2009). Prompt installation and restoration of communication systems for the first responders and disaster managers represent the main technological challenge. It is necessary to establish multi-organizational systems capable of ensuring information updates and easy coordination of all agents involved (Manoj, 2007). Basic humanitarian aid such as water, food, shelter and medical help must be quickly delivered to the victims via operational communication network. The majority of extreme events also demands search and rescue operations that necessitate the existence of a mechanism enabling the rescue units to find survivors' location in a short period of time. All just mentioned factors were very problematic to achieve during the hurricane Katrina, as the whole communication and coordination infrastructure collapsed and emergency services were unable to identify the priorities.

The problems that appeared during the above listed disasters could have been minimized if there was a more elaborate cooperation and communication network allowing the citizens to play a greater role in solving the crisis situation. Citizens can contribute significantly in spreading the early warning messages using for instance social networking services such as Twitter or Facebook,

instant messaging or other online communication platforms. These platforms not only make possible the reception and resending of messages, but also allow the users create and share their own messages. This functionality could be utilized for example in gathering updated information about the current state of the situation during the crisis or even during the usual monitoring surveys. Information obtained in this manner would be more precise and would cover wider range of areas. Citizens could therefore alarm the competent authorities able of assessing the potential risks. The use of social networking would have as well a positive psychological impact on the mobilization of individuals. People will rather believe the testimony of someone they know than an official warning.

Providing the citizens means of two-way communication with national emergency agencies and services would facilitate the coordination of humanitarian aid and volunteers that could contact each other either through social networks or via mobile application specially developed for the purposes of emergency communication. Introduced citizen-centered communication channels should allow the responsible authorities to send longer messages containing instructions about the protocols that the stakeholders need to follow. The authorities would subsequently receive a feedback in form of questions (or not) coming from the stakeholders which would help them to customize the message and correct possible ambiguities. Citizen-centered ECS employing locally targeted distribution of information based on the use of mobile GPS applications by the stakeholders could make the alerts more accurate and ameliorate the entire warning process (Kubát, 2013). The willingness of individuals to make their mobile phones, or other devices, easily traceable would significantly facilitate the search and rescue operation and the targeting of information which could also be useful for the distribution of early warning alerts and their scalability.

The benefits of the citizen coproduction in creating and disseminating crisis related information are similar to those resulting from other e-government services and relationships with the public sector. The main idea is to approach the citizens as customers of the offered service promising early warnings and advices how to survive natural, man-made disasters or other specific and unstable situations. Citizen-centered emergency communication system has a considerable potential to engage the stakeholders in all phases of the crisis cycle and simplify the ongoing processes across the organizational hierarchy responsible for crisis management.

4. Characteristics to take into consideration when building a citizen-centered ECS

All emergency communication systems, whether they are citizen-centered or not, need to satisfy at least the requirements of speed, reach and quality of the transmitted information. The above mentioned characteristics are considered to be critical in all stages of the disaster response strategy. In addition to these, there are other requirements that a citizen-centered emergency communication system should answer. Researchers usually define an ideal ECS as (1) web-based, (2) low-cost, (3) easy to use and access, (4) mobile, (5) reliable, (6) fast, (7) capable of sending various types of messages, (8) linked with GIS, (9) having analytic and management visualization tools, (10) connected with local TV, radio channels and news outlets, (11) able to receive and generate critical information from a variety of sources.

The individuals affected by natural or man-made disasters have very different level of technical skills. Therefore the design of a new communication system should take into account also the abilities of non-technical users which necessitates the creation of an administratively simple interface ensuring intuitive use and the possibility to quickly send alert messages without any

necessary and complicated tutorial. This factor is critical for the system to work effectively but at the same time it represents a great challenge as well, because the interface needs to be highly customizable to fulfil the needs of every individual across the social levels and generations since both have influence on the choice of a communication device and the ability to use it.

Reaching specific audiences and recipients requires the delivery of different formats and versions of every communicated message. There is no need to provide full information to all stakeholders, only the content that affects them directly. Therefore the communication system should assure to some extent scalability of information and make possible the dissemination of detailed messages to the first responders and filtered, less detailed messages, to the public. In addition, the use of multiple communication paths has a positive psychological effect on the active mobilization of the citizens. Single warning is usually not sufficient to induce desired behavior, individuals tend to consult more than just one information channel in order to act and respond to the new situational settings.

To achieve the above listed characteristics, including the criteria of affordability, the ECS in case of an extreme event should use everyday communication infrastructure that are the stakeholders familiar with, which in most cases a priori means mobile phones and smart phones, but the local radio network and other broadcasting services can not be left out of the ECS for reasons of probable mobile and internet networks overload and for their ability to reach all people in the area regardless whatever communication device the citizens possess. However, in spite of the ease of use, the system should interoperate with other related systems, warning providers and recipients while allowing the use of multiple analytical tools. The demands on data processing and filtering are considerable. While building a citizen-centered ECS we suppose that the system will receive data from multiple sources like the Fire and Rescue services, Police, National Weather Service and many others. Furthermore, it is necessary to ensure that the system will still interoperate even with older technologies that some people and municipalities still use.

If the ECS is supposed to use positionally exclusive broadcasting, it should fulfill all of the following requirements that are: (1) information must be available to everyone (citizens, visitors, etc.) who is inside the target area; (2) the ability to encrypt information, based on geographic definition of the target area; (3) independence of the functionality of mobile networks and the Internet, (4) the information provider must be a reputable source; (5) security and robustness of the system against abuse; (6) the possibility of ongoing testing and verification of functionality (Žižka & Podaras).

4.1. InaTEWS - a citizen-centered ECS under construction

In the context of national disaster reforms launched as a reaction to the tsunami 2004, Indonesia proposed a new complex Tsunami Early Warning System (also known as InaTEWS) whose main purpose is to detect and analyze the data about possible danger and consequently disseminate the warning messages. This system is still under construction but the prospects seem to be promising.

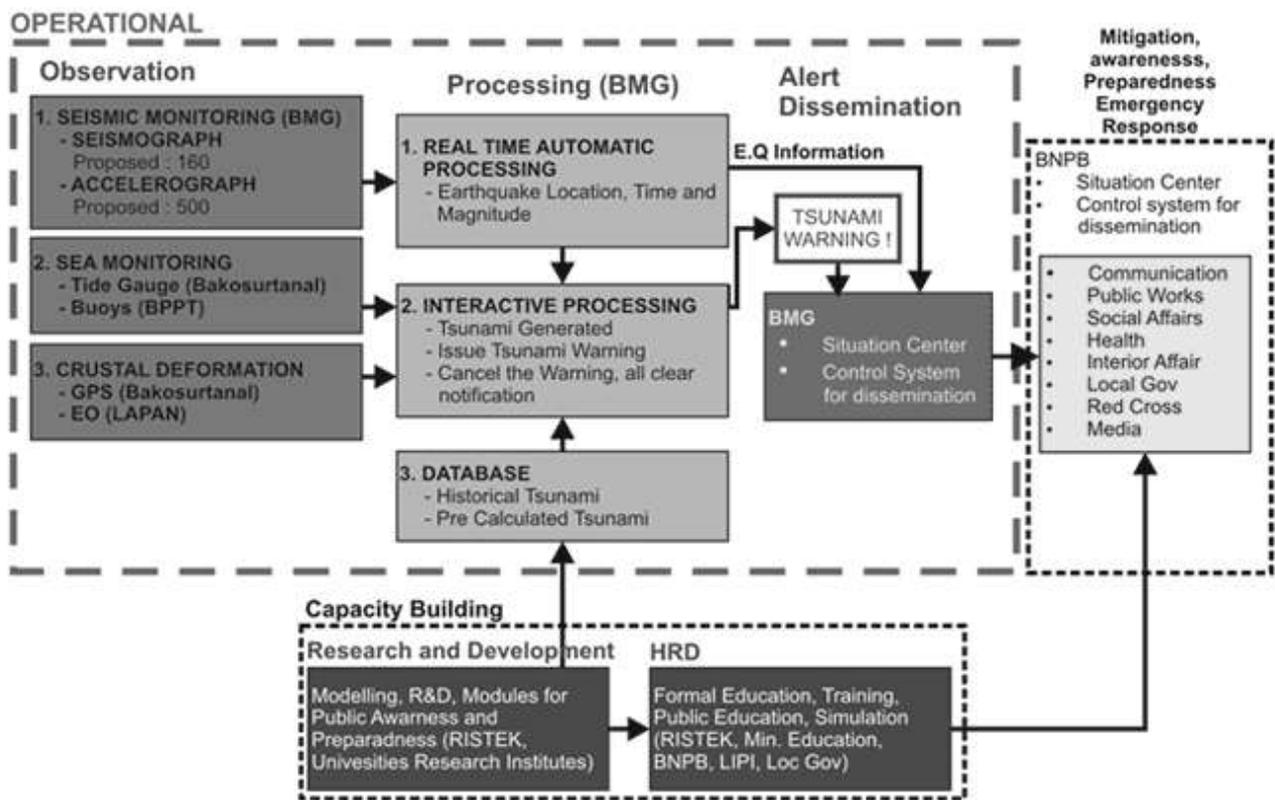


Figure 1: InaTEWS system of information distribution among institutions and the community (International Workshop on Post Tsunami Soil Management,, 2008)

The general concept of the InaTEWS is based on the model consisting of 3 elements proposed by the International Tsunami Information Centre (ITIC). These components regroup activities such as: Operational, Capacity building and Emergency response and mitigation. The operational activities involve monitoring, data collection, processing, analyzing, warning preparation and dissemination. The term *capacity building* comprises research and development efforts, educational trainings and engineering. The purpose of this set of activities is to create a solid scientific background generating high quality human and technological resources. The third element is directly connected to the crisis solving which includes the emergency response and mitigation. This component involves activities such as public education, preparedness and awareness improvement, shelter and logistic mobilization etc.. All the above listed components are connected into one communicational suprasystem whose parts are administrated by numerous institutions. This cooperation is based on an approved operational program that assigns the responsibilities of each institution.

When an earthquake occurs, a seismic signal is transmitted and consequently recorded by the seismometers that send the signal through VSAT to the centers where it is analyzed by an expert who evaluates the source information. When the earthquake is strong enough and the parameters reach the values corresponding to the tsunami, a warning will be generated. The information received from the buoys serves as a confirmation of the data gathered through the seismometers. The BMG Operational Center has also installed a number of processing devices from Germany, China, Japan (NIED), and France. The operational system for InaTEWS is the German system SiscomP chosen for better results in automatic real time processing. The Operational Centre is also planning to develop and implement new decision support system that would integrate the

processing of the information coming from the earthquake monitoring devices, as well as the simulation system using the data from the tsunami database and geospatial coordinates. This new system should allow the performing manager to issue a warning in timely manner and give him recommendations about the measures that should be taken.

The dissemination system has been created for the purpose of sending early warnings to the list of government agencies and approved mass media. The accuracy of the warning messages is assured by the Situation Center and the Control System for dissemination who both evaluate the information they receive. As part of this system the BMKG (Meteorological climatological and geophysical agency) created a civic network using as communication channel the Twitter website. The BMKG Twitter network had a very positive impact on increasing the speed and reach of the national early warning system. The followers of BMKG through their actions of resending tweets coming from the agency directly contributed to the provision of public information services (Chatfield et al., 2013). The communication is possible in both ways since the citizens and people in affected areas may send messages back to the Operational Centre that is able to process these messages and give the citizens feedbacks.

5. Conclusion

Establishing a reliable citizen-centered emergency communication system entails a lot of problems of which the most serious is the stability of the system and its sustainability during a crisis situation, especially when the ECS is mobile- or web-based. Creating a resistant communicational infrastructure should therefore be the first objective of the whole developmental process. For example in the case of the InaTEWS, the two greatest national mobile networks providers closely cooperate with the Operational Center when the tsunami warnings are needed to be sent. The characteristics described in this article represent just a brief overview of the directions that can be taken and of the possible solutions, based on the analysis of the communicational issues that occurred during the selected recent disasters. The possibility of the multi-institutional and multi-agent cooperation also raises questions about the organization and discipline of all the participants, therefore there would be probably necessary to create to some extent a legislative background and incorporate the measures, actions, procedures and desired patterns of behavior into the already existing emergency plans. Construction a citizen-centered emergency communication system from the scratch would require a considerable amount money, thus it would be less financially demanding to use the already existing networks and tools and find means that would allow to connect them and use them as one single suprasystem.

Acknowledgement

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Citizen-Centered Emergency Communication Systems: Emphasizing the Role of Individuals in Crisis Response

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DETECTING EVENTS IN EGYPT BASED ON GEO-REFERENCED TWEETS

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Keywords

Event Detection, Tweets, Migration, Ubicity, Twitter, Geo Referenced Data, Mass Movement

Abstract

Migration is a major challenge of many European member states, early preparedness is imperative for target states for multiple reasons such as provision of adequate search and rescue measures. Specific events such as natural disasters might be in some cases the reason for increased communication by the crowd as well as early indicators of developing migration flows. In order to identify such indicators, we investigated the daily number of geo referenced Tweets in Egypt during the period from October 2013 until March 2014 by using the data handling tool Ubicity. Moreover, we identified certain days where relevant political events have taken place in order to identify possible event triggered changes of the daily number of Tweets. In addition, we extracted the daily number of Tweets in the big cities Cairo and Alexandria. We observed an increase of the daily numbers of Tweets during the period of ostracism of the political party “Muslim Brotherhood”. The largest number of daily Tweets was observed that day, when a rare snowstorm occurred in Egypt. We found good correlation between the number of Tweets in the whole Egypt and those of the two cities Cairo and Alexandria.

1. Introduction

Migration is discussed as a driver of demographic change on the one hand, and as a phenomenon with unforeseen consequences on the other. In any case, migration is at the heart of the political debate in industrialised countries. The European Union considers migration as one of the major challenges and has placed it as a major strategic priority in their agenda. As indicated by Collett (2013), 10% of EU 27 residents is not born in a Member State of the European Union. In this frame the European member states call for harmonization of immigration policy into the Union’s relations with third countries (Given and Luedtke 2004). In order to cope with this challenge, data about migration flows are needed. As Zagheni et al. (2014) states, these data are largely inconsistent across countries, typically outdated, often inexistent and de Beer et al. (2010) point out, that international migration flow data inter alia often lacks adequate measurements of volume, direction and completeness. An attempt to cope with this gap is the widespread use of smart phones, which provide geo-located data via social media communication. They can be also used as an information

source regarding the mobility of a crowd (Noulas et al. 2011). Within this paper we analyse the change versus time of geo referenced number of Tweets in Egypt from fall 2013 to early spring 2014 in order to identify possible relations between political or other events and the change of degree of communication of Twitter users. Such changes might serve as indicators for social instabilities associated with increased migration flows in future investigations.

1.1. Overview on existing investigations

Early detection of any signals indicating possible social instabilities are of imperative relevance for multiple purposes. One of these is the identification resp. foresighting of new migration flows in order to help preparing potentially affected target states in different ways, such as providing search and rescue measures. One possible approach is to use signals from social media as indicator for extraordinary events, e.g. due to high rate of Twitter messages during specific periods. Specifically the use of mobile devices containing additional geo-information offers multiple opportunities to examine the development of critical events. Examples are riots such as those in the UK in 2011, where useful data about the emergence of an event have been obtained in the aftermath. This emphasizes the potential of information obtained via social network services (Glasgow & Fink 2013). Documented as one of the early examples, the potential benefit of information distribution via Tweets was indicated by the landing of the US Airways flight 1549 in New York's Hudson River (Beaumont 2009), where Twitter was prominent because of its immediacy on breaking news. Information retrieved from Tweets promise to be a helpful valuation basis for decision maker and have some advantages over information generated by media. For emergency and disaster management Chae et al. (2014) highlighted that analysis of mass behaviour is necessary to establish a well-founded basis for decision making in planning environments. In the frame of a study Schaust et al. (2013) analyse Tweets during the hurricane Sandy was hitting New York, with the aim to gather indications that event-relevant data have been shared by residents.

In a case study conducted by Ferrari et al. (2011), routine behaviours of mobility in the city of New York can be identified on Twitter by extracting urban patterns from crowd aggregated data on the base of a probabilistic topic model. In order to identify emerging events on the basis of location and time, impressive research has been done by Kraft et al. (2013) aiming on developing a real-time event detection, which alerts users at the moment when an event occurs. While traditional broadcast only provides information after an event, a case study based on data from the Boston Bombing has been performed to demonstrate that streaming Tweets include context information of the current event. Kallus purposes a different approach by referencing not on events directly, but on media coverage (Kallus 2014). Following the intention to get convinced of the predictive capability of Twitter, he explored Tweets which are linked with the 2013 coup d'état in Egypt. By studying historical data and using natural language processing for 7 languages he presents evidence that crowd based data can be used to identify mass events. An attempt to infer migration patterns from Twitter data was made by Zagheni et al (2014). The authors point to the fact, that usually census data are used to indirectly estimate migration flows. Using this approach little can be said about the years between censuses and recent developments. Geo-located data from online sources offer new opportunities to improve the situation. Zagheni et al investigated geo-located data from about 500,000 Twitter users in OECD countries for the period May 2011 – April 2013. For users having posted geo-located Tweets in a regular way, movements within and between countries for periods of four months were investigated. According to the authors their methodology can be used to identify turning points in migration trends as well as to improve the understanding of the relationship between internal and international migration.

1.2. Use case Egypt – historical developments

For a long time Egypt has been known as both transit- and destination country for refugees - mainly originating from Eritrea, Somalia and Sudan. The overthrow of the elected President Mursi, the subsequent seizure of power by the military and the insertion of a civilian transitional government, which is apparently controlled by the former military ruler General al - Sisi , and the radicalization of the followers of the - now banned and since 25/12/2013 classified as a terrorist organization - political party and Islamic movement " the Muslim Brotherhood " caused further unrest and led to a further strengthening of various Islamic groups such as "Ansar Bayt al Maqdis". The deteriorating situation created a non-secure climate in some regions of Egypt but, in the first place, has not led to a massive outflow of its citizens. Several additional incidents caused a sudden outflow of Egypt-originating- and third-country-refugees, residing in Egypt. In order to find potential relations between political or social incidents and number of Tweets we give here an overview on historical events within this period. For this purpose we performed an open source search in order to identify events, potentially relevant for migration, or so called trigger events for migration movements. An overview of political events is given in the period from October 2013 to March 2014 in table 1 (e.g. ZEIT ONLINE AP Kg 2013; tagesschau.de 2013).

2. Methods

2.1. Description of Uximity

Open source data and particularly social media data is by nature vague, ambiguous, imprecise and inconsistent. In order to conduct proper data analysis AIT developed the data extraction, collection and indexing tool Uximity. It is built around the open source distributed search engine Elasticsearch. Uximity extends the functionality of Elasticsearch and provides a generic plugin architecture that enables data scientists to automatically index data streams from multiple sources like designated social media APIs or web crawlers into Elasticsearch. The high performance architecture of the Uximity core component preserves the distributed systems features of Elasticsearch and enables powerful event concatenation upon multiple sources. For the purpose of this paper we created a Twitter-Plugin that connects to the public Twitter-API and collects all geo-referenced tweets, i.e. all tweets that provide attributes for latitude and longitude. We also implemented a Just-In-Time indexing plugin that can be used to manage the indexing behaviour of certain plugins on-demand, e.g. search for additional hash-tags. We plan to extend Uximity with Plugins for various social media platforms to enable a cross-platform search. Additionally, we plan to introduce the concept of Uximity AdOns that can be used as an alternative data sink next to Elasticsearch, e.g. Graph Database. We utilized the Elasticsearch geo-search functionality to retrieve tweets that are located in Egypt. The build-in time aggregation feature enabled us to further subdivide tweets in time slots on daily and hourly basis.

2.2. Method for data analysis

We extracted 1.02 million messages sent in Egypt from the total number of 407 million Tweets (total data volume 840GB) obtained worldwide from October 30th to March 17th with some interruptions in-between due to maintenance and development activities. For this purpose we used the boundary box tool of Uximity. In order to cover the whole area we used a geo-polygon query of nine latitude/longitude pairs to approximate the borders of Egypt. The number of Tweets was allocated to each day of the examined period in order to identify the distribution of the daily number of messages. We sorted Twitter messages versus time in order to identify specific days or

periods of days with considerable higher number of Twitter messages and developed histograms of categories of daily number of tweets. In the next step we identified the days within the examined period when documented historical events took place and allocated the number of Tweets to these days in order to find out if these events are related to an augmented number of Tweets. In order to investigate the potential differences between urban areas and the total area of Egypt, we selected the areas of two metropolis of Egypt, i.e. Cairo and Alexandria. These two cities have together about 12.2 million inhabitants or 14.3 % of the total population of 85 million. We identified the total number of geo-located Tweets of these two cities again by applying the boundary boxes of Uximity and allocated them to specific days within the examined period. Finally we investigated the relation between the daily number of Tweets of whole Egypt, Cairo and Alexandria by determining the corresponding Pearson's correlation coefficient.

Date	Event
6.10.13	Pro-Morsi marches are confronted by police in the Giza neighbourhood of Dokki and Ramses Square, leaving 57 protesters dead.
20.10.13	A shooting during a wedding at the Virgin Mary Church in Al-Warraq, Giza kills five persons
4.11.13	Morsi attends his first hearing on charges of inciting violence and murder. It is his first public appearance since his ouster.
20.11.13	A car bomb is detonated in Sinai, killing 11 soldiers on a bus. According to the armed forces, 37 were injured in the blast.
26.11.13	Dozens of activists are arrested in front of the Shura Council after the police dispersed the demonstration, which did not comply with the controversial Protest Law.
14.12.13	President Mansour announces that the constitutional referendum will take place on 14 and 15 January.
24.12.13	The Daqahleya Security Directorate in the delta city of Mansoura is bombed, killing 16 persons.
25.12.13	The cabinet declares the Muslim Brotherhood a terrorist organisation, referencing a prior court ruling
14.1.14	The clashes between police and protesters loyal to Morsi have left at least 11 people dead on the first day of a vote on Egypt's new constitution
16.1.14	A majority of Egyptians who voted on a new constitution have backed the draft charter, a senior Egyptian official said
24.1.14	Egypt tense on uprising anniversary of revolt
25.1.14	Egyptians mark the anniversary of their revolt in the name of democracy; there has been a powerful sign of the country's stunning reversals Egypt anniversary, clashes kill 29.
1.2.14	Egyptian military says air strikes kill 13 Sinai militants
16.2.14	A bomb attack on a tourist bus in the Sinai peninsula has killed at least three South Korean tourists and an Egyptian driver, officials have said
24.2. 14	Egypt's army-backed government resigned Monday, state-run Nile TV said, adding uncertainty to the nation's three years of upheaval

25.2.14	Egypt takes steps to replace government
2.3.14	Egypt's armed forces chief, Field Marshal Abdul Fattahal-Sisi, has said he cannot ignore calls by the majority for him to run for president Egypt court bans all activities by Hamas.
15.3.14	Six Egyptian soldiers have been killed by gunmen at a checkpoint in the northern Cairo suburb of Shubra al-Khayma

Table 1. Examples of political events of the period October 2013 to March 2014. Information was obtained by multiple open sources

3. Results

Geo located tweets of Egypt from 98 days within the periods from 30.10.2013 to 6.1.2014, 24.1.2014 to 10.2.2014 and 21.2.2014 to 10.3.2014 were analysed. In order to ensure the comparability of data, all days being boundaries of periods were excluded from our evaluations. The reason for this is that data extraction from Twitter has not been performed for 24 hours during the boundary days, making comparisons with other days with 24 hour data extraction not meaningful. The timeline of the daily number of geo located tweets is shown in Figure 1. In Figure 2, a histogram of different categories of number of tweets is shown for whole Egypt. Two accumulations can be observed in Figure 2, one in the range of 7,000 to 8,000 tweets per day, the other around 13,000 tweets per day. The second accumulation corresponds mainly to the days from the 22nd of November to the 6th of January. The minimum of the period from 23.11 to 6.1 (9,818 Tweets per day) is slightly higher as the maximum of the remaining days (9,741 Tweets per day).

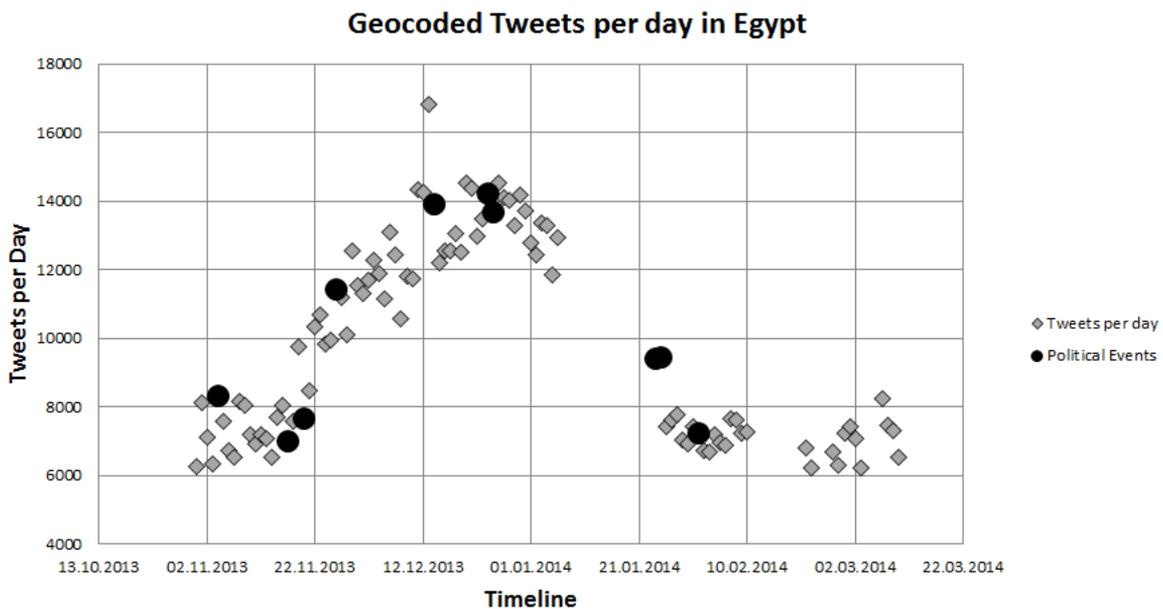


Figure 1. Number of daily geo located Tweets in Egypt in three periods between October 2013 and March 2014 (grey rectangles) and historical events (black bullets).

In addition to the investigation of geo referenced tweets for the whole Egypt we investigated also the timeline of tweets for the cities of Cairo and Alexandria. The timeline of tweets for the two

cities is shown in Figure 3, together with the normalized data from Egypt; the number of all tweets was normalized by the respective median, and e.g. data from Alexandria were normalized by the median of the number of tweets from Alexandria.

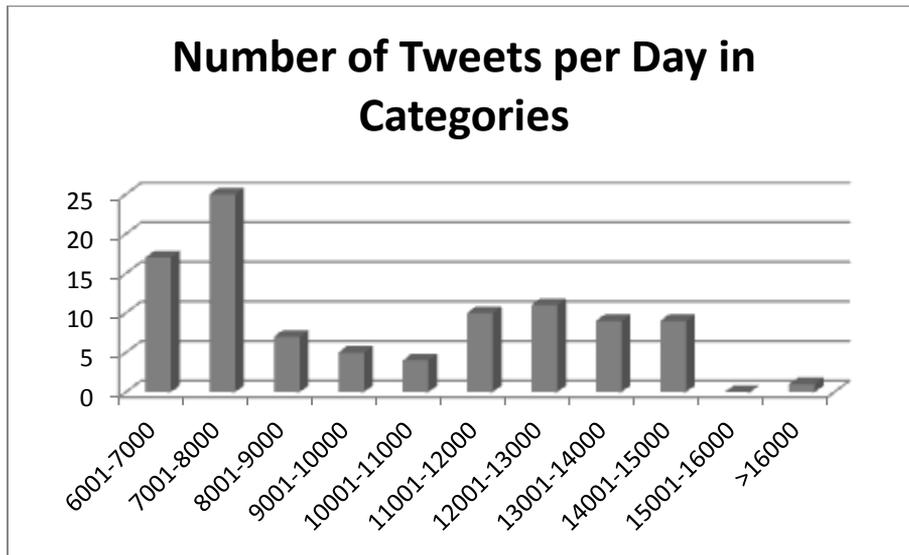


Figure 2. Categories of number of daily tweets. The height of the columns corresponds to the number of days falling in the respective category.

Moreover, trend analyses were performed for all three data sets by determining polynomial functions of the 5th order. The correlation coefficient between the number of tweets from whole Egypt and Cairo is 0.97, between Egypt and Alexandria 0.93 and between Cairo and Alexandria 0.89.

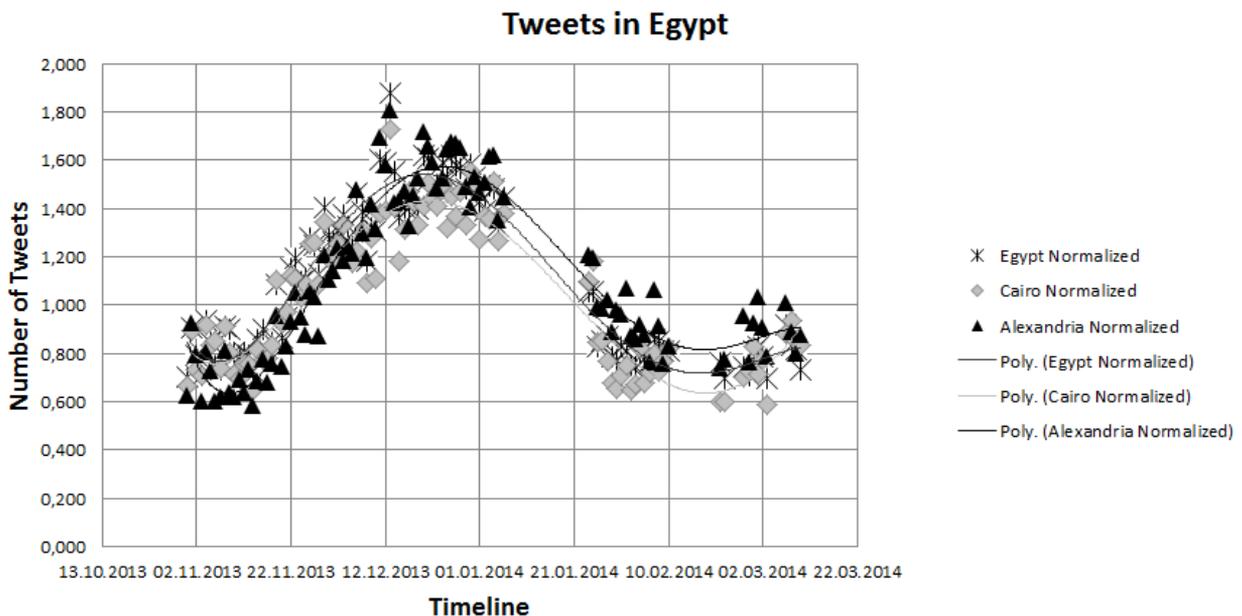


Figure 3. Number of daily geo located Tweets in whole Egypt, Cairo and Alexandria in three periods between October 2013 and March 2014.

4. Discussion and Conclusions

Looking at Figure 1 it can be seen that the number of daily tweets tends to increase starting from approximately end of November 2013. By the end of December 2013 the number of Tweets starts to decrease until the 6th of January 2014. Unfortunately data are not available from the 7th to the 23rd of January 2014. On the 24th of January 2014 and the following days the number of Tweets is considerably lower compared to the period from 22nd of November 2013 to the 6th of January 2014. This obvious increase between approximately the 22nd of November 2013 until the 26th of December 2013 might be associated with the banning of the Muslim Brotherhood and reaching a peak of tweets one day after the classification of the Muslim brotherhood as a terroristic organisation (25th of December). Looking at individual days the 13th December 2013 shows the maximum number of Tweets (about 17,000). This value is about 2,000 Tweets above the second highest value. During this day an extreme rare snowstorm occurred in Egypt. Taken the two developments together the long term change of number tweets can be associated with a political change process during several weeks, whereas the maximum can be associated with a singular, very rare meteorological event. Comparison between trends in number of tweets in whole Egypt and the big cities Cairo and Alexandria show the same trend. This is supported by correlation coefficients between 0.89 and 0.97. By comparisons we observed no visible relation between specific daily number of geo referenced tweets and any documented political event, the only exception is the snow storm on the 13th of December 2013. However, important political changes might be associated with changing Tweets quantity during weeks and indicate a growing interest as well as possible situational unease. In order to ensure reliable outcomes, the stability of the number of Tweets versus time provided by Twitter has to be investigated. For instance, Morstatter et al. (2013) indicate a slight misrepresentation of top hashtags in the public Twitter endpoint in comparison to the population. The authors noticed that the streaming limitation of 1% of all available tweets is not constant over time and strongly depends on filter criteria. However, our results indicate that Twitter offers a reasonable ground for event detection based on geo-referenced data. In order to assess the reliability of our approach, the impact of the difference between boundary box set polygons, used to define the geographical area where tweets are extracted from, and real political borders has to be investigated. We set the polygons in a way ensuring that the whole area of Egypt is included. However, some territories which are not belonging to Egypt are also part of the area used to extract Tweets. These areas are mainly desert, nevertheless there is need to investigate the impact of extra territorial areas in more detail. Taken together, the approach to identify periods with exceptional frequency of tweets can be used as indicator for unusual developments. Such developments are in some cases potential indicators of migration movements. As illustrated by the example of an Egyptian snow storm, Egyptians seem to be favoured to share more frequently information on Twitter about the latest danger, like natural hazards, because there is an imminent threat. The increase of the degree of communication is in fact a type of knowledge provided by the crowd pointing out the relevance of a specific event for at least parts of the population. The data evaluated so far do not allow final conclusions, this work can only be seen as starting point indicating that changes in the amount of Tweets might be both associated with rare events as well as political changes and therefore be a relevant indicator for migration movements under certain circumstances.

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ENTERPRISE AND SOCIAL NETWORKING

TOWARDS SINGLE E-MARKET

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Keywords

Electronic networking, Business networks, e-market, B2B e-marketplace, SME

Abstract

Electronic networking is nowadays one of the key factors of relationships among businesses. Nowadays concepts of integration, interoperability and standardization play important roles in such business networks. However there is still a lack of interoperable standards and the business environment suffers from networking inefficiency which results into low level of e-market evolution for SMEs. As reaction on this situation the paper presents a strategic framework of single e-market concept in bottom-up approach. It includes the creation of interoperable infrastructure for enterprise networking, e-service layer for cooperation and business contractual life cycle and data integration layer with knowledge creation of e-services for better decision support and market formation.

1. eBusiness networking

The issue of business networking passed through a complete redirection in its purpose in last years. The original purpose was according to (Aberdeen Group, 2011) to exchange purchase orders electronically however networks play nowadays completely different roles and they are necessary for optimizing transaction processes and also for improving relationships among buyers and suppliers.

According to (Ford and Mouzas, 2013) business networking is the conscious problem-driven attempts of one or more business actors to change or develop some aspects of the substance of interaction in relationships in which they and others are involved. It is also the process through which all actors attempt to influence the evolving substance of their interactions. Another definition by Österle et al (2000) says that business networking is defined as the management of IT-enabled relationships between internal and external business partners. Business networks are nowadays

based on ICT solutions and thus they are called electronic networks or simply e-networks (Janke and Prídavok, 2012).

The following graph shows us the development of business networking resulting into a current form called **networked economy**.

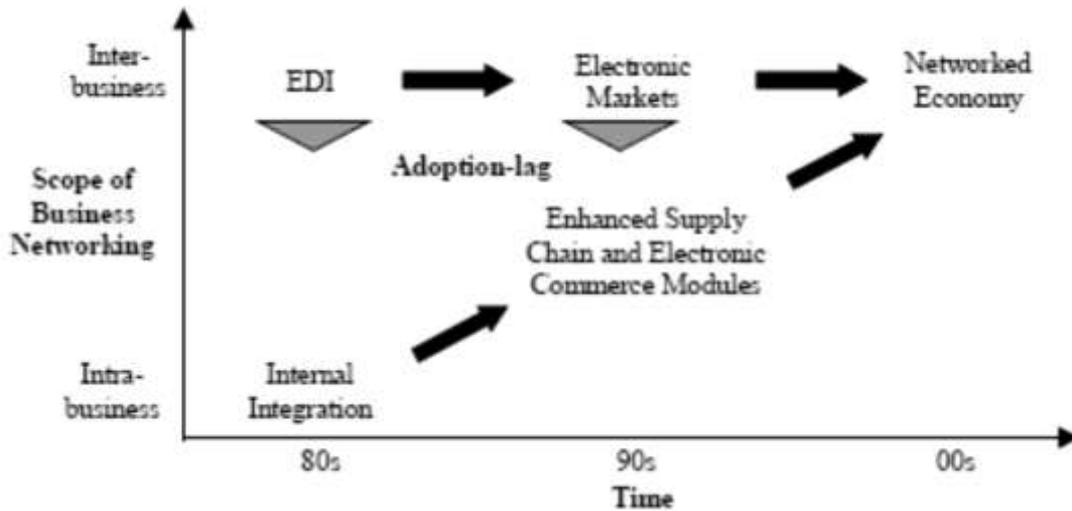


Figure 1: Evolution of Business Networking Systems, Source (Alt and Fleisch, 1999)

According to Ford and Mouzas (2013), relationships among firms in business network can be expressed through activities, resources and actors. *Interdependencies* can happen among some activities for instance among logistics systems, *heterogeneity* shows us how resources of two or more companies have been adapted or developed through interaction and finally *jointness* is a measure of the extent to which the actors in a relationship do things together.

Business processes in networks are called external or collaborative where concepts of **integration**, **interoperability** and **standardization** play important role (Pankowska, 2008). Together, business network environment should be based on interoperability and standardization and this environment should be trustworthy (Delina, 2012) as trust is a crucial factor of sustainability (Szabo et al, 2013).

Integration can be defined as the controlled sharing of data and business processes between any connected applications and data sources (Pankowska, 2008). Integration also allows many features for optimization and automation, although the integration was often considered as risky solution because mainly in private marketplaces participants revealed their business secrets through it (Delina, 2012).

However interoperability has more abstract sense and we can define it as the ability of two or more systems or components to exchange and use information. Another definition of interoperability says that it is the ability of business processes as well as enterprise software and applications to interact. Interoperability is a key factor for the market progression. For the purpose of this paper we will take it as full interworking, so it means interoperability between applications and between different manufacturers' equipment.

As mentioned above, one of the main features of electronic business networking is the standardization. According to Pankowska (2008), standardization means includes doing certain key things in a uniform way. Standardization brings to market networks few positive benefits such as simplification of business processes, synergy effect creation and generating values. Standardization is a necessary condition to develop and ensure interoperability within the network.

Collaboration between SMEs and creation of virtual networks is standard feature of market (Grzebyk and Kaliszczak, 2008; Filip, 2006). Very important element of business electronic networking is collaboration through procurement networks. They can be divided between buyer and supplier networks. Organizations using supplier networks are able to increase spend under management by more than 17% and on-time delivery is improved by 10% (Aberdeen Group, 2011). The main benefits of such networks are: increased ability to promote their products through sales opportunities and lower cost of servicing its customers through the network. However also here can be seen some barriers like inability to support technical configurations or the cost of subscription for them. According to Aberdeen Group (2011), participants in such networks are often able to offer more favourable terms than suppliers which would not be able to offer if they acted individually. Also new participant can bring into network conditions which other participants are not able to offer yet. The creation of such network can bring for buyers also other benefits such as better warranty period, maturity of invoices or better delivery date.

E-procurement networks are now able to grow and consolidate which is beneficial to buyers and suppliers but also to e-procurement service providers. However as stated in (Costa and Tavares, 2014) it is essential to ask if the e-procurement networks will tend to grow indefinitely with huge network effect and what management approaches of service providers should be implemented in order to encourage growth and obtain maximum benefits. Without clear evidence and reporting of economic performance, no IT system will be sustainable. Governance of IT systems relies on expected benefits which has to be measured systematically and with suitable metrics (Gavurova, 2012). According to Janke and Packová (2013), Doucek and Maryška (2012), Fisher et al (2013) and Saruc et al (2013) IT investments finally affect organizational performance.

2. The challenge for single e-market creation

The globalisation of our economy poses a number of challenges esp. to the smaller firms. Cross-border cooperation faces serious problems and obstacles because of not standardized business processes in Europe. Inconsistent development of electronic business environment supporting exploitation of new and more efficient eServices is still one of the biggest barriers to seamless communication, collaboration and generally networking of SME. Current e-environment is characterized by different business standards for electronic document exchange, which is pushed and adopted mainly by bigger players within their respective supply chain. E-Market calls for SMEs friendly business standards for international electronic cooperation to support accelerating their growth. A good example of successful standards implementation is the Baltic Sea region, where new technical and regulatory standards are already implementing.

Nowadays, the common practice of the SMEs is to manage their business documents and processes in the heterogeneous ERP systems installed on the local intranets. In order to exchange documents with the business partners, SMEs in many countries are often using paper-based communication or emails with the unstructured attachments (in PDF format, spreadsheets, etc.) exported from the ERP software. Received documents are usually printed and manually entered into the recipient's ERP system. Majority of the ERP systems for SMEs are not implementing any e-business standard for electronic exchange of documents or organisation of business information leading to very heterogeneous and ineffective SMEs environment.

According to the Expert Group on e-invoicing set up by the European Commission it is needed to emphasize on a faster uptake of e-invoicing and e-business standards within the EU. At the end of 2009, the Expert Group published its final report, including a proposal for a European Electronic Invoicing (EEI) Framework.

Their main recommendations can be summarised as follows:

- Meeting the needs of SMEs as a priority focus, by concentrating on a number of specific business requirements.
- The harmonisation of and the provision of clarity for the legal and VAT framework across the EU on the basis of equal treatment between paper and e-invoices
- The creation of an e-invoicing eco-system that provides maximum interoperability and reach.
- The adoption by all actors within both the private and public sector of a common invoice content standard and data model

But e-Invoicing is only one small part of the standardization needs. Free flow of online services across national borders together with global standards for business information usage related for example to cross-sector product and services classification schemes are still challenges for researchers and innovators in digital business area.

Better standards in Europe and better information on content access rating and classification schema across borders for achieving European single digital market was already recognized in Digital Agenda for Europe and within standardization initiatives, e.g. CEN, the European Committee for Standardization. In summary, it calls for openness and interoperability, more specifically to:

- Recognize and create more and better standards in Europe
- Make better use of these standards
- Ensure interoperability even in absence of standards

Interoperable standards for e-Invoicing and content (product) classification schemas are just the beginning of conducting e-business in the EU Digital Single Market. Even in the Finland which is one of the highest developed countries in adoption of electronic document exchange, more sophisticated e-services like e-Catalogs, e-Ordering, or e-Delivery are still beneath reaching the critical mass.

In conclusion, SME business environment still suffers from inefficient electronic networks and global supply chains which are still the main advantage for large companies and big industrial consortia. All standardization and business platform development projects were till now focused mainly on top-down approach which was not effective for SME business market and their internal legacy systems. Absence of higher transparency of potential and more effective business partners reduces the competitiveness potential of SMEs which are major driving force of our economy. On the other hand, information asymmetry on the market, opportunistic behavior of some market players, weak law enforcement, inaccurate and insufficient credibility and market information increase:

- Business risk leading to high cost for business confidence and trust achievement
- Inefficient decision making through insufficient market information
- Loses from not taking real market opportunities

Even in the case that some standard for electronic document exchange is adopted in some countries, wider standardization still faces several challenges, esp. internationalization, interoperability of electronic business document standards and product and content classification schemes which are barriers to wider electronic networking between SMEs. Current business document standards

covers only the core structure of the documents leaving many parts of the documents unstructured. Together, different sectors are dealing with different standardization problems, some of them are characterized by low number but strong product classification standards (PCS), other are using number of different local standards and some sectors are too heterogeneous without any standardization features in PCS. On the other hand, PCSs don't include some other important business information such as contractual conditions, etc. To support more efficient international e-cooperation and set up new form of smart business e-nvironment we propose the following strategic framework as a concept for approaching to a single e-market.

3. E-business networking for single e-market

Single e-market is a vision which can only be approached not really reached. To develop environment encouraging to integrate into one single space, bottom-up approach on a single e-market is required. Our concept for fulfilling this vision is based on establishing the base platform providing core feature for basic level of transparency and business communication based on modular data integration from internal legacy systems. To be successful, it is required:

- a) to ensure interoperability between selected ERP and legacy systems
- b) to offer easy integration for other stakeholders
- c) to utilize business information from SME legacy systems to build basic information base of network
- d) to integrate this network directly into their legacy systems with no constraints for free or very small cost
- e) to offer simple value added services easily understandable for SME users
- f) to offer complex and sophisticated solutions for more eSkilled SME users as attractor for low eSkilled SMEs
- g) to provide possibility to not sharing of their perceived sensitive information although linked with non-accessibility to market data and to build self-motivational system to share more data for exchange of high value market data
- h) to integrate the ecosystem to "world" known business networks and serves as a gate to global supply chains

Our concept consists of creation the **interoperable data infrastructure** for enterprise networking. This infrastructure will network SMEs by bottom-up approach through networking of their internal information systems (legacy systems) based on shared internal data accepting the level of willingness to share against value offered. It will bring new opportunities, extension and value for SMEs basic information systems, e.g. accounting systems and small ERP. It will be based on innovative and smart standardization approaches dealing also with standardization diversity and adaptability. Each ecosystem or infrastructure should be seamlessly interoperable, adaptable and easily to integrate into global electronic marketplace to achieve higher critical mass of potential business partners and market opportunities. It will be based on interoperability and e-networking between ERP and legacy systems providers from European regions.

The next step is a creation of **e-service layer** for cooperation and business contractual life cycle. New smart eServices for whole business lifecycle, e.g. eSourcing, eProcurement, eNegotiation, eContract management, eCollaboration, collaborative e-procurement, creation ad hoc and longterm

cooperative clusters, eSelling and push practices, reducing business spam, more targeted business, risk, financial and funding management, etc.

To create motivational environment to increase the usage of electronic network services, it is necessary to establish the self-regulation and **trust building e-environment**. It means to develop new kind of trust building electronic services from quality information, reputation building, online dispute resolution, contract execution support to escrow services. Such a feature will encourage to higher liquidity of the market as a crucial element of market sustainability.

Another important layer is **data analytical layer** with knowledge creation e-services for better decision support and market formation. To move from business intelligence to market intelligence. Whole infrastructure with all layers will generate big and exhaustive data with enormous new knowledge identification and creation challenges. New market knowledge will provide information like consumer, company or its employees' behaviour, market niches and dynamics, asymmetry, prediction of demand or other important statistics and causal relations for businesses, public bodies, policy makers or consumers.

Network infrastructure with **data analytical layer** will ensure more efficient integration of third trusted parties services for mediations, arbitrages and escrow with more quality data support for objective decision making and higher transparency in opportunistic behaviours.

Our proposal of the basic concept for single e-market is shown on the following scheme.

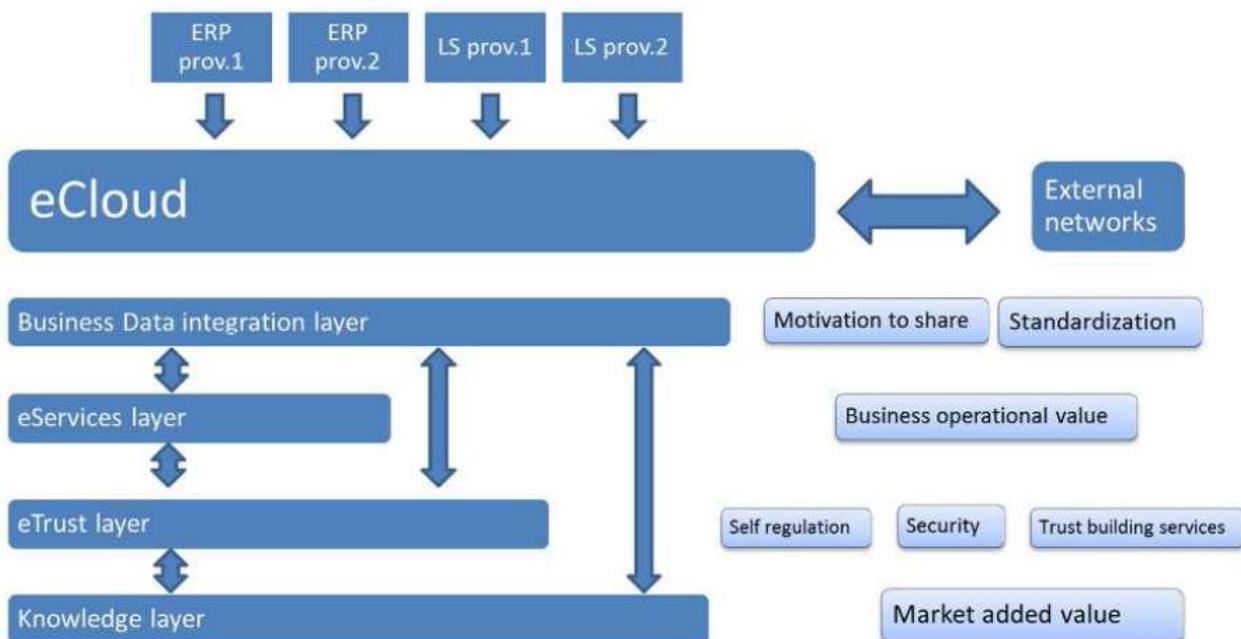


Figure 2 The concept of single e-market

As it is visible, although, we are using the term of single e-market we are still taking into consideration some external networks as external markets to be integrated. The term of single market was developed in traditional economy, where it is usually regionally constrained. In our case, the most understandable way how to explain our concept of single e-market is to imagine boundaries of our system in different dimensions. One can be regional (several countries will agree joint policy support for this concept). Other boundaries are given between different supply chains which are managed by strong market players or consortia. Together, boundaries of our market can be visible in size of companies which is our dominant direction. It means to develop single e-market for SMEs where relatively balanced market positions exist and no or very low monopsony

power is emerging (similar to dominant position of large company within its “private” supply chain).

As a first step to establish such a platform, first standardization efforts are required. The standardization is perhaps the most important aspect in the implementation of the infrastructure that enables the global use of electronic business information and implementation of electronic business processes. From our point of view and concept visualisation, standardization efforts can be divided into the following layers:

- Collaboration protocol and messaging
- Core data components of business documents
- Product and service classification

Collaboration protocol and messaging: The goal of this layer is to establish technical environment where all trading partners can exchange the business information in an interoperable, secure, and consistent manner. The standards at this layer leverage the existing standardized technologies for web services and Internet security such as XML, SOAP and digital signatures. The most adopted standard dealing with this layer is ebXML.

Core data components of business documents: This layer specifies library of standardized business documents covering business phases such as ordering, delivery and invoicing/payment. The standards are defined as the XML schema, which describes all types of the documents, their properties and allowed property values. Since the standards are XML-based, they can be simply implemented by existing XML parsers and validators and embedded in the web services specified in collaboration protocol and messaging layer. The most adopted standard is Universal Business Language (UBL) owned by OASIS and recommended by European Commission.

Product and service classification: At this layer, the standards provide normative list of trading items, their attributes and attribute values. Standards are provided in the form of the controlled vocabularies or taxonomies encoded in XML or other formats including the plain text or spreadsheets with vocabulary terms localized in different languages. Some standards are recommended for global use and translated to many natural languages. Others are provided for national use, limited to one sector, or specific for two cross-sector industries. The examples of the global product classification standards include Central Product Classification (CPC, Classification of Products by Activity (CPA) or Common Procurement Vocabulary (CPV).

To provide cloud-based platform for standardization and electronic exchange of SMEs business documents and content and organization of business information, it is needed to provide cloud platform with common technical infrastructure for providers of the ERP systems, supporting them in adoption of e-business standards. On the other hand the platform should provide standardized and unified access to the SMEs business processes, which is a prerequisite for the new innovative services such as electronic discovery of new business partners, electronic procurement and business analytics on various levels (company, sector, cross-sector/national or European). In that way, the platform should integrate and leverage existing ERP software, which is already installed and commonly used by the SMEs. In this way, cloud platform is aimed to break any technological or organizational barriers in the adoption of the standards on the SMEs side, directly providing useful service for efficient, secure and reliable electronic exchange of documents between collaborating partners integrated with the already known user interface of the ERP software.

4. Conclusion

The real networking solution between millions of European SME companies can increase market transparency within global supply chains, increase and utilize new market opportunities and competitiveness. Integration of their local or international ecosystems into global marketplaces will increase their market opportunities and understand market and product innovation trends. Through trusted market environment the cost for reduction risk will be reduced and business lifecycle will accelerate. Through knowledge layer, the business decision making will be more efficient and bankruptcy and opportunistic behavior deforming market will be reduced. It will lead to more stable and healthy market.

To be able to fulfil this framework vision, the eCloud data and e-service infrastructure encouraging emerging of new smart e-services for business and consumers is necessary to develop. New “bottom up” approach, sharing knowledge together with wider and suitable standardization of business information will be the first big step towards approaching to a single e-market for SMEs in European space.

Acknowledgement

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INTERNAL COMMUNICATION AS A NEGLECTED PART OF ICT MANAGEMENT

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Information systems, ICT, Communication Barriers, Internal Communication

Abstract

The paper focused on one of the neglected parts of information and communication technologies management which is internal communication. ICT is one of the basic elements (assumptions) for a formal setting of functional internal communication, and it also affects the level of its efficiency. Insufficient internal communication, in turn, indirectly affects efficiency of ICT in the organization. The problem (i.e. insufficient setting up of ICT within organizations which is a barrier for higher efficiency of internal communication) was identified by the conducted survey. Methods of descriptive statistics, correlation analysis and some methods of multivariate statistics such as exploratory factor analysis, principal component analysis and cluster analysis as well as joint entropy were used for the evaluation of the data from the perspective of individual barriers. Wrongly set processes can be the cause of all other barriers because when the processes are wrongly set then, even if there is enough will, time and knowledge, internal communication processes cannot be optimal.

1. Introduction

The experience with information systems efficiency in companies is summarized by Prof. Kosturiak as follows: „I have been to many companies and have experienced many situations. There is one thing common to all of them – discussion about information system. If the company is not functional, people often find two reasons for that – the information system is being installed or it has just been installed. The former means that the company processes are not working because we have not spent enough money to install the information system which will solve the majority of the problems. The latter, it is the information system to be blamed for the processes not working well, despite the fact we have spent a lot of money on it. The only difference is that the former state contains a hope that it will work properly sometime in the future, the latter says that we have spent

more than we had budgeted and now we know that it will not work. There are optimists in all companies who try to find the way out of this situation – everything will work properly if we find and install new information system. One idea is, however, common – and it is the discussion about the information system.“ (Kosturiak, 2013, p.1).

Further on, we will focus on one of the most important phenomenon crucial for the company profitability closely connected to information systems and these are the barriers of internal communication in small and medium enterprises as a neglected part of ICT management. The presented article follows this structure: First, it focuses on literature summary, then, internal communication will be defined, followed by the research and its evaluation, and finally, the summary.

2. Literature review

The issues of ICT – as the area of significant costs – are covered in detail by (Bankole, Brown, & Osei-Bryson, 2013). Human capital is one of the key factors affecting the expansion of ICT and the realization of macroeconomic outcomes not only in transition economies. While the ICT regulatory policies have shifted to encourage increased ICT investments, the ability to formulate and implement complementary practices to investment in ICT and human capital development strategies remains a continuous problem (Samoilenko & Ngwenyama, 2011). In the process of information system creation, one must take into account that the information is produced (processed) in one physical site, stored in the same or in another site and communicated through the physical means to the site of utilization. All the three entities (production, communication and utilization) exploit instrumental items as facilities that are hosting pertinent devices, hardware, software, operation systems, applications, files, physical means of communication (internal and external network), and all these are linked to the human factors as operational management policy, training, working activities and the end purpose of the delivered information. Internal communication, comprising all of these means and processes, will therefore become an important issue to discuss. The delivering systems provide information to the end users who exploit it for their specific aim. Information and all the instrumental items, which are the components of the delivering system, need specifically dedicated interdepartmental protection in order to reduce the possibility of information breaches (Abbo, 2012).

2.1. Internal communication as a neglected part of ICT management

Internal communication can have various factors in organizations and when solving investments in ICT, internal communication is often neglected. Internal communication is communication within an organization and it is necessary that all the information systems are functional. It goes in all directions among line staff (those who do the specific work of the organization and work directly with the target population), administrators, supervisors, clerical and support staff, volunteers, and perhaps even the Board of Directors (Rabinowitz, 2013). A difficulty with incorporating internal communication to increase efficiency within information systems is discussed by (Tariszka-Semegine, 2012). The importance of ICT technologies in the context of an organization and its management is also proved by (Vodáček & Vodáčková, 2001) and in *Rethinking the Future* (Gibson, 1999) the management academics consider communication to be one of the most important competencies in leaders. Despite this fact internal communication is usually not taken into account when projecting new information systems. The book *Effective Internal Communication* clearly illustrates the importance of communication in all managerial activities

from the viewpoint of management (Smith 2008, Keřkovský & Drdla, 2003) also focuses on strategic management of company information.

The problems with company inefficient internal communication are found in many companies. According to the survey of the European Agency for Safety and Health at Work (EASHW, 2010) – committed to making Europe a safer, healthier and more productive place to work, and promoting a culture of risk prevention to improve working conditions in Europe – it is possible to highlight several findings regarding the most frequent sources of stress in the workplace, i.e. the impacts which influence work stress. On the other hand, inefficient one can easily cause work dissatisfaction, employee fluctuation and poor business performance (Yates, 2006). Further research shows that communication is one of the most important sources of conflict, stress and dissatisfaction but also the source of understanding, mutual cooperation and enhanced work performance leading to competitiveness and innovation. Some research also proves the impact of internal communication on employee engagement (Gallup, 2008).

The main aims of internal communication (naturally not the only possible) could be set as follows:

- information transfer necessary for *work performance*,
- information and motivation link necessary for *co-operation* and *sharing know-how*,
- and forming of desired morale, labour behaviour and attitudes necessary for reaching *employee stability* (Holá, 2006, p.45).

Communication is a complicated process where it is necessary to observe all factors which can influence it (Miller, 2009, p.8). If the communication is sufficient and functional, the company will know it thanks to the feedback (Baron and Armstrong 2007). Communication process is also the basis for knowledge and know-how transfer (Mládková, 2004). In successful co-operation it is necessary to share and connect the knowledge which brings new findings and knowledge through synergy. The comprehensive content of internal communication shows that it is a matrix of personal work, internal marketing and managerial communication. The basic prerequisites which set the proper function of internal communication system are as follows:

1. company culture based on moral and ethical values,
2. declared organizational strategy and company communication strategies and communication plan,
3. unified management team and full responsibility for company communication,
4. defined work duties, organization structure, main organization processes etc.,
5. declared social policy supported by personal work with the aim of finding mutual respect between the organization and employees,
6. setting communication standards that ensure the integration of new employees into organization, explaining the company's business, providing information on the main objectives and financial performance of the company, staff assessment and career management and next,
7. efficiently set internal marketing, mainly internal public relations influencing the relationship of the worker to the organization,
8. communication competencies of the managers,
9. open communication including feedback and

10. technologies – setting information and communication infrastructure for internal communication needs.

All these above-mentioned factors create efficient internal communication and in synergy represent quality of communication (Holá, 2011, p. 65).

Current information technology positions itself, by its nature, in deeply multicultural environment, therefore, the awareness of this basic fact is considered to be one of the most important prerequisites students, users, creators of the IT transfer should not only know but be systematically prepared for, educated and trained in that (Pikhart, 2013).

3. Methodology

One of the objectives of internal communication survey (LMC 2012) was to identify the main barriers to reducing its effectiveness. The methods of qualitative and quantitative research were used, all data were processed in statistical programme STATISTICA[®]. The combination of qualitative and quantitative research makes it possible to reach better results and interpretation of the researched problem as was proved for example by (Strauss & Corbinova, 2008).

Before the quantitative research, the qualitative research was carried out through the means of focus group with 9 managers (who are appointed to be responsible for communication or HR managers responsible for communication) in companies which focus on internal communication improvement. The scope of internal communication was defined before the discussion and basic terms set as well. The aim was to find basic barriers of internal communication in the organization which is systematically focused on internal communication improvement. The barriers were defined as the causes for communication failure which also slow down the processes and reduce efficiency, e.g. insufficient communication and information infrastructure.

The barriers were defined as the causes of communication failure which prevent reaching better efficiency. These were the barriers derived from the qualitative research:

- lack of time,
- lack of finance,
- lack of knowledge and skills,
- insufficient technologies,
- wrongly set processes,
- lack of will,
- lack of interest.

The above-mentioned barriers were then put in the questionnaire to validate their significance quantitatively and to confirm their correlation with internal communication efficiency. The focus group method was used to check the perception of these barriers and the scale from 1 (min) to 7 (max) was applied. Standard research methods for management research were applied (Easterby-Smith, Thorpe, & Lowe, 2008).

The survey carried out by LMC, Ltd. company (LMC, Ltd. is the leading operator in the Czech market of electronic work and one of the leading European e-recruitment companies) in cooperation with the Institute of Internal Communication during the spring of 2012, and the research brought several interesting findings regarding internal communication in Czech companies

(LMC, 2012). The managers of 252 collaborating companies completed an online questionnaire. The authors of this article are members of the Institute of Internal Communication and can handle the data of the survey. Apart from statistical evaluation of the barriers, the authors used the evaluation of uncertainty level of the barriers involved in the internal communication. The level of uncertainty is expressed by entropy. The findings of the research prove the necessity of internal communication improvement through reducing these barriers so that the company can be more competitive in the global marketplace.

To reveal the structure and bonds in variables further research methods were used, such as factor analysis (FA) cluster analysis (CLU) there are common statistical analysis and next independent method level of uncertainty evaluation (LUE).

All these analyses help understand the bonds and links of particular variables with each other and their connection with internal communication efficiency.

4. Results

The file of respondents includes both of two categories according to the size of the company as follows: The category SMEs up to 250 employees and the category Corporations with more than 250 employees. The respondents evaluated in the scale from 1 to 7. Median is 4, i.e., efficient with serious reservations, 57% of the respondents evaluated from 1 to 4, i.e., rather inefficient and efficient and 43% respondents evaluated internal communication from 5 to 7, i.e., efficient and rather efficient. Particular barriers were evaluated in the questionnaire on a scale from 1 to 7 (max). Because of user-friendliness 7 was maximal, verified by the focus group. Distribution of particular barriers is visible in the box graphs in Figure 1. The comparison of individual box graphs provides us with a simple illustration of different perception of these barriers.

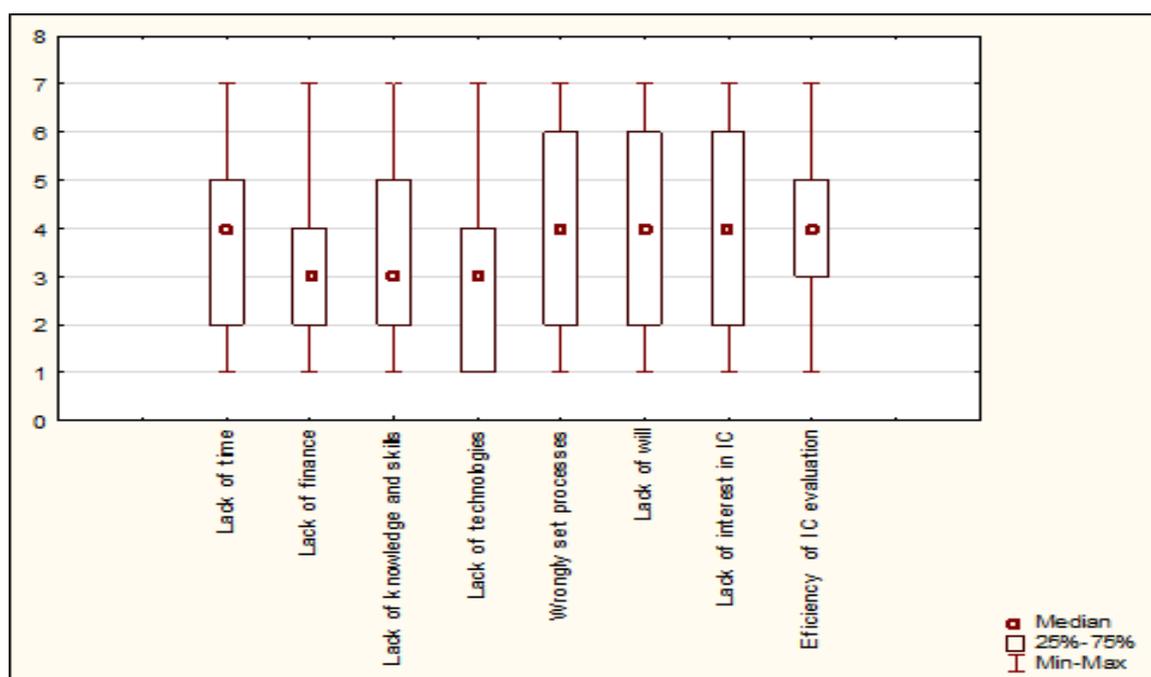


Figure 1 Box plot graphs of distribution of particular barriers and internal communication efficiency Source: own figure

Wrongly set processes, lack of will and lack of interest are perceived as the strongest barriers in internal communication. Lack of finance and insufficient technologies are perceived as the weakest barriers. Figure 1 also shows distribution of internal communication efficiency evaluation. Median and concentration illustrate how the particular barriers are perceived. Median is the same as in the barriers: lack of time, wrongly set processes, lack of will and lack of interest. An insufficient technology is the weakest barrier.

Correlation matrix in Table 1 shows the size of correlation coefficient in particular evaluated characteristics. Coefficients marked bold are statistically significant ($p < \alpha$). Null hypotheses with zero correlation coefficient in correlation with individual barriers and in correlation with internal communication efficiency evaluation were tested on the level of significance $\alpha = 0.05$. The tests were done in statistics software STATISTICA[®].

Table 1 which shows correlation coefficients is clearly visible that all barriers (apart from lack of time) significantly correlate with internal communication efficiency evaluation and significantly correlate with each other (marked correlation coefficients are significant on $p < 0,05$), efficiency evaluation.

Correlation of variables	Lack of time	Lack of finance	Lack of knowledge and skills	Lack of technologies	Wrongly set processes	Lack of will	Lack of interest in IC	Efficiency of IC evaluation
Lack of time	1,000	0,223	0,241	0,273	0,182	0,147	0,141	0,035
Lack of finance	0,223	1,000	0,326	0,432	0,117	0,127	0,177	-0,166
Lack of knowledge and skills	0,241	0,326	1,000	0,448	0,567	0,485	0,518	-0,311
Lack of technologies	0,273	0,432	0,448	1,000	0,300	0,301	0,284	-0,181
Wrongly set processes	0,182	0,117	0,567	0,300	1,000	0,594	0,624	-0,452
Lack of will	0,147	0,127	0,485	0,301	0,594	1,000	0,789	-0,434
Lack of interest in IC	0,141	0,177	0,518	0,284	0,624	0,789	1,000	-0,457
Efficiency of IC evaluation	0,035	-0,166	-0,311	-0,181	-0,452	-0,434	-0,457	1,000

Table 1 Correlation matrix of individual barriers and overall internal communication Source: own table

4.1. Factor analysis

Factor analysis which reduces a lot of detailed information in a smaller number of more accurate generalizations (Ferjenčik, 2000) is presented in Table 2. In the first column there are all evaluated variables, in the second and third we can see factor loadings of these variables in two identified factors. Concrete numbers represent the correlation between particular item and the factor. For example lack of knowledge and skills as well as wrongly set processes highly correlate with factor 1, and also lack of will and lack of interest in internal communication.

Assessed variable	I.Factor	II.Factor
Lack of time	0,351491	0,489023
Lack of finance	0,427621	0,665439
Lack of knowledge and skills	0,783581	0,065955
Lack of technologies	0,617541	0,468277
Wrongly set processes	0,782789	0,293889
Lack of will	0,797961	0,360602
Lack of interest in IC	0,830800	0,336429

Table 2 Results of exploratory factor analysis Source: own table

These items highly or not at all correlate with factor 2, and this factor, on the contrary, correlates with lack of time lack of finance and insufficient technologies. To put items in these factors there should be factor loading $> 0,4$ (Bedrnová, 2012, p.70).

In Table 2 the barriers are evident which strongly correlate with the first factor, i.e. lack of knowledge, wrongly set processes, lack of will and lack of interest, and they can be subsumed

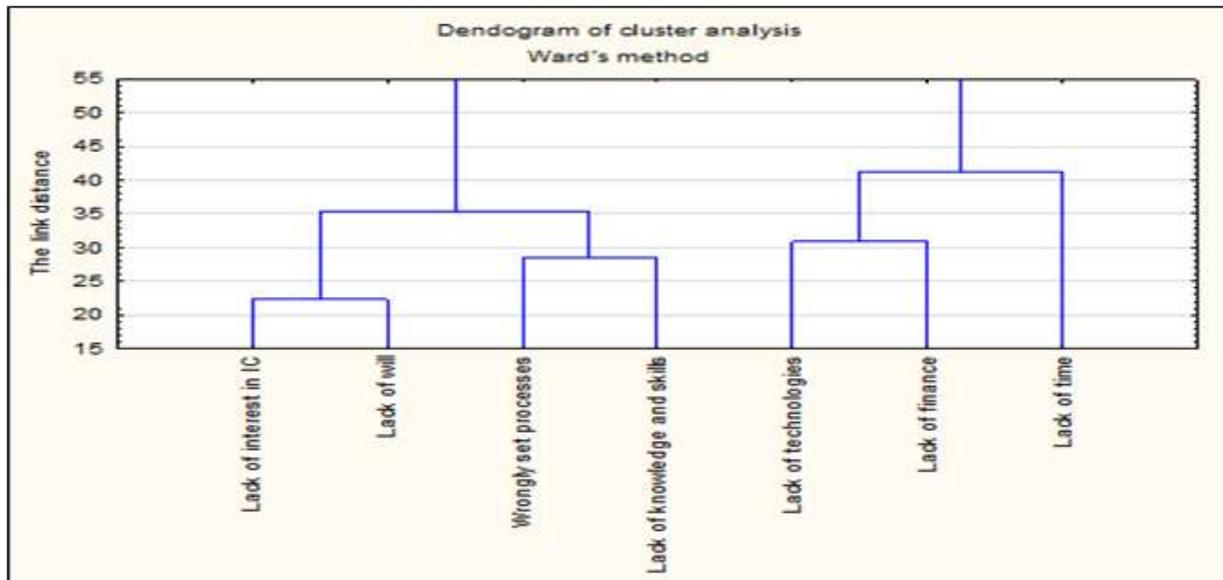


Figure 2 Dendrogram of cluster analysis of evaluated barriers of internal communication Source: own figure

in a more general factor 1, i.e., *the managerial competencies*. The strongest correlation of the second factor is with the lack of finance, lack of time, and they can be subsumed in factor 2, i.e., *the capacities*. Insufficient technologies will not be included in factor 2 because they strongly correlate with factor 1. The result of factor analysis therefore can be the generalization of these two factors, lack of managerial competence and insufficient capacities.

4.2. Cluster analysis

Another research technique used in the research was cluster analysis of individual variables. Ward method was used as a cluster method, whose optimization principal is to minimize heterogeneity of clusters according to internal group criterion of the sum of squared variations of the objects from the centre of gravity in the cluster (Meloun & Militký, 2012, p.454). The tightness of the clusters is visible in Figure 2.

The strength of correlation, the closeness of the relationship of particular barrier evaluation is observed in the dendrogram of cluster analysis for 7 variables -barriers (see Figure 2). The dendrogram clearly shows the differences of characteristics in clusters. Items which are connected with low distance share common similarities and items connected with high distance have low similarity level. According to the dendrogram of evaluated items it is clear that lack of interest and the closest to evaluated items it is clear that lack of will and each other, and furthermore, wrongly set processes and lack of knowledge and skills. This cluster therefore represents insufficient managerial competencies. This cluster analysis proves potential influence of demographic variables (category, system and strategy of internal communication) and also the influence of the barrier type on the evaluation of internal communication.

4.3. Level of uncertainty evaluation

The evaluation of barriers can be done with the level of uncertainty with which each barrier influences internal communication. The level of uncertainty can be expressed by the entropy (Golan, 2006).

$$H = - \sum_{i=1}^n p_i * \log\left(\frac{1}{p_i}\right) = - \sum_{i=1}^n p_i * \log_2 p_i$$

Barriers	Joint entropy [bit]
Lack of technologies	2,55
Lack of time	2,54
Lack of knowledge and skills	2,53
Lack of finance	2,41
Lack of interest in IC	2,34
Lack of will	2,31
Wrongly set processes	1,82

Table 3 Barriers and their joint entropy Source: own table

If we try to find which barrier is crucial from the information viewpoint for internal communication, i.e. which represents the biggest barrier, then Table 1 and the joint entropy can be used. The higher joint entropy value, the higher insecurity. Joint entropy is calculated according to the formula.

$$H = - \sum_{j=1}^m \sum_{i=1}^n p_{ij} \log_2 p_{ij}$$

In Table 3 we can see that the lowest value of joint entropy is in wrongly set processes. Therefore, this is the most important cause of the barriers in internal communication from the information viewpoint.

5. Conclusions and further research

From the conducted research analyses FA, CLU and LUE exploited for revealing the structure and links of variables, or barriers there are the most important conclusions as follows:

- The evaluated barriers correlate with each other and, except for the barrier lack of time, they negatively correlate with internal communication efficiency evaluation.
- The barriers can be divided into two groups: the barriers of managerial competencies (with lack of interest in internal communication, lack of will, lack of knowledge and skills and wrongly set processes). In the second group there are the barriers of lack of time, lack of finance and insufficient technologies. These two groups create important factors which influence internal communication efficiency.

- The insufficient managerial communication competencies in managers are much more influential than the barrier of insufficient capacities.
- Technologies correlate with the barrier of insufficient finance and it is not only investment in IT but also education and training, therefore, they belong to the barrier of insufficient capacities.

Managerial competencies represent the basic prerequisite for success not only in internal communication. Lack of knowledge and skills, on the other hand, can be the cause of lack of the interest and also its consequence. However, the most crucial is the will and interest, and on the basis of these the necessary know-how can be created. Wrongly set processes can also be based in insufficient know-how.

The barrier of insufficient managerial competencies is caused by the inconsistent strategy of the company which should consist of necessary competencies in compliance with main aims of the company. These managerial barriers generally influence the overall operations of the company, not only internal communication. This proves that internal communication is an integrated and natural part of the company processes and structures. Managerial barriers have a great impact on internal communication efficiency assessment and without removing them it is not possible to enhance internal communication and ensure that the company is more efficient.

Insufficient technologies and lack of finance represent another barrier. These barriers are perceived nor very negatively and do not have such an important impact as the barrier of insufficient managerial competencies. Investment in technologies is not productive without managerial competencies and the evaluation of information technologies importance is not so overestimated (Smith, 2008).

The managers from the sample feel a biggest barrier in the lack of interest and will and in both cases 49% of respondents mark these barriers as strongly negative and the dissatisfaction with these attributes also influences internal communication efficiency evaluation. The presented researched has proved that the will and interest are the biggest motivator to activity and continuous improvement, engagement, cooperation and success. Systematic setting of internal communication can support company efficiency and influence all processes. However, the basis of it is sufficient skills and knowledge which go hand in hand with engagement (the will and interest).

Further research should be focused on internal communication, now from the viewpoint of public administration and interaction office vs. the citizens. And also whether there is any significant impact on internal communication and this should be verified by further research.

Acknowledgement

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Internal Communication as a Neglected Part of ICT Management

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WHAT DO CZECH ICT STUDENTS THINK ABOUT THEIR CURRENT AND FUTURE JOBS?

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Keywords

IT Students, Work At Study, Labour Market, Employability Of Graduates

Abstract

The aim of the paper is to present and analyze key results from EUROSTUDENT V Survey which has been realised in the Czech Republic in 2013. The paper is focused on students of study programmes related to information and communication technologies. As the key results for this group of students we consider the questions and answers concerning labour market so we analyse the current employment of students (do they work during studies or study while working), link between their study programme and current job, reasons for working and study and their study and job workload. As very important we consider future chances for employment on both national and international labour market from their own perspective which we can compare with true data on employment of ICT graduates.

1. Introduction

Situation of graduates at study programmes related to information and communication technologies (hereinafter: ICT graduates) is a subject of interest of many researchers. Maryska et al. (2012) point out the relation between ICT university education and the development of the whole economy. Doucek et al. (2011) emphasise the importance of fulfilment the requirements on graduates of ICT study programmes applied by the Czech ICT industry for improvement its competitiveness. Marek (2013) analyses the wage evolution in the Czech Republic including the view on individual industries. Mazouch & Suchankova (2013) point out the importance of lifelong learning and analyse the connection between formal education and lifelong learning. The unemployment of ICT graduates divided by the Czech universities is analysed by Fischer & Vltavska (2013).

The aim of this paper is to analyse the current and future situation at the labour market from the point of view of current students of study programmes related to information and communication technologies (hereinafter: ICT students). What is the share of ICT students who are employed during their studies? Do these students work during studies or study while working? Is their current job related to their study programme comparing to non-ICT students? Why the ICT students work at study and what is their study and job workload? Are the ICT students satisfied with their workload?

The key result of the survey consists in the assessment of chances of ICT students at the labour market after graduation, both national and international. Students' own perspective is compared to the analysis of the true unemployment of ICT graduates (Fischer & Vltavska 2013) and the perspective of ICT students is compared to the perspective of non-ICT ones.

The rest of the paper is organised as follows. In the next chapter the survey EUROSTUDENT V is briefly introduced and the methodology used is described. In the chapter 3 the results of our analysis are presented and discussed and finally some recommendations for the educational policy related to ICT study programmes are given.

2. Data and Methodology

For our analysis we use the unique micro-data from survey EUROSTUDENT V, which was carried out by the Ministry of Education, Youth and Sports (namely the project Ipn KREDO CZ.1.07/4.1.00/33.0005). The survey was realised in the Czech Republic in 2013. This survey covered all state and public and selected private higher education institutions. After removal of uncompleted or insufficient questionnaires, the dataset consists of 4,664 respondents. This number of respondents allows us the detail analysis of selected sample of respondents, e.g. students of individual study programmes like ICT study programmes (296 respondents). Table 1 shows the basic descriptive statistics of the dataset. There are 86.3 % male ICT students. 72.2 % of ICT students study at the Bachelor degree, the most ICT students represent age group 22 to 25. Students are notably full-time students.

gender	female	13.7
	male	86.3
age categories	up to 21	36.3
	22 to 25	42.8
	26 to 30	14.2
	over 30	6.7
qualification being studied for	bachelor	72.2
	master	27.8
formal status	full-time student	86.6
	part-time student	13.4

Table 1 Descriptive statistics, ICT students, % Source: EUROSTUDENT V

For our analysis and for comparison of ICT and non-ICT students, we use standard statistical and descriptive methods (e.g. contingency tables and chi-square test). These methods are described in detail by Field (2008).

3. Results and Discussion

Students could evaluate themselves on the scale between no work to full-time job during the semester (Figure 1). 44.9% of ICT students have a paid job during the whole semester. Only 22.5% of ICT students work from time to time during the semester and the rest of ICT students do not

have any paid job. Results differ from all Czech students at the public HEIs where approximately 60% of students have regular or part-time job during semester.

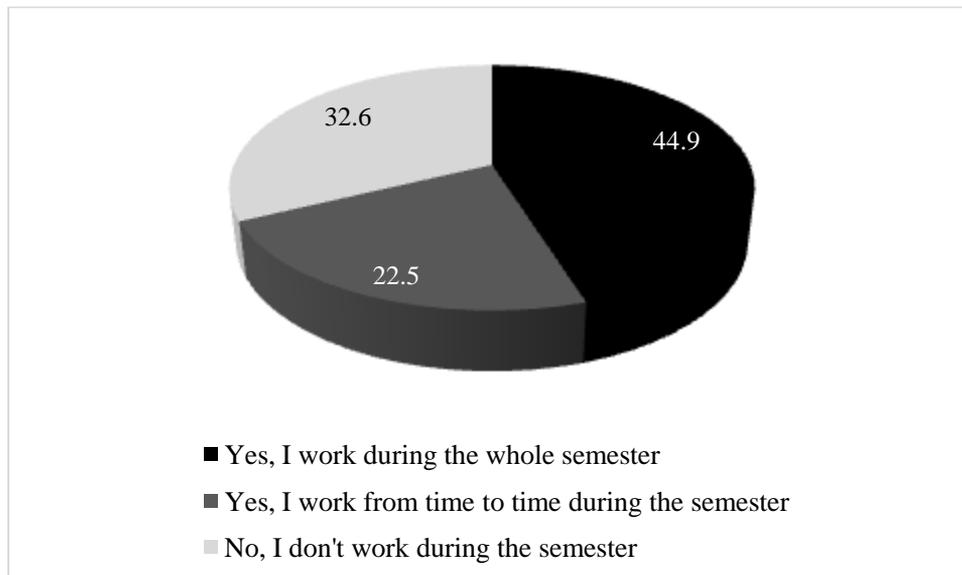


Figure 1 Do you have a paid job during current semester?, ICT students, % Source: EUROSTUDENT V

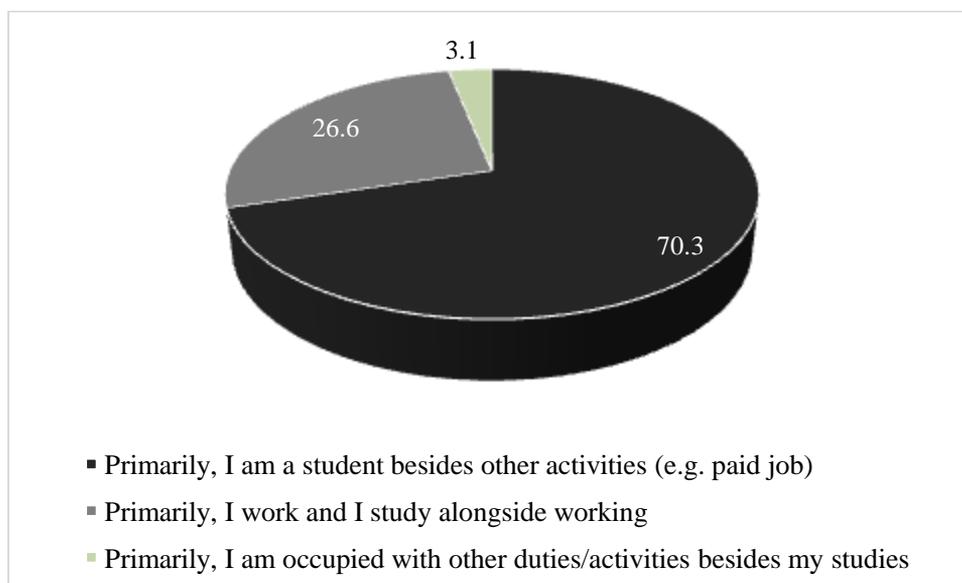


Figure 2 Which of the following describes your current situation best?, ICT students, % Source: EUROSTUDENT V

Since ICT students mostly work during study we would like to know how they describes themselves. ICT students assess themselves primarily as students (see Figure 2). Only 26.6% of ICT students evaluated themselves as persons who primarily work and study alongside working. The same results could be found in comparison with all Czech students. Since students work during the studies the average time spend weekly at work present very interesting statistics. ICT students spend approximately 22 hours per week at work while all Czech students at public HEIs spend approximately 20 hours per week at work (private HEIs students spend more than 30 hours per typical week at work).

What Do Czech ICT Students Think about Their Current and Future Jobs?

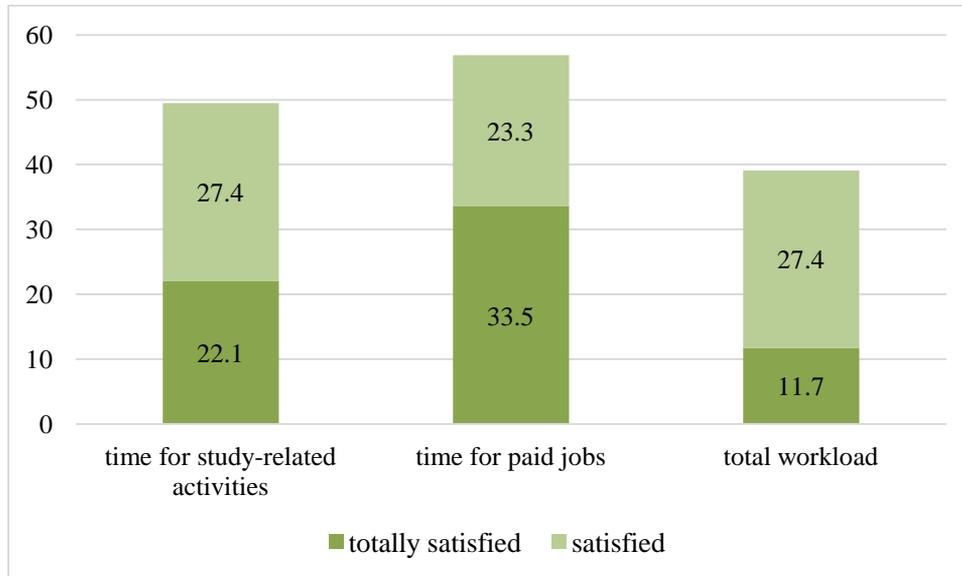


Figure 3 Looking at your workload based on the time you spend on study-related activities and on paid jobs, please rate your satisfaction with your workload. (%) Source: EUROSTUDENT V

Figure 3 shows only portion of totally satisfied and satisfied ICT students with their workload. ICT students are totally satisfied (33.5%) and satisfied (23.3%) with their time for paid job. They are less satisfied with their total workload.

The interesting question is why ICT students work. Do they work to fund their living, to gain experience on the labour market or do they work because they have free time to spend? As Figure 4 shows (only the portion of students who totally agree or agree with the exact answer) they primarily work to gain experience on the labour market. They do not agree with the statement that they have free time to spend. Results closely correspond to results of all Czech students.

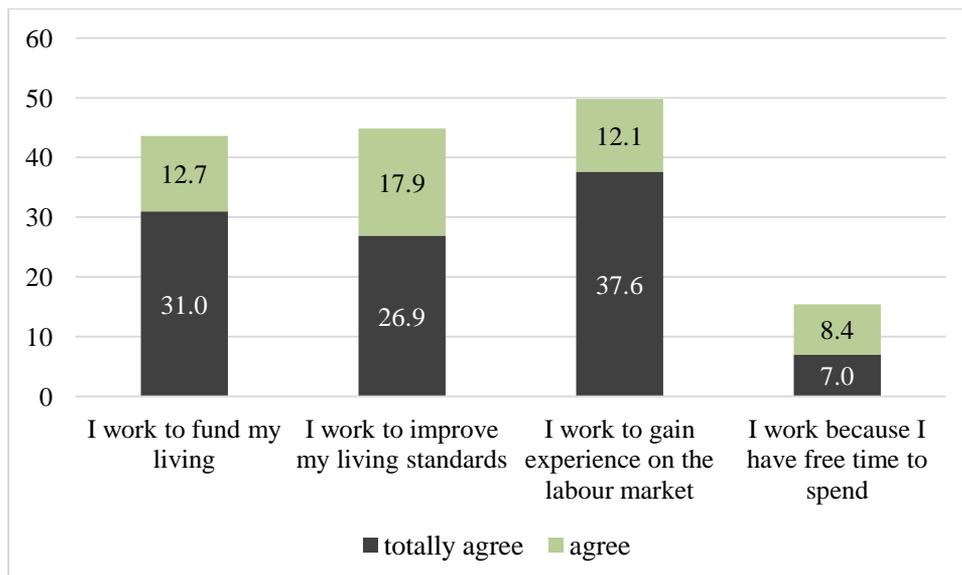


Figure 4 To what extent do the following statements apply to your situation?, ICT students, % Source: EUROSTUDENT V

Figure 5 presents results about the relation of the current study programme and paid job of students. Paid job of ICT students very closely relates to the study programme in 26.9% and closely in

14.8%. In comparison with all Czech students, the portion of very closely related answers is higher but in overall examination (very closely and closely) the relation of job and study programme is approximately the same for ICT students as for all Czech students.

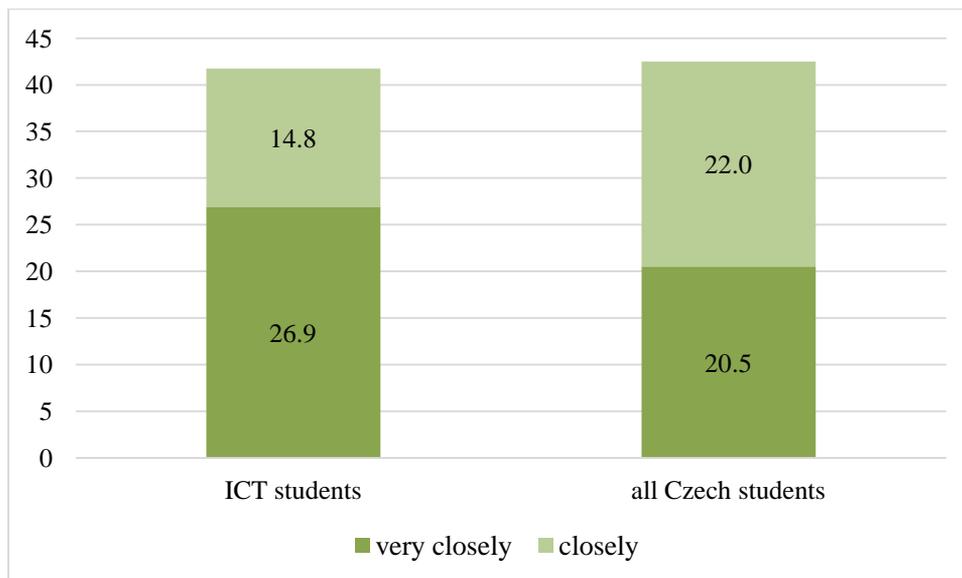


Figure 5 How closely related is your job to the content of your study programme?, % Source: EUROSTUDENT

V

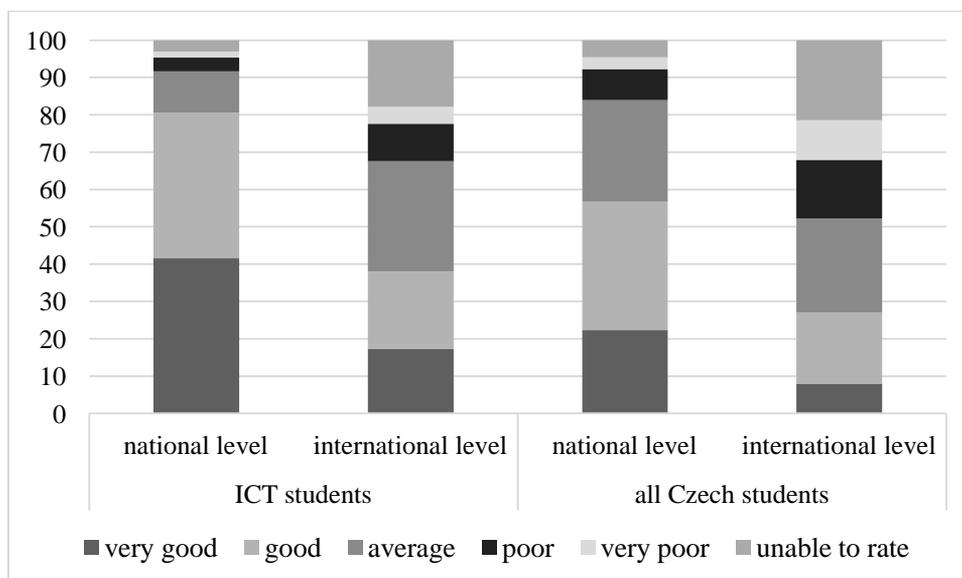


Figure 6 How do you rate your chances on the labour market after graduating from your current study programme?, % Source: EUROSTUDENT V

Students were asked to evaluate their chances on the labour market on the national and international level (Figure 6). ICT students think more positively about their chances both on national and international labour market as their work is more international than for example teachers. 41.5% of ICT students evaluate their chances on national labour market as very good in comparison with 22.3% of all Czech students. ICT students think about their very good chances on international market in 17.3%. On the contrary, there are only 8% of all Czech students who evaluate their

What Do Czech ICT Students Think about Their Current and Future Jobs?

chance on international labour market as very good. These results correspond to the low unemployment rate of ICT students as described by Fischer and Vltavska (2013).

When we look closer to the chances on the national labour market by the qualification being studied for there exists statistical significant relation between these variables (using Chi-squared Test, 5% level of significance). There are 40.8% of Bachelor ICT students who evaluate their chances on the national labour market as very good. Very similar opinion state Master ICT students (43.4%). Statistical significance were found in breakdown by formal status of students. Figure 8 shows that full-time students evaluate their chances on the national labour market as very good or good in 82.8%. Chances on the international labour market are evaluated more pessimistic. Only 38.9% full-time students and 32.3% of part-time students asses their chances as very good or good.

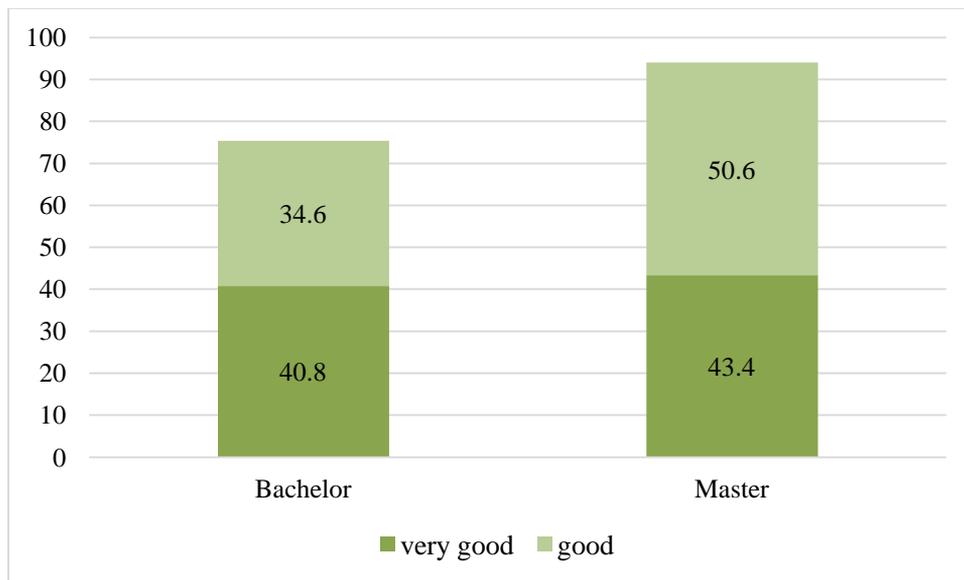


Figure 7 How do you rate your chances on the national labour market after graduating from your current study programme?, ICT students, % Source: EUROSTUDENT V

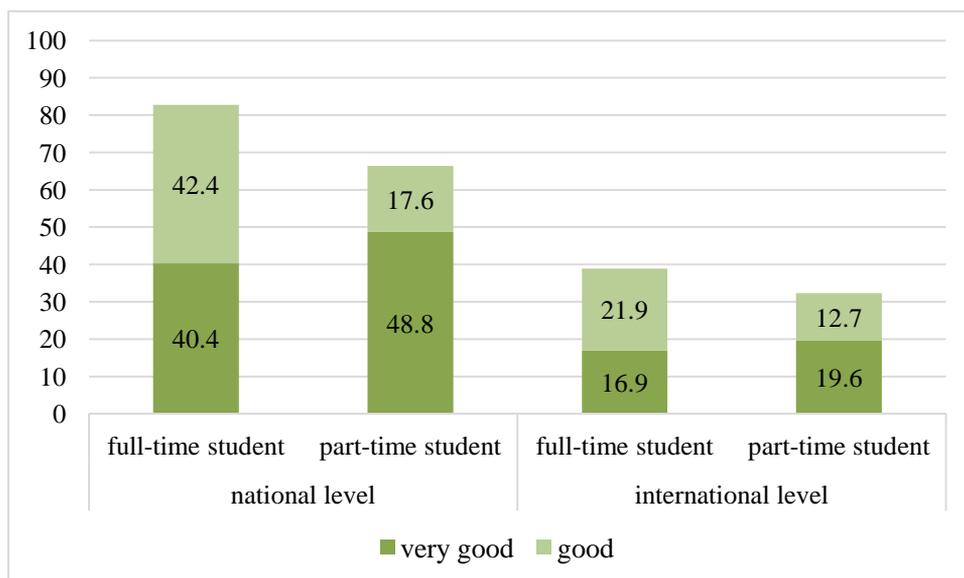


Figure 8 How do you rate your chances on the labour market after graduating from your current study programme?, ICT students, % Source: EUROSTUDENT V

4. Conclusion

This paper presented main conclusions about ICT students according to the unique micro-data gained from the EUROSTUDENT V survey. This contribution sought to find out if ICT students work during studies or study while working. Moreover, we examined whether their current job is related to their study programme. As the results show 41.7% of ICT students' asses their current job as very closely or closely to the current study field. This result corresponds to the opinion of all students in the Czech Republic.

These results provide less obvious view on the position of ICT students at the labour market during their studies. These results are unique do to the uniqueness of the micro-data set from the EUROSTUDENT V survey. In future, it will be possible to compare these results with situation in other countries which join the EUROSTUDENT V survey, the results in other countries are nowadays being processed.

For further research, we recommend to study the differences between individual higher education institutions and to deeply analyse the relation between the results of the survey and the data from the labour market. Furthermore, the results could be compared to the results of the survey on PhD students, which is realised during 2014.

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FINANCIAL SUSTAINABILITY OF DIGITAL PUBLIC SPACES

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Keywords

Digital Public Space, Telecentre, Financial Sustainability, Budgeting

Abstract

With the wide-spread use of e-services by citizens nowadays, traditional concept of digital public spaces, that used to provide mostly ICT and internet connection, is evolving. Digital public spaces are enhancing their activities; they provide information, support, training and other services for the community. They are also facing new challenges, among others with their financial sustainability. In this paper we analyze best practices of digital public spaces that were identified within the E-COOP project, from the perspective of their budgeting.

1. Introduction

Nowadays, with the wide-spread use of ICT, various kinds of digital services, or e-services, are offered to people not only by companies, but also by the government. Using these e-services, people can arrange all kinds of matters with authorities, commerce, among each other, etc. Currently, more and more people have all the necessary equipment and internet connection at home, and therefore, modern digital public spaces, or telecentres evolved from early access points, that provided only equipment and connection.

A digital public space (DPS), or telecentre can be referred as a physical building, place, facility, where people can use all kinds of information and communication technologies and internet access, that is provided, for their social, cultural and economic development, where they can obtain information, training and help, and where they can form communities with similar interests. It represent a step forward apart from traditional view such as:

“Telecentres (which are also referred to as e-centres, or e-kiosks) are physical centres whose purpose is that of providing connectivity to the public through telephones, computers, the Internet and other devices related to information and communication technologies (ICTs).” (Masiero, 2011)

Based on definition of Bailey and Ngwenyama (2010), we define web-based digital public spaces as a virtual public space where people use and are trained to use information and communication technologies (ICTs) for supporting communication and interaction between them and with other individuals, communities, and public authorities. Physical DPS is physical public place with infrastructure where people use and are also trained to use information and communication technologies (ICTs) for supporting communication and interaction between them and with other individuals, communities, and public authorities.

In order to further specify functions of the telecentre, we have to look at their development paths, in which they were evolving depending on their environment and community needs. Graham and Marvin (1992) “identified five main development paths:

- adult education: aimed primarily at delivering ICT courses to local adults (individuals and community groups);
- community service: aim to deliver a variety of community services, including communications services (e.g. fax etc.), office services (word processing), training and occasionally information services and advice;
- special interest group: aimed at addressing the needs of a specific group in the community, for example, women, ethnic minorities, disabled people;
- local economic development: primarily concerned with provision of services to local (small) businesses with the aim of regenerating the local economy. They may also provide accommodation for new companies.
- private business services: set up by private sector companies to provide services on a commercial basis.” (Ellen, 2000)

Today, in order to survive, modern digital public spaces, telecentres, have to be primarily implementers of community’s needs. They have to serve not only as a place for e-services, but also as a local e-government helpdesk, as a local employment agency, as a local information center, as a local tourist information center, as a local education center, as a local start-up center and innovation center, as a local remote office center etc.

Telecentres are in the middle of mechanism of creating digital cities with all possible e-services provided. These e-services are not only offered by traditional providers, but also created by people themselves depending on their needs. Telecentres provide support for communities (both virtual and physical) while creating new e-services to create digital city, and thus improving the community and also the whole region, while ICTs are perceived as a catalyst for economic growth. (Prídavok, Delina,2013)

In order to survive, modern telecentres have to contend with several problems, or challenges. Namely, they have to meet various types of stakeholders needs, they have to engage the attention of various types of communities, they have to provide various types of e-services, and operate within various types of grand schemes and business models.

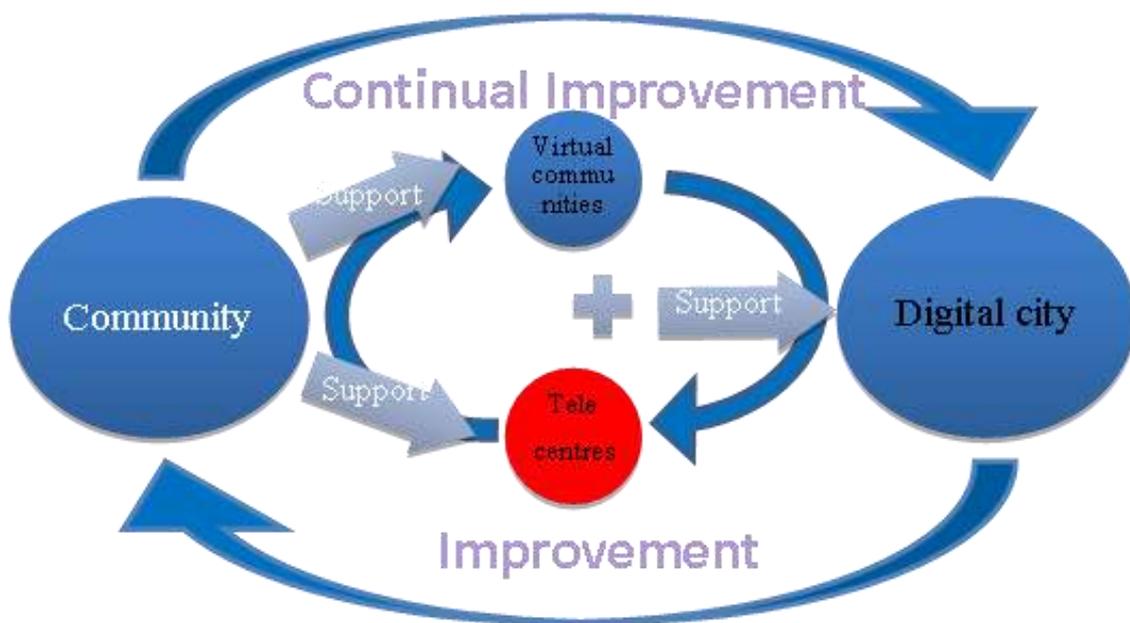


Figure 1: Community and the telecentre

Digital public spaces, telecentres are generally operated by local authorities or by community-based organizations and have to be economically sustainable in long-term period. This puts pressure on government, local community, authorities and volunteer funds, from which are the digital public spaces financed. On the other hand, they are partly financed by money they charge for their services. In term of amount of money needed for sustainability “the capacity of covering operating costs, which is necessary in order to go beyond the initial “pilot” stage, is enough for telecentres to be considered financially sustainable” (Masiero, 2011). Other definition claim, that “telecentres are financially suitable if they are able to generate enough revenue from the local community for activities it offers” (Maddon, 2007). Although funding current activities is important, from our point it is not enough. To survive rapid development, telecentres have to find continuous improvement’s mechanism, which will enable to implement new innovative services, required and trusted within community (Szabo, Ferencz, Pucihar, 2013), and also allocate enough resources to provide these services.

Most suitable solution to establish economically sustainable self-funded digital public space is crowd-funding, employing people from community to solve task from third parties. That is the way how can digital public space put knowledge of community members into a practice and also contribute to growth of the region.

2. Methodology

The research in this paper is based on survey conducted by INTERREG IVC project Digital Cooperatives (E-COOP). The purpose of this initiative is to provide policy makers and relevant stakeholders with compared analysis and recommendations on digital mediation practices, identified within the partner territories, and to identify ways of enhancing regional/local public policies in implementing new form of digital public space called E-COOP. In order to do that, 12 partners during 2013-2014 conducted study to investigate how the digital public spaces could evolve, based on mediation between the users and to offer new services to create a more collaborative environment. The study was based on analysis of 59 digital public spaces from 12 EU

countries. Digital public spaces were examined in 21 areas in order to determine their basic features and unique characteristics. The issues regarding the economics of digital public spaces were covered by areas such as budget, funding strategy and sustainability. The same approach will be used in the research. Moreover, we also decided to divide practices to physical and web-based. From our point, there is fair distinction between economics of those two groups. Because some of the practices provided insufficient information, for the purpose of this paper, the initial sample was reduced to 46 practices. (Table 1) Description of types of digital public spaces is presented in Table 2.

Country	Physical	Web-based	Summary
Finland		4	4
France	4	3	7
Greece	3	1	4
Hungary	3	1	4
Italy	4		4
Poland	4	2	6
Romania		1	1
Czech republic		2	2
Slovakia	1	2	3
Spain	3	1	4
Sweden	1	2	3
United Kingdom	3	1	4
Summary	25	21	46

Table 1: Sample distribution regarding countries

Type of service	Physical	Web-based	Summary
Co-working place	1		1
Digital literacy and Mediator Training	11	5	16
Incubators and Innovation centre	5		5
Internet access and collaboration	4		4
Preserve and promote local cultural heritage	1	3	4
Community e-Service	2	12	14
Volunteer organization	2		2
Summary	26	20	46

Table 2: Type of digital public space

3. The results

3.1. Budget

The budget of digital public space represents key aspect of its financial sustainability. It differs based on the services they offer to citizens. Figure 2 represents boxplots of budget distribution based on various types of DPS. Because most of the practises in the sample were funded by EU funds and regional initiatives, they prepare budget for a three years period. That is the reason why most statistics made in this research were conducted for this period.

As the analysis of best practises revealed, DPSes that provide only Internet access and support simple collaboration tools, don't have high variability of costs from one BP to another. To run such digital public space, it usually requires approximately 20,000 EUR per year to facilitate operation costs and staff costs. These digital public spaces are usually managed by 2 employees and one part time project manager. Operational costs of such public spaces usually range from 5,000 EUR to 10,000 EUR.

Situation changes when the digital public space starts to offer courses in digital literacy, it begins to use the mediators as lecturers or starts to train their own mediators. They often have to hire experts for training, buy licensees for software and also expand their own infrastructure. Such expenses require additional funding, which is usually provided by funding from European Union. From our sample, all 16 digital public spaces which offer some kind of training were financed by EU funds. The average budget for a three years' time was 181,030 EUR. It usually covers initial budget for hardware and connectivity, training for mediators, staff costs and lectures fees for a three year period. Average staff consists of 4 persons and a number of temporarily hired lecturers. The impact of physical location and infrastructure on budget can be seen when the comparison is made among physical DPSes and web-based ones. For a physical public space which offers courses and training the average budget represents 221,186 EUR for three years period. The average budget for similar oriented web-based practises was about 37 % smaller.

Special categories of digital public spaces are Community e-Services. They support the development of community by providing special publicly available e-services. Such services created for people by people became very interesting topic for municipalities and also for commercial sector. Budgets in these DPSes have usually the same structure as any e-service development project. It consists of cost of equipment and cost of e-service, web, and application development. After development phase is done, there are additional cost for training the users and maintenance. In the study we analysed 14 different Community e-Services. All of them were funded by EU funds, by regional agencies for innovation or by municipalities. In term of budget variability, box plot analysis identified two practises with extremely high budget. Both practises have operational budget higher than 1,500,000 EUR. After removal of these extreme values, the budget variability and budget average became smaller than in previous type of DPSes. Even though the budget of half of the sample was smaller than 9,000 EUR, the average cost of such project was 167,604 EUR.

Last group of digital public spaces consists of Incubators and Innovation centers. According to our sample, apart from any previously mentioned digital public spaces, incubators and innovation center provide unique services not only for citizens, but also for small and medium size entrepreneurs. Mostly they are physical spaces and provide training, working place, support for unemployed or self-employed. In term of size and structure these DPSes are usually the biggest. Mostly they accommodate many various projects, training courses, and counselor offices. These are the reasons, why these types of digital public spaces have on average highest budget of all. The

variability of their budget is based on the services they offer. For example, average budget for a three year period is 564,210 EUR. But because of high variability of the sample, this average has only a limited information value.

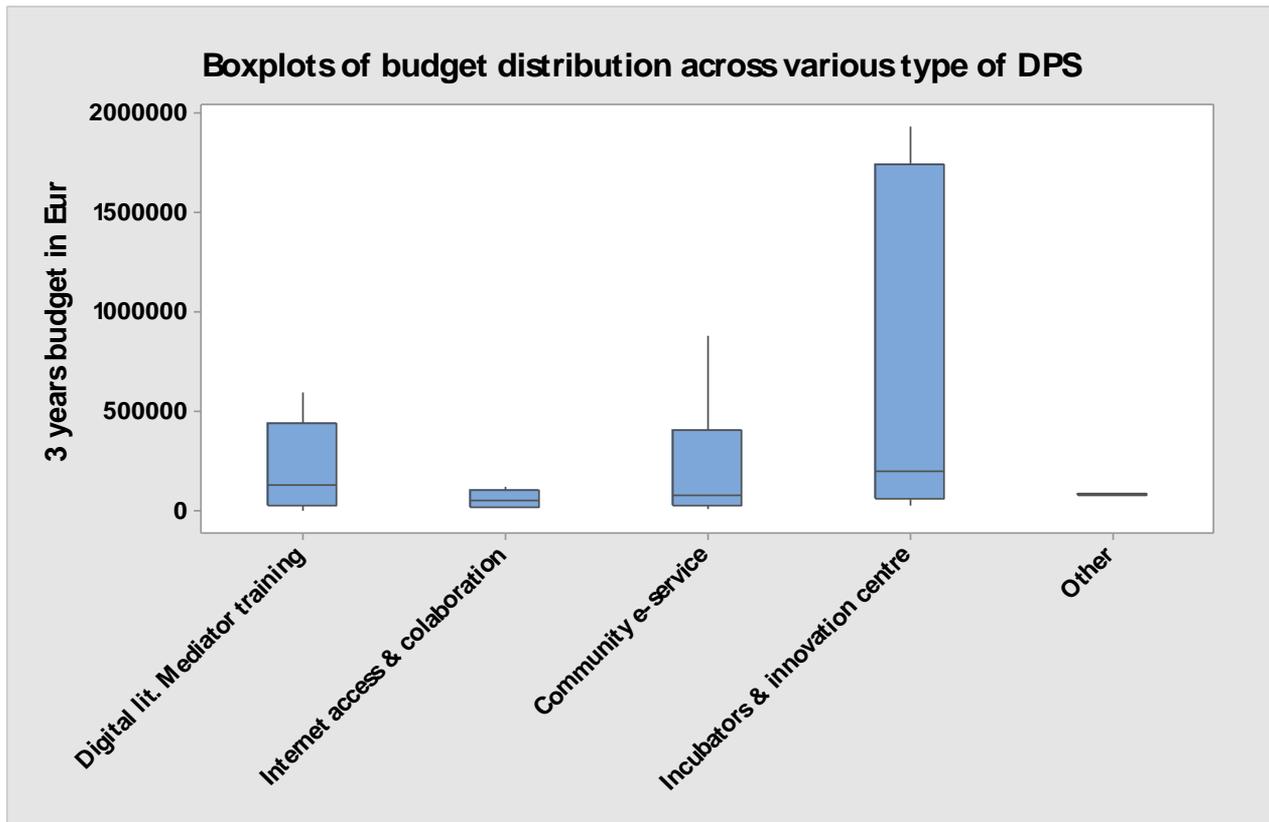


Figure 2: Boxplots of budget distribution across various type of DPS

3.2. Funding strategy

The vast majority of identified best practices, projects depend on public funding. Under public funding we understand public resources from government, local authorities, European Union (through various types of projects) and other projects funded by NGOs or other organizations, local sponsors etc.

Most practices are not solely funded by these public funds, but they represent majority of the budget. However, some practices are funded by the combination of EU funds and local authorities' budgets. On the other hand, minority of practices are trying to minimize needs for funding by advertisements on their pages, incomes from provided courses or other services, or using volunteers as much as possible and using free software.

Another possibility of reducing the costs seen in some cases is by using premises, equipment and staff of other institutions, e.g. libraries, museums, which fall within the local authority running the project. Excellent example of minimizing costs comes from the UK, where only initial funding for equipment and for volunteer training was needed, but nowadays, with functioning system of volunteers and training, only negligible operational costs are needed.

Only 5 practices do not depend on public funding, their funding is conducted by membership fees, provisions and income from their activities.

3.3. Sustainability

Economic sustainability of practices, projects raises large awareness due to the budget cuts of public authorities. Except mentioned methods (volunteers, fees, income from own courses etc.), most of practices rely on the combination of funds from new projects (financed by EU or local authorities), advertisement and fundraising. Only minority of practices are trying to broaden their offers for paid courses and activities, or minimizing costs (since they already have infrastructure).

3.3.1. Digital public space as a business model

Describing general business model for digital public space based on our sample is very hard, because most of the cases differ from each other. Although they are usually founded by authorities (EU funds, municipalities), majority of researched digital public spaces try to be financially independent and are searching for ways how to accomplish this aim. This leads to unique characteristic which should be understood regarding business models of digital public spaces. It is their evolution. In terms of virtual DPS, evolution process is obvious. It usually starts with an idea, which is transformed to e-service, which leads to creation of start-up. Use of this e-service creates community of users which attracts advertisements and sponsors. The evolution of physical DPS is different. Most of DPSes in sample started as internet access point and after a while they began to provide other services for their citizens. Provided services had mainly educational character, such as training and courses regarding use of ICT and programming (paid by municipalities, government, grants). These courses help to form communities, and provide them with skills. Apart from the courses, most of DPSes also provide service similar to employment agencies, or provide offices for starting entrepreneurs. Only a few of researched DPSes (4) were able to move to the next level and became an employer. They were able to acquire projects from municipalities and local business and employ their own users as programmers, web-designers, guides, cooks (catering services), designers, organisers, etc. Moreover, these DPSes became frequent winners of public procurement offers. This short time projects helped DPSes to get funding and users to get required experience.

Other option considered by only one case is public-private partnership. Next interesting strategy also implemented by one practice is raising public awareness about the importance and value of the culture, of their work, in order to get wider support from local businesses, not only through the Corporate social responsibility.

4. Conclusion and discussion

In this article we analyzed best practices identified within the E-COOP project from the perspective of their budgeting, specifically amount of the budget, funding strategy and sustainability. In term of budget we found out that the variability of budgets among countries of EU differs based on the type of services provided by digital public spaces. Digital public spaces, which are held by one or two people and provide only access to the internet and basic collaboration tools for citizens have similar budget among the EU countries. With the activities like mediation, training and service development, the variability of budgets becomes wider.

We found out, that most of best practices rely mostly on public funding, which is affecting their sustainability. Digital public spaces should therefore minimize their dependency on public funding, e.g. by offering broaden variety of paid courses and services, by creating a network of community volunteers, or by minimizing their operational costs after building infrastructure. Very effective seems to be an idea of DPS as employer - train talented members to become the highly

skilled professional and use them as individual/team to outsource services for local businesses and municipalities.

We recognize that situation regarding digital public spaces vary in different countries, as well as in different parts of a sole country. From our point of view, main factors that are affecting situation in digital public spaces across Europe (and thus the financial sustainability) are the level of development of e-services in specific area (not only in the means of services themselves, but also in the means of ICT infrastructure and access to this infrastructure), funding opportunities (not all funding possibilities are equally developed in different areas) and the community itself (its ability to participate, co-create new services, volunteering, etc.).

Thus, building next-generation financially sustainable digital public space, vary from area to area. In areas with strong, committed community volunteering, co-designing new services or crowd-funding can be used to reduce operational costs. Conversely, in areas with not so active, coherent community, larger initial costs will be needed (not only to encourage the community and build e.g. the volunteer network). ICT infrastructure is also very important factor building next-generation financially sustainable digital public spaces. Areas with under-developed ICT infrastructure will need higher initial funds to create the infrastructure and basic services. Regarding the funding opportunities, the use of business angels, crowd-funding or public-private partnership projects, is determined by the level of experience, that citizens, communities, countries have with these mechanisms.

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ANALYSIS OF THE POSSIBILITIES OF IMPROVING AN ONLINE REPUTATION OF PUBLIC INSTITUTIONS

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Keywords

Reputation, Internet, Marketing

Abstract

This paper deals with an issue of reputation, especially with a modern phenomenon of reputation in the digital world of the Internet. By analyzing perception of reputation of the selected subject - faculty of a public university in the real and digital world, paper aims to explain fundamental aspects which determine perception of traditional and online reputation. For the purpose of demonstrating the variability of those aspects, analysis of reputation perception from the point of view typical customer - full time student has been carried out comparing the selected institution with all the domestic competitors on the market. By understanding differences between factors affecting traditional reputation and factors affecting reputation in digital world, it is possible to propose best practices which can be utilized as a tool for increasing competitiveness in the market of educational institutions.

1. Introduction to online reputation

The issue of the use of Internet tools in the Internet marketing itself is still very young. However, it is possible to state that any new techniques and media used within the portfolio of marketing tools may help to distinguish from the competition. The competition is immense among commercial and non-commercial entities. The times when having "only" a quality product was sufficient for prosperity on the market are long gone (Bačík, 2008, Wierzbinski, 2014, Soviar, Vodak, 2012). It is increasingly difficult to reach one's target audience. Saturation of the market by advertising messages (also referred to as "ad smog" in literature) is a problem that marketing managers all over the world faces on a daily basis. Without considering resources and effort it is often the case that an

advertising message is lost, or simply ceases to exist in the context of other more or less important information of various kinds. Shortening of communication paths by using information technology, specifically the Internet and its tools, appears to be an appropriate solution in marketing practices (Doucek, 2008). The Internet offers possibilities of a clear and precise targeting of a message at selected market, often as far as individuals (Janke, Packová, 2013). At the same time, communication path is significantly reduced when entities are able to communicate directly with their customers (Lajčin, Frankovský, Štefko, 2012). Customers, in this case Internet users, themselves request information by which they greatly increase the acceptance rate of communicated messages. Internet, however, enables relatively simple sharing of information creating space also for entities whose motives may not always be the ethical. The issue of reputation is therefore the most relevant issue within the context of digital identities of entities which use the Internet for the purpose of marketing communications (Delina, Janke, Tkáč, 2011; Prídavok, Delina, 2013). Positive reputation or positive image is of utmost importance for universities. Image as a summary of the ideas, attitudes, opinions, and experience gained in relation to a specific university or department can be both positive and negative. Its building is a challenging, complex and long-term process and it should be part of marketing activities of universities, mainly because positive image could be an ideal source of unusual competitive advantage. This stems from value that organizations are able to create and use for long-term growth (Nimrichterová, Lieskovská 2009).

1.1. Reputation in the real world

Reputation can be defined as a set of existing information on the credibility of a subject to date. It is basically an indicator that identifies past experiences of third parties in relation to potential business partners or participant in any other immediate relation (Einwiller 2001). Reputation may in some cases be identified with good name. This is not considered to be false. The term is semantically related to position or stance acquired in opinions of others, as well as image of which reputation is a complementary and integral part (Doorley, Garcia 2007). Reputation is one of the most important parts of the image of a company, firm or corporation as a whole. In today's modern world of business, where it is essential to properly take a responsible approach to building a positive image of a company, reputation is one of the key concepts and factors affecting how public sees a company, how it perceives it and accepts its operations and activities. (Vaculčíaková, 2003). Its importance increases significantly especially recently, when it is not enough to have an attractive product, know-how, entrepreneurial spirit, ability to improvise and flexibility to gain hoped-for success in business environment. It requires a little bit more. Positive reputation is becoming truly one of the most effective weapons that can be highly effective in tough competitive struggle and at the same time determine the market value of a company. It is appropriate to sum up that most authors see reputation as a crucial determinant affecting several factors of the economic nature forming a favourable competitive position in the struggle for individual customers (Haywood, 2002).

1.2. Online reputation

Spoken word differs from written or published text. What is said will fall into oblivion of time. Losing cognizance of written text is more difficult. With the boom of media, especially the Internet, we encounter the concept of online reputation, but the fact remains that it cooperates on networks of interpersonal relationships, whether in daily or virtual life (Tovey, Masum 2011). Currently, the significance of the concept of online reputation is growing more rapidly than ever before. Understanding of how the online reputation forms, develops and disperses is far from the notion of

"simply". In today's era of enormous focus on social media we may see how pieces of information spread not in days, but in hours and even seconds (Schiller 2010). Moreover, people use the Internet and social networking tools for all kinds of purposes. One of them is finding out who they can trust and who to rely on in the decision-making process. Ultimately they more often turn to people or organizations with the best reputation and credibility, and do not take wealth or nominal power too much into account. This is logical, because even with common decision we usually turn to those whom we trust (Tovey, Masum 2011). It is a known fact that the Internet is flooded with lots of words, pictures, photos, blogs and articles that, unfortunately, or fortunately, have the power to influence reputation, in both positive and in a negative sense, and context of this information can reveal a lot about a company. The fact that specialized interest groups may also either enhance or completely destroy the reputation of a company, its brands and individual products, should not be neglected (Beal, Strauss 2009). It is thus obvious how drastically was the dynamics of creation and management of corporate reputation changed by the Internet. In the growing trends of orientation on consumers and individual media, companies gradually find that it is increasingly difficult to make their voices or opinions heard because in digital community any user can become a journalist anytime by writing reviews, blogs, or simply publishing their experience with a product and they may judge a company as well as a brand. Thus, by creating new communication channels the Internet switched the balance of power. As a result, companies' reputations are not defined by what companies do and how they act, but by how others perceive them and respond to their actions and statements. Therefore, apart from PR promotion as such companies now have to take into account also efficient management of online reputation and development of new digital relationships and systems that significantly differ from the original "top-down" model (Bunting, Lipski 1996).

2. Aims and methods of analysis

Comprehensive analysis of reputation and subsequent comparison of its specificities in the real and the digital world offers a comprehensive view of the issue discussed. The following chapter presents the objectives and explains the methods used in the context of the analysis undertaken.

2.1. Research object

A selected faculty of a public university operating on the Slovak market of educational institutions (Faculty of Management, University of Prešov in Prešov) was chosen as object of the research. The faculty presents itself in the real as well as digital world. Reputation is investigated through its real customers - fulltime students of bachelor's study programme.

2.2. Main purpose

The main purpose of the analysis was to highlight the complexity of reputation investigation within real and digital world as well as various determinants of positive (and negative) reputation. Through careful examination of the research object in both environments comparison of selected object with its potential competitors within the Slovak market of educational institutions was carried out to ensure greater informative value. Partial objective was to specify the so-called "best practices" tools kits that can help increase market competitiveness.

2.3. Research methods and procedures

From the point of view of methods and procedures the analysis was divided into two parts: the first part included analysis of the factors affecting the reputation within the real world carried out

using an extensive questionnaire survey. In order to determine the perceived reputation of the selected faculty as well as its competitors, students of one class (approx 120) of the selected faculty were asked to complete the questionnaire. These students represent model customers choosing from a range of educational institutions particularly on the Slovak market. In the next step an extensive sentiment analysis was carried out according to the methodology the author Sasko (2011). According to presented methodology digital identity of each subject (economically oriented faculties of public universities in the Slovak market) was analyzed using the Google search engine. For the purposes of the sentiment analysis the first 10 search results of each subject was taken into account. One of the main factors in the evaluation process was sentiment of the results. This can be loosely defined as the nature of results found by entering keywords. Positive, neutral, but also negative feedback can be found in the results. These sentiments, as well as positions on which they were displayed, provided a picture of research subjects, and thus ultimately determine its online reputation. Analysed subjects were assigned numerical values representing scores of their online reputation strength on the digital market.

As part of the analysis, digital and „real“ world reputation of all economically oriented faculties of public universities in the Slovak market was compared. Factors influencing reputation within the real as well as digital world were then identified.

3. Results and discussion

3.1. Reputation in the real world

Analysis of the real world reputation of twenty economically oriented faculties of Slovak universities perceived by students then enabled to generate ranking and identify customer perception of these entities. Factors that influence students’ perception of the real world reputation were identified as a part of the analysis. We use customary abbreviations for faculties identification as tested in the analysis due to better clarity and authenticity. Real world reputation of the Faculty of Management of the University of Prešov has different colour in the chart. The following ranking of subjects was compiled based on the perceived reputation measured on the Likert scale 1-5 according to the arithmetic average:

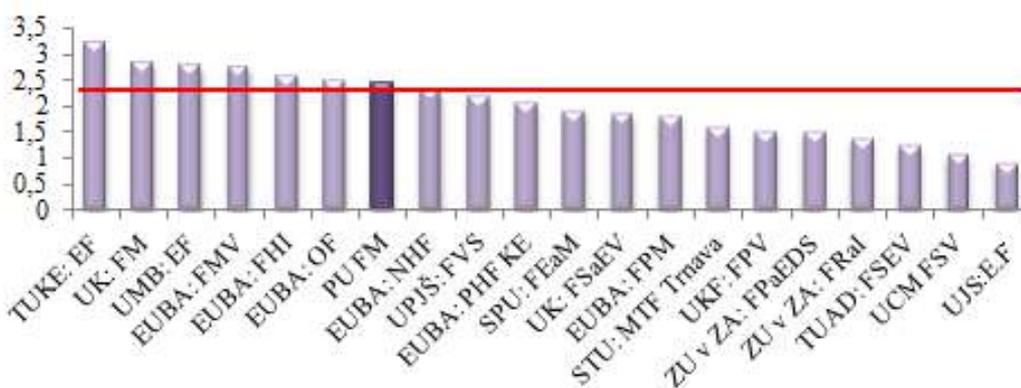


Figure 1: Ranking of faculties based on analysis within real world; Source: our data

Line indicating the average threshold separates faculties based on the results of the perception by students above the line of average and faculties that did not gain rating sufficient for the given average. Students allotted scores based on their perceived quality, which was a sort of cumulative quantity of positive or negative factors within the real world.

3.2. Online reputation

By sentiment analysis, 20 selected faculties at Slovak universities were tested in order to detect their online reputation. The chart presents summarized ranking and scores gained by individual faculties on the basis of sentiment analysis.

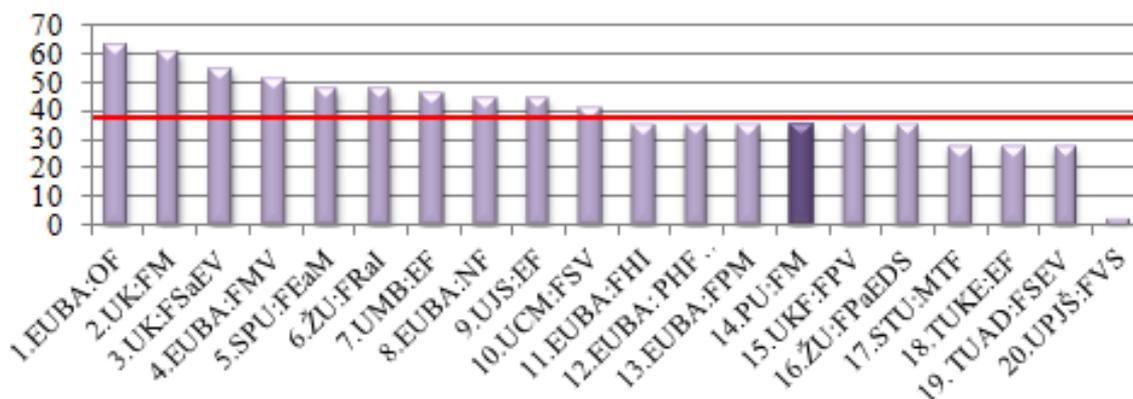


Figure 2: Ranking of faculties based sentiment analysis; Source: our data based on Sasko (2011)

The chart also shows faculties scoring above average and below average, which was 39, 95 points. We use customary abbreviations for faculties identification as tested in the analysis due to better clarity and authenticity. Online reputation of the Faculty of Management of the University of Prešov has different colour in the chart. The analysis revealed that most of the search results / digital presences were neutral, so a strongly positive or strongly negative references in top search engines results could therefore mean the difference between the first and the last place. In the case of school, which ranked first in the evaluation of economic faculties of public universities - Faculty of Commerce of University of Economics in Bratislava - the following was considered: Positive sentiment of the third search result was a link to a website on universities, which included a brief description of the Faculty in the sense that its mission is in line with its status to provide quality economic education. Positive sentiment ranked seventh, azet.sk catalogue, also described Faculty of Commerce of University of Economics in Bratislava as an institution that provides quality economic education and trains highly qualified professionals. In contrast, a faculty which ranked last in our rankings, Faculty of Public Administration at Pavlov Josef Safarik University in Kosice, gained only 2 plus points in the overall sentiment analysis due to strongly negative sentiment of the sixth and seventh search results. Two negative references affected this unfavourable ranking in the analysis of sentiment. One of them was found on the www.birdz.sk portal where someone stated that the Faculty is "nothing much". The second was a mention at www.pluska.sk website where the key decisive factor was a sentence with a significantly negative impact on sentiment, specifically the claim that the Faculty of Public Administration of the University of Pavlov Josef Safarik in Kosice "produces" the highest number of unemployed. Nature of search results and sentiment of words used in a given reference have a significant impact on the overall perceived image of an institution.

3.3. Discussion

Based on the analysis we can conclude that digital and real world reputation is determined by various factors. Comparison of reputation perception in the real and digital world is shown in a transparent manner using a spider chart. The comparison is based on values differing in the results of sentiment analysis for digital world and the replies of the respondents in the questionnaire survey

in the real world. When analyzing the sentiment, scale was designed to compile the chart based on scores, while arithmetic means of the scores of individual responses was used to create ranking of universities according to opinions of students. The following chart is a visual graphic display of data obtained from the real and the digital world. It applies here that the further the score is from the centre of the chart the more positive it is for a given educational and its reputation thus better. For better interpretation of the context arithmetic means of subjects within the real world were magnified tenfold in order to better illustrate varied perception of reputations within various environments using two different measurement methodologies.

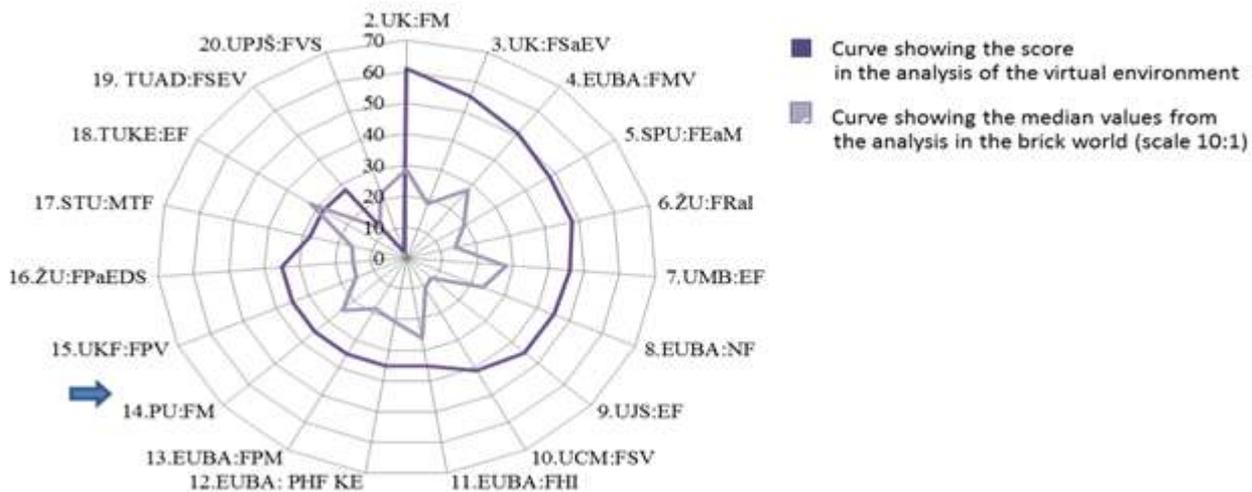


Figure 3: Comparison of the results of both analyses, Source: our data

To provide clearer empirical results between two types of reputation, individual rankings of faculties were tested by Kendall coefficient (τ), which measures the strength of dependence between two serial variables. The calculated value of τ was less than tabular critical value, so we have not rejected the hypothesis of independence on the significance level $\alpha = 0.01$. We can conclude that there is no statistically significant dependence between reputation in the virtual environment and the real world.

4. Summary

Based on our analysis elements that are considered opinion-forming within the real world need to be summed up here. Quality of the educational process, innovativeness, methods and tools used during educational process, expertise and relevance of provided knowledge and its subsequent rate of utilization in practice can be considered fundamentals for the creation of positive reputation in the real world. These factors are ultimately reflected in the perception of students as a single cumulative value - perceived quality. In contrast, in virtual environment the issue of building positive reputation acquires much more dynamic character. Building positive image of an entity and long-term purposeful effort to create a positive reputation can be devastated in an instant, for example by spreading false, fraudulent or intentionally harmful messages. The whole issue of building reputation is thus very fragile. A simple mention with a slight negative feeling or tone can very simply and easily damage company's name, its brand, the level of products and services it provides. Factors affecting reputation, its orientation, development and level on the Internet are various references in web pages presented by search engines, their nature, and strength of sentiment relating to a specific entity. Entities gaining top scores in our ranking have a competitive advantage

over other rated entities in terms of Internet reputation. Apart from strength of sentiments of individual search results the order in which individual pages were shown was decisive here. As with faculties ranked near the top, the key factors, such as tradition formed over the years on the Slovak market, which evokes a kind of stability educational institution, bore positive sentiment. Highlighting the quality of the educational process, generally known achievements of an educational institution, innovative methods and tools used in education and also expertise and excellent employment rate of graduates of a faculty and their chances in the labour market were also very positive factors. Unfortunately, not all faculties were able to sufficiently inform about this achievements in a way which is desired in the digital world (from positive publicity in the mainstream media after positive references on Internet forums). We should also take into account rating agencies that can significantly enhance the reputation of an entity towards a positive, desirable development, i.e. to the most positive state possible, by rating a subject with stars and by various ranking on their websites. From the point of view of application of successful practices institutions should most of all try to provide relevant information in the clearest way possible on their web sites, ensure the quality, attractiveness and appeal of their own web sites. Their important aim, in their own interest, should be a purposeful effort to limit negative publicity and, on the other hand, strengthen and work on positive publicity. This can be achieved by active Internet communication policy in the form of spreading positive information on major Internet portals, such as electronic versions of major Slovak dailies or through virtual social networks. The best way to eliminate negative or neutral publicity in the first ten search engine results is a literal displacement of negative publicity and perceptions of an entity by actively working on a coherent marketing communications policy on the Internet.

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SMART PRE-COMMERCIAL PROCUREMENT ENVIRONMENT: INNOVATIONS DRIVEN FROM THE DEMAND SIDE

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Keywords

ICT, Innovation, Pre-Commercial Procurement, Smart Environment

Abstract

Nowadays, to be competitive and successful it is necessary to implement innovation into processes. It seems to be as a crucial step not only in private but even in public sector. To support innovation creation in a public sector, a new approach: Pre-Commercial Procurement has been introduced. The aim of this paper is describe a PCP concept, which leads to a creation of innovations driven from demand side, where requirements by citizens are using to develop a solution which would contribute to a higher life quality. As PCP is a new concept, there is no solution supporting management of PCP, what led to an idea to create an e-tool which would simplify realization of PCP in the terms of time saving, eliminating a paper work, etc. The PCP platform introduced in this paper has been created with regard to requirements of public sector in Italy, where PCP is quite widespread.

1. Introduction

Nowadays, the public sector has to face many societal challenges. To address these challenges, new and more sophisticated solutions, not available on a market yet, are very often required. There is a need to implement such solutions to keep or even raise the competitiveness of our market and quality of life (EC, 2013). Very important is not only to support R&D, but as said European Commissioner Viviane Reding, “Europe must create a commercial environment that encourages more rapid innovation and take up of research results.” (EC, 2006)

After many dialogues and discussions, the new approach: pre-commercial procurement (henceforth: PCP) has been developed (Commission of the European Communities, 2007). This approach supports cooperation between public and private sector when creating innovative solutions with the aim to solve socio-economic problem, react to challenges or to public concern, and for which there is no solution available on a market yet that could be procured through traditional commercial procurement. In order to integrate R&D into procurement, a new phases before commercial procurement has been created (EC, 2006). For this approach especially the use

in R&D field, in terms of separating primary from mass production, sharing potential risks and benefits, and finally selecting of suppliers in each phase based on competition principles are characteristic (Commission of the European Communities, 2007). This new approach can lead to stimulation of innovations, increasing the level of investment and reducing risk through co-financing, allows to stimulate the innovations, increase the level of investment and reduce risk through co-financing (Progr-EAST, 2013) where finance are used for high-risk investment projects related with difficult predictability of R&D results. PCP could be the right solution to long-term lack of cooperation between private sector in R&D field and public sector that is in position of buyer of new technologies, what confirmed also the experiences by Asian and USA.

Basically, the idea of PCP is to drive technological innovation from the demand side by sharing the risks and benefits from R&D between a single purchaser and a plurality of independent providers, each awarded a separate contract for such activities as solution exploration and design, prototyping, and/or development of a limited volume of first products or services in the form of a test series. This requires a multi-stage selection described on Figure 1, which is usually followed with PPI, when developed solution is commercializing. As the whole idea of innovation creation using PCP comes before first phase of PCP starts, also Phase 0 has been added.

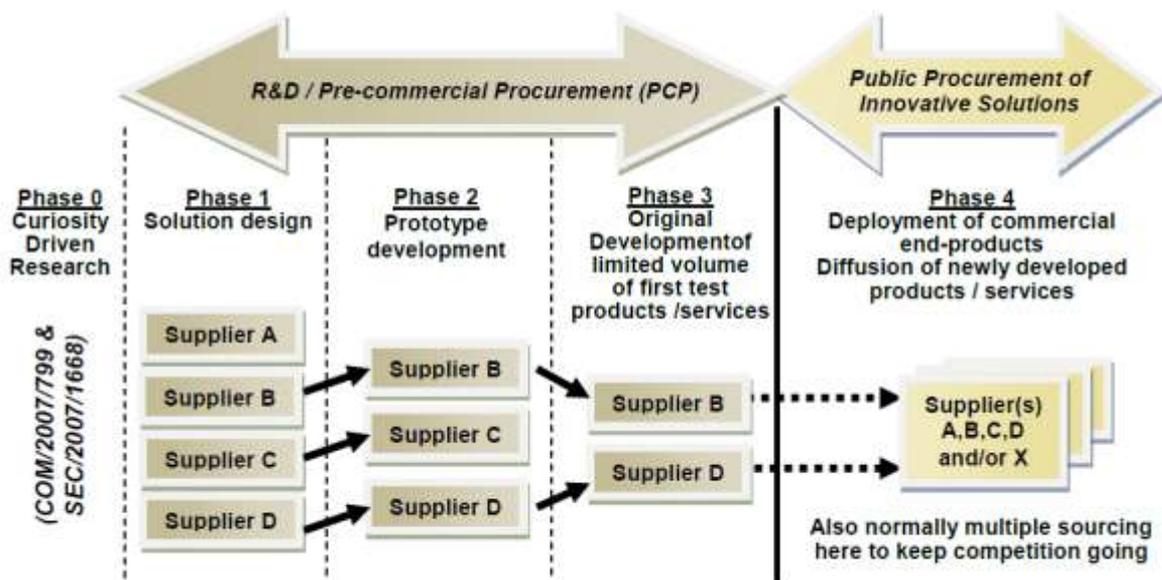


Figure 1 PCP Process (LieveBos, 2014)

Benefit and risk sharing, which are the features differentiating markedly differentiating commercial procurement from PCP, enable increase of innovation activities and the level of investment itself because of reducing the risk through co-financing from both, procurer' and supplier' side (Progr-EAST, 2013). As more stakeholders from both, supplier and procurer side are involved, one of the most important condition seems to be a trust, which authors as Szabo et al. (2013) consider as a crucial factor for innovation.

The intention to implement innovations also into the public sector is confirmed by the framework of Horizon 2020 that on contrary to previous programs puts more emphasis on pulling innovations into the market from the demand side, what means from the side of public sector in order to bridge demand and supply. Within Horizon 2020 framework the budget of €140 Million in 2014-2015 was set to support just procurers from around Europe to cooperate on innovation procurement (PCP,

PPI) (EC, 2014). As intention of EC is to start new PCPs, an effective e-solution would help to avoid many problems and bothering when comparing to realization of PCP in traditional way related with paper work. Importance of ICT support tool is actual (Basl & Douček, 2013) especially in the field of still not fully discovered process of PCP. Implementing ICT in this process can bring number of benefits when comparing to today's common PCP process. Just to mention a few: more transparent publication of using public sources, higher number of international consortiums with the aim of innovative procurement and improvement of administration processes within PCP in the context of saving time and optimization thanks to p2p learning, knowledge transfer from one procurer to another. Removing obstacles of communication through providing tool for recording, editing, sharing and transferring the data, can encourage cities and municipalities to choose innovative pre-commercial procurement, as biggest problem – lack of practical experiences would be significantly reduced. Having all these benefits in mind we developed e-solution for effective procurement of innovation based on the requirements that we aim to introduce in this paper.

2. Requirements on ICT support in PCP processes

Pre-Commercial Procurement is an approach of R&D services procurement to solve a socio-economic problem or challenge of public interest for which there is no solution available on the market yet. So PCP is not concerned with the procurement of already existing products or services on the market but with the R&D phase, which involves a few steps - solution exploration, design, prototyping, up to the development of a limited volume of first line of products or services.

PCP is an approach pulling innovations into the market from demand side, what means from the side of citizens according to their requirements on solution which will be developed within procurement of R&D services (PCP). Using this concept should be overcome the barrier between what citizens want and what are public organizations procuring. The importance of citizen's involvement in decision making on the level of government has been confirmed also in Marsh (2008) and Concilio & Molinari (2011), but on the other hand, as previous observations by OECD or European Commission showed, the most of public organizations do not meet citizen's needs when buying new solutions (Carstensen & Bason, 2012). From this point of view, implementation of PCP approach seems to be an answer to mentioned problem, whereas it leads to an advance the public good and creation of a public value as well (Bland et al. 2010).

Several handbooks and guidelines have been published in the recent past to support undertaking of PCP in the current administrative practice, but no solution has ever been set up in order to improve the familiarity and easiness of use of this administrative/procedural innovation by esp. small sized public bodies. In order to overlap this gap, we developed a "Smart PCP Environment", a platform, which fits all requirements provided in Table 1. To collect all these requirements we started composing a state of the art in the field of pre-commercial procurement what was followed by analysis of actual PCP cases, such as Enigma or Decipher. The output of this research was general description of processes within PCP and identification of needs of main stakeholders' groups – procurers (cities or municipalities), suppliers (companies), consultants and independent spectators (citizens or grant-providing agencies). As next step we were searching for experts to consult innovation procurement. As in Slovakia just a few persons have ever been involved in such a processes, we decided to consult this problematic with experts from one of the leading European countries in PCP – Italy. The source of valuable information was also discussions during workshop in Palermo, with representatives of Italian municipalities, which already made some cases of innovation procurement. Finally, interview with 3 Slovak procurement experts was made. As well as with Italian experts, also in Slovakia, the interview has form of in-depth interview. According to

our findings, there is a need of two main functionalities on solution developed: the first one is related directly to the procurement phase within PCP, while the other one is related to the phase before the concrete innovation – the Idea Management where the whole idea of innovation creating comes.

FUNCIONALITIES	PURPOSE
Idea Management	
Vertical and horizontal discussion Options: public/private discussion Voting system Tags Archive of conversation Searching tool Categorisation of topics Following the discussion	Discussion among all stakeholders Sharing information only for appropriate stakeholders Selecting best ideas Simplifying a search Storage all information Quick search Quick overview of topics Monitoring of interesting topics
Benefits	
<p>New factor of motivation, creating database of many potential co-procurers and suppliers, who would be invited by others or attract by discussions about their fields of interest. Thanks to security features, there would be no need to worry about stealing identity and you can simply get and edit contacts to many institutions or persons, with information about rating composed according to their activity on platform.</p> <p>Composing state of the art in more simple way, saving time, with the opportunity to involve more institutions and experts leading to qualitative better results.</p> <p>Simpler and more transparent communication with partners within consortium leading to better cooperation, preventing misunderstandings and creating virtual environment for sharing ideas and so making brainstorming.</p> <p>Effective communication channel between procurers and suppliers, recording data which could be used in case of some problems would appear.</p> <p>New communication channel, from the view of public authorities, for getting feedback by inhabitants thanks to which, it would be possible to make consensus about spending public sources.</p> <p>Fast and effective collection of opinions on all levels thanks to voting system without need to make costly referendum.</p> <p>Users can be still inform about topics just in their interest thanks to tags, what would not mean bothering them, but providing them precise information they would like to get, what can encourage them to activities.</p>	

Multi-phases Pre-Commercial Procurement	
Interface for both, procurers and suppliers	Access for procurers and suppliers with different rights and information available
Document sharing	Documents gathered at one place
Setting the PCP	Defining all information needed
Assignment of rights and functions	Ensuring, that only persons with some rights are allowed to perform some activities within PCP
Sending the invitations into PCP	Request and reply for participation and their overview in an electronic form
Archive of PCP	Storage of all PCP
Multi – stage evaluation and selection	Evaluation of each supplier at the end of each phase to select the best ones to continue in PCP
Defining the criteria for evaluation	Setting own criteria with respect to a character of PCP
Overview of news	Information if there is any change since last log in
Automatically sending of notifications	Information about activity related to PCP
Communication tool	
Connection to Idea Management tool	Message sending to the other stakeholders
	Quick switch to other tool
Benefits	
<p>Effective stakeholder management – you can simply set access to information to particular users as well as get them concrete rights – responsibilities.</p> <p>Elimination of duplicity recording data for different purpose – once you record them, you can use export them into documents and simply send it to others. You can also set rights to see, edit, print or send a document to somebody else what is very needed as there are always confident data.</p> <p>More transparent processes as all co-procurers as well as suppliers can see what is just happening and what documents have been recorded.</p> <p>Thanks to pre-defined form for pre-commercial procurement, it is very simple to include all necessary information, also for representatives of institutions with no previous experience with PCP.</p> <p>Simpler way of knowledge transfer – thanks to all data recorded – what can lead to faster PCP popularization and process optimization within PCP cases.</p>	

Table 1 Summary of requirements collected

According to findings we made also use case diagram describing user's interaction with the system and depicting the specifications of a use case (Figure 2).

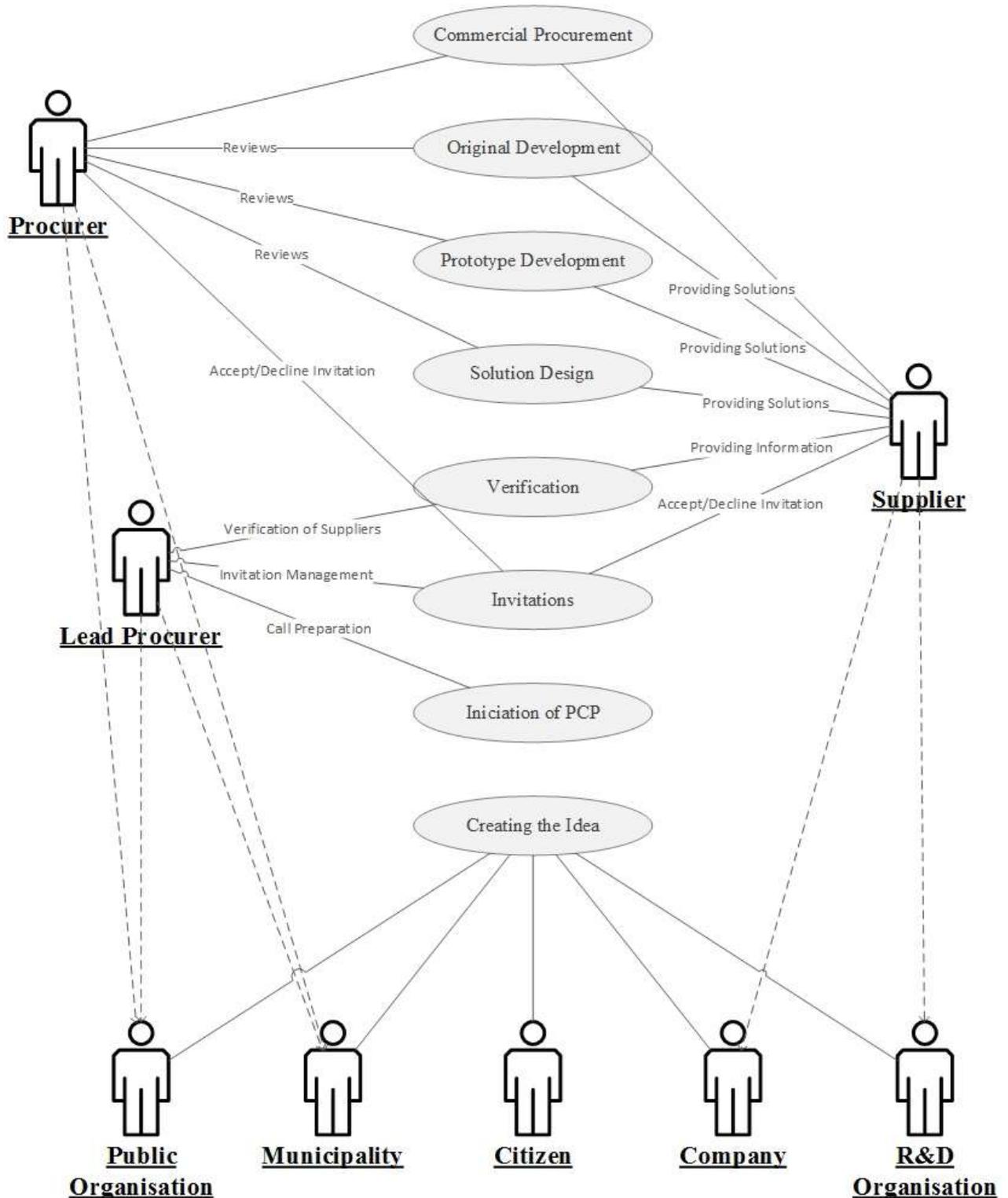


Figure 2 Use case diagram

3. Smart PCP Environment

While several handbooks and guidelines have been published in the recent past to support undertaking of PCP in the current administrative practice, nothing comparable to existing eProcurement environments (systems) has ever been set up in order to improve the familiarity and easiness of use of this administrative/procedural innovation by especially small sized public bodies. So we decided to change this situation and provide a tool which can be helpful in the process of implementation and administration of PCP. The output of our activities is a SMART PCP ENVIRONMENT, which has been developed in the context of the CEE TC Program project CentraLab (www.smart-pcp.eu). This environment is based on the Living Lab concept, whereby a multitude of stakeholders – such as municipalities, enterprises, RTD organizations and citizens – together co-create innovative solutions for their mutual benefit and also for the benefit of society. The basic technology underlying the SMART PCP ENVIRONMENT is a cross-platform framework enabling different applications with heterogeneous purposes (from communication to problem solving, from collective purchasing to eProcurement) to work together. .

In this sense, the SMART PCP ENVIRONMENT can be seen as an aggregator of state of the art technologies that are made available as a cloud eGovernment service to small and medium sized municipalities and other public sector bodies engaged in the design and implementation of PCP calls. Thanks to an easy to use interface, anchored to an underlying “ideal” workflow describing how the PCP procedure should be carried forward, the user is accompanied by the system to the selection of the most appropriate services and tools in support of the multi-stage procurement process, grasping all the benefits from automation, social networking and interoperability/integration of diverse ICT tools.

3.1. Main component features

Communication platform

The communication platform is an interactive discussion space – akin to a social network group – involving all the innovation stakeholders with legal competences or vested interests in the specific PCP call. These may include for example: the procuring agency in charge of the call, other public bodies that have been involved in similar PCP calls in the past and may therefore act as “advisors”, relevant R&D entities (such as universities and research laboratories) in the selected domains, the potential candidates to bidding under the present call (such as enterprises and SMEs, individually or in partnership), other stakeholders (such as the citizens or citizen associations that could be benefited by the resulting innovation). This social network will particularly act as a problem solving space, where questions regarding legislation, administrative best practice, requirements formulation and engineering, and evaluation of the innovation degree of potential solutions can be answered well before the actual PCP call is launched.

Third- party applications

The third-party applications represent the core of the SMART PCP ENVIRONMENT consisting of different procurement applications (e-tender, e-auction, data analytics, etc.) not only publicly funded (e.g. developed within the CentraLab project or other projects), but also commercial applications provided and funded by private companies.

3.2. Scheme of the platform

With the aim to describe the platform and its basic functionalities we made a simple scheme which you can see on the Figure 3.

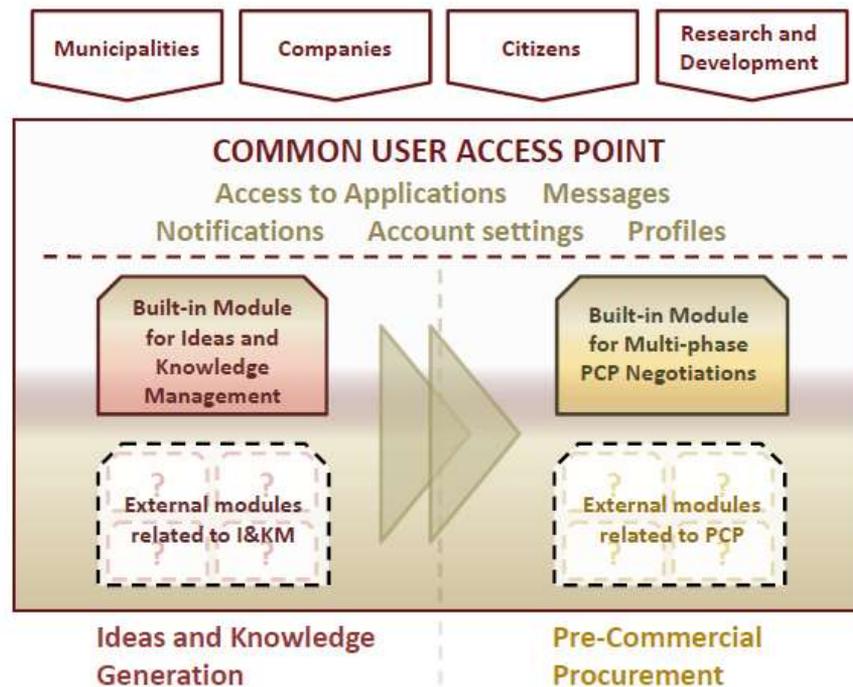


Figure 3 Scheme of the SMART-PCP Platform

Describing it from top to bottom, as first we can see possible stakeholders including municipalities, companies, citizens and representatives of R&D sector. Via one single user access point, they can access applications, messages for private or group communication, set notifications about activities within system and create and manage their profiles which could help them to find project partner. All tools are basically divided into 2 groups as there are 2 main phases of process for pre-commercial procurement. First phase – preparation means mainly communication about proposed idea and possible solutions. Here we can find sophisticated innovative tools for idea management and decision support, as it can be pretty difficult to manage ideas of many interested subjects. Phase of Pre-Commercial Procurement means negotiation with the aim to get the best value for your money. Here we developed tools for receiving offers, solutions, reviewed and finally award them.

4. Conclusion

Smart PCP platform is a unique solution in the form of an interactive platform developed as LivingLab. Thanks to openness and interoperability, it is easy to add new elements (e.g. servers, modules...) and we can simply connect it with external systems which are made with respect of industrial standards as our platform. Application of ICT technologies in the administration of PCP could significantly improve the application of innovation procurement as ICT leads to more effective processes not only in the private but even in the public sector (Gavurová, 2011; Šoltés, Gavurová, 2013). From this point of view, implementation of ICT tools also in the networking part of PCP followed by collaboration part can bring higher effectiveness for all stakeholders from 4 main groups: municipalities, citizens, companies, research and development organizations. Each of them could obtain benefits using our platform within innovation procurement. Municipalities, as

representatives of public sector, with primary intention to improve life conditions of inhabitants, thanks to smart PCP platform can communicate with them easier and more transparent, removing obstacle, providing often demanded information. Public sector, thanks to this feature, can become more transparent, use tools of risk management and identify actual socio-economic challenges in shorter time. In the position of procurer it means also better value for their money as products or services bought via PCP fits better special requirements what is one of the condition for long term effectiveness and efficiency of expenditures. Generally thanks to e-networking there should be also growth of horizontal cooperation activities with other municipalities.

Our requirements analysis claimed also need of functionalities for opposite side of procurement process – suppliers. The most often it is company in this position what could mean potential of growth thanks to new orders, partnerships as eCollaboration can help rapidly answer to market demands, so the participation in networks, especially for SMEs it is crucial when trying to stay competitive and successful (Delina, Tkáč, 2010; Saruc et al. 2013). Another benefit is less risk connected with development thanks to 2 aspects – sharing risk with procurers and very detailed survey of needs of procurers, later transferred to form of requirements what is predictor of satisfied procurer and other potential customers, as pre commercial procurement can be followed by classic procurement for which our platform offers also a wide variety of helpful tools, for all 3 phases – preparation, procurement and execution. Using Smart PCP platform can lead to improvement of overall competitiveness as using different ICT tools, which, as it has been proven, have a positive economic impact on companies (Gavurová, Šoltés, 2014).

Social responsibility is discussed in today's society and our platform should be, beside other goals, one of the initiatives, tools to improve social feeling and become active citizen. More transparent information about public finance allocation, together with user-friendly communication platform can be strong motivation factor to stay in touch with representatives of their town or village and in case of need, help them. Together with innovation procurement it could lead to better life conditions of many people including new job offers as result of growing level of investments which should be achieved thanks to pre-commercial procurement.

Overall better working conditions for representatives of research and development sector could be achieved and support by our platform., in the meaning of higher investment in innovation activities which results should have better potential of taking-up thanks to natural character of PCP conducted with respect to all official standardization and regulations and possibility to make initial offer to much more wide variety then average, thanks to e-networking features of Smart PCP platform.

There are many benefits which could be achieved thanks to cooperation of public government and other stakeholders in innovation processes. But as it is still relatively new, unknown concept and there is strong need to support activities of PCP not only via official project calls and political activities raising awareness, but also through practical help thanks to ICT technologies removing obstacles and encouraging to active networking leading to future collaborations.

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ENABLING BUSINESS INTELLIGENCE FOR SMES INFORMATION SYSTEM

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Keywords

Business Intelligence, open-source, cloud computing, SaaS, SME, collaborative BI

Abstract

SMEs represent majority of enterprises in the EU. They have similar budgetary, administrative and other limitations. Decision making process takes place also in these enterprises. Information system of a SME often lacks Business Intelligence capabilities. This paper aims to present short analysis of 3 selected technologies that can enable BI capabilities for SMEs information system.

1. Introduction

Modern information society, in which we live, is getting more and more interwoven with a need of fast and flexible access to information, necessary for the process of making key business decisions. The Business Intelligence (BI) has its place in an information system of large enterprises, yet SMEs often lack resources for such solutions, despite the fact they represent majority of enterprises in the European Union.

This paper aims to present a short analysis of 3 selected technologies (open-source tools, SaaS and cloud computing and collaborative computing) that can enable BI capabilities for the SMEs information system and their potential in case of building a BI solution.

2. The information system, Business Intelligence and SME

2.1. The information system

Tvrđíková (2000) assumes, that an information system is a collection of people, methodologies and technical means for gathering, transmission, storing, processing and presentation of data, aimed at formulating and offering information according to information recipient's needs, which is actuating in the management system. Also, agreeing with O'Brien (2003), information systems are distinct from the information technology in that an information system is typically seen as having ICT components. Information systems are also different from business processes – information systems help to control the performance of business processes.

A typical large enterprise information system encompasses transaction processing systems, like e-business suite, point-of-sale transactions processing systems, CRM or supply chain management system that usually build up an enterprise resource planning (ERP) system etc. (see the left side of figure 1). The impact of e-marketing services management on the economic performance of an enterprise was studied by Dorcak and Delina (2011) – e-marketing is a natural part of the e-business in the enterprise. Also features that facilitate some sort of a computer aided decision-making are usually included.

Medium and small enterprise’s information system usually tends to have reduced architecture complexity needs but in many cases, however, lacks computer aided decision-making capability. As Szabo and Ferencz (2013) argue, the innovation and prosperity go along and the decision-making capabilities are not currently dedicated to only large enterprises. Nowadays, the true motive of information system’s innovation and usage of some kind of Business Intelligence tools is whether the business management involves such use cases that need such computerized support, or not, and not the size of the enterprise.

2.2. The Business Intelligence

According to Turban et al. (2007), BI’s major objective is to enable interactive access (sometimes in real-time) to data, to enable manipulation of data, and to give business managers and analysts the ability to conduct appropriate analyses. By analyzing historical and current data, situations, and performances, decision makers get valuable insights that enable them to make more informed and better decisions. The process of BI system’s usage is based on the transformation of data into information, then into decisions and finally into actions. Figure 1 shows main components of a typical BI system.

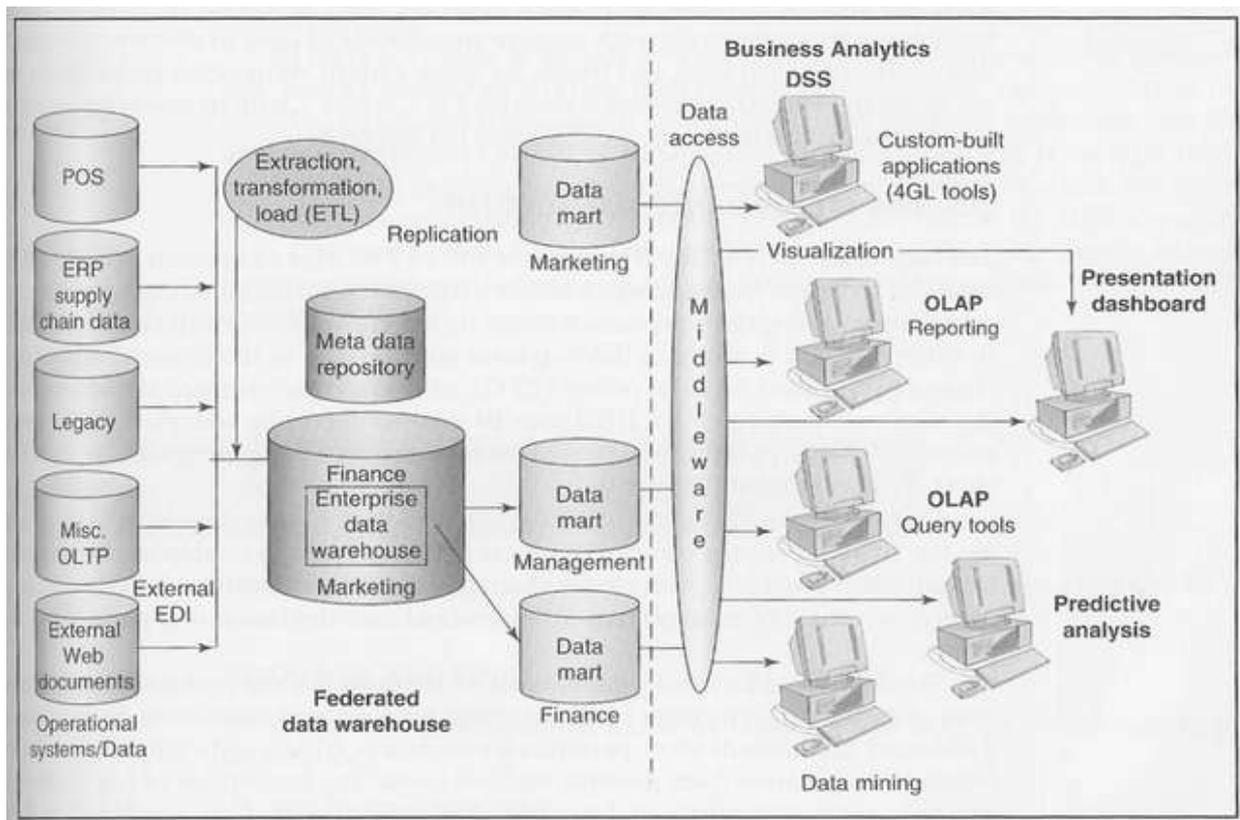


Figure 1 Main components of a typical Business Intelligence system (Turban et. al., 2007)

BI facilitates to manage a company by knowledge and if it is an integral part of company's information system, it provides meaningful and actionable insights into data, present in various parts of the information system. Business Intelligence is often viewed as a huge complex of analytical applications, methodologies and models only suitable for large enterprises and selected analysts. However, this industry paradigm, more or less, changed and the BI is starting to grow also into SMEs environments, enabling them to also make better decisions and manage themselves by knowledge through affordable BI tools.

Novotný et. al. (2005) states that the term BI was established by the Gartner Group's analyst Howard J. Dresner in 1989 who described it as "a set of concepts and methods for improving business decisions." He highlights the importance of a data analysis, reporting and query tools that steer the user through a quantity of data and help him with the synthesis of valuable and useful information. However, the concept is much older. It has its roots in MIS reporting systems of the 1970s. During that period, reporting systems were static, two dimensional and had no analytical capabilities.

A concept which emerged in the early 1980s was called EIS (Executive Information System). EIS expanded the computerized support to top-level managers and executives. EIS introduced new capabilities like dynamic multidimensional (ad-hoc or on-demand) reporting, forecasting and prediction, trend analysis, drill-down to details, status access, and critical success factors analysis. The concept of EIS was transformed into BI after establishing the term BI, since a good BI enterprise level system should contain components of former EIS. Turban et. al. (2007) states, that by 2005, BI systems started to include artificial intelligence capabilities as well as powerful analytical capabilities and also data mining features based on highly sophisticated data analysis using mathematical and statistical algorithms and methods and concluding predictions and pattern based analyses from huge amounts of data.

Today's BI is among others characterized by increased pressure on the interconnection of analytical applications with the strategic goals and strategy formulation, increased pressure on primary data quality improvement and revision of the structure of BI systems costs using new design methodologies.

2.3. Definition of SME

According to European Commission's Recommendation 2003/361/EC (adopted by Commission on 6. 5. 2003) an enterprise qualifies as micro, small and medium-sized enterprise (SME) if it fulfils criteria laid down in the Recommendation (summarized in the table 1).

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

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

In addition to the staff headcount threshold, an enterprise qualifies as an SME if it meets either the turnover threshold or the balance sheet threshold, but not necessarily both. Micro, small and medium-sized enterprises are socially and economically important, since they represent 99 % of all enterprises in the European Union. They provide around 65 million jobs and contribute to the entrepreneurship and innovation. However, SMEs face particular difficulties which the European

Union and national legislation try to address by granting them various advantages. The application of a common definition by the Commission, Member States, the European Investment Bank and the European Investment Fund ensures consistency and effectiveness of those policies targeting SMEs. By those means is the risk of distortions of competition in the Single Market minimized (2009, European Commission).

Levy and Powell (1998) argue that SMEs are often more flexible, adaptive and innovative than large enterprises and have sometimes quicker response to costumers needs. The paper by Hanclova, Rozehnal, Ministr and Tvrđíková (2014) presents analysis of Business Intelligence tools' usage patterns in Czech and Polish SMEs. Authors state that the computerized decision support is already used in some forms in firms that were addressed in the analysis. Other similar analyses also contain argumentation that indicates higher levels of BI tools' usage in many other SMEs in the Europe and in the world as well, making the BI even more pervasive.

3. Technologies that can enable BI for the SMEs information system

3.1. Open source BI tools

The open source software is a software category in which the source code and certain other rights that are normally reserved for copyright holders are provided under a specialized software license. The software then meets the Open Source Definition and/or is offered legally in the public domain. This permits users to use, change, or improve the software and redistribute it in a modified or unmodified form again under similar open source licence. It is often developed in a public and collaborative manner. Agreeing with Gentile (2009), commercial open source software has risen to prominence in recent years, proving its value as an enterprise-ready technology delivering flexibility and leading-edge capabilities at an attractive price, and so it is with open source BI tools. They have potential to reduce budgetary requirements and the risks of BI solution implementation, and due to platform independence, openness of the code and mostly affordable price provides a significant advantage over proprietary tools. Open source BI tools are therefore quite suitable for enabling BI in the SMEs information system.

There are 2 main open source BI projects: Jasper and Pentaho. These projects deliver complex BI platforms for enterprises of every size or a BI solution as an embedded module. Table 2 shows BI tools that are delivered by the JasperSoft company (founder of Jasper project), Pentaho company (founder of the Pentaho project). These projects encompass main topics of the BI (analysis, data integration, visualisation etc.) along with other successful standalone open-source projects, ranging from database management systems to data integration tools.

Platform / toolset name	Project website
<i>Jaspersoft BI Suite Professional</i>	<i>www.jaspersoft.com</i>
JasperReports, JasperServer, JasperAnalysis, JasperETL	
<i>Pentaho BI Suite Enterprise Edition</i>	<i>www.pentaho.com</i>
Pentaho Mondrian, Pentaho Reporting, Pentaho Data Integration, Pentaho Analysis, Pentaho Data Mining, Pentaho Dashboards	
<i>Other</i>	
Business Intelligence and Reporting Tools (BIRT)	www.eclipse.org/birt/phoenix
Talend Open Studio, Talend Open Profiler	www.talend.com
MySQL Relational Database Management System	www.mysql.com
JBoss jBPM	http://www.jboss.com/products/jbpm/

Table 2 Overview of available market-leading open-source BI tools

3.2. Cloud computing and Software as a Service (SaaS)

The cloud computing is a concept of sharing dynamically scalable and virtualized resources usually as a service that is provided over the Internet. Users don't need to have knowledge of, expertise in, or control over the technology infrastructure in the "cloud" that supports it. The term cloud is used as a metaphor for the Internet, based on how the Internet is depicted in computer network diagrams (figure 2), and is an abstraction for the complex infrastructure it conceals.

A key feature of the cloud computing concept is that it could drastically lower IT infrastructure costs, as well as needs to maintain knowledge of the infrastructure. All of this is maintained by cloud computing application providers. As for the BI system's features delivered as a cloud application, there are still strong arguments against such solution, mainly related to performance and security issues. However, this technology holds large future potential for planning the implementation of BI capabilities in the SMEs information system, mainly because of lack of need to maintain in-house hardware and software for such solution.

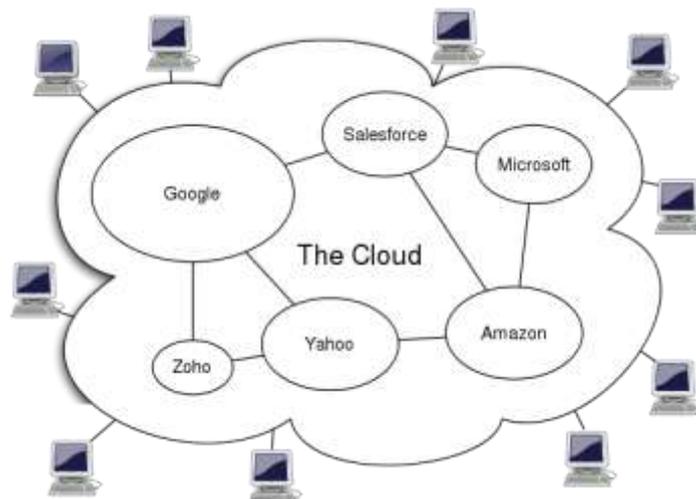


Figure 2 Public cloud providers' network

Software as a Service (SaaS) is a software deployment and distribution model that accompanies the cloud computing paradigm, whereby a provider licenses an application to customers for use as a service, typically on-demand. SaaS software vendors may host the application on their own web server or download the application to the consumer device, disabling it after use or after the on-demand contract expires. The on-demand function may be handled internally to share licenses within a firm or by a third-party application service provider (ASP), sharing licenses between firms.

As a part of cloud computing technology environment, the SaaS BI, as a form of outsourcing BI solution, has also a large potential for SMEs or small departments in larger companies that don't have required IT resources or don't want to manage them. However, even if SaaS delivered BI applications are web based, in case of integration, there are still some drawbacks, e.g. cloudy pricing models which, as Lawson (2008) argues, sometimes hide additional integration costs (if the problem shows up). Therefore if a SaaS model is to be leveraged in the BI solution planning process of a SME there should be a serious complex assessment made on vendors and their SaaS appliance offerings and available references.

3.3. Collaborative BI (social computing)

Past few years were in light of popularity explosion in the usage of social networking and video-sharing sites, wikis (public or private websites that facilitate collaborative creation of knowledge and sharing it with wider user audience), blogs and folksonomies (collaborative tagging and social classification and indexing websites/service) (e.g. Facebook, MySpace, Delicious, Youtube, Wikipedia etc.). Agreeing with Bentwood (2009) public communities and “externally” facing enterprises should not be ignored. The concept of sharing content throughout social media and related services and computing tools with user communities brings another opportunity for enterprises of every size. They allow them to leverage Internet users’ natural tendency of sharing various content with members of like-minded community to gain richer business and customer insights and potentially make the decision-making process collaborative and more intuitive using these tools.

Gentile (2009) argues that web based applications, e.g. Google Wave, will allow collaboration in analysis and reporting using variety of other enterprise information sources that will help users make faster and better decisions. The key will be in the design of reports and carrying out analysis in a collaborative environment so that it is shared consistently and with broader audience. In this sense, “the enterprise social computing” will approach the mainstream use, where e.g. Panorama Necto platform already gained significant market share. And due to SMEs natural flexibility and adaptability tendency, the collaborative BI holds great opportunity for them to run a potentially low cost but mainly a collaborative decision-making process.

4. Conclusion

The aim of this paper was to analyze 3 selected opportunities for the adoption of the BI in a SME. These topics were:

- **open source BI tools** (flexible and adaptable solutions with lower price than proprietary counterparts),
- **cloud computing and BI applications delivered through the SaaS deployment model** (low IT infrastructure costs, flexibility and scalability, various implementation options, no infrastructure knowledge needed),

- **collaborative BI** (leverage Internet users' natural tendency of sharing content, collaboration in externally facing enterprises/communities with Internet users, i.e. potential and current customers).

Implementation strategy of the SME that should include these technologies should be well prepared to mitigate risks of BI implementation failure or cost overrun which can be fatal for the SME sized company. In case of SaaS model based software delivery, vendor's license details and references should be well considered and explored to avoid unwanted surprises.

Acknowledgment

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CORPORATE PERFORMANCE MANAGEMENT

PERFORMANCE MANAGEMENT AND MEASUREMENT RESEARCH IN THE CZECH REPUBLIC: 1993-2013

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Performance Management, Performance Measurement, Bibliometric Analysis, Czech research

Abstract

The aim of this paper is to analyze research outputs in performance management and measurement (PMM) area published by Czech researches from 1993-2013 using bibliometric approach. Outputs published in Scopus and Web of Science are considered for this analysis. This analysis can help to map productivity and efficiency of research authorities in the Czech Republic and their impact on PMM research in global and local context. Based on this analysis recommendations for further research trends of Czech researchers are discussed.

1. Introduction

Performance management and measurement (PMM) became hot corporate business management topic since nineties of 20th century. Following the interest in business practice many academics and people who stay between academic and professional world started research activities in this field (see e.g. Kaplan & Norton, 1992, Eccles, 1990, Neely, 1998, Bititci, Carrie & McDevitt, 1997 and many others). While by eighties of 20th century tools and methods of PMM were developed as one of issues in various research fields, e.g. management accounting and controlling, finance and economics or management control systems, since nineties PMM was constituted as stand-alone research as well as professional area (see e.g. Neely 2002 or Neely, Gregory & Platts, 2005 who summarize lessons learned in first decade).

Following these research initiatives pushed by researchers in US and UK dominantly, Czech academic and professional community started activities in PMM area. Research outputs in world context were mapped and analyzed in details (see e.g. Petera, Wagner & Menšík 2012 as a guidepost for such outputs) however there was any specific research done to map and analyze PMM research results for Czech researchers to understand the structure, dynamics and research impact of activities in Czech researches' community. The only available output was published by Buhovac & Groff (2012) who mapped empirical oriented PMM research in central and eastern European countries.

The aim of this paper is to analyze research outputs in PMM area published by Czech researchers from 1993-2013 using bibliometric approach. Outputs published in journals and conferences listed

in two world-wide respected databases, Scopus and Web of Science are considered for this analysis. This analysis can help to answer questions like:

- What are the most productive and efficient Czech research authorities in PMM research area?
- Which journals are willing to publish PMM research outputs of Czech researchers?
- What is the impact of Czech PMM research in global and local context?

Based on this analysis recommendations for further research trends of Czech researchers are discussed.

2. Methodology

The research uses bibliometric methods to map and analyse research outputs in PMM area in the Czech Republic. Papers, both articles in journals as well as conference papers listed in two most respected databases, Scopus and Web of Science are searched. This inquiry was realized in May 2014 so we can assume that not all papers published in 2013 are listed in the databases yet.

Basic search term was formulated for the field “Title” as

(measurement OR management) AND performance

with additional term *Czech* in the field “All fields” (Scopus), respectively “Address” (Web of Science). Time span was set as 1993 – 2013. From achieved results all documents with main authors who are outside Czech Republic and all documents which do not focus on business or economic performance (usually papers concerning performance in area of Engineering, Medicine and similar) were excluded manually. In addition, all Czech authors who have been looked up in previous step were searched in references lists of all papers listed in Scopus database and searched out for search term (*measurement OR management*) AND *performance* to map impact of non-listed papers of Czech authors on world-wide research community in PMM area.

According to these criteria 46 papers were found and used for further analysis. Basic analysis of this sample shows that 18 articles in academic journals and 28 conference papers were published in this period. For comparison, during the same period 3 040 papers can be founded for search term (*measurement OR management*) AND *performance* in Scopus database within subject areas Business, Management and Accounting and Economics, Econometrics and Finance, i.e. narrower searching area than applied for mentioned Czech sample. Comparable result to this figure for Czech authors is 10 papers. We can also mention that US, UK and China are three leading countries according to number of paper published in PMM area.

Figure 1 shows number of papers published by Czech researchers in each year.

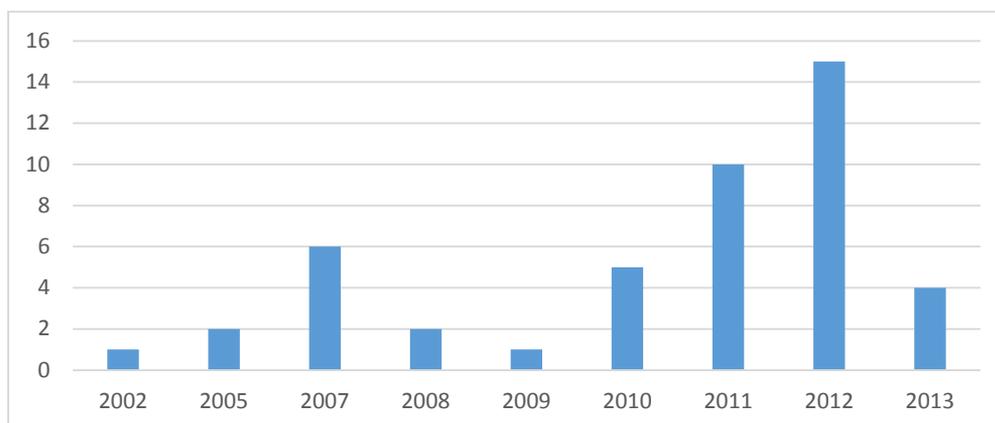


Figure 1 PMM papers published by Czech researchers: 1993-2013

Except of one paper there are no research outputs by 2004 published by Czech researchers. After some fluctuation during 2005-2009 the number of papers published from 2010 is markedly increasing (2013 data were not completed before this inquiry). For comparison of trends and dynamics, Figure 2 shows yearly counts of papers focusing on PMM area which are listed in Scopus and published world-wide (red line, counts divided by 10) and papers in the sample which was showed in Figure 1.

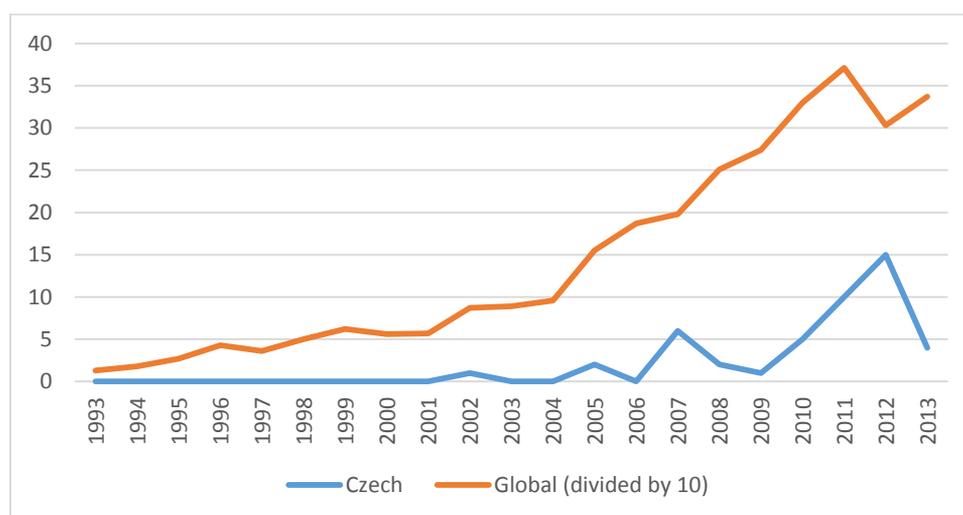


Figure 2 PMM papers published world-wide and by Czech researchers: 1993-2013

Comparison of data and trends in Figure 2 shows that Czech researchers were adaptors rather than pioneers in PMM research because of no publications in first decade. Other reason for delay can be seen in transformation of Czech economy after 1990 with significant impact on restructuring the system of Czech universities which focus on economics and management research fields. On the other hand, increasing interest in PMM research after 2005 is evident for global as well as Czech research community.

For all particular Czech PMM papers additional data were searched:

- number of citations by authors within and outside Czech Republic to find impact of papers on local and world-wide community (Web of Science and Scopus data analysed),

- affiliation of main authors to research institutions to map structure and dissemination of Czech researcher’s community (data from papers used if available otherwise web search realized),
- main research methods applied in papers to structure research outputs according to research style, and
- research fields or issues focused in papers to understand priorities of Czech research effort.

Applied research methods and focused research fields were recognize based on paper abstract primarily; in case of poor abstract based on paper text. Following classification of research methods was used: theoretical – archival, theoretical – literature review and summary, theoretical – models’ and concepts’ design or development, empirical – survey or descriptive analysis, empirical – case study, empirical – others (e.g. experiment). Following classification of research issues was used: PMM general (general concepts, frameworks, models and systems description, evaluation, design, enhancement etc.), Links of PMM to corporate strategy and management, PMM implementations in specific industry, company or process and Environmental and sustainability aspects in PMM. For one paper it was possible to find neither abstract neither full paper.

Realized citation analysis follows recommendation of Reuters, Thompson (2008).

3. Results

Results of the analysis can be structured in three main areas – (1) research productivity and recognition according to research subjects, (2) publications of PMM research outputs in listed journals with regard to their influence, and (3) structure of applied research methods and variety of research fields and issues.

3.1. Research productivity and recognition

Productivity metrics show how many papers were produced by individual research institutions and how many academics are involved in research publication as main authors within individual research institutions (see Figure 3).

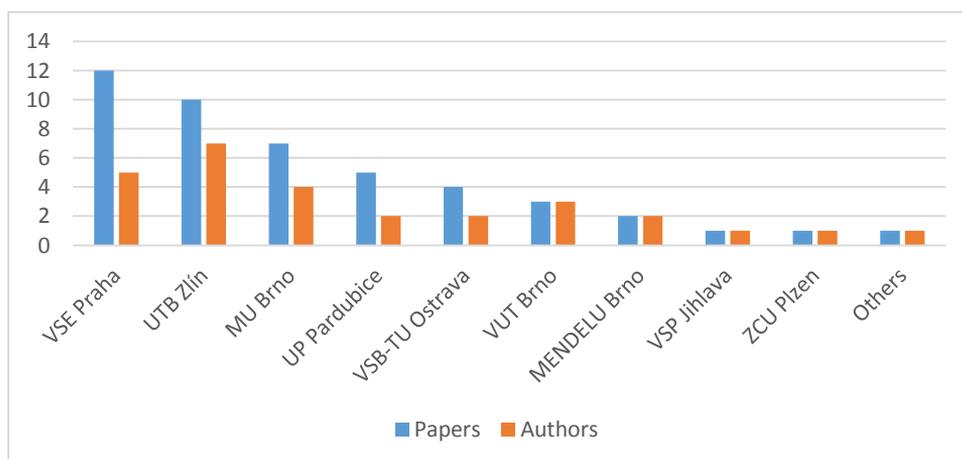


Figure 3 Count of papers and authors according universities

The most productive Czech authors with 4 published papers are (in alphabetical order): Jiří Hřebíček and Michaela Stříteská, followed by authors with 3 published papers: Adriana Knápková, Marie Mikušová, Petr Petera and Jaroslav Wagner.

Recognition metrics measure impact and influence of published research outputs on other researchers (see Figure 4). First, total count of citation and second, count of citation by researchers outside Czech Republics are shown.

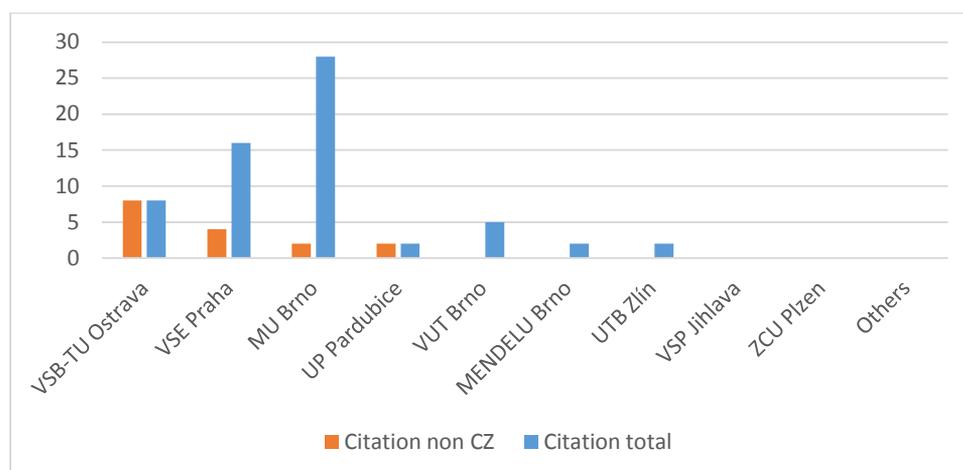


Figure 4 Count of citation and citation outside Czech Republic according universities

The most influencing Czech author measured by count of citation after exclusion of self-citations are Jiří Hřebíček (12 citations), Jaroslav Nenadál (8), Ota Novotný (7) and Michal Hodinka (7). Count of citations of particular papers differs substantially. Figure 5 shows count of citation of particular papers which are ordered according to this factor.

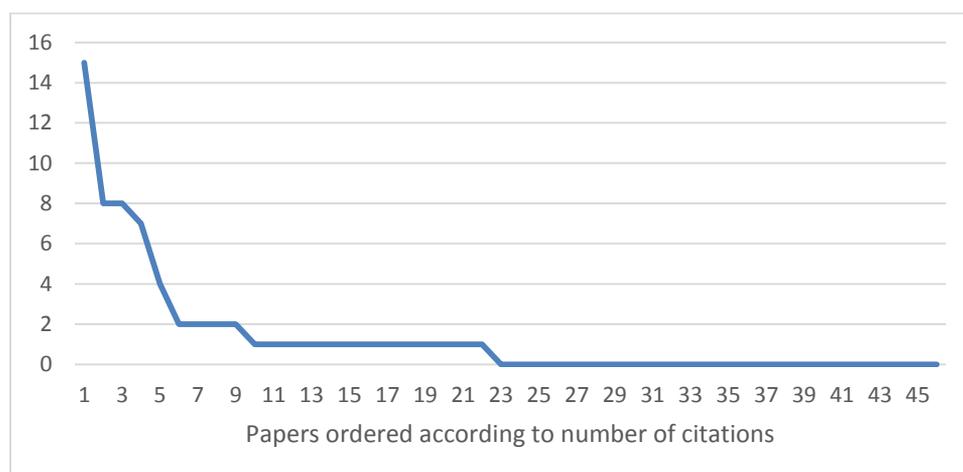


Figure 5 Count of citation of individual papers of Czech researchers

3.2. Journals publishing Czech researchers' PMM research outputs

There are 12 journals publishing PMM research outputs of Czech researchers which are listed in Scopus or Web of Science databases. Counts of published papers, citation impact of journal papers in the sample and basic publishers' data are shown in Table 1. Because of very small counts of papers published in particular journals relevance of data about average number of citations per paper in sample is limited. The table also shows that only three of journals have positive impact factor according to Web of Knowledge – Journal Citation Reports.

Journal	N of papers published	Aver. N of citations per paper in sample	Journal's Impact Factor	Publisher	Country
Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis	5	5	-	Mendel University of Brno	Czech Republic
E a M: Ekonomie a Management	3	0,33	0,633	Technical University of Liberec	Czech Republic
European Financial and Accounting Journal	1	2	-	University of Economics in Prague	Czech Republic
International Journal of Energy and Environment	1	2	-	International Energy and Environment Foundation	Iraq
International Journal of Knowledge, Culture and Change Management	1	0	-	University of Illinois	USA
International Journal of Productivity and Performance Management	1	8	-	Emerald Group Publishing	UK
Journal of Competitiveness	1	1	-	Tomas Bata University in Zlin	Czech Republic
Journal of Organizational Management Studies	1	1	-	IBIMA Publishing	USA
Lekar a Technika	1	0	-	Czech Society for Biomedical Engineering and Medical Informatics	Czech Republic
Management Research Review	1	2	-	Emerald Group Publishing	UK
Politicka Ekonomie	1	2	0,722	University of Economics in Prague	Czech Republic
Technology Analysis and Strategic Management	1	1	1,095	Taylor & Francis Group	UK

Table 1 Journals publishing Czech researchers' PMM research outputs

It is also quite interesting to mention that all papers of the sample published in the journal *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis* (which has the highest count of published papers) were written by authors from different universities in Brno and all papers from the sample published in the journal *E a M: Ekonomie a Management* (second journal according to count of published papers) were written by authors from universities which are mentioned as “cooperating faculties” at the web page of this journal.

3.3. Research methods and research issues in the sample

All available papers (or their abstracts) in the sample were analyzed according to research methods applied and research issues focused. According to research issues papers were classified in groups - PMM general (I-1), Link of PMM and corporate strategy and management (I-2), Implementation of PMM in specific industry, company or process (I-3) and Environmental and sustainability aspects in PMM (I-4). Results of the analysis are presented in Table 2.

	I-1	I-2	I-3	I-4	Total
Empirical - survey	8	1	2	-	11
Empirical - case study	-	-	4	-	4
Theoretical - “new ideas”	8	1	8	6	23
Theoretical - literature review	3	-	1	-	4
Theoretical - archival	2	-	1	-	3
Total	21	2	16	6	45

Table 2 Research methods and issues

We can see that theory-oriented research trying to bring “new ideas” is the most expanded type of paper, followed by empirical research oriented to field survey. Regarding research issues PMM area in general and implementation of PMM in specific industry, company or process overhauls other issues markedly.

4. Discussion

Resulting above mentioned findings together with insights recognized during papers’ analysis there are several points for discussion. They can serve as a start-point for recommendation to following work in PMM area in Czech researchers’ community:

- Almost all papers are written by single authors or groups of authors from the same university.
- There are many theoretical papers searching for “new ideas” (i.e. concepts, frameworks, models etc.) with low citation impact; thirteen papers from this subgroup (i.e. more than one quarter of all papers in the sample) have any citation at all.

- Only one third of journal articles is published in journals abroad.
- Many papers are mentioned as a result of specific short-term research project.
- Verbal or even narrative writing style dominates in many papers. The level of formalization as well as application of statistical methods is elementary.

According to our opinion above mentioned reasons weaken the performance of Czech performance management and measurement research. We suppose that some challenges can be useful in this regard.

Team working. Many high-quality and world-recognized research papers are result of co-authoring among both academics from different universities as well as academics and professionals. Such team working - especially with respect to size of Czech Republic - can or should be initiated at national as well as international level.

Implementation-oriented research. We mentioned that Czech researches are still more followers rather than initiators of new trends in PMM research. Implementation-oriented research projects or application of PMM concepts and models with respect to specifics of Czech economy seem to be good area for those researches rather than to search for “new PMM continent”.

Research marketing and promotion. If Czech paper bringing new ideas should ever be recognized in world-wide community it is necessary to make adequate marketing and promotion activities in this regard. First, the paper has to be published in English. Second, research project, its development and results should be presented at prestigious conferences as well as on web pages of research project or research organisation. Third, longitudinal high-quality research activities of one research team can bring higher reliance on quality of this team by consumers, i.e. other researchers.

Submitting abroad. Just a couple of papers is published in journals outside of the Czech Republic. Unfortunately, we don't know how many papers are submitted however, we assume that this quantity is quite limited due to rejection fear. Whereas in Czech journals results of reviewing process are more predictable. So, dauntlessness to submit papers in different international journal is general recommendation in this regard.

Strategic research planning and control. Many Czech PMM papers are published as outputs of specific short-term research project supported by some granting agency. To justify the reasonability of financing researches are stressed to bring visible research outcomes in short-term horizon; whereas in prestigious journals the time from submitting to publication can be counted in months or even years. That's why publications in prestigious journals can be expected more as results of long-term projects financed either by institutional support or a chain of consecutive projects in the same field enabling long-term research planning and control.

Improving application of advanced research tools and methods. On the first hand, Czech PMM researchers use mainstream research method like concepts' and methods' development and design in theoretical research or field survey in empirical research. On the other hand, they don't use advanced mainstream research tools and methods like formalization by modelling or advanced statistical analysis for field data analysis. It causes complications by citing of such papers due to e.g. low preciseness of verbal concepts' formulation or limited insights provided by results based on elementary statistical analysis.

5. Conclusion

During 1993-2013 performance management and measurement was constituted as stand-alone research discipline. Ten years after the beginning Czech research started to publish research output in this field in Czech as well as international research journals. Our findings show that Czech PMM research is realized in few of Czech universities and published especially in Czech academic journals. During 1993-2013 Czech researchers published 18 journal's articles and 28 conference papers focusing on PMM area which are listed in Scopus or Web of Science databases or cited by other papers listed in Scopus database.

The recognition of Czech PMM research outputs is limited; only nine papers have more than one citation. Papers realizing empirical survey and especially theoretical papers trying to bring new PMM concepts and models are the most popular by Czech researchers. Papers deal with development of PMM area in general and with implementation of PMM in specific industry, company or process.

Based on "hard" as well as "soft" findings based on this analysis some recommendations for further research activities can be offered: (1) team-working among universities and professionals at local as well as international level, (2) focusing on implementation-oriented research, (3) enhancing research marketing and promotion activities, (4) prioritising to submit papers to international journals, (5) emphasizing the importance of strategic research planning and control, and (6) improving application of advanced research tools and methods.

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PROFESSIONAL COMPETENCE OF CONTROLLERS IN THE CZECH REPUBLIC: RESEARCH EMPIRICAL STUDY

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Professional Competence, Controller, Management Accountant, Developmental Tendencies

Abstract

The article describes the outcomes of the project whose purpose is – on the basis of the “Draft for a Common Statement” – to state generally accepted requirements for the professional competence of managerial accountants and controllers. The paper concludes that, despite the fact that Draft is only the first step, it brings substantial contributions: it has led to a better understanding of the differences which accompany this profession’s development in different parts of globe. It enables better identification of common features, but also differences in profiles and professional orientations of professional accountants, auditors and professional accountants in business, and of managerial accountants or controllers whose quality professional development is the principle aim of this project.

The important part of the project is the empirical research focused on changing the requirements of managers and controllers, and mapping the current situation in the Czech Republic in this area. The research compares the opinions of two groups of respondents – experts who are responsible for the professional competence development of controllers on the one hand, and managers and controllers operating in a business environment on the other. The paper provides results relating to following areas: the general content of controllers’ activities, controllers’ authority and responsibility, requirements for controllers’ education, professional skills and practical experience, ethical aspects of management accounting as well as the quality assurance of the controllers’ work.

1. Preface

Especially the changes in business environment and growing needs for a quality company management but also global crisis leading to recognition how important for the companies’ success is the quality of their financial management manifest itself besides others in the growing pressure to competence of professional accountants and – in their frame - also controllers and managerial accountants as experts whose principle aim is to enhance primarily long-term financial effects on the basis of “accounting understanding of the world” and through the general coordination and optimisation of company processes.

From this view-point, the aim of this article is to describe the outcomes of the pilot project whose general orientation is to define quality standards for the work of these experts and consequently to

develop a framework for more precise specification of requirements for their education, skills and experience but also for their ethical approaches, values and attitudes.

2. Literature Review

Most of researches (Kaplan, R., Cooper, R., 1998, Burns, J. and Yazdifar, H., 2001, Merchant K., 2003) confirm significant role of quality financial management in changing environment which is influenced by following tendencies: inter-disciplinary nature of company management, emphasizing its the strategic horizon, its multidimensionality, integration of all substantial aspects of purposive business management including inter-relationship (but also divergence) between the user and processing areas of quality information systems (Simons, R., 2004, Parker, L., 2002, Merchant K., 2003). This situation has significant impact not only on substance of company management control system including its information support (Carruth, B., 2004) but also on professional education, skills, experience and ethical values and attitudes of financial managers.

- The pressure to enhance professional competence of these experts is apparent in many sizes; it is demonstrated especially by
- Newly formulated requirements of companies which are generalized in textbooks and the other outcomes from academia in which the ability and necessity of qualitative changes in the work of these experts has been stressed;
- Reactions of universities and professional bodies with economic orientation which feels the necessity to implement these requirements into the education curricula and into the pre-qualification certification systems of the professional competence development.

In this regard, some authors devote their special attention to controllers or managerial accountants. For example Kaplan (1998) states that especially ICT development has enabled to liberate these experts from routine data processing, what gives them the opportunity to

- Spend less time by the standardized statements development and – conversely – to devote more attention to analyses and interpretation of submitted information;
- Communicate more intensively companies' aims and means of their fulfilment with those people from departments who participate in the aims' realization; and
- Shift the part of its work from the area of comparison of actual and desired companies' results to the area of decision-making about a future course of business process.

Similarly, according to Grandlund a Lukka (1998), controllers should not act as internal information support providers only, but more as business partners who are co-equal members of decision-making teams and as experts whose authority and responsibility is to explain why a certain type of information is or is not relevant for a certain decision and – consequently – who are expected to enhance the decision-making quality.

Zralý (2007) reacts on changing role of managers, controllers and managerial accountants and the interactions among them, as well as on growing requirements on interdisciplinary approach and linking up inside the management control system by suggestion of the approach titled as the “controlling convergent concept”.

All above-stated changes in the content of controllers'/managerial accountants' work have been manifesting itself also in new requirements to professional competence and capabilities of these experts. Before, they were required to have adequate knowledge, skills and experience of the

management accounting instruments and methods and their implementation and use in the frame of company information systems. Recently, they should use these competencies more as means to successive aims – to ability to integrate on interdisciplinary basis management accounting information with non-financial and qualitative one, to capability to justify, interpret and present ascertained results, to give adequate information support for decision-making and to ability to strengthen companies' synergic effects through the communication and integration relations they develop and cultivate (see for example Burns – Yazdifar, 2001, Yasin 2005, Hoper, 1980, Horvath, 2006 and Zralý 2007).

They are the reasons, why new approaches to systems of professional development have been encouraging by important institutions interested in eliminating business problems, for example by World Trade Organization, World Bank, United Nations and – in connection with that - also by professional organizations as International Federation of Accountants (IFAC), United Nation Conference on Trade and Development (UNCTAD) and International Group of Controlling (,2010) which focus on definition of requirements and standard implementation for financial managers.

Nevertheless, current initiatives are still at the beginning; for example International Education Standards developed by IFAC have the only seven general standards and one special standard for auditors, UNCTAD syllabuses are considered to be too disciplinary oriented, outcomes of the “old school education” are focused primarily on technical skills (familiarity with the methods and tools of management accounting) and they do not focus sufficiently on practical skills and interdisciplinary aspects of financial management.

Moreover: unlike auditors whose activities in the public interest have been the subject of legislative treatment (and afterwards also of worldwide harmonisation of juridical standards), analogous legal harmonisation of requirements for managerial competencies has been perceived to be not only useless but even harmful with regard to creation of barriers for the experts' free movement and monopolies' development for judgment of their quality.

Also historical development difference in the areas of managerial control and applied managerial approaches manifests itself by the fact that these experts are not only titled differently in various parts of the globe but they are also equipped by different level of authority and responsibility and they operate in different levels of a company hierarchy.

More over, according to many research outcomes the level of soft skills (an ability to argue, interpret and present discovered results and to connect financial information with non-financial, intangible and “invisible” sizes of business activities) is important; this aspect is undervalued in all respected materials devoted to financial managers professional competence development (Yasin, M. M. , Bayes, P. E., Czuchry, A. J. ,2005, Pierce, B. and O'Deam T., 2003, Grandlund, M. – Lukka, K., 1998, Jablonsky, F. S., Keating, P. J. and Heian, J. B., 2004).

3. Empirical Research Methodology

The aim of the empirical phase of research which follows the definition of conceptual general outcomes is to map how the above stated tendencies manifest themselves in the recent requirements of professional competence of controllers and management accountants; moreover, the question has been analyzed – as previously already stated – from two view angles:

from the view-point of experts who are responsible for their professional competence development in the pre-qualification stage;

from the view-point of managers and controllers/managerial accountants operating in a business environment.

The research should give a comprehensive answer to the question to what extent the changing requirements of the professional competence of these experts are perceived in practice and reflected by institutions which are responsible for their universal education.

With regard to this aim the questionnaire was developed in two versions:

- a version concisely titled **“A controller/management accountant should be...”**, designated for the first group of experts; and
- a version concisely titled **“A controller/management accountant is...”**, designated for the second group.

The respondents of the second group are randomly selected companies operating in the Czech Republic (number of employees over 100, turnover over €50m and sales also over €50m). Companies from various industries are included in the sample.

Concerning the content and structure of both versions they are identical to a significant extent. Their basis was derived from the above stated analysis of the “Draft for a Common Statement”. However, other materials have been also used as inspiration sources, especially:

- IFAC International Standards for Professional Accountants (IFAC, 2003);
- Revised Model Accounting Curriculum (UNCTAD, 2011);
- Syllabuses of the specializations “Accounting and Company Financial Management” (Major) and “Controllershship” (Minor) taught at the Faculty of Finance and Accounting of the University of Economics, Prague;
- Education and certification programmes of professional competence development of both the Chamber of Auditors and Union of Accountants professional bodies operating in the Czech Republic; and
- Education and certification of the British Association of Chartered Certified Accountants (ACCA).

A relatively broadly focused questionnaire, based mostly on questions, required answers on a scale from 1 (strong disagreement) to 5 (strong agreement), but – to a lesser extent – also required Yes or No answers and open answers. It investigated the experts’ opinions in the following problem areas:

- the position of controllers/management accountants in the companies’ organizational charts;
- the structure of departments of controllership/management accounting;
- the relationship of these departments to accounting, tax and other departments which, from different view-points, are interested in the company’s financial management;
- the general content of the controllers’/management accountants’ activities;
- areas and extent of the controllers’ authority and responsibility;
- the specific content of the controllers’/management accountants’ activities;
- requirements for education;
- requirements for professional skills and practical experience;
- controllers’/management accountants’ role in ethical aspects of undertaking;

- the selection of potential candidates for a controller / management accountant positions;
- quality assurance of the controllers'/management accountants' work.

The intention of the research team was to work with the questionnaire in two stages:

- the aim of the first stage was to verify the questionnaire's understandability and completeness in individual interviews with 20 – 30 representatives of both groups of respondents; and
- on the basis of this phase, analyze both questionnaires to formulate a structure which would be appropriate for their electronic distribution and assessment.

4. Research results, discussions, conclusions

The research is in the stage in which:

- 27 interviews with experts of the first group were conducted and evaluated; 21 of them participated in the first stage (they also judged the understandability and completeness of the questionnaire) and responded to the questions of “A controller/management accountant should be ...” questionnaire; and
- 74 interviews with experts of the second group were conducted and evaluated; 5 of them participated in the first stage (they also judged the understandability and completeness of the questionnaire) and responded to the questions of “A controller/management accountant is ...” questionnaire.

The evaluation of the questionnaires brought the following results.

The present research did not produce an unambiguous response regarding questions of controllers' position in companies' organizational charts, desired structure of the departments assuring controllers' functions, or their relations to accounting, tax and other departments engaged in various aspects of companies' financial management.

In our opinion, it is not only the difficult generalization of progressive tendencies but also the different Anglophone and Germanic approaches to these questions which are applied in the Czech business environment which can be the main reasons for this ambiguity.

Nevertheless, most respondents of both groups supported a solution in which controllers or management accountants act under the supervision of the chief financial officer and stressed that these experts should not have straight-line authority and responsibility, so that they can act more like “the company's economic conscience”.

Regarding the general content of these experts' activities, both groups of respondents were almost unanimous regarding the desired content of the controllers'/management accountants' work. The correctness of data which are processed subsequently into the output information used in the managerial control and the successive quality, availability and transparency of the information rendered to company management belong into the responsibility of these experts.

In compliance with the above stated role of the company's economic conscience, both groups of respondents also agreed that a controller/management accountant should not bear primary responsibility for the company's financial results; nevertheless, we can notice slightly higher level of average and mode of responses provided by the second group of respondents, i.e. managers and controllers. In our opinion, it is possible to interpret in a sense that while the first group strictly reject this responsibility for financial results, in practice controllers earn a part of their bonuses

based on the results. Nevertheless, this tendency comes more from the necessity to communicate interest for the company's results across all company employees, regardless of whether they directly influence them or not.

In relation to the preceding general content, the questionnaire also investigated the desired and actual areas of the controllers' authority and responsibility. The results are stated in Table 2. They show the respondents' agreement with the opinion that a controller should be equipped with an adequate level of authority and responsibility in the areas in which he/she serves as:

- coordinator of activities connected with the company's aims and means of their fulfilment formulation;
- expert preparing scenarios of future solutions for management;
- a methodist who is responsible for company directives on pricing, costing, budgeting and management accounting development and who also pays attention to their adherence;
- an expert facilitating and supporting communication between departments in all areas of company management which require coordination;
- a communicator who is responsible for transferring reached results to the relevant management levels and someone who should comment on, explain and interpret these results to managers; and finally
- an expert who should participate substantially in the regulations of a company financial management development including the system of remuneration and motivation.

What is remarkable is that the results in the areas of coordination of activities connected with the company aims and means of their fulfilment formulation are significantly different. According to the first group, the role of these experts is crucially important in this area; however, according to the opinion of experts from companies, controllers do not support this area very intensively. In their view, controllers are more focused on the technical and process activities of controllership and information support of management, and they are not involved so much in general questions of strategy formulation and implementation.

Also, a relatively low agreement exists between both groups of experts regarding whether a controller should act as an originator of an information system or its parts.

Conversely, both groups found a consensus that a controller should not have the authority to influence source allocation (e.g. he/she should not decide about the sold products volume and structure, accept make-or-buy decisions or about the development/decline of customer, territory or distribution channels).

Approximately 25% of respondents mark the financial results value of 4 or 5. The sub-results for this group in relation to areas of controller activities are interesting. The average value of this group for the area of preparation of scenarios of future solutions is 2.72 and for the area of decisions on resource allocation only 2.61. That means a discrepancy between responsibility for financial result and power to influence this result.

Regarding the specific content of the controllers' activities, the research has acknowledged the quite crucial role of controllers in ensuring the aims of target information i.e. in planning and budgeting on the strategic, tactical and operational levels, including processing and presentation of forecasts, estimates and expectations. The respondents' answers also stressed the importance of "traditional controllers' task" – adequate information support in assuring business factors and

phases (research and development, purchasing, production, logistics, sale, human resources management etc.).

Surprisingly, substantially lower agreement exists regarding controllers' participation in the management accounting system and connected internal reporting system development. The respondents also did not find strong agreement in response to the question "To what extent should controllers bear responsibility for the quality of company project management, risk identification and management and organization structures development?"

We can also notice a fundamentally different answer to the question whether a controller should assure quality information support in the areas of business factors and phases management (research and development, purchasing, production, logistics, sale, human resources management etc.) between experts from academia and practice. Nevertheless, after analysing the data, the difference in this opinion may be caused by the sample of respondents; the companies included in the pilot part of the research have a relatively simple business cycle and these factors didn't apply to them.

In the area of requirements for education, both groups of respondents strongly highlight the knowledge of financial accounting and reporting, management accounting and corporate finance; on the other hand, knowledge of law, auditing, marketing and international aspects of business are considered to have lower importance; in the ICT area, the controller is considered to be mainly a user rather than an originator and verifier of processing and user quality;

In the area of requirements for professional skills and practical experience, both groups of respondents consider soft skills to be important; nevertheless, they perceive technical skills even more relevant for the controllers' professional competence. According to the research, however, the recent situation in the Czech Republic is worse in the area of soft skills of controllers as company managers are not convinced about their importance;

Both groups of respondents also confirm how important for a company it is to define, enhance, support and communicate effectively ethical principles and rules of undertaking; on the other hand, the research also confirms a very poor level of application of ethical principles and rules of business in practice; this is the reason why this aspect should be incorporated into the quality standards as a very important one;

The results of the investigation into controllers' professional development needs confirm that both groups of respondents consider professional development to be quite crucial for the quality of the controllers' work; in this regard, management enables its controllers to continue their professional development, but it does not always verify whether controllers enhance their professional competence;

The statistical results of quality assurance of the controllers' work confirm the necessity of evaluating controllers' work. On the other hand, answers to open questions such as "How is the controllers' work evaluated?" were very general.

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Professional Competence of Controllers in the Czech Republic: Research Empirical Study

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AN EMPIRICAL INVESTIGATION INTO CSR REPORTING BY THE LARGEST COMPANIES WITH THEIR SEAT IN THE CZECH REPUBLIC

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Corporate Social Responsibility Reporting, Corporate Sustainability Reporting, Environmental Reporting, Global Reporting Initiative (GRI)

Abstract

This paper presents results of the first phase of a research project on corporate social responsibility (CSR) reporting. In this phase we analyzed CSR reporting by companies falling among the 50 largest (by sales volume) corporations in selected industrial sectors in the Czech Republic. The findings show that only 7 of 50 companies published a standalone CSR report with indicators computed primarily for their operations within the Czech Republic. The median length of the standalone CSR report was 50 pages. Only 2 of these 7 standalone CSR reports were prepared according to the Global Reporting Initiative (GRI) guidelines and only 1 of these 2 was audited and evaluated as fulfilling the requirements of application level A+. One more report that was also audited did not follow any standard. A variety of GRI performance indicators were used in the standalone CSR reports we analyzed, mostly environmental and economic ones. From the social indicators the main reporting indicators belonged to the group “labor practices and decent work.” Indicators of “human rights,” “society,” and “product responsibility” were reported only minimally if indeed at all.

1. Introduction

There is broad agreement in the literature that corporate social responsibility (CSR) is increasing in importance (Roca & Searcy, 2012, p. 103; Roper & Parker, 2013, p. 2262), despite the variation in definitions of the term “corporate social responsibility” (for an overview of some of these definitions see, e.g., Kitmueller & Shimshack, 2012; Esrock & Leichty, 1998). One of the possible ways in which companies might seek to improve their image and their relationships with stakeholders is through appropriate CSR reporting (sometimes also referred to as “corporate sustainability reporting”), which may be understood as a specific form of communication with stakeholders about their approach to the relevant sustainability issues. Although there are interesting terminological considerations concerning the similarities and differences between the terms “corporate social responsibility reporting” and “corporate sustainability reporting,” we do not

address these questions in this paper and for present purposes we treat these terms as interchangeable.

In this context it is also important to mention trends toward “integrated reporting” (as addressed, e.g., in Ballou, Casey, Grenier, & Heitger, 2012). It seems to us that the integrative approach to reporting may be valuable because it enables companies to address both financial and non-financial issues, including intangible assets (Siska, 2013), and their interconnections, and thus better express their impact on a company’s performance; nevertheless, discussion of these issues is also beyond the scope of this article.

Our present aim is, first, to introduce our research project, and, second, to present the results of the first phase of this project, which was aimed specifically at the analysis of CSR reporting practices by the biggest companies (according to the sales volume) with their seat in the Czech Republic.

2. Literature review

2.1. Reporting on corporate social responsibility

There is neither a generally accepted definition of the term “CSR report,” nor agreement about the content and extent of the information that should be disclosed in these reports. Corporations disclose information about the relevant issues in diverse documents – in annual reports, standalone sustainability reports, integrated reports, and also on their company web pages. Because of the lack of general agreement about the desirable content of CSR reports, there are great differences between the reports of various companies.

Reporting on corporate social responsibility in general is broadly covered by the literature. Comprehensive reviews can be found, for example, in Fifka (2013), and Roca and Searcy (2012). Trends in corporate sustainability reporting were analyzed in Daizy, Sen, and Das (2013). Up-to-date information about trends specifically in standalone CSR reporting can be found in Patten and Zhao (2014). Determinants of corporate social responsibility disclosure were addressed in Cowen, Ferreri, and Parker (1987). Here, we are especially interested in issues related to standalone CSR reports. Because the preparation of standalone CSR reports is voluntary, one might expect that such reports would be issued only by companies with an interest in social responsibility; nevertheless, in fact the situation is more complicated than this. On the one hand, issuing a CSR report may be motivated by an effort to prove the interest of the company in sustainability issues; on the other hand, the main motive may be a desire to obscure bad social or environmental performance. More detailed account of these issues can be found in Mahoney, Thorne, Cecil, and LaGore (2013).

With the growing importance of corporate social responsibility, there is also a rising need for standardization of the content of CSR reports. The most comprehensive and widely accepted set of guidelines on CSR reporting today is represented by the GRI (Global Reporting Initiative) recommendations. The GRI guidelines are currently at version 4, which was released in May 2013, with the guidelines presented in two parts – Reporting Principles and Standard Disclosures (Global Reporting Initiative, 2013a), and Implementation Manual (Global Reporting Initiative, 2013b). To illustrate the extent of GRI adoption, we may note that at the present time the “Sustainability Disclosure Database” (<http://database.globalreporting.org/>) contains a total of 18,258 reports (classified into several groups: specifically GRI-G1, GRI-G2, GRI-G3, GRI-G3.1, GRI-G4, GRI-Referenced, and Non-GRI). The majority of the reports in the database follow standard GRI ver. 3 (9,856 reports) or GRI ver. 3.1 (3,035 reports); standard GRI ver. 4 is used only in 177 reports (i.e. 0.97 % of all reports). Although the GRI guidelines are gaining importance, the standards nevertheless still have their critics (e.g. Milne & Gray, 2013).

Another (albeit less widespread) standard which is relevant from the viewpoint of increasing the quality of social, environmental, and economic performance is AA1000, which was released by the organization AccountAbility (<http://www.accountability.org>), wherein, for example, decent workplaces are addressed under the standard SA8000. Both these standards are discussed in Beschorner and Muller (2007).

2.2. Global Codes of Business Conduct

Within their CSR reports, corporations often refer to the utilization of various codes of business conduct: a comprehensive account of these issues can be found for example in Cavanagh (2004), which addresses the Caux Round Table's Principles for Business, the Global Sullivan Principles, and the United Nations Global Compact with Business.

3. Methodology of empirical research

The research project "CSR Reporting in Central and Eastern European Countries" was prepared by the International Performance Research Institute, and we participate in this project by conducting research and providing data from the Czech Republic. The central objective of this project is to determine the degree of development of CSR reporting in the selected countries. The project has three phases:

- *Analysis of the sustainability reports published by selected corporations.* The analysis concerns the existence and type (e.g. standalone, part of an annual report, no report) of reports published by the largest (according to sales volume) companies, and provides a content analysis of these reports.
- *Interviews with two selected companies.* Two companies are then selected for interview, one with no CSR reporting, and the other with high-quality CSR reporting. The interviews strive to find out how companies understand sustainability, what their motivation is for dealing with sustainability and social responsibility, how they address these issues at present, and what changes are expected in the future.
- *Empirical survey conducted via questionnaire.* This will be aimed at finding additional information about issues related to CSR reporting.

In this paper we provide results obtained during the first phase of the project. Specifically, we verify the existence (or lack of) and type of CSR reports, and perform a content analysis on the standalone CSR reports of the 50 largest companies with their seat in the Czech Republic. The companies examined were from industries classified in NACE Rev. 2 under C – Manufacturing; D – Electricity, Gas, Steam and Air Conditioning Supply; F – Construction; G – Wholesale and Retail Trade, Repair of Motor Vehicles and Motorcycles; and J – Information and Communication.

4. Results

4.1. Collection of data and characteristics of our sample

In order to obtain the relevant information we collected data from several sources. Firstly, we utilized a ranking of the 100 largest companies with their seat in the Czech Republic, the "Czech top 100" (available at <http://www.czechtopy100.cz>). From this database we obtained basic information (number of employees, sales volume etc.) about the 50 largest companies which fall

under one of the industry groups defined in chapter 3. Then we checked the Internet pages of these companies and tried to find information related to CSR, the latest annual report, and the latest standalone CSR report. Statistical characteristics of the final sample of companies can be found in Tab. 1.

Statistics	Sales (thousands of CZK)	Number of full-time employees
Minimum	8,845,874	43
Maximum	262,649,000	31,359
Average	38,464,844	3,710
Standard deviation	51,797,588	5,956
Median	17,377,854	1,800
Skewness	2.9564	3.5562
Kurtosis	9.0357	13.9062

Table 1 Sample characteristics (year = 2012, N = 50). Source: <<http://www.czecht100.cz>>, own calculations

4.2. Existence of and type of information on CSR

The basic results of our inquiry into the existence, type, and extent of the information provided on corporate social responsibility are summarized in Tab. 2 and Tab. 3.

Characteristic	Number of companies	%
Only an annual report with some information on corporate social responsibility/sustainability is available	42	84.00
Standalone CSR report is available	8	16.00
Total	50	100.00

Table 2 Types of CSR reports (N = 50). Source: own research

Our findings concerning the types of reports available are quite surprising (especially if we take into account that only the largest companies in the Czech Republic were examined), since only 16 percent of the companies in the sample provided a standalone CSR report. Patten and Zhao (2014, p. 134), by contrast, reported that the percentage of the largest 250 companies in the world issuing standalone CSR reports grew from 35 percent in 1999 to nearly 80 percent by 2008.

Characteristic	Number of companies	%
Company has Internet pages and these are accessible	49	98.00
Information on sustainability exists and there is a hyperlink to this information on the main page of the company website	24	48.00
Information on sustainability exists but there is no hyperlink to this information on the main page of the website	17	34.00
There is no information or only minimal information on	8	16.00

Characteristic	Number of companies	%
sustainability on company webpages		

Table 3 Availability of CSR information on company webpages (N = 50). Source: own research

In Tab. 3 we can see that, with the exception of one company, all have functional webpages and that the majority of companies have at least some information on sustainability on their pages. Esrock and Leichty (1998) point out that the existence of a hyperlink to CSR information on the main page may be understood as a sign of high importance being assigned to CSR issues in a given company. We checked for the existence of such a hyperlink and found it on the main pages of 24 companies.

4.3. Analysis of standalone CSR reports

In the remainder of this paper we focus on the analysis of standalone CSR reports. Some corporations issue a standalone CSR report at the level of the whole enterprise without giving specific information about the social or environmental performance of the company in individual countries. In our analysis we considered only those standalone CSR reports within which it was possible to find indicators related to the operations of a given company in the Czech Republic. Within the sample of 50 companies, we found 7 such reports. The statistical characteristics of the 7 companies with standalone CSR reports are summarized in Tab. 4.

Statistics	Sales (thousands of CZK)	Number of full-time employees
Minimum	16,683,000	488
Maximum	262,649,000	31,359
Average	122,339,819	11,365
Standard deviation	90,854,038	11,994
Median	107,280,000	5,962
Skewness	0.3277	1.0973
Kurtosis	-1.8503	-0.8602

Table 4 Sample characteristics (year = 2012, N = 7). Source: <<http://www.czechtop100.cz>>, own calculations

Comparing these figures with the statistical characteristics of the full sample of 50 companies (see Tab. 1), it is obvious that the companies with standalone CSR reports are on average “larger” both from the viewpoint of sales volume and also from the viewpoint of the number of full-time employees.

Consequently, we analyzed the properties of the standalone CSR reports obtained, with our key results set out in Tab. 5. We might add that three reports were entitled “Corporate Social Responsibility Report,” and the other reports entitled “Corporate Responsibility Report,” “Sustainability Report,” “Our Responsibility. Report” and “Joint Report on Occupational Health and Safety and on the Protection of the Environment” (we omit the years in the titles of these reports).

Rep. property	R1	R2	R3	R4	R5	R6	R7
NACE code	C	D	D	C	C	C	J
Domicile of the majority owner	Germany	Czech Rep.	Germany	Poland	Czech Rep.	Luxembourg	England
N of pages of the last report	80	111	83	45	36	50	23
N of available reports	3	3	13	8	4	5	3
Type of the last report	indiv. country	indiv. country	global	indiv. country	indiv. country	indiv. country	indiv. country
Last year of the last report	2012	2011	2013	2012	2012	2012	2013
Frequency	every 2nd year	every 2nd year	every year	every year	every year	every year	every 2nd year
Standard	GRI 3.0 / B	LBG	GRI 3.0 A+, AA 1000, ISAE 3000	none	none	none	none
Audited by third party	no	no	yes	no	no	no	yes
Targets	yes	yes	yes	no	yes	no	yes
Bad news	yes	yes	yes	yes	yes	yes	no
UN Global Compact	yes	no	yes	no	no	yes	no
OECD Guidelines for multinational enterprises	yes	no	yes	no	no	no	no
ISO 14 001	yes	yes	yes	yes	yes	yes	yes

Table 5 Characteristics of standalone reports (N = 7). Source: own research

The number of pages of the standalone CSR reports varies from 23 to 111 with an average of 61.14 pages and standard deviation 28.76. The median length of these reports is 50 pages. The length of the reports prepared according to some standard is substantially higher than the length of reports that do not follow any standard. All companies have some experience with the preparation of a standalone CSR report; none of them was preparing their standalone report for the first time. Note that one of the reports (R3) was prepared at the level of a parent company with seat outside of the Czech Republic; nevertheless, we included this in our analysis because it contains at least some indicators that are calculated individually for the Czech Republic. The frequency of publication of the standalone CSR reports is in 4 cases every year, and in 3 cases every second year. UN Global Compact principles were mentioned in 3 reports, while the other global codes of business conduct

(Caux Round Table's Principles for Business, Global Sullivan Principles) were not mentioned. Two corporations use GRI standards, with one of these two companies having prepared their CSR report at the level of a parent company with seat outside of the Czech Republic.

Last, we analyzed the content of the standalone CSR reports to identify which indicators are reported. We took into account only indicators which were highlighted by companies themselves, whether by placing the indicators into tables or in figures. We organized these indicators into groups according to two criteria. Firstly, we classified performance indicators according to the approach suggested in GRI ver. 3.0 (see Global Reporting Initiative, 2006) into three groups – economic, environmental, and social, which includes subgroups of labor practices and decent work (LA), human rights (HR), society (SO), and product responsibility (PR). Secondly, we utilized the classification proposed by Roca and Searcy (2012, p. 109), which distinguishes the following groups of indicators: interaction with community (I1), emissions and effluents (I2), employees (I3), energy (I4), financial (I5), health and safety (I6), management (I7), operations (I8), purchasing (I9), research and development (I10), reclamation (I11), satisfaction (I12), service (I13), waste (I14) and water (I15). Please note that the total number of performance indicators in case of classification according to the GRI (see Tab. 6) is lower than the total number of indicators in case of the second classification (see Tab. 7). This is so because some of the indicators are not recognized as performance indicators by the GRI. The results of our analysis are summarized in Tab. 6.

Report	Economic	Environ- mental	Social				Total
			LA	HR	SO	PR	
R1	39	30	13				82
R2		18	1				19
R3	1		1				2
R4	10	13	7		1		31
R5	4	14	7				25
R6	7	7	11	1	1		27
R7		9					9
Total	61	91	40	1	2	0	195

Table 6 Number of GRI performance indicators in standalone reports. Source: own research

Unfortunately, in the case of the company whose report was prepared at the level of a parent company with seat outside the Czech Republic, only 2 GRI performance indicators are disclosed specifically for the Czech Republic, which practically disqualifies this report from further analysis. From Tab. 6 we can see that the reports we analyzed did not disclose any product responsibility indicators and only included a relatively small number of performance indicators falling within the areas of human resources and society, while 40 indicators from the GRI category “social” belong to the LA category (labor practices and decent work), which is quite unbalanced. Finally, according to the number and variety of indicators it seems that CSR report R1, which follows GRI guidelines, is more comprehensive than other reports. Tab. 7 summarizes our results from another viewpoint (we only display groups of indicators which were present in the reports analyzed).

Report	I1	I2	I3	I4	I5	I6	I8	I9	I12	I14	I15	Total
R1	0	14	11	2	42	5	8	1	0	12	2	97

Report	I1	I2	I3	I4	I5	I6	I8	I9	I12	I14	I15	Total
R2	2	14	0	1	0	1	1	0	1	0	3	23
R3	0	0	1	0	2	0	4	0	2	0	0	9
R4	0	9	1	2	13	6	0	0	0	2	1	34
R5	3	11	5	0	0	3	1	0	0	2	1	26
R6	4	3	7	0	7	6	4	2	0	3	0	36
R7	1	1	0	6	0	0	1	2	2	0	0	13
Total	10	52	25	11	64	21	19	5	5	19	7	238

Table 7 Number of indicators in standalone reports. Source: own research

Financial indicators are used most often, followed by indicators of emissions and effluents.

5. Discussion and conclusions

The majority of companies in our sample disclose information related to CSR in their annual reports and on their web pages. This paper does not provide a detailed analysis of annual reports. Nevertheless, our preliminary analysis of these reports suggests that the published information often does not exceed legal requirements and thus is very restricted. Deeper analysis of the annual reports and web pages and an examination of their relation (complementarity or duality) with standalone CSR reports is one possible way forward for future research.

As for standalone CSR reports, we found that they had been published by only a minority of companies in our sample. If we exclude the report which was prepared primarily for the foreign parent company (R3), only *one* of the reports in our sample follows GRI guidelines for CSR reporting. It seems to us that the major imperfection of the published reports is their incompleteness, in the sense that companies tend to be selective about the indicators against which they disclose information within their CSR reports. It is important to note that, for example, the Global Reporting Initiative (2013a, pp. 16–18) explicitly requires that CSR reports follow the principles of sustainability context, materiality, completeness, balance, comparability, accuracy, timeliness, clarity, and reliability. Analysis of the reports from the viewpoint of compliance with these principles will be another point of focus for the further research.

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ARCHITECTURE OF THE REFERENCE MODEL FOR COST ALLOCATION AND PROFITABILITY MANAGEMENT

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Keywords

Performance Management, Business Informatics, Allocation, Profitability

Abstract

The proposed model deals with cost allocation and profitability management in business informatics. This paper provides information about selected key principles, factors, architecture and overall business concept of the proposed Reference Model for Cost Allocation and Profitability Management. Architecture is based on Business Intelligence principles and main – core logic is based on Corporate Performance Management and Activity Based Costing principles. Important part of the designed model is data model that store all data used with the Reference Model for Cost Allocation and Profitability Management.

1. Introduction

Changes in the economy and overall behavior of companies caused changes in internal company management. Pressure for changes is palpable in the area of measuring results and performances at microeconomic level.

Measuring results and performances has a very long tradition. Over the last decades there has been rapid development of tools for measuring results and performances with the support of information and communication technologies (ICT).

This paper aims to present a conceptual Reference Model for Cost Allocation and Profitability for efficient management of corporate informatics (REMONA) based on the principles of Corporate Performance Management (CPM). Through this paper should be started discussion about the REMONA to obtain feedback and opinions on its design. The REMONA model is proposed as part of an academic project of the Faculty of Informatics and Statistics at the University of Economics in Prague in association with the companies Profinit, s. r. o., Lodestone Management Consultants, A.G., AM-Line, GmbH.

2. State of the art

Management of the economy of business informatics is an area which has to be addressed in detail in the context of the management of an entire company. (Chen, 2004)

Cost allocation, pricing, and profitability is growing in importance, especially in periods when the company are undergoing a negative economic development. It is in such periods that managers demand detailed, accurate and up-to-date information about all individual parts of the company. (Kral, 2010) Key activities and goals according to (Dimon, 2013; Lomerson, Tuten, 2009; Turban, Leidner, McLean, Wetherbe, 2007; Dorcak, Delina, 2011; Pridavok, Delina, 2013) include at present:

- Companies try to minimize or eliminate activities and processes which do not generate the required value.
- Measuring and managing a company as a whole and company informatics as one of its parts is a phenomenon being closely monitored.
- Proving that investments are warranted (for example, in ICT) and proving the achievement of expected or required results.

All activities involved in the identification and keeping records of costs and earnings are closely related to financial and management accounting and its methods, such as ABC (Activity Based Costing) and these are part of CPM. CPM focuses on support for solving managers' key tasks. (Dimon, 2013; Cookins, 2009)

Research done in the last decade (for example Chandler, 2007; Muhammad, 2010; Remenyi, Bannister, Money, 2007; Maryska, Wagner 2013; Maryska, Novotny, 2013) shows that management and measuring of the performance of a company is difficult and requires relatively complicated solutions (Variana, Farrel, Shapiro, 2004; Remenyi, Bannister, Money, 2007).

3. The REMONA

The aim of the model is to offer a solution for two important task solved in all companies: 'cost allocation' and 'profitability management'. These tasks are closely connected with definition of 'Dimensions', 'Metrics', 'Drivers' and 'Activities'. Another requirement for the model is the possibility of its rapid and easy adaptation to a specific company in which it will be implemented. This is achieved in the case of the REMONA model by its logic being implemented as much as possible through appropriate links between data cubes and related dimensions.

The proposed model is based on basic requisites, limitations and requirements which must be fulfilled to ensure that REMONA can be easily and quickly implemented in a company. The model design is based on the following:

- The overall design of the model must be a general one so that it can be tailored to the needs of a target organization.
- The proposed model must support easy and quick integration into corporate architecture.
- The model will support easily modifications that can be made primarily through configuration of the system.

- During the preparation of the model the necessary dimensions and key metrics must be identified for tasks carried out in a given area.

The design of the model is based on answers to crucial questions. What are current and expected main problems in company's economics and what the priorities of the solution? Do we use for management the approach of services and service level agreements? What key metrics are required for the management of the economics of the system for corporate informatics? Is there documentation of the management of corporate informatics and database management from which data can be obtained? How high a level of detail will be necessary for analytical tasks in the management of economics of corporate informatics?

The proposed REMONA model is designed to permit easy and quick adaptation (modification) of the solution according to the character of the answers to these questions by parametrization without high costs of additional alterations.

3.1. Architecture

The architecture can be described from several views with different degree of detail and elements describing the model. The basic view of the architecture is represented by individual layers integrated in the model. It is a layer of (Figure 1):

- primary data sources,
- data integration – Data Stage (addressing questions of data pumps (ETL) and data quality),
- core of data warehouse and data marts, – partly addressed in REMONA,
- application layer and user interface layer (object of REMONA),
- a metadata layer passes through all the layers which is of key importance for end users as it guarantees a standard language and description of all indicators and attributes which are part of REMONA and the other layers of the company information system.

The architecture of the model shown in the following picture (Figure 1) is based on the traditional architecture of a BI solution and modified for the purposes of the model with the aim of allowing its integration into the architecture of an ordinary organization. The picture shows in detail a view of the individual components of the architecture described above as part of data warehouse and application layer.

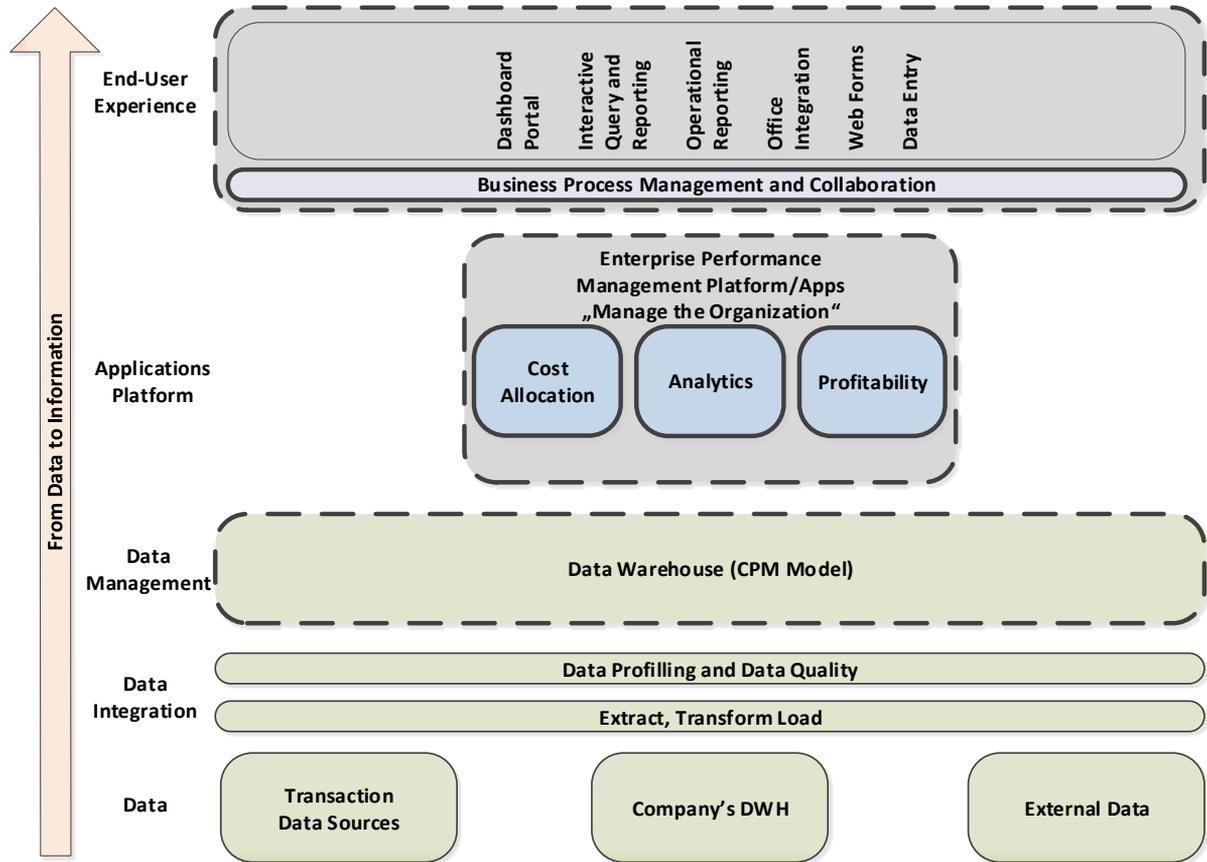


Figure 1: Architecture of model at company level, Source: Author

The model is primarily based on consolidated data sources, which are in an organization normally represented by the data warehouse (Company's DWH) in the layer "Data". If the structure, detail and contents of the data in the data warehouse are not sufficient for the analytic tasks to be performed in the designed model, other data sources will be used (Transaction Data Sources, External Data). Over the layer "Data", it is always necessary to prepare the data integration tools within which the data is imported and processed according to the requirements and needs of the target system. Within the processing of data from the "Data" layer to higher-level layers, also issues of data quality are handled. The two layers mentioned so far – "Data" and "Data Integration" – are not the primary objective of the proposed model and will always be specific for each implementation.

The subsequent three layers ("Data Management", "Applications Platform", "End-User Experience"), which are marked in dashed line, are the subject of the proposed model. During the model design, a general model of data warehouse/mart will be developed, which will be used solely for the purposes of the developed model. This data warehouse/mart will support the implementation of the tasks of cost allocation, profitability and management in their context of performed analytic tasks.

The last layer ("End-User Experience") is a layer that will allow for user-friendly access of the technologies by which the tasks of cost allocation and profitability are solved.

3.2. Data Management Layer

The data model and the data warehouse developed according to it must cover the needs implied from the analytic tasks to be performed over it.

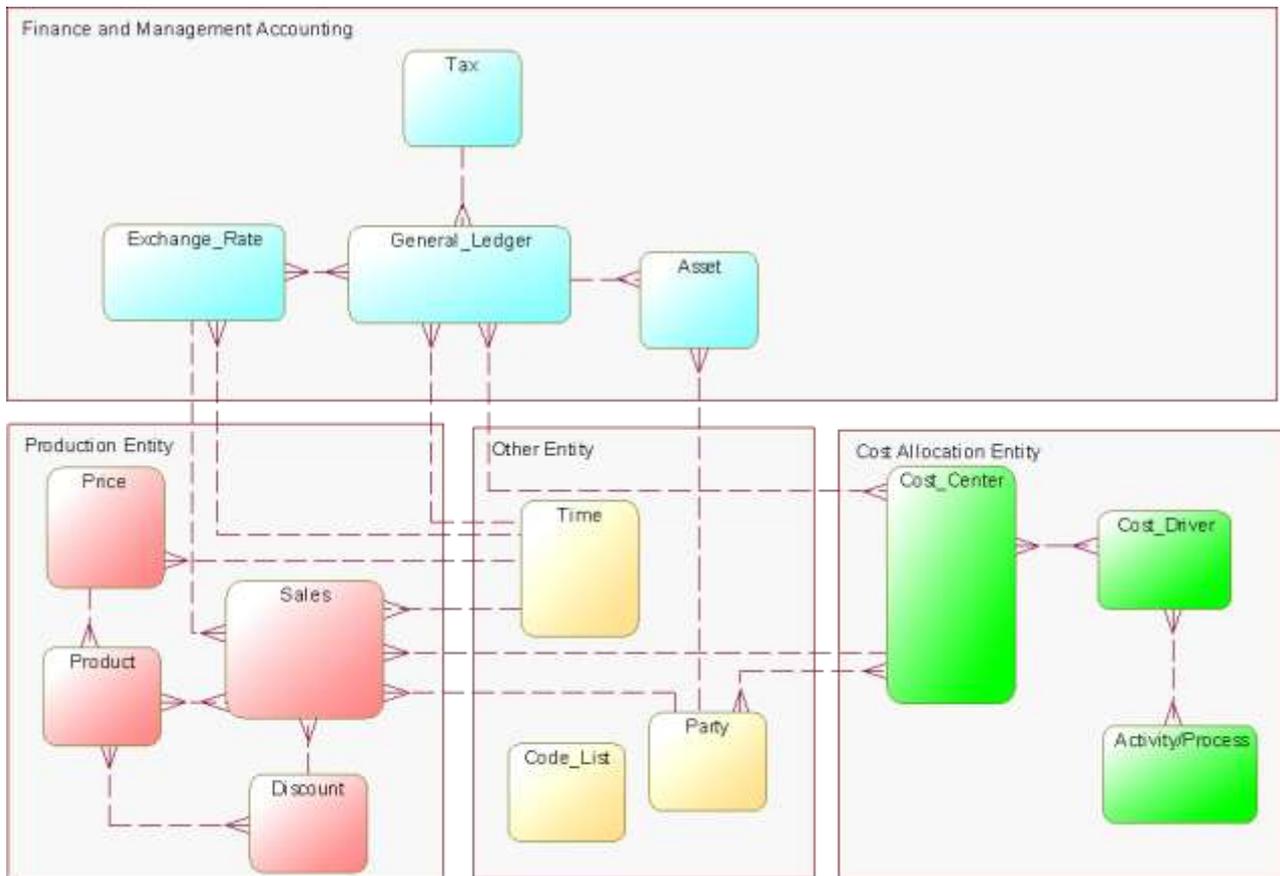


Figure 2: Conceptual model of REMONA data mart, Source: Authors

Figure 2 presents the conceptual design of the data model, containing the key entities and elements that must be possible to record in the target solution and which will be used by the subsequent analytic layer.

The conceptual model is divided into four compact sections, which are further detailed up to the level of physical data model, which is implemented in the selected database technology. The conceptual model is divided into the areas “Finance and Management Accounting”, “Production Entity”, “Cost Allocation Entity” and “Other Entity”. Each of these areas covers a specific field. For “Cost Allocation Entity”, this involves mainly the data related to the definition of cost allocation parameters, which includes the definition of dimensions “Cost Center”, “Cost Drivers”, “Activities and Processes”. In the area “Production Entity”, this is data implied from day-to-day operation of the company, which includes sales of products and services, i.e., the company's products, definition of their prices and discounts, etc. The area “Finance and Management Accounting” focuses the field of data sources that are related to financial and management accounting.

3.3. Business Concept Model of the REMONA

The current form of the model is represented by the following model in the Figure 3. We see the structure of the multidimensional cubes in which calculations are performed and data are stored. The model is developed in the IBM Cognos Express.

The application layer (part CPM tools and part REMONA in Figure 1) in which all the logic of REMONA is placed, is based on interconnection of appropriately designed data cubes containing

analysed data and parameters for calculations using analysed data and appropriately selected dimensions that enable the data to be analysed.

A key element of the model is appropriate design of the individual cubes.

- Area of historic data which are read in from primary and other systems (in the context of this model usually from tables placed in DWH or data mart),
- Area of Cost Allocation,
- Area of Planning and Modelling, which addresses the task of management profitability.

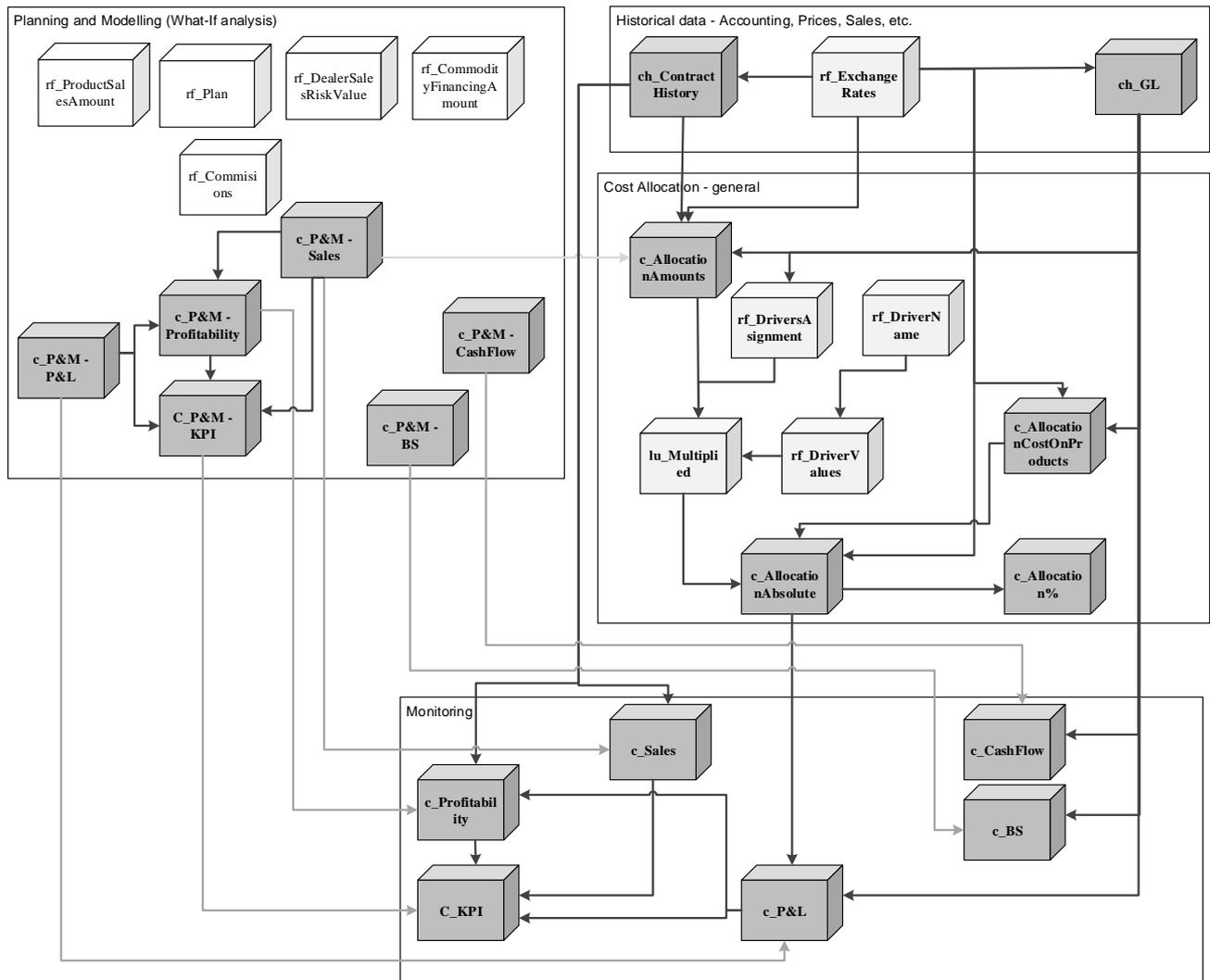


Figure 3: REMONA – links between multidimensional cubes. Source: Authors

3.4. Application Platform Layer – Cost Allocation Principles

The following Figures describe the main principles of cost allocation. The first Figure, describing the main principle of cascade cost allocation; the abbreviations CC1-CC4 represent the different cost centers that can exist in a company. As an illustration, CC1 can be, for instance, Management (assets, structures, etc.), CC2 = ICT, CC3 = Personnel Department, etc. The determination of the “Cost Center” must always be in the form of a dimension so that their number could be

dynamically modified and corresponded of the needs and requirements of the organization implementing the model. The result is determination of the different cost types.

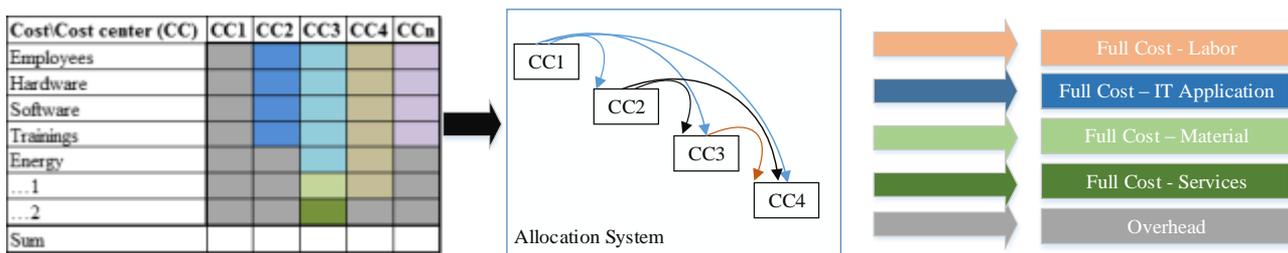


Figure 4. Cost Allocation Principles – 1, Source: Authors

The following Figure describes the applications of the method “Activity Based Costing”, which is based on the total costs by type and these are further broken down by the defined “Drives” into “Activities”. Activities subsequently form the process the result of which is a concrete product or service. The costs of product or service thus determined are added to the total cost calculation of direct and indirect costs, which are then compared to the revenue. “Revenue” enters the calculation as an external element. For ICT, “Revenue” can consist, for instance, of income from the sales of ICT services. The result of comparing the total costs and the total “Revenue” (either in detail of a concrete product or all products of the organization as a whole), the profit or loss is determined.

4. Conclusions

Practical verification and the proposed model will be used both for practical application in companies and will be further available to students, who will be able to visualize the issues of cost allocation and profitability on the model and support of these tasks by hardware.

We expect to have for practical use:

- Identification of key metrics which are useful to address the issue of cost allocation, profitability, and related analytical tasks.
- Proposed dimensions necessary to carry out the economic tasks.
- Methodology for implementation of the proposed model in a company – determining implementation milestones and possibilities of adaptation of the proposed model according to the characteristics of the target company.

The benefits of the proposed model for theory can be formulated in these aspects:

- Research into cost allocation and profitability in the context of PI.
- Expansion of the theoretical basis of cost allocation and profitability in PI.
- Determining appropriate dimensions and their characteristics.
- Design of the model and its architecture.

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BUSINESS STRATEGY IN ECONOMIC CRISIS

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Keywords

Business Strategy, Information And Communication Technology, Economic Crisis, Business Model

Abstract

In the time of permanent, unanticipated changes, it is vital to constantly improve internal processes in order to secure the company's stability on highly demanding market. Contemporary companies need to find the means of achieving maximum efficiency possible, and to continually seek for economic prosperity, as they are threatened with the less expensive goods from Asia as well as from the BRICS countries (Brazil, Russia, India, China, and Republic of South Africa). Goal of this article is to analyze and identify new innovation strategies contributing to reduction of influence of the economic crisis. These new strategies are demonstrated by three case studies, one case study is about big company - Hilti and the data are from the literature resource. Two other companies are from the Czech Republic. These case studies are completed by the qualitative survey. This survey was organized by interviews in 10 companies and was oriented to Business Mapping for Resilient Financial Performance, General Information, Critical success factors, Business Mapping (products, processes, their modification and supply chain), Resources, Capabilities, Strategies (Growth strategies, Market penetration, Product and capability development, Market development, Diversification), Business Continuity strategies, Crisis Management; Crisis Adaptation.

1. Introduction

Business models are seen as a key component of organizational success; in the scientific sense they provide the conceptual reasoning and academic logic, drawing parallel to modelling of organisms (as in biology), econometric models, scale models, and even 'recipes' or patterns adopted to motivate change in organizations - cross-disciplinary in nature (Baden, 2010, p.89). However, most of these researches as Basl (2009, p.61) and Chesbrough (2010, p.360) are specific to draw instances and inferences of business models and their innovation in large multi-national firms, like internet and information and communication technology (ICT) driven business models of Google and Apple, franchise-based model of McDonalds, pay-per-rental service model of Netflix, low-cost business models of Ryanair and Wal-Mart, web 2.0 based open platform of Wikipedia, user-added value model of Facebook, business model of micro-finance based socially responsible Grameen Bank (Massa 2012, p.128), or the story of business model failures of Kodak and Xerox (Chesbrough and Rosenbloom, 2002, p.53).

Strategy articulates the types of appropriate innovation. Strategy development is a flexible, creative process. Strategy analysis is an essential step in designing a competitively business model. For instance, in the rapidly shrinking textile manufacturing industry of Europe or U.S. lack of new

disruptive innovation business models along with long product life cycles is marked by intense pressure on rapid new product, process and business introductions just to maintain current position. What is clear is that firms have to focus on knowledge intensity be it product or business processes to combat the competitive threat. For products in the arena for manufacturing, it is not just materials of past which can be manipulated to yield novel properties but rather consist of a canvas of integration of various emerging scientific disciplines of bio, nano, information technologies to build seamless frontiers for financial growth (Markides, 2013). Similar higher order strategies must be adopted in the case with business processes which must become sophisticated to avoid duplication. These include ambidextrous competencies with new alliances to combat the real threat from SE Asia and clusters for robust structures to mention a few.

“Every new business we have ever engaged in has initially been seen as a distraction by people externally, and sometimes even internally, “says Amazon CEO Jeff Bezos (Seizing white space, Johnson,). “ They will say, “Why are expanding outside of media product? Why are you going international? Why are you entering the marketplace business with third party sellers? These are fair questions. But they all have in their hearts one of the reasons why it is difficult for incumbent companies to peruse new initiatives. It is because even if they are wild success, they usually have no meaningful impact on the company’s economics for years. The creation of sustained value is the core purpose and central process of economic exchange. Traditional models of value creation focus on the firm’s output and price (Vargo, 2008, p.150). Current understanding highlights that ‘value’ is always the value in the eyes of the customer. This insight is crucial as it explains one mechanism for changing profitability (typically declining). Simply put customers’ expectations and views on value change.

A firm’s business model describes how an organization creates, delivers and captures value based upon a core value proposition. A firm must also manage the ways its equipment, processes and people perform to ensure that the business model is executed in the most effective and efficient way possible (Zott, 2007, p.190). “Adapting to changes or initiating of these changes, these two actions need to be handled properly. To accomplish the substantial results, the firms cannot count on spontaneous evolution or on employee initiative” (Veber, 2009, p. 477). The effects could be divided according to the degree of introduced changes. These changes may concern only a small number of the business processes or it may be a significant change of the system in general (Řepa, 2007, p.281).

2. Research methodology

Organization is a very complex organism consisting of key resources and processes. What does happen when an opportunity or some radical change arises? The objective of this article is to find the key successful factors of transformation during the changing conditions as for example customer’s expectations or economic crisis. The detailed survey was developed for a better understanding and an increased awareness of business model innovation. One part of the survey consists of a questionnaire (face to face interview) and second part of the research was realized by three case studies. One case study from the literature and two case studies from ICT companies were used to explain different strategies. Ten companies participated in the interviews. Two of them represent big companies (more than 100 employees), the remaining companies are small and medium sized. Two companies are from ICT sector and eight of them are manufacturing companies.

2.1. Questionnaire survey

The survey's objective is to gain complete information about respondents on the basis of obtained empirical data. The questions concern the respondents' needs, preferences, means to success and competitiveness, main products, resources, possibilities for the development, and information concerning the processes, their functioning and involvement in supply chain. In addition, the questionnaire survey examines the strategy, innovation, and implementation of information and communication technologies. The collected data will be used in order to identify the deficiencies in particular business activities of the respondents.

It is absolutely indispensable for a proper and effective company's functioning to assess and then interpret the in-depth information correctly in order to use it effectively. For the purpose of effective decision making in the business field it is necessary to gain a piece of information concerning market demands, in other words to discover the desires of the today's as well as the potential customers. It is unproductive to supply the market with unreasonable quantity of products, because in the terms of business only the sold product is the right one. The customer, whose demands are satisfied in time, for an adequate price and by a quality product, plays the crucial role in the business, and therefore determines its success.

Obtained results indicate that information and communication technologies are indispensable for the firm's functioning. Nevertheless, the survey suggests that the newest modern technologies are not put into practice. The majority of firms use obsolete hardware and software which is innovated only in case of necessity. As an example may serve the Windows XP operating system whose support is no longer provided, however, the firms did not start innovation of their operating systems until it is absolutely necessary.

Currently, the firms are concerned about their turnover, assets, liabilities, profitability, the growth of their efficiency, competitiveness, and ensuring of the business growth. Therefore, it is essential for them to be able to use a reliable information system based on modern technologies. In the times of financial instability, it is necessary for a firm to secure its position, and to strengthen its structure. In addition, a firm needs to be flexibly adapting to the changes of the consumers' behavior.

The obtained data from the survey suggest that the respondents are aware of the importance of focusing on their customers, and therefore, they try to meet their demands. It is not relevant whether their client is another firm or a final customer. During the financial crisis, the firms even intensify their invested effort put into satisfying the demands and needs of their clients. In order to balance the loss of customers they enhance the quality of care that is taken of their remaining customer base. The main objective of the firms' efforts is to increase the degree of the customers' loyalty and satisfaction. These two main qualities guarantee a meaningful business functioning.

The radical projects are not implemented frequently because of their high-risk involvement that is given by a wide range of changes and also by a long-term return of investments. More frequently, the firms use simple low-risk projects based on new technologies or they eliminate the visible deficiencies in their business processes. Next part brings some examples of the three different ways of business strategy:

- Strategy of leasing versus owning
- Strategy of alliance
- Strategy of differentness

2.2. Strategy of leasing versus owning – Hilti (Case Study)

Good example of changing business model is Hilti with machinery products. Instead of buying tools individually and dealing with their upkeep and management on their own, customers could pay monthly fee to have a full complement of tools at their fingertips, kept well inventoried and full repair. A customer has always the newest technology, well organized and readily available. Hilti takes care of everything. Hilti needs to keep maintaining costs low and to be much disciplined with its customers about contractual add-ons.

Additionally, the company had to devise a process to manage and to maintain fleets of tools more inexpensively and effectively than its customers had. It required a constant supply of fresh tools that could immediately replace the ones that broke. It means that on the customer’s side, Hilti had to develop a web site that would allow construction managers to view all the tools in their fleets to monitor their usage rates.

This data help managers conveniently handle the cost accounting associated with these assets. The big challenge was to change the behavior of the customers from buying the program instead of the product (see table 1). Furthermore, the salespeople had to find the courage to do the new task. This strategy can be the strategic weapon how to beat the competitors.

	Traditional power-tool company	Tool fleet management services
Customer value proposition	Industrial and professional power tools and accessories	Comprehensive tool fleet management service on site-productivity
Profit formula	Low margins, high inventory turnover	Higher margins, asset-heavy tool leasing, monthly payments for tool maintenance, repair and replacement
Key resources and processes	Distribution channel Low cost manufacturing plans in developing countries R&D	Strong direct sales Contract management IT systems for inventory management and repair Warehousing

Table 1 The Hilti Business Model (Johnson, 2008, p.89)

2.3. Strategy of alliance –FLORES Profitable Solution (Case Study)

In 2009 the reorganization of the former Prague K2 Atmitec SYST s.r.o. organization began which stopped implementing of information system K2. Atmitec SYST started to build a new identity and production program. An important step in this direction was renaming K2 Atmitec SYST on Flores Profitable Solution which occurred in late October 2010. Almost immediately after the termination of cooperation with the manufacturer of K2, Flores announced that they were working intensively on their own ERP system. A large number of software companies in the Czech Republic were highly skeptical about the claim of developing the new ERP system.

Development of ERP system is very challenging, and most importantly very expensive project. However, Flores did not start to build entirely on a green meadow. Flores approached this problem innovatively, they built it on the experience of many implemented custom projects, its comprehensive implementation team reassigned to the development, actively began to work with people who were interested in the creation of the new product. It was seen as a shift from the

traditional approach to agile methodologies which are mainly users and customers became part of the development process. Flores received a very strong partner at the end of 2010 when the company signed a strategic agreement with Abra Software. Abra software offered information system for small and medium businesses.

Flores had experiences with IS for large enterprises. In our market there was created a unique combination of two manufacturers and suppliers of ERP systems which suitably complemented their focus. In addition, along with previous statements and actions they share a common vision. Cooperation brought Flores mainly acceleration of the development of the new ERP system, under which exploits the technological experience of Abra. In conjunction on creating at the core of IS, both companies will in the future save a significant part of the cost of research and development. Thanks to the collaboration Abra extends the product portfolio and offers in hardware technologies and operating systems as services. According to the first announcement, the two companies will retain their legal status and their market segments, but they will work closely together in all areas of their activities: the development, distribution of current and upcoming solutions and services.

Flores innovates its business model at the beginning of cooperation with existing company. The creation of associations of customers, who collaborated on the development of the new ERP and especially with involvement of agile methodologies, can be one of the possible reasons of success.

2.4. Strategy of differentness - Insurance broker Credit & Hypo Consult, Ltd. (Case Study)

The company tried to differentiate the business from its competitors by doing things correctly and offering to a customer clear and valid piece of information: “Tell to customer’s truth”. When the customer knows that he will have some advantage and save time or money then this information has to be based on real assumption. Furthermore, the company as the first one on the market developed a platform which enables the customers to compare all the features of products or services and not only to compare the price. Therefore, they tried to give to the customers as many clear and easy handling front-end functionalities as possible. Major part of modelling of these processes was developing from scratch complete ERP system to handle all major processes. Partially, it was necessary since it was not possible on whole market to buy such a specific SW. As a result the company succeeded and in few months from project kick-off they managed to double the conversion rate without using call center. When they finished the core part of ERP they could open the call centrum and the conversion rate of customers buying product again would growth almost twice.

3. Conclusion

Achieved results of the questionnaire survey reveal that the growth strategies and plans are not in the center of firms’ interest during the time of crisis. On the contrary, the firms try to adapt to given circumstances in order to maintain their business continuity. During the crisis, the firms do not try to achieve economic growth. Especially small and medium businesses do not have any crisis management; they plan their crisis strategy according to the current situation only after the hit of the crisis.

Obtained data enabled us to identify the most important factors as quality of products and processes, quick and flexible reaction for customer needs. These are the main factors of the response to dynamically changing market situation. Also the new innovations of products or services help to succeed in business as we can see in the three case studies above mentioned. These innovation processes include both basic business processes as well as innovations of the business

models in general. The survey demonstrates necessity in innovation of the processes and technologies during the changing conditions as economic crisis. The questionnaire survey provided also other main result: an acquisition of adequate set of empirical data about individual companies, which can be used as a source of information for a further study. The authors would like to continue in the research and to find the distinctions in the key success factors in different areas of entrepreneurship and strategies.

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CRM PERFORMANCE MEASUREMENT USING AHP AND CRM SCORECARD

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Customer relationship management, performance measurement, CRM Scorecard, AHP, B2B organizations

Abstract

This research examines the application of the AHP (analytic hierarchy process) method for the CRM (customer relationship management) performance measurement in B2B (business to business market). The aim of the paper is to define rank of factors measuring CRM performance. In the first part of the paper, theoretical base is described considering CRM performance measurement issue and the CRM Scorecard description. Research methodology introduces the AHP method. The following part of the paper deals with the application of the AHP method – identification of factors measuring CRM performance, calculating coefficients for each factor via group of experts (managers of companies on the B2B market), ranking the factors in accordance with their importance. This study reveals fundamental factors important in the CRM performance measurement models in the B2B market.

1. Introduction

According to Blattberg et al. (2001), Customer Relationship Management (CRM), a management philosophy that focuses on the nurturing of customer relationships, emerged as a response to decreasing customer loyalty and increasing competition. An understanding of how to manage relationships with customers effectively has become an important topic for both academicians and practitioners in recent years. CRM is the principle of relationship marketing that is necessary for contemporary markets, especially services. There are several concepts of CRM that companies use for collecting information about their customers. According to using CRM software companies get to know consumer behaviour of customers, demographic and other characteristics.

Companies manage their own customers' databases to segment and target to the best groups of customers. They can differentiate communication with each segment and adapt the offer. In the case of important customers we can talk about individual marketing. Its goal is to create closer relationship between customer and company (one-to-one marketing). Companies expect their own benefit, for example increase of revenue, market share or customers' loyalty, due to investments into CRM system.

Richards and Jones (2006) identified the main benefits of CRM implementation for company. They conducted the managerial opinions and attitude to CRM systems analysis and defined the benefits as:

- Improved ability to target profitable customers,
- Integrated offerings across channels,
- Improved sales force efficiency and effectiveness,
- Individualized marketing messages,
- Customized products and services,
- Improved customer service efficiency and effectiveness,
- Improved pricing.

Lots of contemporary companies in the B2B market use a CRM system for communication with their customers or suppliers. Companies try to calculate CRM implementation success, quantify the level and performance of the CRM concept, for example in comparison with competition or in time. Must say, there is no one and only concepts that is the best for every company. CRM systems are designed mostly individually and that's why their performance measuring differs too and is very flexible. Different authors describe several methods or possibilities how to measure CRM performance, we have to adapt in the concrete situation, market.

The aim of the paper is to define rank of factors measuring CRM performance. This research is based on application of the AHP method for modelling CRM Scorecard in the B2B market. We use CRM Scorecard model for its coherence and possibilities of adapting to any company. The AHP method was chosen for its detailed procedure of ranking the factors and future development of our research.

In the beginning of the paper, the theoretical base of CRM performance measurement is described, including the CRM Scorecard model. Research methodology introduces the AHP method. Application of the AHP in the CRM Scorecard was achieved by cooperation with experts (managers of companies in B2B). Due to their views and estimations the coefficients of the factors was calculated. The factors were ranked based on the importance in the CRM performance measurement process. In the conclusion, results and future research steps are summarized.

2. Theoretical background of the CRM performance measurement

CRM performance measurement is important for comparison in time, verifying estimated development and achieving stated effects or for comparison among competition. In accordance to long term measurement, managers can determine the successful and the unsuccessful procedures, detect strengths and weaknesses in the communication process with customers as well.

There are several methods how the CRM performance can be measured. The choice of one of the methods depends mostly on the experience of the company. These methods are for example Balanced Scorecard (Kaplan & Norton, 1992) or CRM Scorecard (Kim & Kim, 2008), CRACK model (Chlebovský, 2005), cost-oriented approach (Moedritscher & Mussnig, 2005), CRM Maturity model (Sohrabi, Haghghi, & Khanlari, 2010) or quantification of monitored factors without using any concrete model.

Kaplan and Norton (1992) designed the Balanced Scorecard model (BSC) that serves as a coherence tool for CRM performance measurement in the companies. They identified the factors influencing CRM performance, these factors are divided into four groups:

- Financial perspective – value for shareholders,
- Customer perspective – value for customers,
- Internal business perspective – efficiency and effectiveness in business processes,
- Innovation and learning perspective – sustaining and continuous innovative and learning process.

Wang, Lo, Chi, and Yang (2004) used BSC for customer behaviour analysis and measuring relationship between customers and company. Izquierdo, Cillán, and Gutiérrez (2005) applied BSC for marketing activities performance measurement and measuring results in economic output of the company. Bohling et al. (2006) focused their research to identification factors that influencing successful CRM system implementation.

This BSC concept is defined mostly for companies strictly oriented on their financial outcomes, the “Company-Centric BSC”. Nowadays the relationship company-customer is preferred, so this concept doesn’t fit into contemporary market conditions. Kim, Suh, and Hwang (2003) modified the concept to “Customer-Centric BSC” and applied this new concept for the Korean online shopping centre. The factors measuring CRM performance are divided into four groups:

- Customer value – lifetime value, customer loyalty,
- Customer satisfaction – level of satisfaction with products or services,
- Customer interaction – operational excellence, channel management of customer services, management processes,
- Customer knowledge – status of the customer segment, customer data management.

Table 1 shows comparison of factors influencing CRM performance measurement between Company-Centric BSC and Customer-Centric BSC.

Company-Centric BSC	Customer-Centric BSC
Financial perspective	Customer value
Customer perspective	Customer satisfaction
Internal business perspective	Customer interaction
Innovation and learning perspective	Customer knowledge

Table 1 Comparison of Company-Centric BSC and Customer-Centric BSC; Source: Kim, Suh, and Hwang (2003)

Kim and Kim (2008) developed BSC into the CRM Scorecard model. The CRM Scorecard model evaluates contemporary CRM performance level and readiness of the company for future implementations. The model operates with factors influencing CRM performance and factors influencing successful CRM system implementation. This model is more comprehensive, it is focused on the customers and company’s CRM strategy. There is a synthesis of the Company-Centric BSC and the Customer-Centric BSC. Factors are divided into four groups:

- Infrastructure perspective

- IT - CRM technology,
- Human capital – employee behaviour, employee satisfaction, management attitude,
- Organizational alignment – training, reward system, organizational structure,
- Culture – partnership, market orientation, explicit goal,
- Process perspective – customer acquisition, customer retention, customer expansion,
- Customer perspective – customer loyalty, customer satisfaction, customer value,
- Organizational performance perspective – shareholder value, profitability, customer equity.

Each group of factors contains several concrete measurable variables, by which managers can evaluate the CRM performance level. By applying for example the AHP method, we can calculate importance indexes of the factors and we can modify the CRM Scorecard model for the individual company.

Kim and Kim (2008) applied the CRM Scorecard model for the Korean bank institution. Authors Shafia et al. (2011) modified the concept as fuzzy CRM Scorecard model for Iranian industrial market. Soeini, Jafari, and Abdollahzadeh (2012) adjusted the factors into the specific CRM Scorecard model for Iranian government corporation.

3. Research methodology

To calculating the importance indexes of the CRM Scorecard factors we conducted Analytic Hierarchy Process (AHP) analysis. AHP is a multi-criteria decision making method (MCDM) that uses pairwise comparison of the factors or groups of factors (Ishizaka & Labib, 2011). AHP was applied in CRM performance measurement for example by authors Kim and Kim (2008). Our AHP application included three steps: the hierarchy compilation as the CRM Scorecard model (Kim & Kim, 2008), the importance weights determination via experts, calculating the coefficients for each group of factors and for each factor. For evaluating the importance of the factors, there are several proposed scales that can be used (Ishizaka & Labib, 2011), we chose the linear scale with parameters 1-9 (Saaty, 1977). Value 1 means that the importance of two factors is equal, value 9 means the highest difference of the importance between the factors.

We used normalized weights w_i that we calculated by weighted average of the row geometric mean:

$$w_i = \frac{\sqrt[n]{\prod_{j=1}^n s_{ij}}}{\sum_{i=1}^n \sqrt[n]{\prod_{j=1}^n s_{ij}}}, \quad (1)$$

where s_{ij} are elements of Saaty's matrix S and $s_{ij} = 1$ and

$$s_{ji} = \frac{1}{s_{ij}}. \quad (2)$$

The consistency ratio (CR) verifies the consistency within expert's views. Critical values of the CR is number 0,1, the values $CR \leq 0,1$ are considered as consistent. The consistency ratio is calculated by the formula

$$CR = \frac{CI}{\lambda_{max}}, \quad (3)$$

where λ_{max} is maximum eigenvalue and can be calculated as follows:

$$(4)$$

where w is a vector and $(S.w)_i$ is an i -element of the vector. The random index (RI) value is determined in Table 2.

N	1	2	3	4	5	6	7	8	9	10
RI	0,00	0,00	0,58	0,9	1,12	1,24	1,32	1,41	1,45	1,49

Table 2 Random Index; Source: Saaty (1977)

4. Applying AHP within CRM Scorecard

We conducted the research among academics, business managers and marketing managers from different B2B organizations. We obtained 6 valid datasets (2x2x2) due to explorative research. In Figure 1 you can see the scheme of the hierarchy process within the CRM Scorecard model (Kim & Kim, 2008). First line defines the objective that is CRM performance measuring. The second line is represented by four fundamental groups of factors in CRM performance measurement – organizational performance, customer perspective, process perspective, infrastructure. Each group contains further specific factors that can be measured by concrete variables and indexes.



Figure 1 Hierarchy of the CRM Scorecard model; Source: Kim and Kim (2008)

In Table 3 the results of AHP are shown. Values of the consistency ratio were lower than 0,1 in all cases of comparing. In accordance to experts, the most important group of factors in CRM performance measurement is Customer perspective (41,2 %). Less important are Organizational performance (25 %), Process perspective (21,2 %) and Infrastructure (12,5 %). We calculated local weights of the factors in each group and global weights for comparison the factors independently.

Customer perspective factors are the most important in CRM performance, especially customer satisfaction (63,5 %). Customer satisfaction was perceived as the prerequisite of customer loyalty

and customer value either. When the customer is satisfied, his value for the company grows and he tends to be more loyal.

Perspective	Measuring factors	Local weights	Global weights
Organizational performance (0,250)	Shareholder value	0,342	0,086
	Profitability	0,292	0,073
	Customer equity	0,366	0,092
Customer perspective (0,412)	Customer loyalty	0,088	0,036
	Customer satisfaction	0,635	0,261
	Customer value	0,278	0,114
Process perspective (0,212)	Customer acquisition	0,266	0,056
	Customer retention	0,488	0,104
	Customer expansion	0,247	0,052
Infrastructure (0,125)	Employee behaviour	0,081	0,010
	Employee satisfaction	0,069	0,009
	Management attitude	0,301	0,038
	Partnership	0,091	0,011
	Market orientation	0,153	0,019
	Explicit goal	0,125	0,016
	IT	0,117	0,015
Organizational alignment	0,062	0,008	

Table 3 Results of AHP; Source: authors

Organizational performance factors were almost equal, the coefficients of each factor are close to value 0,3. However, we can identify customer equity (36,6 %) and shareholder value (34,2 %) more important than profitability (29,2 %). The perceived value of the company for shareholders and customers is more relevant than whether the company is profitable or not.

Process perspective factors were determined by customer retention (48,8 %), customer acquisition (26,6 %) and customer expansion (24,7 %). Customer retention was the most important factor that may be related to customer satisfaction. Experts agreed that customer acquisition and customer expansion can be influenced by type of the product (FMCG versus durable goods).

Infrastructure factors were difficult to compare in some cases because not all factors were comparable among themselves. The most important factor was management attitude (30,1 %) that was perceived in most cases as a precondition to success of the other factors. The second and third most important factors were market orientation (15,3 %) and explicit goal (12,5 %) that determines proper company management in the market. IT (11,7 %) represents software reliability necessity. Partnership (9,1 %), employee behaviour (8,1 %), employee satisfaction (6,9 %) and organizational alignment (6,2 %) reflect the importance of teamwork, morale and good relationships in the workplace.

All coefficients of global weights are displayed in Figure 4 in the last column. Hundred percent was divided among all factors considering the importance coefficient of the group of factors. For CRM performance measurement are the most important factors:

- customer satisfaction (26,1 %),
- customer value (11,4 %),
- customer retention (10,4 %),
- customer equity (9,2 %),
- shareholder value (8,6 %),
- profitability (7,3 %).

Factors such as customer acquisition (5,6 %), customer expansion (5,2 %), management attitude (3,8 %), customer loyalty (3,6 %) are less important for CRM performance measurement. Infrastructure factors, besides management attitude, are the least important factors.

5. Conclusion

The aim of the paper was to define rank of factors measuring CRM performance. This research was based on application of the AHP method for modelling CRM Scorecard in the B2B market. The hierarchy structure was compiled as the Korean CRM Scorecard model. The importance weights were determined via experts (academicians, business and marketing managers). The coefficients for each group of factors and for each factor (local and global weights) were calculated.

For CRM performance measurement are the most important the factors regarding customer (customer satisfaction, customer value, customer retention, customer equity). The least important factors are infrastructure factors (internal processes).

Proposed further research could be comparing the results using different scales, for example root square, inverse linear, logarithmic etc. Compare the results in B2C organizations or among different product markets. The research can be developed by applying further methods – ANP (Franek & Kresta, 2013) or DEMATEL.

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CRM Performance Measurement Using AHP and CRM Scorecard

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CLOUD COMPUTING: RISKS AND CHANCES

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Abstract

Cloud computing is still “risky” today: both software and data are outsourced to a third party, who must be trusted to do only the things intended and paid for with it, and to guard it against various attacks by third parties. Some of these risks are discussed in this paper, but while the specific properties of cloud computing introduce these risks, they could similarly be used to improve security. Several ideas are presented, where specific properties of cloud computing, namely standardization, scalability, and flexibility can be used for innovative security models.

1. Introduction

Cloud computing is a very “modern” term. But what is it really? Is it a new technical development, an organizational scheme, a management philosophy? Or just a new name for old things, like buying computing resources at a mainframe? Currently still no official and generally accepted definition exists [BSI], but most definitions contain the following elements:

1. On-demand self-service: The business is concluded as far as possible without human interaction, allowing e.g. automatic increase of resources too.
2. Standardized access via network: No specific client is needed to access the services offered; common standards are employed.
3. Shared resources: Resources are allocated by the provider, i.e. not a specific computer is rented, but rather some “computing power” which is provided by an arbitrary machine (or part of one) somewhere. Multi-tenancy is the norm.
4. Elasticity/scalability/flexibility: Resources are provided as needed and can be increased and decreased almost arbitrarily and especially fast. I.e., the amount of resources is only dependent on payment, but not on availability, installation manpower etc.
5. Measured services: The service is provided according to some abstract measure, but not in terms of hardware, machines etc. Payment is for “Gigabytes”, “GHz*seconds” or similar units.

Seen from this definition, cloud computing relies on some technical advances, especially virtualization, but is more a specific business model. Instead of buying a product (server) with associated services (housing, internet access, management etc), directly a “end-user” service is bought (mail services for 50 persons, storage for 30 TB, ...). This paper first investigates some

chances and risks of cloud computing based on the individual elements of the definition. And while typically in most publications the difficulties are emphasized, we will afterwards discuss several ideas where the unique properties of cloud computing could improve security or bring other advantages, like resilience against “official” attacks like data retention or lawful interception (eavesdropping, communication analysis etc).

2. Chances and risks

Cloud computing necessarily involves a loss of control, while allowing greater flexibility. Therefore it provides not only chances, but also risks. Let’s therefore take a look at the individual elements of the definition from a technical point of view (business advantages & drawbacks are ignored here).

2.1. On-demand self-service

Self-service typically results in lower prices, but also comes at a cost, as no or little advice is available. This means, every user will have to find out on his own, whether the interface of the desired service is matching a local interface (e.g. versions can be problematic), or whether it supports the desired elements at all. As no consultation is provided, all errors (except perhaps for incorrect information) will have to be borne by the client. A result can be that additional experts are needed for assessment. Compared to in-house hardware with the “own” operating system this is much riskier: Operating system “A” will always interface nicely with operating system “A”, and if not the provider of the software will have to fix this; the same applies to other software, e.g. business support/enterprise systems. In a cloud setting it might not even be visible which OS or software package is providing the cloud service, and all inconsistencies (e.g. little deviations from standards where they are not completely clear or simply bugs) will be problematic, as both providers will always blame the other side. Therefore limiting the interaction to simple and widely used protocols or specific software (e.g. one system in one version is supported, everything else “might work, but your own risk”) could be necessary. This is however a chance as well, as it encourages adherence to standards - both for cloud providers and “local” software! - and increases the chances of “transferability”, i.e. of changing the cloud provider. Therefore standards-based services should be preferred over product-based ones, although this typically means a lower level of integration (see below).

2.2. Standardized access via network

Standardized remote access ties in with the previous item. However, a few additional points should be mentioned. For instance a standardized protocol means, that it must be either very general (applicable to all situations; e.g. IMAP) or very specific (one software – fits only this; like MAPI/Exchange ActiveSync). A result is lower efficiency, as a lot of unneeded “baggage” of generality has to be implemented, while simultaneously the specific intricacies for an application have to be emulated to fit this protocol. Another problem is that not all protocols are suitable for communication across large insecure networks and additional precautions might be necessary - or they must be converted to a different protocol or require special adapters.

From a security point of view as a whole this is probably advantageous, as it leads to few protocols used, which are clearly specified. All kinds of filtering are therefore easier to implement and result in a reduced attack surface. A drawback is that “piggybacking” (transporting a different protocol over another one, or “misusing” one for a different purpose) also introduces lots of security

problems. The best example is HTTP: in its basic functionality simple and widely employed, it is often used to “tunnel” various other data (for instance online storage or chats) across a firewall, in this way circumventing security measures with the result that e.g. protocol-specific scanners need to be integrated into web proxies.

2.3. Shared resources

Sharing resources with other users can be problematic if availability is not guaranteed – but which is typically available in cloud computing. I.e. other users cannot negatively impact my paid-for resource usage. In very small areas this is however possible (which might also be used as a potential data leak): for instance memory cache speed depends on other shared applications. But this is normally several magnitudes lower than all other delays, like internet communication or databases, so for most purposes this is irrelevant. Shared resources also contain a “static” aspect, harddisks. While the systems ensure that no one can read “old” data belonging to a previous customer from a (virtual) hard disks, the same is not true for the cloud provider, who can even create full snapshots often undetected. This poses a risk in two ways: disclosure of data to the cloud provider (not only while the machine is in use, but also retroactively – albeit presumable only for a short time), and computer forensic difficulties (sometimes traces are desirable, e.g. for investigation).

Tying in with the next point, sharing resources can be a problem for elasticity. If more resources are needed than are physically available at the current location, either the whole software environment must be transferred to a more powerful system (e.g. moving the virtual machine), or other systems on the same shared hardware must be moved away. Both is problematic, so typically elasticity only exists at the beginning or for additional (mostly separate, like additional webserver) resources. Extending resource usage during use may be impossible for a single system (e.g. more CPUs for the current database), even if it were physically possible.

2.4. Elasticity/scalability/flexibility

As discussed above, elasticity of individual systems is rather lacking or exists only partially, e.g. for storage space. Scalability (which/how many systems) on the other hand is normally unlimited, but could also be problematic. For instance, if the owning company (or others clients) needs lots of computing power (example: Amazon before Christmas), you might suddenly be limited or not be offered any extension if necessary or only for increased price. Also currently cloud services often resemble a conventional operating system: applications running in one cloud ecosystem cannot be directly moved to another one. They need to be at least “recompiled”, which often means partial redevelopment. With cloud providers the management is potentially problematic too, as automatic reservation of resources etc. requires a common interface across several providers. First approaches for such interoperability are however present (Claybrook 2011; Lewis 2012). These also render it easier to integrate private clouds, i.e. use public servers only for “overflow” or less critical tasks.

2.5. Measured services

Service is measured in cloud computing in details, but not necessarily (easily) comparable between providers. A good example is storage: while the amount of data to be stored can be perfectly measured (Bytes), the speed of access to it is much more difficult to compare (e.g. average speed, bandwidth, delay). Similarly CPUs can be measured in GHz – but dependent on the actual hardware this can mean very different things. Practically e.g. Amazon EC2 is renting resources per hour – but with numerous variations (e.g. depending on the OS, RAM/HD size, CPUs. For example

the “Linux ON-Demand-Instance” has 29 different options!). Identifying the actual computing power or “use” a client receives with his individual application can therefore be challenging.

Because of this, cloud computing is not yet really a commodity. For instance, when buying a bottle of water, you know pretty well what exactly you will receive, both in quantity and quality and this is typically sufficient for specification (and small differences in taste are typically irrelevant). Distinguishing elements are primarily the mark (and other non-rational aspects) and the price. This does not yet hold true for cloud computing as you cannot buy “1 GFlop for 10 seconds”. Some differentiation is obviously necessary, but still too much is present or artificially introduced.

3. Security aspects of cloud computing

Cloud computing is often primarily perceived as a security problem. This is common knowledge and at least for some of these difficulties (partial) solutions have been found. However, here we would like to take a positive view on cloud computing from the security standpoint: can we use the specific properties of cloud computing to improve security? Perhaps this is not possible in general, but at least regarding some aspects or special circumstances. Several ideas will be explained.

3.1. Frequent moving

As resources can be used elastically and also in many cases can be allocated automatically, a new approach to hide your activities becomes available: “running around”. The basic idea is, that some task is started on cloud provider A, then moves to cloud provider B to continue it, and transfers soon after to provider C for the finishing touches. In this way no provider has any possibility to find out about the whole task, as one only sees some input, while another only has access to results.

An example for this approach would be to create an interoperable virtual machine, which is then moved between physical systems of one cloud provider or those of several providers. Some parts could be executed “at home” in addition.

This approach has the following advantages:

- Every cloud provider only sees a part of the input/output the VM is requesting/producing. If not time-critical, correlating in- and output can also be made difficult through an intermediate move. It can be challenging for the provider to change the program in a way to complete the original request on the same machine (based on a snapshot) or force moving to a known machine to be able to “decode” everything, even if he creates a full working copy. In this way “casual” copying and eavesdropping and automated analysis gets significantly harder.
- It is not necessarily required to move the complete virtual machine. Mobile agents (taking their code along with them) are an alternative example. Then decoupling between cloud providers becomes easier as only the basic system needs to be created separately, while agents can stay the same (e.g. through interpreted code). Also the amount of data transferred on a move is reduced.
- Correlating log files becomes much more difficult, as these will need to be integrated with movement logs, i.e. which VM/agent was at which position when and which log entries therefore belong to it. Suppose e.g. that two VMs executing similar tasks repeatedly exchange their position: creating a coherent log of any single activity will be challenging.

- If mobile agents are used, local traces are more difficult to evaluate (e.g. forensic images of virtual disks), as they do not refer to a single user/instance. This will make no difference if complete VMs are moved.
- Although requiring more development effort (to be able to employ the systems of several cloud providers), portability may be increased. If resources at one provider are scarce, unavailable, or too expensive, more of the (sub-)tasks can be sent to other providers. In this way the granularity of flexibility can be improved independently of the cloud provider.

However, also some problems/risks and disadvantages are present:

- Virtual machines must be interoperable in the sense of being able to run within the ecosystems of multiple cloud providers. This can be a problem of the format of the VM, but also of the underlying hardware. Moreover, not all providers will allow complete VMs, e.g. without their own instrumentation for management.
- Renting resources might be available only for a long time (see above, e.g. hourly rates). This is therefore only applicable for tasks requiring a very long time to complete. This could be ameliorated by “pipelining”, i.e. executing numerous similar (or potentially also completely different) tasks after each other. I.e., if VM 1 moves to the next “step”, VM 2 takes its place (depends on the contract whether this is acceptable). Mobile agents do not suffer from this.
- If the same (or a similar) task is repeated often, over time a cloud provider can “assemble” all steps. He might not see all elements of a single job, but the nature of the jobs cannot be hidden any more. The only countermeasure is to always give subtask 1 to cloud provider A, but never subtask 2, on the cost of losing flexibility. Therefore this approach is better suited to tasks where the individual results, based on input/communication needs to be hidden, but the activity itself (i.e. what/how results are produced) not.
- While perfectly suited for calculation-intensive tasks or those requiring external communication (e.g. to third parties), data-intensive problems might be difficult to solve as a lot of “base” data might need to be transferred (instead of/in addition to comparatively small code). Also, if for instance table lookups are needed, all the information needs to be present at every machine, so the cloud provider can access it as a whole (but see the next section for an approach to solve this).
- Efficiency is reduced as some resources must be used for the process of transferring the VMs/agents, during which they cannot be used productively. Additionally no real work is performed during that time so the total time required for completing the job increases.
- The end result cannot be hidden from the last cloud service provider. Therefore continuous jobs, similar to a web server producing multiple responses to numerous requests, are better suited.

In total, frequent moving costs resources and time, but renders it significantly harder for a cloud provider (or third parties with access to cloud provider systems) to obtain a coherent view of the activities taking place in the VM. If the result depends on third-party information (=external input), no reconstruction might be possible at all in special circumstances.

3.2. Fragmentation

Instead of temporal flexibility spatial distribution can be employed. Here a task is split into several subtasks or aspects, which each is executed separately on different cloud-provider’s systems. Every

provider therefore only sees a small part of the result, which might not be useful to him as he cannot understand the big picture. For this the separation should be especially unintuitive, e.g. when a song is to be transformed somehow, separating it into numerous brief samples is not a good idea, as even from a few seconds it is possible to identify it. Much better is a separation based on e.g. the frequency domain – if that is possible for the intended transformation (one provider receives only the low frequencies, another the high ones, potentially also split into shorter parts and mixed).

One example significantly improving privacy is the following. For each customer the E-Mail address needs to be verified and a newsletter sent to them or the ZIP code needs to be matched to the city (because of e.g. frequent changes by the post). Normally everything would take place on a single computer (=cloud provider sees the whole database) or in a cloud environment be distributed according to customer record content (provider one sees all customer with names starting with A, provider 2 has the Bs etc.; = each cloud provider sees complete records). Through fragmentation e.g. one provider works solely on ZIP codes (and does not see anything else from the records), while another one sees a large part of the record (e.g. name needed for personalized newsletter), but lacks e.g. the postal address and telephone numbers.

This approach has the following advantages:

- If a single task can be distributed, then speedup can be achieved through more distribution, i.e. more resources and from different providers. This only requires a one-time investment, but is therefore only suitable for repetitive tasks, which will occur similarly for a longer time or where the “splitting” to several providers is possible automatically.
- Separation need not be completely equivalent, i.e. not all tasks need to be identical. This should not lead to a vertical splitting (e.g. by record numbers; see above), but for instance special corner cases can be handled differently and more effectively.
- Depending on price, availability and processing speed more parts can be allocated to a single provider. If care is taken that each cloud provider only sees non-contiguous elements, even significant concentration will reduce the advantages only little. E.g. all even segments are handled at cloud provider A, all uneven ones at provider B.
- Falsification of data by a cloud provider becomes much harder, as he only sees a small bit (→ difficult to identify which element to change) and cannot perform larger changes at all (e.g. not a single but complete record or consistent changes for all records).

However, also some problems/risks and disadvantages are present:

- The data needs to be separated in an uncommon way, but the intended calculation must still remain possible. In a reduced version e.g. only problems of class A are executed in cloud 1, while all class B problems are executed somewhere else. In this way the individual problems and their solutions remain accessible to a cloud provider, but at least an overview on what/how many jobs are there in total is no longer possible.
- A separation as required here is opposite to the normal process of parallelization, where the “natural” or “typical” separation is used (for instance “each customer record is handled separately” would have to be changed to “each data field is sent to a different cloud provider”). Such partitioning potentially also renders debugging more difficult.
- Even individual aspects can be very interesting and revealing, For instance the example presented above still allows statistics about the distribution of customers across the country (which would otherwise not be available!). To prevent even more disclosure of data, for each new task the distribution needs to be randomized (if e.g. different combinations of

fields are used) or remain the same (if a similar process is executed, e.g. on the same fields), or over time a provider may obtain a complete view of all the data.

3.3. Anonymization network

Cloud services can also be used to hide communication trails, similar to a TOR network (TOR). In this way a cloud provider does not necessarily know who exactly the customer is. Obviously this is restricted somewhat through the payment, but here also anonymous options might exist (prepaid cards similar to those used for mobile phones) or hidden behind “proxies” like resellers. The idea is that data to be calculated upon (or VMs, agents, code, ...) is not sent directly to the provider, but rather through several other cloud services. Each VM acts as a node and receives data as well as forwards it. So the direct user is always known to the cloud provider or third parties, but the actual activity takes then place somewhere else. In this way the communication (which cannot be hidden) is separated from the actual execution of the task. Combined with encryption some data (unknown whether it is code or data as well as its content!) is received from a known person and then passed on. The provider performing the activity on the other hand does not know where data and code stems from, as he only sees another provider as the source (and this or yet another one as the target for the result). Note that with asymmetric encryption e.g. the results can be encrypted with the public key so one on the further way has any chance of accessing it as the private key is nowhere present at any of the cloud providers.

This approach has the following advantages:

- Everyone who has only a partial view on the cloud providers involved will not be able to correlate input with output and computation. The amount of “secrecy” can be determined by the user himself, through adding/removing additional steps of transfer. Randomization (each “work-packet” can take a different path) increases the chance of anyone obtaining only a very limited view at best.
- This produces a second-level cloud ecosystem, where the actual users are disconnected from the companies providing the immediate service. Such intermediaries could also offer additional services like load-balancing between providers. While obviously this will cost something (both resources and money), it enables anonymity and e.g. scale effects, when “wholesalers” obtain large amounts of resources and resell them at a discounted price.
- Communication between cloud centres (same or different provider) is typically quite fast, so only little time is lost. However, de-/encryption still has to take place at every stage. Only very “small” instances are required for this, but it seems more secure to not separate the nodes into “communication” and “calculation” nodes – every node should be able to serve both functions as the intra-system traffic is much easier to access and log.

However, also some problems/risks and disadvantages are present:

- Similar problems as with the TOR network are to be expected: For instance the last cloud provider will see both code and end result data unencrypted. This cannot be avoided (unlike in TOR, where you can use HTTPS to prevent the exit node from reading the traffic!) as the actual work needs (absent working and efficient homomorphic encryption; Tebaa/El Hajji/El Ghazi 2012) decrypted code and data. Also, for the TOR network it has been proven that anonymity can be broken if lots of exit nodes are controlled. This means that the final calculation may not be “combined” on a single provider at the end but must remain distributed and final assembly has to take place at the end user.

- Every cloud provider still knows whether he is an “end” provider in both directions: whether he has unencrypted data and operates on it, or whether he receives/delivers data to the final recipient (assuming the reasonable supposition that a cloud provider can create a list of all other such providers; even private clouds can be identified as such). Through obfuscation this danger might be reduced.
- Unless data is reordered and padded and randomly delayed this might still allow matching attacks to identify one message as belonging to a specific calculation. Like the TOR network it is therefore dependent on numerous and varied end users and simultaneously time uncritical services. The common low bandwidth of the TOR network can here be improved significantly.
- Data itself must be anonymized: If the end customer can be “retrieved” from it, all the separation becomes useless. This can be compared to E-Mail anonymization: hiding the IP address is complicated and nice, but useless if the E-Mail text contains a signature with the real name.

3.4. FastFlux network

This is a typical technique of botnets to hide the location of web servers, which is based on frequent changes to the DNS. I.e., not the actual service is moving, but only the association of a domain name to one of the multiple servers. While the use is typically clearly illegal, like phishing, a similar technique is also useful as a security feature. Instead of “physically” moving code or data (see above), they are redirected to numerous servers randomly. This therefore contains aspects of load balancing and peer-to-peer networking, potentially also distributed control. As a result, the actual service provider for a specific request changes frequently, but only logically. Neither the user nor a single cloud provider can determine (and ideally influence) where the next request will end up. This is therefore an enhancement to the approaches described above. It also renders censorship much more difficult, as both “normal” and “undesirable” requests are changing frequently and are intermingled. I.e., a server hosting political content might answer requests for something completely different soon after.

Somewhat similar to this is the current DNS in regard to the root name servers. These are very few logically (=count of IP addresses), but numerous physically. Using the anycast technique a request is sent to the nearest “local cache”. This is however realized through routing protocols, which are typically comparatively slow and take place on the highest levels of the Internet – this approach is unsuitable for many small and brief services, so these would have to be realized differently.

This approach has the following advantages:

- Blocking (or tracing) a single service becomes very difficult if it spans multiple requests. Each request ends up somewhere else and it might not be predictable for anyone in advance where it will be implemented. This could however result in payment problems, if the decoupling takes place in both directions. So either the customer or the provider needs to stay the same (who would then pay) or the request carries its own fee with it (e.g. mobile agents with “electronic coins” in its wallet).
- If a node goes down or is blocked, the request merely needs to be restarted. Resilience is therefore automatically built in – or rather all programs have to be prepared in advance for scenarios, where resilience can be added easily. If other nodes notice this, they might even be able to start up a replacement server/service automatically.

- This is well-suited for retrieving information reliably, but less for updating data, as either a central “database” must exist or any such information must be replicated to all other nodes as well. Information dissemination is therefore the best target area.

However, also some problems/risks and disadvantages are present:

- Each request is served by a single provider only. Therefore unless a task is split into several requests, individual tasks can be perfectly monitored. Still, monitoring individual users behaviour becomes harder, as their requests will not end up on the same server (as typical for load balancing) or even with the same provider. Therefore also maintaining a session is challenging, as each would have to be synchronized to all nodes – sending it only to the “next” server would be counterproductive. Client-side state storage reduces this problem.
- All data required for serving all requests must be present everywhere, i.e. each server must be able to complete any task. To reduce this limitation a significant number of systems are needed: several for “disconnecting” users from servers (similar to proxies), and for each of them several for splitting the work into smaller and distributed parts (= $O(N^2)$!).
- The control system is a very weak point and needs to be either external to the cloud or distributed. However, because of cloud servers typically being permanently available, each participating system can simultaneously act as a DNS or simple load distribution server, allowing randomization also on this level.
- Load balancing could be integrated as the current load can be a factor when deciding where a request will be served. However this reduces the randomness and opens the approach for attacks, e.g. artificially introducing load imbalances through slowing down of servers.

4. Conclusions

While there are still problems left in cloud computing, especially from the security point of view, the cloud itself could be used to reduce some of them. They might be complicated and cost some money, but this functionality cannot (or only very difficultly) be provided differently.

These ideas are all based on artificial “randomization” and “decoupling”:

- Splitting data and/or computation across providers without technical reasons.
- Introducing “unnecessary” mobility of data and/or code.
- Decoupling providers from customers through additional proxies/mixers, with nobody knowing a direct or permanent association.

Closer investigation how such approaches can be implemented are needed and very desirable, especially in an age of surveillance both by private companies (data for targeted ads) and countries.

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INFORMATION ASSURANCE IN CLOUD COMPUTING

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Abstract

Cloud computing raises over the last few years much attention as a mean to improve scalability, reduce IT expenditures, and change the ratio between the operational and capital expenditures. But in the same time cloud environment is accompanied by much vulnerability, thereby increasing the organization's risk. As a result, companies expend significant resources to assess and monitor the availability, integrity, confidentiality and compliance of cloud service providers in order to be sure, that the control systems at the side of cloud provider are compliant with the control systems of their own. The paper deals with the specifics of cloud assurance. The specifics are discussed on the base of five inherent components of each assurance activity: three-party relationship, subject matter, criteria, execution and conclusion/findings.

1. The Basics of Cloud Assurance

Cloud computing has come a long way from being a mere buzzword to a meaningful tool with a lot of potential for consumers of technology products and services. The adoption of cloud computing has accelerated in the last few years, and it continues to undergo phenomenal growth. The characteristics of cloud computing lead to enormous opportunities as well as risks. Some of the risks already exist, but will be elevated, and others are new. (ISACA, 2012) declares that top four negative influences on cloud adoption and innovation are information security, data ownership/custodian responsibilities, regulatory compliance and legal/contractual issues. Taking stock of these risks is as important as knowing how to leverage this development for one's company. One way how to provide assessment of the cloud risk and related controls is to initiate assurance activities.

The Merriam-Webster dictionary defines assurance as “the state of being sure or certain about something” (Dictionary, 2014). The Chartered Institute of Internal auditors defines assurance as “An objective examination of evidence for the purpose of providing an independent assessment on governance, risk management and control processes for the organization” (IIA, 2014). (IFAC, 2005) presents, that “assurance engagement means an engagement in which a practitioner expresses a conclusion designed to enhance the degree of confidence of the intended users other than the responsible party about the outcome of the evaluation or measurement of a subject matter against criteria”.

On the base of the above definitions we can summarize, that an assurance initiative consists of five components: three-party relationships, subject matter, criteria, execution and conclusion. Each of those components within the cloud computing environment is described in further detail in the following sections.

2. Three-party Relationship

A three-party relationship means the mutual communication between a responsible /accountable party for the subject matter, an assurance professional, and an intended user of the assurance report.

An accountable party is the individual, group or entity (auditee), usually involving management that is ultimately responsible for subject matter, process or scope (ISACA, 2013, p.16). In cloud computing the accountable party is the cloud provider.

Depending on the circumstances, user of the assurance report could include a variety of stakeholders. In the cloud ecosystem these can be both from the cloud provider organization or cloud user organizations. Depending on the nature of the cloud deployment model, there could be other stakeholders interested in assurance, e.g., the Data Protection Authority (DPA) of a country whose citizens store data in the cloud. Other examples of users are shareholders, creditors, customers, the board of directors, the audit committee, legislators or regulators. For some types of assurance activities, the auditee and the user can be identical, e.g., IT management. This situation is typical for self-assessment.

The assurance professional (auditor) is the person who has overall responsibility for the performance of the assurance engagement and for the issuance of the report on the subject matter. In cloud computing the assurance professional can be either from the cloud provider organization (cloud provider audit), or from the cloud user organization (cloud client audit), or one can be the third party (third party audit).

Cloud provider audit (assurance by CSP) is motivated by incentives and challenges to establish, monitor and demonstrate ongoing compliance with a set of controls that meets their own and their customers' business and regulatory requirements. The greater the assurance, the more confidence a client will have in the CSP, which results in increased adoption and deployment of cloud solutions in the industry. The level and type of assurance should be driven by the type of cloud service model (i.e., SaaS, IaaS or PaaS), the cloud deployment model (i.e., public, private, community or hybrid) and the users of the cloud.

Cloud client audit (assurance by cloud client)²⁵ is most often used for vendor risk assessment, vendor due diligence, vendor assessment in the phase of vendor selection and in the phase of contract negotiation (SLAs). Regardless of the form of report, users must determine the impact the CSP can have on them and evaluate the scope of the independent examination, including the completeness and adequacy of testing performed and results.

Third-party audit is becoming increasingly common for CSPs as they are inundated with assurance requests. (NIST, 2011, p.8) describes cloud computing reference architecture, which identifies the major actors, their activities and functions in cloud computing. A cloud auditor is one of the actors providing an independent examination of cloud service controls with the intent to express an opinion thereon. In order to provide third-party audit there is a need to establish a standard framework for assessing and authorizing cloud service vendor. It is a very complex process and

²⁵ (ISACA, 2011) calls this type of audit/assurance “vendor management audit”.

therefore the first examples of application are focused on government agencies²⁶. The main tasks of such a framework are:

- To accredit third parties to conduct assessment.
- To identify criteria for assessment (e.g. NIST SP 800-53 – Security and Privacy Controls for Federal Information Systems and Organizations).
- To publish requirements, templates, and supporting materials for cloud customers and vendors (e.g. <http://www.FedRamp.gov>).
- To address the security risks by incorporating it into the terms of SLA (Service Level Agreements).
- To establish continuous monitoring of cloud providers control systems.

3. Cloud as a Subject Matter

In cloud computing the general subject matter are cloud services and related deployment models. But within services and deployment models we can furthermore provide more detailed focus on some specific information, practices, controls, or quality attribute of the cloud service (such as reliability, effectiveness, efficiency, availability and confidentiality). The subject matter can include the design or operation of internal controls and management practices over any aspect of the cloud provider, or compliance with privacy practices or standards or specified laws and regulations. Assurance can also be provided for various perspectives or scopes within a CSP. It can be provided for specific objects or assets, such as internal control, data, patents, alliances, human resources, projects or programs. Assurance can be provided at various levels within the CSP—at the overall enterprise level or the level of a specific entity such as a geographic area, data center or service offering. The different levels of subject matter scoping is shown in Figure.

4. Assurance Criteria

Assurance criteria are the standards and benchmarks, used to measure and present the subject matter and against which the practitioner evaluates the subject matter (ISACA, 2013, p.15). Nowadays there exist a lot of different regulations, standards, best practices, guidelines, etc. that can serve the auditors as a criterion for assessment. The existing assurance frameworks can be classified into three broad categories:

- Existing widely accepted regulations customizable and applicable for the cloud, examples:
 - Data protection law, cyber security regulations or government information systems regulations.
 - COSO - The Committee of Sponsoring Organizations published Internal Control – Integrated Framework and Enterprise Risk Management – Integrated Framework.

²⁶ Starting with June 6, 2014 USG agencies are required to accept only cloud providers that have been assessed and authorized through the Federal Risk and Authorization Management Program (FedRAMP)

- COBIT 4.1 and COBIT 5 - IT governance frameworks and toolsets that allows managers to bridge the gap between control requirements, technical issues and business risks.
- ISO/IEC 27000-series – provides recommendations on information security management, risks and controls within the context of an overall information security management system (ISMS).
- ISO/IEC 20000 - international standard for IT service management based on ITIL.

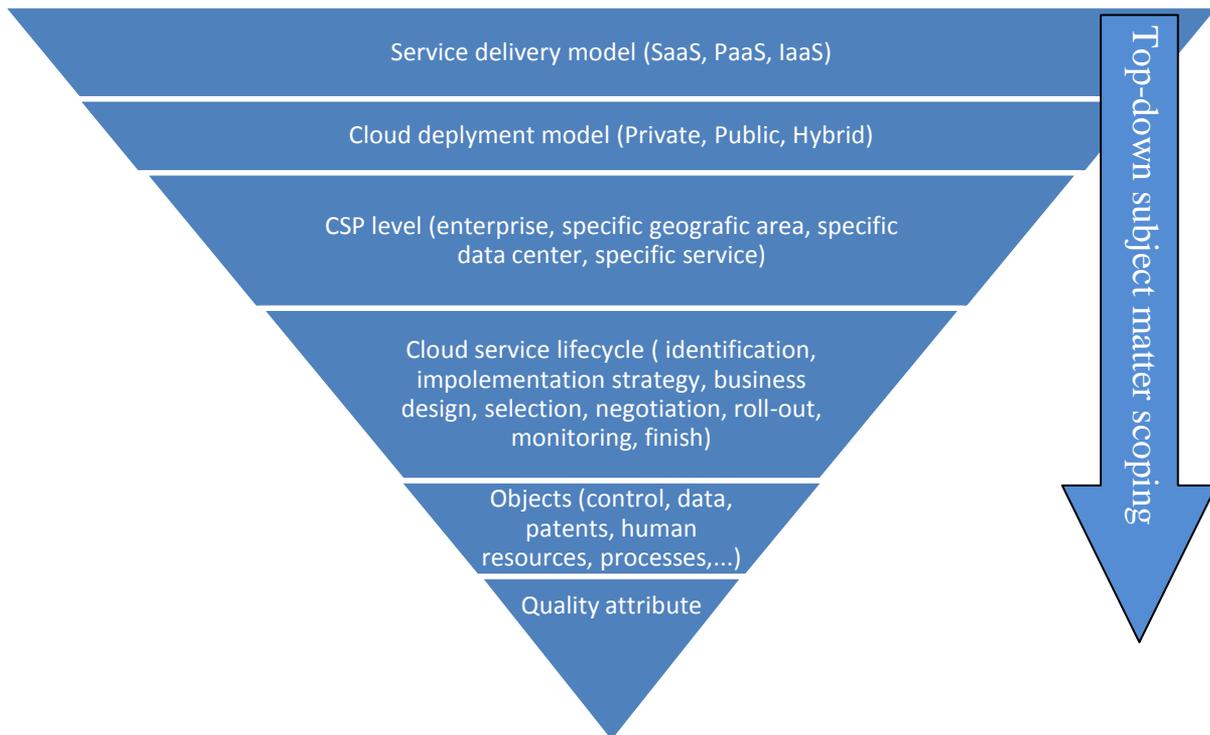


Figure 1: Levels of subject matter scoping

- Frameworks built for outsourcing, examples:
 - SSAE 16– Statements on Standards for Attestation – is a regulation created by the American Institute of Certified Public Accountants (AICPA) for redefining and updating how service companies report on compliance controls.
 - GTAG 7 - published by IIA (Institute of Internal Auditors) is a global technology audit guide on outsourcing
 - IAOP (International Association of Outsourcing Professionals) is the global, standard and certifications setting organization and advocate for the outsourcing profession (one IAOP chapter deals with cloud computing).
- Frameworks built for the cloud, examples:
 - CSA (Cloud Security Alliance) – published Cloud Controls Matrix (CCM) which provides fundamental security principles to guide cloud vendors.
 - Jericho Forum - launched its Self-Assessment Scheme (SAS), a tool that allow vendors and their customers to check the effectiveness of an IT security product in meeting their needs, particularly as more organizations adopt cloud computing.

- ISACA Cloud Computing Management Audit/Assurance program – a tool and template to be used as a road map for the completion of a specific assurance process.
- SANS Institute - published the document An Introduction to Securing a Cloud Environment.

Additional regulatory and compliance requirements diverse according to cloud type and industry.. Example can be Electronic Protected Health Information (ePHI) or HIPAA. A side benefit of the specialization is that the assurance requirements are limited and better defined. US public companies must design and implement internal controls to help their CSP clients comply with the US Sarbanes-Oxley Act of 2002 or with FISMA Cloud (Federal Information Security Management Act for cloud).

European Community pays special attention to cloud computing, too. For example, ERP-hosting providers that support the processing of financial transactions for EU companies must design and implement internal controls to be compliant with Data Protection Directive 95/46/EC²⁷ of the European Parliament on the protection of individuals with regard to the processing of personal data and on the free movement of such data. To maintain compliance with the Directive, the institution should consider using a cloud provider in a country already assessed by the European Commission as having adequate protection, or a US provider who has signed up to the Safe Harbor Regulations²⁸ or use European Commission approved contract terms with its cloud provider. Furthermore the Commission's stated aim is to introduce new, pan-European certification schemes for cloud computing, including data protection, by 2014. The European Network and Information Security Agency ("ENISA") and other relevant parties were asked to assist in this process. These certification schemes will address data protection, especially data portability, and focus on increased transparency of cloud service providers' security practices. Although the Commission has provided a rather detailed list of factors to be considered by these new certification schemes, it should be noted that participation in the schemes will be voluntary.

5. Assurance Execution

When undertaking an assurance activity, the audit and assurance professional eventually executes the assignment by following a structured approach to reach a conclusion on the evaluation of the subject matter (ISACA, 2013, p.16). A structured approach includes assurance life-cycle stages definition together with inputs, outputs, tools and other details identification. Even to the fact, that there exist internationally accepted general assurance guidelines (e.g. Cobit 4.1 IT Assurance Guide or Cobit 5 for Assurance) in practice there a need to tailor these guidelines to the specifics of subject matter, environment where the assurance initiative takes place and to the applied assurance approach. Focusing on the cloud computing and relevant assurance approaches, there exist three basic types of approaches:

- Risk –based assurance.
- Regulation-based assurance.
- Balanced Scorecard (BSC)-based assurance.

²⁷ In 2012, the Commission proposed a major reform of the EU legal framework on the protection of personal data. The new proposals will strengthen individual rights and tackle the challenges of globalization and new technologies cloud computing included

²⁸ This can be checked e.g. on the US Trade Information Center - Export.gov website: safeharbor.export.gov/list.aspx

To conduct a risk-based assessment of the cloud computing environment, there are generic risk frameworks such as COSO, ISO 27001, ITIL, Risk IT of Cobit 4.1, Cobit 5 for Risk (ISACA, 2013) and others (see part 4) (Gadia, 2011). This approach is based on the assumption, that first of all we need to identify the high-level risks (risk scenarios), then we need to understand the controls helping to decrease, avoid or transfer risks and the last stage in this type of assurance is to determine whether the controls are in place and how effectively they work (see Figure).

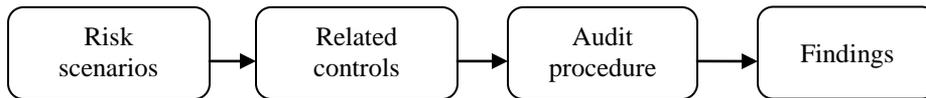


Figure 2: Stages in risk-based approach to cloud assurance

Regulation-based assurance is based on the idea, that there exist „ready-made“ guidelines for cloud computing assurance activities that represent the best practice in this area. Thus the assurance professional (auditor) have to choose the best fitted guideline, analyze its gaps and/or utilities in relation to specific environment and then provide audit procedure (see Figure).

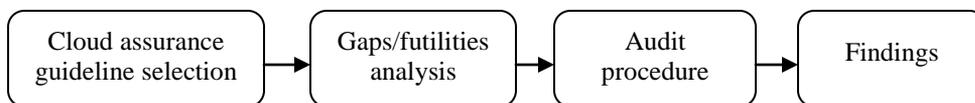


Figure 3: Stages in regulation-based approach to cloud assurance

The most complex approach to cloud computing assurance is based on the idea of Balanced Scorecards. Kaplan and Norton have introduced the balanced scorecard at the enterprise level. Their basic idea is that the evaluation of an organization should not be restricted to a traditional financial evaluation but should be supplemented with measures concerning customer satisfaction, internal processes and the ability to innovate. These additional measures should assure future financial results and drive the organization towards its strategic goals while keeping all four perspectives in balance. They propose a three-layered structure for the four perspectives: mission, objectives and measures. The advantage of BSC-based assurance is the complexity of assurance which is imbedded in its four perspectives and illustrative separation of missions, objectives and measures for assurance by CSP and assurance by cloud client. Assurance professional must first develop cloud BSC either for user of cloud or cloud provider (or another stakeholder). Missions, objectives and measures of four perspectives represent the summary of subject matters convenient for assurance activity planning. Next the priorities and relationships of subject matters should be identified and then the audit procedure can start (see Figure).

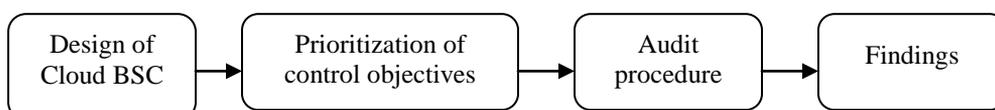


Figure 4: Stages in BSC-based approach to cloud assurance

None of the above approaches of assessment does exclude the application of another. The ideal is their mutual combination. The final decision about the type of assurance is on the responsible /accountable party for the subject matter. But nevertheless it would be useful to

- apply risk-based approach in case the cloud services are already implemented and there exist some threats (non-compliance, security, quality) that can damage the business processes,
- apply regulation-based assurance in case one need a quick and highly formalized general assessment focused mainly on security issues,
- apply BSC-based assurance in the earliest stages of cloud transition project when either the cloud customer or provider like to view the project as an business case and set the main objectives and measures from different types perspectives (not only security and compliance).

6. Assurance Findings

The process of evaluating the results of audit or assurance testing, after confirmation, to arrive at conclusions and recommendations can be complex. What appears to be a problem may, in fact, be the effect of a problem, not the cause (ISACA, 2013, p. 16).

Therefore, it is important for the audit and assurance professional to follow the conclusion process, from confirming facts with key individuals in the areas being audited to determining root causes. The individual findings can then be used to provide examples that support higher-level analysis:

- Developing various scenarios leading to potential recommendations.
- Selecting an appropriate recommendation that is practical and achievable.
- Identifying steps necessary to ensure buy-in of key stakeholders.

The most common and internationally accepted standard for service providers reporting is SSAE 16 (see part 4). It introduces three types of service organization controls (SOC) reports:

- SOC 1 Report – Report on Controls at a Service Organization Relevant to User Entities' Internal Control over Financial Reporting.
- SOC 2 Report – Report on Controls at a Service Organization Relevant to Security, Availability, Processing Integrity, Confidentiality, or Privacy.
- SOC 3 Report – Trust Services Report for Service Organizations.

Especially SOC1 and SOC2 reports are recommended for cloud computing. A SOC 1 report is for service organizations that impact or may impact their clients financial reporting. A SOC 2 report is for service organizations that hold, store or process information of their clients, not financial reporting significant (e.g. would not affect their income statement or balance sheet). Furthermore there exist two types of SOC reports:

- Type 1 report just provides a report of procedures / controls an organization has put in place as of a point in time and a
- Type 2 report has an audit period and provides evidence of how an organization operated their controls over a period of time. It does not mean, that Type 2 report recommends tighter control requirements, but just describes how a company's control environment operated over the specified audit period (typically not less than 6 months). In a Type 2 report, management at the service organization is required to present a written assertion about whether:

- Its description “fairly presents” the system that was designed and implemented throughout the specified period.
- The controls were suitably designed throughout the period to achieve the control objectives.

In practice we can apply the whole set of other assurance conclusion reports, that can be more flexible and can be tailored to the specific needs of cloud computing stakeholder needs. In each case these assurance reports should be compliant with the reporting standards that are a part of ITAF (IT Assurance Framework) (ITAF, 2013, p.85). Except these formal standard items the report should cover:

- The governance affecting cloud computing.
- The contractual compliance between the service provider and customer.
- Control issues specific to cloud computing (data protection/segregation, encryption standards, logging, authentication to cloud, configuration management, monitoring/compliance function, vendor integration, confidentiality/privacy).

7. Conclusion

Companies and their CSPs need tools to help streamline their efforts while driving greater compliance and security of cloud computing. Assurance is the most convenient tool, but its application on to cloud computing has been provided in a non-coordinated way in past. The paper provides the basic overview of the state-of-the art. We can predict, that the growing maturity of cloud computing will empower the maturity of cloud assurance and thus in the near future the internationally accepted criteria, practices and certifications will be available.

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LOUD SECURITY PROBLEMS CAUSED BY VIRTUALIZATION TECHNOLOGY VULNERABILITIES AND THEIR PREVENTION

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Cloud Computing Security, Virtual Machine Based Rootkits, Virtualization Security, Virtual Machine Introspection, Self Cleansing for Intrusion Tolerance

Abstract

In public “Infrastructure as a Service” (IaaS) clouds, several Virtual Machines (VMs), owned by different customers, are executed on a single physical machine. This multi-tenancy gives malware the chance to not only take control over a single VM; but additionally the malware can start attacks against other VMs on the local hardware and also against the Hypervisor. If the worst case occurs and an attack on the Hypervisor succeeds, all the VMs on the physical machine are compromised.

We present risks and known attacks on virtualization infrastructures and discuss approaches for prevention, specifically Virtual Machine Introspection (VMI) and Self Cleansing for Intrusion Tolerance (SCIT).

1. Introduction

Virtualization Security in a public cloud providing IaaS (Mell, 2011) is very important, because of e.g. Multi-Tenancy - executing multiple VMs on one physical machine offers many possibilities to malware for attacks. This paper is designed as a motivation and a starting point for readers to think about the security pros and cons of virtualization.

Using the services of a Cloud Provider (CP), you as a customer cannot identify on which physical server your VM is located and it is deployed together with instances of VMs of other customers. Even using many instances of VMs, you never know, whether they (or some of them) are located on the same physical machine or not. This is suboptimal concerning availability (e.g. distribution) and security (no “foreign” VMs on the same hardware). Additionally you have (almost) no chance to secure your VM against the virtualization layer and the Virtual Machine Monitor (VMM).

The Federal Office for Information Security in Germany wrote in (BSI, 2011): “...*With a few exceptions, no attacks on the hypervisor have yet appeared in the wild [...] - they have only been described in theoretical terms or as proof-of-concept. Should an attack succeed, however, the consequences are devastating.*”

“*Shared Technology Vulnerabilities*” are listed only at the last (9th) position in the current list of “Cloud Computing Top Threats” of the Cloud Security Alliance (CSA, 2013). This threat, which also includes virtualization vulnerabilities, occupied position 4 three years ago. This is good news. However, the text describing this type of vulnerability also includes sentences like “*This vulnerability is dangerous because it potentially can affect an entire cloud at once*”.

The conclusions from these assessments are somewhat unpleasant: the problem is tremendous because of the multiplier effect of the many affected users. Due to the increasing use of cloud computing and based on a concentration of few large providers, one can fear/assume that the impact of a (single) security incident will affect more and more users simultaneously. So far, the concerted joint efforts of manufacturers, CPs and researchers have prevented successful (known & public) attacks. Thus it proves exceedingly difficult to successfully attack a VMM, nevertheless the possible impact – if it really happens – is huge.

Our aim is to illustrate security risks concerning the physical implementation through the assumption that one instance of an infected VM gives malware the possibility to break out and infect other instance of Virtual Machines or in the worst case, the VMM itself. We concentrate on data-leakage attacks, which often stay unrecognized for a long time, as they typically do not prevent normal operation. Because of the high speed of machine-internal communication these attacks may also be very fast. This e.g. shares some similarities with the Heartbleed attack (Heartbleed, 2014) (CVE-2014-0160).

2. Security Risks by Virtualization

In this section we discuss a scenario showing several risks concerning cloud architectures, known security vulnerabilities implied by the architecture of different virtualization-types, and the danger posed by VMBRs (Virtual Machine Based Rootkits).

The architecture of many commercial cloud providers is not public. So we consider a simplified cluster as an example.

Below we describe several individual risks, enumerated from a to f as shown in Figure 1:

- a.) VM to VM over the Internet: Once infiltrated, malware can use the power of a VM to operate against the Internet and other targets, but it can also execute attacks against VMs on the same physical system.
- b.) From the Internet: If the attacker does not have access to a VM, he has to come from the outside. Here it does not matter if the origin is really from the outside or from another VM.
- c.) VM to the outside: This type is concerned by attacks like (D)DoS to other machines or by misuse as part of a botnet (sending Spam-Mails, etc.).

These three types (a-c) are classical attacks; we do not describe them in detail.

- d.) VM to VM directly, on one physical machine: Though this type of outbreak is a possibility, we do not know of any incidents, where one VM has infected another VM without any communication over the Internet or going through the VMM.
- e.) VM to external storages: If a VM is infected and has access to a cluster-storage to which other VMs also have access, this is one way for supposedly safe machines to get infected. For example you also can imagine a type of shared-folder option like in common VM solutions. Another problem concerning this attack is the storage of VMs (while turned off) in an external site-storage. While the machine is turned off, there's no actual problem (and

no active defence-mechanisms), but there still exists the risk of restoring an infected VM back on a formerly clean VMM.

- f.) VM to VM over the VMM: This is probably the most dangerous outbreak of malware used in a VM. If malware is able to gain control over the VMM via “Virtual Machine Escape” (or via a VMBR undermining the VMM), the security of the physical machine is gone and therefore the safety of this part of the cloud is not guaranteed any more.

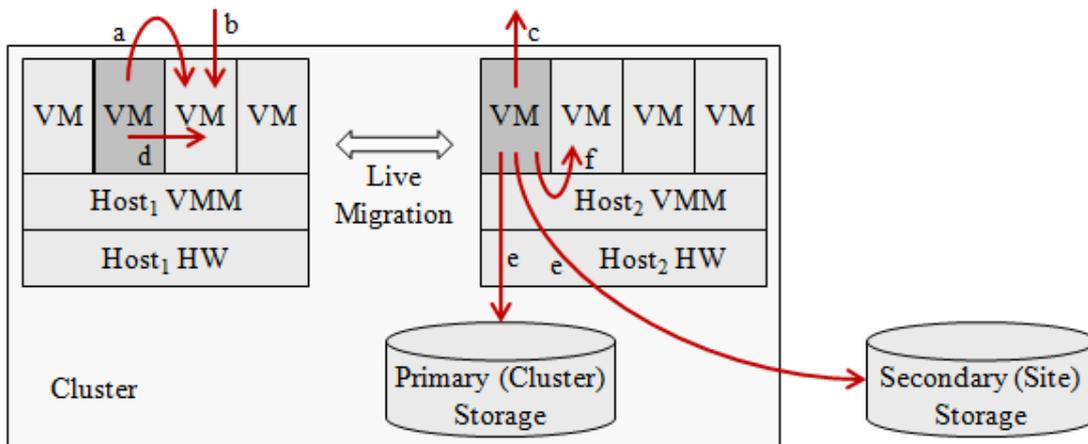


Figure 1: Simplified Cluster as Cloud Infrastructure; several terms follow Apache CloudStack (Cloudstack, 2014)

Security implications from weak implementations of core virtualization requirements are discussed in (Pearce, 2013). It describes attack types such as VM-Escape (in general) VM-Escape to host (f) and VM-Escape to VM (d).

In 2006, a research group from Microsoft Research and the University of Michigan demonstrated the first instance of a Virtual Machine Based Rootkit (VMBR). This new type of Rootkits has the goal to undermine the active Operating System (OS) and hoist it into a VM without getting the user’s attention. The paper “SubVirt” (King, 2006) describes step-by-step how malware is able to do this.

After this innovative functionality of malware, Joanna Rutkowska from Invisible Things Lab presented another VMBR which is able to hoist the running OS into a VM on-the-fly - with no need to reboot. This VMBR has the name “Blue Pill” (Rutkowska, 2006). The Rootkit allocates so much memory that sensitive kernel-code must be switched to the hard drive, where it can be modified by the Rootkit. This modification is not possible while the code is in the main memory. When the code is reloaded into the main memory and executed, the Rootkit gains control over the system.

Two years later, at Black Hat 2008, the “Xen Owing Trilogy” was presented. In a three-step-presentation and live demo it was shown how to subvert the Xen Hypervisor (Wojtczuk, 2008) using DMA (direct memory access) attacks and the “Xen Loadable Module Framework”. They also gave a guidance of how to prevent a Xen Hypervisor of being subverted. There is also a comparison between Xen, Microsoft’s Hyper-V and VMware’s ESX/vSphere. Known vulnerabilities concerning these security breaches are listed as CVE-2007-4993 and CVE-2007-5497 (CVE). Other attacks against Intel and Xen are provided in (Wojtczuk, 2011) .

Further risks concerning our scenario are the so called “Virtual Machine Escapes” - the threat of malware being able to break out of its isolated environment, the VM, and taking control over its VMM. One exploit of this type affecting VMware is listed as CVE-2008-0923 (CVE). A working

exploit was “Cloudburst”, where the guest systems were able to write into the Hypervisors file system through the “Shared Folder” functionality.

Newer exploits of VM-Escapes are from 2012: the VUPEN Method (Rashid, 2012) and other incidents, e.g. where a manipulated VMDK (Virtual Machine Disk) descriptor file was uploaded to the VMM and was able to load VMware ESXi system files directly to the VM (Finn, 2012). An incident on Xen’s 64-bit para-virtualized Hypervisor is shown in (Schwartz, 2012).

Closing this section we want to draw some attention to a few related publications on how to prevent such attacks: (Sabahi, 2011) treats many general securing aspects. Other authors (Christodorescu, 2009, Garfinkel, 2003, Ibrahim, 2010) describe the usage of Virtual Intrusion Detection/Prevention Systems (vIDS/vIPS) or deploy security software in a special privileged VM (SecVM) and the approach of VMI - observing VMs from the outside.

3. Possibilities to protect and avoid

An attack against the VMM can originate from many sources, for example if there is an intrusion into the central cloud management or if the customer’s accounts are hacked. Because this paper focuses on how to prevent breaking into the VMM from a customer VM, we concentrate on the VMs and the VMM here.

Protection measures against “VM-Escape to host” (see above) are addressed in (Pearce, 2013), who proposes VMM integrity checking, attestation and security-aware design, programming and testing for (at least) EAL5 level according to (Common Criteria, 2014) as security measures. This includes (amongst others) VMM patching, host security measures (similar to physical machines) and “...measures to detect the malicious code in the VM (as legitimate software does not need such functionality).” Therefore the following chapter “VM Introspection” deals with detection of this malicious code in the VM.

The following subsections discuss two examples of security concepts. These two concepts do not provide a substitute for other precautions, but must always be seen as an additional step to reach a higher level of security. Additionally, note that they do not cover all attack vectors described above, but concentrate on selected aspects only.

3.1. Can Virtual Machine Introspection (VMI) help against VMM flaws?

We have now talked about several security challenges in the cloud. There are also security benefits because of virtualization. The following example concerning VMI shows one of these technical benefits. (Garfinkel, 2003) states that “*Being able to directly inspect the virtual machine makes it particularly difficult to evade a VMI IDS since there is no state in the monitored system that the IDS cannot see.*” And (Lanepce, 2013) proposes “... *that IDPS should be placed at the hypervisor level, as that choice provides many security benefits compared to other designs.*” (IDPS = Intrusion Detection and Prevention System).

If an attacker takes over a VM of a legitimate user to misuse it as the origin of a “new” attack against the VMM, a VMI-based IDPS has a good chance to detect this intrusion into the VM. This positive statement results from the assumption that the attacker will use malicious code to infiltrate the VM and that this malware is already known, so that the VMI-IPS can deal with it. An example can be found in (Christodorescu, 2009). Their Rootkit detection monitors kernel pointers, which are typically modified by Rootkits. But even in this case, the authors consider reducing the number of

false positives by switching from whitelisting to blacklisting. Thus in many cases only already well-known Rootkits will result in an alarm.

The occurrence of a detection method leads straight to the next problem: how can/should the IDS, and thus the CP, react to the suspected threat? As an example, (Nance, 2008) shows different VMI approaches and analyzes technical concepts in the context of their VIX-tool. Nevertheless, legal aspects “... *where the monitoring process results or effects can have real and serious legal consequences*” are listed in “Future investigations”. Especially if the alarm was a false-positive, an immediate deactivation of the VM may lead to claims for compensation.

There are additional legal issues: to what extent is the CP allowed to analyze the main memory, storage, network traffic and all other activities of a customer’s VM, even if the CP does not need this information for billing? Does a customer really desire that the CP monitors all activities *inside* the VM, including all the files and data written to ephemeral and persistent storage in addition to all network activities (which are typically inspected by a firewall at least)? Of course, several customers will accept an offer from their CP for “Security as a Service”. Nevertheless, there will be other customers as well.

It is evident that the cloud customer also has duties, such as to implement appropriate safety measures, to use security tools and to keep the software up-to-date. However, these obligations exist regardless of whether or not the system is operated in a cloud or directly on hardware located at the premises of the company. In the chapter “*Cloud computing providers and you: a shared responsibility*” (IBM, 2011) states for instance that “*By design, the IBM staff and tooling do not access or scan a client’s virtual environments.*” Additionally the responsibility for all patch management lies in the hands of the client. In contrast to this, e.g. if the CP just automatically installs patches on a virtual image at rest instead of protecting VMs until they can be updated (CSA, 2011), how can customers use software which is only guaranteed to work for certain patch-levels? So in general security responsibility must remain with the customer.

Securing the VMs against attacks from the outside is an important step to protect a cloud. VMI gives the CP an additional line of defence, which is located between network security and the VMM itself, by ensuring that “unsecured” VMs are also observed. Because of customer privacy and legal issues, in general only attacks from a whitelist (also known as *knowledge-based* or *signature-based* detection) will result in an immediate “hard” reaction comparable to an IDPS. If an attack is already known, fully analyzed, and included in the signature-database of the IDPS, the probability of false alarms will be typically low enough to take immediate steps. A behaviour-based IDS can find attacks which are unknown so far, “... *but its accuracy is a difficult issue.*” (Debar, 2000). This is still (to some extent) true for cloud environments: the deviation from a “normal” behaviour is often difficult to measure, because the normal behaviour of customer’s VMs may change rapidly without any further notice and varies between customers.

Additionally, the detection of Rootkits and backdoors in VMs do not help against malicious customers. IaaS customers always have the permission to access and modify their environment inside the VM, e.g. to install new software like a backdoor.

CPs apply updates to their core infrastructure on a regular basis. Therefore, we feel confident that known vulnerabilities inside the VMM, for which IDPS signatures are available, have been patched already. Anyhow, IDPS signatures, which recognize attacks against the VMM, are by no means redundant, as they offer the chance to identify malicious customers or VMs which have already been subverted by attackers.

Due to the rapid patch update cycles, it can be stated: a dangerous attack must be so new that there exist no IDPS rules and no patches against it. Thus it must be (at least) a zero day attack. Therefore

– as already noted in the introduction – it is exceedingly difficult to successfully attack a VMM. However, if these circumstances occur, the VMI cannot rely on IDPS signatures to protect the VMM, even if new attacks or variants are sometimes detected by them (Holm, 2014). Additionally, the logs of behaviour-based IDPS need to be analyzed carefully to detect hints of any such incident, an increased workload requiring specialised personnel.

It should also be noted that VMI, as any security measure in general, is not for free. Depending on the depth and scope of operation, a VMI-based IDPS may require a lot of performance: how will the CP charge these costs? Despite the clear separation of functionality, e.g. into privileged VMs, in-depth VMI makes the VMM more complex and thus eventually also more error-prone.

The short summary is as follows: Alarms of an IDPS, indicating an attack of a VM to the VMM, can only lead to direct switching off (or freezing) the attacking VM when the probability of a false positive is very low. Unfortunately, for new zero-day attacks this is rarely the case. So the benefit, that it is hard(er) to circumvent a VMI-based IDPS than a standard host-based system, is often not as large as expected. Thus customer's VMs in public IaaS clouds must still be considered hostile!

3.2. Can SCIT reduce the effects of VMM flaws?

SCIT (Self Cleansing for Intrusion Tolerance, 2014) restarts a system from a known good state in certain intervals for security reasons. This concept acts on the pessimistic assumption the worst case happens and that an incident may occur fully undetected, and tries to remedy it through a “reset”. An overview on other intrusion-tolerant system architectures can be found in (Nguyen, 2011).

SCIT shares many similarities with “Software Rejuvenation” and “Recovery Oriented Computing”. These concepts typically differ in the targets and often concentrate on dealing with software-, hardware- or human operating-errors (Huang, 2006).

Assumptions: SCIT follows a pessimistic point of view and a low degree of trust: if a computer system has been exposed to potentially successful attacks, it is classified as penetrated and compromised. This assumption is maintained even when there are no signs of actual attacks or intrusions. Thus the considerations are conceptually independent from other precautions like IDPS, or special security layers and trusted hardware, which try to ensure the integrity of a system. If a server offers services to a public network, it is always exposed to attacks. We assume the same situation for VMMs running VMs in a public IaaS cloud on them.

SCIT assumes that an intruder needs time to infiltrate the system and to do real damage; it reduces the intruder residence time by decreasing the server exposure time, the time a server is online until the next new (re-)installation. (Huang, 2006) shows in an example that this period can be reduced to less than 5 minutes using the same resources as with typical primary-backup-redundancy.

Cleansing: As in everyday life, a suspicious server is taken out of service and is (re-)installed to a clean state. SCIT performs automatic reinstallations at periodic intervals. While e.g. (Arsenault, 2007) suggest special hardware in this case, a typical solution in the context of CPs will rely on secure remote boot from a network interface which is connected to a dedicated out-of-band management network. Thus the cleansing operation may consist of a simple image-copy during reboot or just use a reboot to clear information stored in an overlay file system in RAM. Additional security related tasks, e.g. integrity checks, might be part of the cleansing (offline) phase. At this time for instance a simple file-content comparison could potentially reveal successful resident intrusions, even if they managed to circumvent the built-in integrity verifier mechanisms of the VMM. E.g. the Intel Trusted Execution Technology (TXT) supports and promotes such integrity verification of the image during boot (Intel, 2014).

Availability: While one server is offline, (an)other server(s) must take over its services (=VMs) to preserve availability. Many papers about SCIT describe that it is therefore suited best for stateless systems and supports stateful services only for short-termed sessions. So SCIT supports services with no or almost no state like stateless packet filtering, static HTML webservers (Bangalore, 2009) or DNS servers. Additional papers concerning this topic can be found e.g. in (Arsenault , 2007, Huang, 2006).

SCIT for VMMs: In contrast, the cost for taking a physical server in the cluster down will be remarkable, even if the VMM is assumed to be stateless to a large extent: similar to (Smith, 2008) the VMM should write logs and performance data to a central storage system. Nevertheless, in most cases several active VMs must be migrated to other servers by life-migration (Clark, 2005). The migration of all active VMs from a server is similar to the case that health monitoring based on hardware sensors predicts a hardware problem (Nagarajan, 2007), but occurs far more frequently and not only in exceptional circumstances. Automatic hot stand-by reduces this time on the expense of efficiency.

Policy based SCIT: Because of the expected large effort for VM migrations, a policy based solution – as opposed to simply taking servers down for cleansing in fixed (or better random) intervals – is recommendable. (Yongki, 2012) adapts SCIT to withstand DoS attacks based on historical data. (Lim, 2013) uses an adaptive SCIT policy based on response delays in combination with CVE scores and file integrity for attack prediction and the decision process, how many and which system(s) should be online. Because we do not want to go any deeper into resource scheduling strategies and concentrate on stealth attacks, we use the description in (Lim, 2013). To secure the VMM against yet unknown attacks, our scoring policy should not solely rely on data from CVE and CVSS (Common Vulnerability Scoring System). And if the integrity-verifier, which is built into the VMM or the cleansing process, recognizes that e.g. the `/etc/passwd` file has been changed, this will result in a “red alert” and an immediate response, and not just reduce this server’s online time.

SCIT policy based on VMs trustworthiness: We propose to estimate the threat of a VM on the VMM based on the runtime of the VM (as in “simple” SCIT) and on customer-specific criteria of the VM owner. There are several indications for a CP to classify customers. Technical aspects depend on the policy of the provider and how much technical information about the VMs is (allowed to be) available by the customers.

Examples for customer classification: history (trouble-free customer for a long time), line of business (e.g. security company is rated higher), credit reports about the customer, attack history ...
Examples for technical classification: number of CPUs, size of memory, open TCP/UDP ports, OS, ... including all data which is used by CP for billing.

On the one hand the rating is inherited from the customer to his/her VMs. This aspect is especially important if the provider does not collect any security-relevant technical information from the VMs. On the other hand, technical information about VMs influences the rating of the customer at least in the long run: what should the CP think of a customer whose VMs repeatedly create assured security alarms? This again has strong similarities with (Lim, 2013, Nguyen, 2011). The simplest relation between the remaining online time of a VMM until the next cleansing and the guest VMs can be described as follows: in periodic (real) time intervals, the remaining online time is decremented by the sum of all the ratings of all VMs which are active on this server (higher rating means lower trustworthiness here).

SCIT for VMMs and green computing: If several servers in a cluster are automatically turned off during under-utilization to save power (Pinheiro, 2001), this is an ideal environment for SCIT. The

cleansing process can be seen as an extension to power-aware scheduling. Nevertheless the algorithms have to be modified, especially because in SCIT every server has to be taken offline regularly; it is not enough to re-initialize an arbitrary server, as for power-saving reasons.

Heterogeneity / Diversity: When an attacker is locked out because of cleansing, it is very likely that he will try to exploit the same vulnerability again. Attackers will learn to execute their offenses more quickly e.g. by scripts. SCIT may use diversity in software or configuration to additionally discourage the intruder by the fact that (hopefully) only a few systems are susceptible to a dedicated vulnerability and that the majority will not show the same flaw - and the attacker cannot predict where he will end up after a cleansing.

Using different virtualization platforms within one cluster adds problems: problems that can be anticipated with the compatibility of the images and in particular the necessary live-migration between different vendors make this all but impossible. A promising general approach is “Security through Diversity”, by which – instead of the distribution of identical images – every instance is “custom built” (=compiled with randomization of addresses, instructions etc.) and thus unique. (Larsen, 2014, Williams, 2009) provides a good overview of this concept.

“Rating”: SCIT without policies and without diversity can be seen as a kind of “brute-force” mitigation measure, if the analysis within the cleansing process does not result in security-relevant information. Fast individual attacks, as Heartbleed, still are possible even if SCIT includes diversity. Nevertheless, many attacks will need longer to succeed if several variants are not prone to the same flaw. Additionally there is the hope that an attacker (because of SCIT!) "by mistake" also attacks non-vulnerable systems or has to resort to more suspicious behaviour and the reactions of these systems give evidence of the ongoing attack. E.g. a stealth attack on one vulnerable VMM may result in IDS warnings or a denial-of-service (bad enough!) on another VMM.

3.3. Combination of IDPS & SCIT

(Nagarajan, 2011) develops a cost model for IDPS false positives/negatives and combines this with SCIT. The results show that the costs of a false negative are reduced by SCIT; thus the number of false negatives may be increased, rendering false positives more unlikely. We already mentioned that if we want to turn off an attacking VM, the probability of a false positive must be very low. For this reason SCIT can support and enhance the IDPS in our scenario.

4. Conclusion and further Work

The classifications in the text, how long a VMM should be online before cleansing, just show the basic approach. We did not simulate advanced (adaptive) concepts until now; this is ongoing/future work. These calculations also have to integrate the security risk, if an attacking VM is migrated from one physical computer to another, because this may result in a new field of activity for the attacker. Considerations to isolate potentially attacking VMs, if necessary by "putting all the presumably rotten eggs in one basket" have not been investigated yet too.

The paper lists several examples of known attacks against the virtualization layer. And it would be too optimistic that in the future there will be less or even no errors in this area.

The discussion of the selected two security measures shows that both increase security, but it also illustrates their limits. The comments on VMI point out that reliable recognition of zero-day attacks in IPS is still an ongoing major concern. This not only involves topics such as artificial intelligence

or big data, but legal issues as well: threat detection services relying on telemetry data of multiple companies must not compromise their privacy.

The combination of SCIT and diversity is particularly promising. Concentration trends in hardware and software cut costs because the development expenses can be distributed to many customers. But this trend simultaneously promotes a kind of monoculture that renders the use of heterogeneous products more difficult and expensive. Thus our hope is directed towards widespread and extensive use of machine-made automatic diversity. As might be expected, the combination of several measures (in our example IDPS + SCIT + diversity) gives the best overall result. Thus only permanent and continuing efforts and activities of all parties concerned will ensure that the status quo of security is maintained. From a technical view this includes (without any claim to completeness) research and development in hardware security mechanisms, tamper-proof and encryption devices, OS, network, and application security, computer languages and compilers and runtime environments, software testing, algorithms for AI, software design and engineering processes, ... Finally we all are called to arms to maintain security!

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RISKS AND AUDITING OF CLOUD COMPUTING IN HEALTHCARE FACILITIES

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Audit, Cloud Computing, Healthcare, Information System Quality, Outsourcing, Risk Analysis

Abstract

Healthcare facilities use a number of information systems, which differ in their purpose, importance and sourcing. Currently, it is possible to observe the trend of outsourcing and especially Cloud Computing expanding in healthcare facilities in the Czech Republic. This change brings new risks and needs for modifications of existing approaches to audits of services and systems. This paper presents a new framework of Cloud Computing audits based on medical environment specifics.

1. Introduction

In healthcare facilities, information systems are used both for administrative and medical purposes, such as diagnostics, imaging and monitoring. Sourcing of these systems includes both insourcing and outsourcing (including Cloud Computing). Currently, outsourcing is beginning to be used to larger extent even in healthcare, where previously mainly insourcing was used. The current situation on the healthcare Cloud Computing market is demonstrated by projections by Markets and Markets: in 2013, a 20.5% shift towards Cloud Computing was expected (Kar, 2013). C. Hahn, K. Ereğ, J. Repschläger and R. Zarnekow in their study (Hahn, Ereğ, Repschläger, & Zarnekow, 2013) describe Cloud Computing as a kind of outsourcing. Based on this classification, it can be argued that audits of Cloud Computing can be based on the same principles as audits of outsourcing. It is necessary to adapt the way healthcare IS/ICT audits are conducted, however, so that they fully take into account specifics of not only the industry but also Cloud Computing.

The aim of this paper is to analyse risks associated with Cloud Computing in healthcare facilities and to propose a suitable framework of Cloud Computing audits taking into account specifics of the healthcare environment and possibilities of using internal and external audits as a tool for verifying quality of systems delivered and as a possible tool to manage risks. The following research methods were used: firstly, risks of Cloud Computing were identified and analysed on the basis of a literature review and a case study in a Czech healthcare facility; secondly, an audit framework and its key activities were derived. The structure of this paper corresponds to the above.

2. Risk analysis of Cloud Computing in healthcare facilities

Prior to a risk analysis of Cloud Computing, it is necessary to look into specifics of the healthcare environment. The healthcare sector is different from the commercial (manufacturing and services) sector. In fact, it is closer to civil services (e.g. in being strongly regulated). The differences are caused by the following factors, which have a major impact on IS/ICT risks. The following list was compiled on the basis of the literature review (Lee, McDonald, Anderson, & Tarczy-Hornoch, 2009), (Antlová, 2013) and interviews with managers of healthcare facilities during the case study.

- Human Life

According to Maslow's (Simons, Irwin, & Drinnien, 1987) hierarchy of needs, human life belongs to the basic physiological, safety and security needs. These are the most fundamental needs, without which humans cannot satisfy the following levels of needs. Healthcare IS/ICT has become critical to the nursing processes and mainly to the medical processes that directly affect human life. For example, a Picture Archiving and Communication System (PACS) is essential for diagnosing e.g. brain injuries as it provides the necessary data. The example together with (Kunstová & Potančok, 2013) demonstrates that healthcare IS/ICT can have a direct impact on quality of patient care and human life.

- Highly sensitive data

On one hand, it is important to actively deal with protection of patient data due to legal, ethical and moral reasons (Seiner, 2007). But on the other hand, physicians need to share patient data (Lee et al., 2009) to secure sufficient evidence for treatment. Data sharing and transmission among doctors significantly complicates its protection and poses security risks.

- Strong regulation

The healthcare sector is heavily regulated in terms of protection of sensitive data, human health and required level of patient care. Laws and international standards require detailed documentation of medical cases. During the case study, enormous administrative work associated with healthcare records was revealed.

- Huge amounts of data

Radiology and medical imaging departments alone produce up to several gigabytes of data per day. Such volume of data must be processed, stored, distributed, displayed and archived efficiently taking into account prioritization of individual departments.

- Flat rates and costs versus revenues of individual cases

Majority of healthcare facilities in the Czech Republic (especially hospitals) are financed through flat rate payments which are based on a reference (previous) period. Final financial statements are usually carried out with a month or a year delay. (Gygalová, 2009) Due to the system of flat rate payments from health insurance companies, which are based on reference periods, it is also difficult to monitor costs versus revenues per case (patient).

- Prejudice

A number of physicians, other healthcare professionals and patients still have a very negative attitude towards and prejudice against using new technologies (IS/ICT) in the healthcare sector.

The risk analysis was carried out as a part of the case study in a medium size (Feige & Potančok, 2013) healthcare facility, a Czech hospital. During the case study, interviews with the senior managers, the IS/ICT executives, the patients and the hospital staff were conducted. The length of the interviews ranged from 30 minutes to 1.5 hour. The beginning of each interview was unstructured, followed by a semi-structured part. In the risk analysis, the specifics of the healthcare environment (see above) played the essential role. The following risks were identified and sorted by relevance with the assistance of management and staff of several healthcare facilities in the Czech Republic using the method of paired comparison (Černý & Glückaufová, 1982).

- Leakage of sensitive data

As described above, patients' data and diagnoses are very sensitive. When using Cloud Computing, at least a part of IS/ICT is transferred to a third party. Transmission over the Internet is usually used. For a more detailed picture of the risks arising from transfers to third parties, it is suggested to first analyse the internal environment (especially the data life-cycle), and subsequently to look at the external environment (GrantThornton, 2013). Data security is defined by several standards; in healthcare it is for example (AICPA, 2013) or (HHS, 2013a).
- Dependency on the Internet connection and its quality

Cloud Computing is extremely dependent on the Internet and requires a very powerful connection. It is necessary to realize that high real-time availability of data is necessary for healthcare facilities (because this data is used during operations and treatments).
- Impact on the processes (medical and nursing)

Medical and nursing processes form the core processes of each healthcare facility. Quality of patient care and in some cases human lives as such depend on them. Cloud Computing can have an adverse effect on these processes. For example, processing time in radiology and medical imaging could be extended due to longer response times caused by outsourcing PACS systems using Cloud Computing.
- Dependency on a provider

By using Cloud Computing, healthcare facilities lose a certain degree of control over IS/ICT. The extent of loss depends on the degree and type of a selected Cloud Computing solution.
- Transformation of IS/ICT operation and organization

Changes to IS/ICT operation and organization caused by using Cloud Computing may be too large and difficult to grasp for healthcare facilities. (Rodney, 2012)
- Change or return to the original state

Currently, in the field of IS/ICT, it is not possible to freely change providers and forms of Cloud Computing (and even sourcing strategies).
- Conflicting priorities and different business cultures

Conflicting priorities of medical staff and members of staff focusing solely on IS/ICT can cause problems in perceptions of patients and their health priorities.

3. Audit of Cloud Computing in healthcare facilities

As mentioned above, the main aim of this paper is to present internal and external audits as a tool for verifying quality of delivered systems and as a possible tool for managing risks. When reviewing literature, it is possible to look into more general approaches (audits of outsourcing), because Cloud Computing can be classified as a type of outsourcing (see above).

In the following section, an audit is defined as *"objective verification of status, phenomenon, intention, and reality compared with the desirable situation or phenomenon (model, norm or standard). Audits are carried out by an expert – an auditor, the result is a comprehensive feedback by the auditor. An audit is one of the management tools."* (Svatá, 2011) This general definition is fully sufficient to apply to IS/ICT audits and to be used further on. An audit can be further classified as internal or external depending on a person (entity) performing it. Apart from performing persons (entities), it is necessary to take other distinguishing criteria into account: these include audit objectives, and inclusion of areas and persons responsible for correction.

In his paper *You Can't Outsource Control* (Zarrella, 2008), E. Zarrella states impacts that outsourcing expansion has on auditors. According to the author, auditors must properly perceive how the business has changed as a result of IS/ICT outsourcing. Many other papers, for example (Sayana, 2004) and (Ross, 2001), react to the changes in IS/ICT sourcing and point out the need to standardize audit instructions (directives) for outsourcing, which should differ from instructions for audits of insourcing. It is important to realize that audits of outsourcing must contain all essential elements of a proper audit. *"An IS audit of outsourcing involves all elements of an IS audit, including application security, network security, physical and environmental security, system administration and business continuity planning."* (Sayana, 2004)

Audit organizations and associations have reacted to the growing market of outsourcing services. The Information Systems Audit and Control Association (ISACA) currently provides guidance in the *IS Auditing Guideline: G4 Outsourcing of IS Activities to Other Organisations* (ISACA, 2008). This guideline together with other guidelines, standards and procedures is a very important source for all auditors. In addition to ISACA, audit standards are also published by the Institute of Internal Auditors (IIA). As its name suggests, IIA focuses primarily on internal auditors, and thus together with the above mentioned guideline these standards make the coverage of standards relevant for this paper complete. IIA sets out standards for auditing IS/ICT outsourcing in its *Global Technology Audit Guide 7: Information Technology Outsourcing* (Mayurakshi & Ramaswamy, 2007). The American Institute of Certified Public Accountants (AICPA) has published a standard, *Statement on Standards for Attestation Engagements No. 16 (SSAE 16)* (AICPA, 2013), which has replaced *Statement on Auditing Standards No. 70 (SAS 70)*. This standard focuses on organizations providing services (such as outsourcing and Cloud Computing) and forms a basis for audits of data security, because it defines elements of protection. In addition to the above mentioned official guidelines, a number of recommendations and general procedures exist. They focus mostly on a specific area or do not cover IS/ICT audits in such width and depth, but they can be used to design audits or solutions for specific areas. For example (Sayana, 2004) summarizes relevant issues and points out the most important activities of an audit. The Committee on Computer Audit has published a checklist of necessary audit requirements in the banking sector (CommitteeOnComputerAudit, 2002), which includes 15 areas of an audit together with their benefits. General audit procedures are also described in (Svatá, 2011) or (Cascarino, 2012).

General guidelines, standards, procedures, and papers are extended and specified from within each particular industry, in this case by the healthcare sector. *The Health Insurance Portability and Accountability Act of 1996 (HIPAA)* (HHS, 2013a) regulates health data management

in the U.S. applying to data in both paper and electronic form. It defines three categories of safety measures (administrative, physical access and technology) with specific requirements (HHS, 2013c); and also its own audit rules and requirements. These are precise rules for audit processes and reporting (HHS, 2013a). *The Health Information Technology for Economic and Clinical Health Act (HITECH)*, which seeks to promote healthcare IS/ICT, is very closely linked to HIPAA. Paragraph D (on privacy and security risks) of HITECH is especially important for privacy and security audits (HHS, 2013b), because it defines 4 categories of violations ((A) Did Not Know; (B) Reasonable Cause; (Ci) Willful Neglect – Corrected; (Cii) Willful Neglect – Not Corrected), penalties and periodic audits with its purposes. *"The Secretary shall provide for periodic audits to ensure that covered entities and business associates that are subject to the requirements of this subtitle and subparts C and E of part 164 of title 45, Code of Federal Regulations, as such provisions are in effect as of the date of enactment of this Act, comply with such requirements."* (3LionsPublishing, 2014) The Association of Healthcare Internal Auditors (AHIA) has prepared *AHIA Auditing and Monitoring Framework – Seven Key Components* (Weatherford, 2004), which defines audit requirements and emphasizes auditor independency from the particular department or area. If a healthcare facility is not subjected to the above-mentioned laws and frameworks, it still should carry out audits of medical records. In such a case, audit tools and scope should be set internally by healthcare facilities themselves. *"Audit tools to monitor quality of records should therefore be defined at a local level and should serve as a basis for evaluation and discussion. Audit tools and systems should primarily focus on serving the interests of your patients/clients rather than on the convenience of the organization."* (ČAS, 2008)

The most important activities of a Cloud Computing audit have been compiled on the basis of instructions (directives), the literature review and the interviews with management of healthcare facilities during the case study. The purpose is to define essential steps of a Cloud Computing audit in healthcare. Detailed elaboration depends on specific requirements of a particular audit.

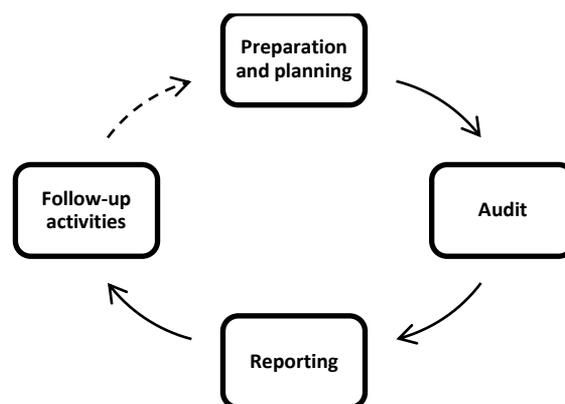


Figure 1. Cloud Computing audit procedures in healthcare facilities

Preparation and planning

Prior to preparation of an audit, it is necessary to conclude a contract. (Weatherford, 2004) Definitions of the audit purpose, scope and objectives are the essential parts of the contract. Mutual communication between the auditor, the healthcare facility and the Cloud Computing provider is crucial for the audit.

The auditor must be familiar with the nature and extent of IS/ICT outsourcing and must take into account the specific requirements imposed on healthcare facilities (see above) by stakeholders (such as the state and its laws). The case study has shown that the extent to which systems are outsourced and the importance of the outsourced systems should be considered as well. It is

necessary to determine contractual possibilities to carry out internal and external audits (ISACA, 2008), which should be done by lawyers. Before starting the actual audit, it is necessary to prepare tests to assess functioning, security, and financial aspects of IS/ICT and evaluate the risks listed above with the greatest emphasis on data security and continuity of main healthcare processes. Within the phase of preparation and planning, relevant previous audit reports should be requested in order to maintain continuity and to enable evaluation of the follow-up activities.

Audit

IS/ICT audits require cooperation between the auditor and the provider. If they are not willing to cooperate, it is necessary to inform the management and propose a modification of the following procedures. Note that according to (Zarella, 2008) human relationships between all parties involved are more important than contractual arrangements in this phase. The auditor must verify (ISACA, 2008) existence of formal contracts, contractual provisions on possibilities of auditing (internal and external) and monitoring the services provided; SLA existence and mechanisms for its monitoring and events reporting; security policies in connection with risk management; and adequacy of the provider's capability to continue operations in case of a disaster (which is very important due to the above-mentioned specifics and health risks). The audit further verifies if goals (functions, security, cost-effectiveness, etc.) are being fulfilled, whether there are no negative impacts of using Cloud Computing and whether the IS/ICT strategy reflects the specifics of outsourcing (Sayana, 2004). The defined tests (see the preparation and planning phase) are performed as a part of the audit. The auditor works with the risks and related measures and identifies changes in the risks.

Reporting

This phase involves creation of a final report (in a format meeting the audit requirements). The final report should include (ISACA, 2004) findings, conclusions and recommendations with justifications. It is also necessary to mention all limitations to the audit. Prior to final submission, the report should be consulted with the IS/ICT service provider (an internal IS/ICT department or an external partner). (ISACA, 2008)

Follow-up activities

Follow-up activities are even more important than the conclusions of the audit as they lead to corrective and improvement actions. In this respect, internal audit results play a more substantial role in these activities thanks to internal audits' inherent characteristics.

The auditor should request information relating to the final report from the user and the provider. Consequently, it should be verified whether necessary follow-up steps have been taken in the scope, quality and time required in the final report (ISACA, 2008). It is very important to re-train employees in order to learn from the audit. (Weatherford, 2004)

4. Conclusion

The aim of this paper was to analyse Cloud Computing audits in healthcare facilities taking into account risks and possibilities to use audits to improve IS/ICT quality.

Healthcare imposes very specific requirements on IS/ICT because its top priority is quality of patient care and human health. It is a discipline that uses a significant amount of information systems and data for its operation. The results of the case study confirm that Cloud Computing and IS/ICT outsourcing are used in the health sector in the Czech Republic. The expansion and introduction of Cloud Computing poses new risks that are closely connected to the specifics of the

healthcare environment with leakage of sensitive data, dependency on the Internet connection, and impact on key processes (medical and nursing) placing at the top of the assembled list of risks.

This paper identifies the most important activities of a Cloud Computing audit and their sequence. The analyses show that audits taking into account the specifics of Cloud Computing can be used as a tool for assessing and improving quality of IS/ICT. Internal audits should be primarily used for this purpose.

Applicability of the results is twofold. Firstly, auditors, Cloud Computing providers and healthcare facility management are able to employ the defined activities within individual audits with possible benefits for patient care quality. Secondly results may be used in further research. It is still necessary to address related topics, such as HIPAA in terms of Czech healthcare facilities or optimal audit settings for different sourcing strategies.

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**THE STATE OF ICT – ITS TRENDS AND
DEVELOPMENT BOTH ECONOMICALLY AND
TECHNOLOGICALLY**

THE STATE OF ICT: SOME ECO-TECHNOLOGICAL ASPECTS AND TRENDS

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Abstract

We are witnessing and benefiting of advantages of the remarkable ICT evolution. A development hardly matched by any other technological advance both in depths as well as in the lateral dimension.

In spite of all doomsday prophesies and prognosis ICT is moving ahead. Just over the last 20 years only, CPUs improved by a factor 2400, DRAM's by 1000 and NAND Flash by 32000, paralleled by an increase in network speed by a factor of 840 and Internet traffic by a an annual CGR of more than 30 %. Can this continue?

We shall review the status of R&D in its quest for solutions, some of the challenges ahead, the desired innovations, and the economic consequences of this drive. Will future investments into technology be sufficiently rewarding and economically feasible?

The advancements mentioned are inseparably from the R&D efforts of the key players and their strategy, we will look at the changes now reshaping the scenario.

A new generation of consumers and the first generation of digital natives has arrived and shaping future markets, applications, and reciprocally being shaped by them.

ICT is penetrating, fertilizing and empowering new areas as energy, photonics, health, and medical applications creating by their weight future markets and R&D directions.

Finally we will complete our review be perusing the status of the development of "more than Moore (MtM)" as well long range options.

1. The Eco -technological SCENARIO

A new ecosystem has emerged during the past decade

- the aggressive bi-annual introduction of new semiconductor technologies allowed ICs to be produced cost efficiently, to integrate extremely complex systems on a single die or in a single package at very attractive prices,
- Manufacturer of ICs offering foundry services were able to provide new ASIC's at attractive cost leading to the emergence of the profitable new businesses as "design only" houses.
- The development of sophisticated equipment for advanced ICs proliferated to adjacent technology fields and thus enabling the realization of flat displays, MEMS sensors, radios, and areas as medicine, energy etc.

- Internet and the rise of mobiles led to extensive deployment of fiber cables and multiple wireless technologies ranging from communication satellites to thousands of repeater stations.
- Internet of things inspires many innovative product houses, ITC companies, data- and information distributors, battling now for dominant position in this newly created market.
- All this facilitated the creation of unexpected markets as the social NWS.
- Up to 40% of the global productivity growth of the last two decades has been attributed to the impact of ICT.

From a technological point of view, the scenario looks as below:

The first era, until the last decade was the era of classical geometry driven scaling.

The second era, the era of equivalent scaling, supported the growth of the semiconductor industry in the past decade, and will continue to do so until the end of the present decade and beyond.

Significant R&D efforts are concentrated on improving device performance by use of III-V materials and Ge (higher mobility than Si).

2D scaling will reach its limits very soon, but both logic and memory devices are entering the third era, the era of 3D scaling.

SOC and SIP products have become main drivers and the total volume of smart phones and tablets surpassed production volume of microprocessors in the past years thus shifting dramatically the emphasis of the industry.

MEMS have become an indispensable part of cars, smart phones, and video projectors, tablets, games platforms, inkjet printers.

These advances are shifting in sight advances ranging from robots (from household assistance to personal care and prosthetics) to the futuristic enhancement to the muscle memory by wearable computers.

1.1. How did the Industry fare

We shall review the situation of some key players based on the recent facts and figures as the 2Q14 results, their 2013 annual and the SEC reports.

We see a Janus-headed picture, the contribution of ICT to growth and GDP and the rising question:

1.2. Will economics doom Moore's law?

While many trends appear positive for the continued applicability of Moore's law from a technological perspective, economics could prove its undoing. Recent developments indicate that the economics of continued miniaturization could break down as cost-per-transistor reductions flatten for nodes with feature sizes below 28nm, because of the rapidly rising costs of technology development and capital equipment needed to produce next-generation nodes. The extreme investments required for leading-edge lithography technologies and the process complexities required for nodes at 32nm and 28nm and below, drive these cost increases.

Moving from 32nm to 22nm nodes causes typical fabrication costs to grow by roughly 40 percent. It also boosts the costs of process development by about 45 percent and chip design by up to 50 percent. These dramatic increases will lead to process-development costs that exceed \$1 billion for nodes below 20nm. In addition, the state-of-the art fabs needed to produce them will likely cost \$10

billion or more. As a result, the number of companies capable of financing next-generation technology will likely dwindle.

2. Technology

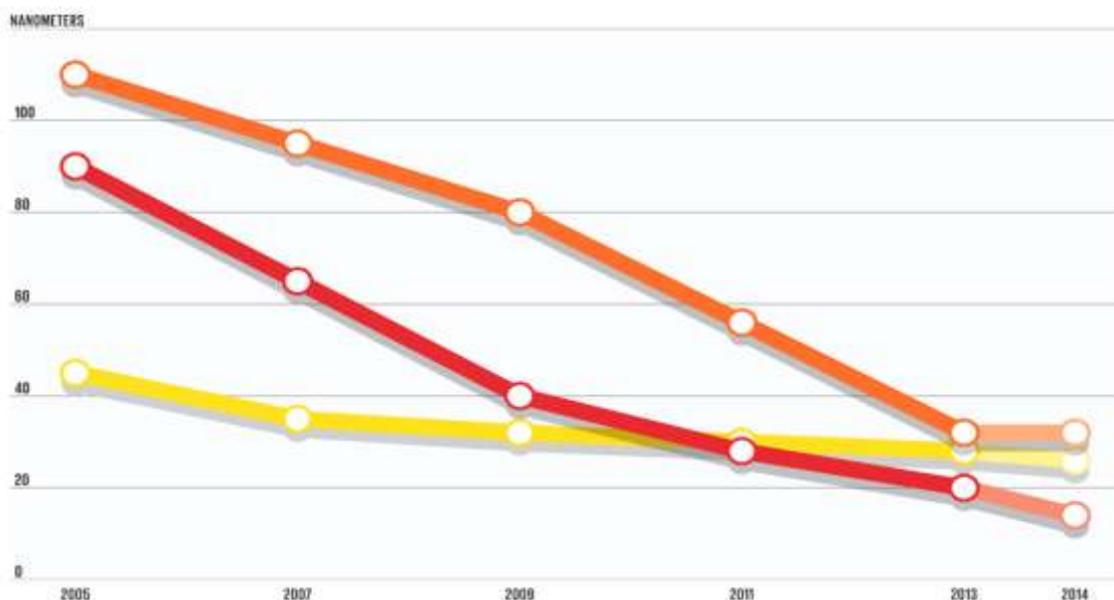
Heterogeneous system integration of multiple technologies in limited space (GPS, phone, tablet, Mobil etc) has revolutionized the semiconductor industry shifting the emphasis from performance driven to reduced power.

Since most of energy is lost in metal interconnects, photonics may offer the solution.

Not only the internal but also the macro-power consumption becomes a challenge. In 2008 1.1Petaflops (10^{15}) computing consumed 2,8MW power, extrapolating to Exascale (10^{18}) might dissipate 2,3GW (~ two nuclear plants).

2.1. Logic

To maintain the dynamic performance increases in the last decade innovation in device structures and new materials had to be invented as Cu/low-k dielectric at the 120nm technology node, SiGe source/drain for the 65nm node and metal electrode/high-k dielectric gate stacks replacing poly-Si/SiO₂ gate stacks at the 45nm node. However, the node name is losing its previous significance as shown below.



Pic. 1: GlobalFoundries

Key chip dimensions, such as the transistor gate length (low, yellow) and the metal one half pitch (top, orange) have decreased but not strictly tracked the node name (middle, red).

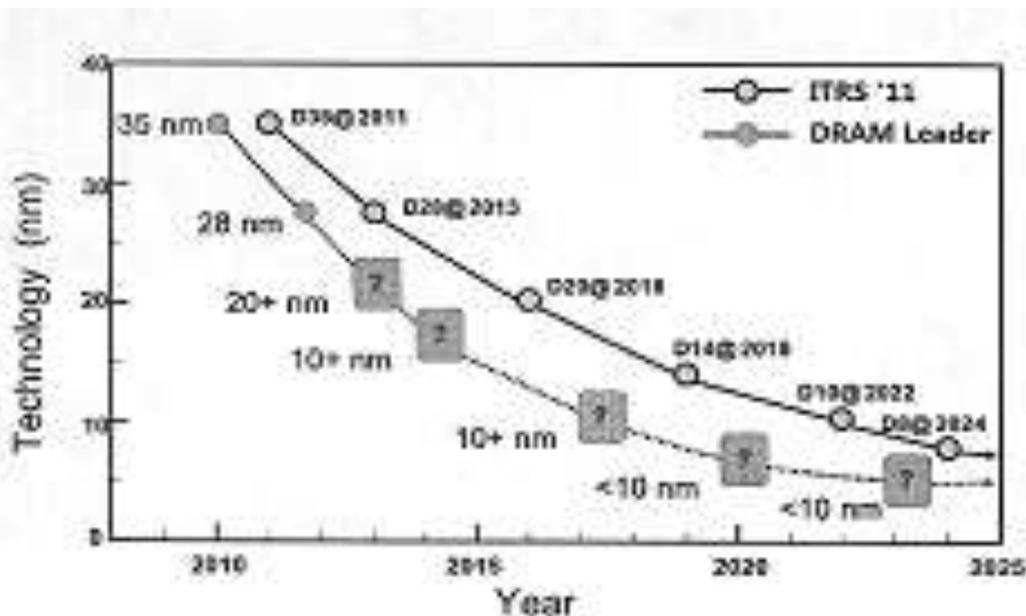
The performance of an MPU executing program is limited by the interaction between processor and memory - the current approach to increase the MPU cache is increasing the floor space that the SRAM occupies on an MPU chip. However, this leads to a decrease of the net information throughput. CMOS logic beyond 2018 will replace strained Si MOSFET channel with an alternate material with higher mobility as Ge, SiGe a variety of III-V compound semiconductors and graphene.

This leads R&D efforts to the areas of high mobility III-V materials or Ge channel materials to enhance the electron / hole mobility and enable power reduction. A few materials have emerged as front-runners for the two kinds of transistors needed for logic circuits. For the positive-channel field-effect transistor (pFET), the leading candidate is germanium, which can transport charge four times as fast. For the negative-channel FET, or nFET, which depends on the movement of electrons, engineers are considering a mix of elements from groups III and V of the periodic table. One of the most promising is indium gallium arsenide (InGaAs), with an electron mobility of more than six times that of silicon.

Emerging research materials include memory and logic devices, as the mentioned planar p-III-V, n-Ge, nanowires, graphene, and other 2D materials, complex metal oxides as well as emerging lithography and approaches novel molecules to enable ultimate patterning and DSA (Directed Self Assembly).

2.2. Memory

DRAM density has doubled every 18 month but downscaling to the sub10nm will represent a major challenge. Downscaling from 90 to 20 nm was possible by structural changes. It is crucial to maintain important criteria of minimum cell capacitance to have an adequate signal for sensing and reasonable retention times.



Pic. 2: ITRS and DRAM supplier

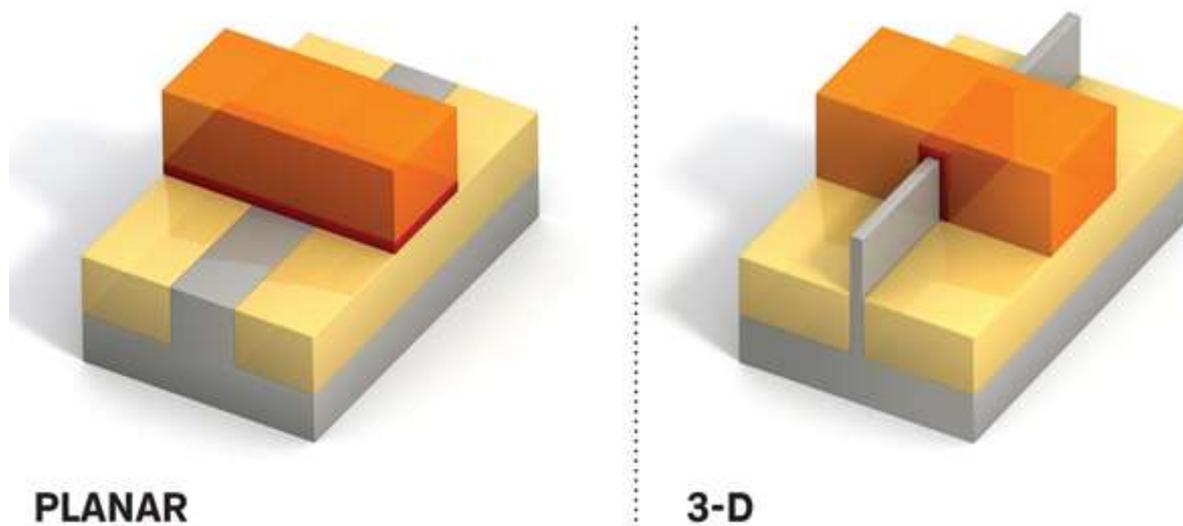
2.3. Architectural Concepts

Future 3D technology architectural concepts encompass 3D dense packing for interconnects, fluid cooling, and power delivery of energetic chemical compounds transported in the same fluid with little power for pumping.

Interlayer cooled 3D chips could thus solve the cooling bottleneck thereby allowing stacking of several stacks, but are still limited by power delivery and communication. Electromechanical power delivery would eliminate the electrical power supply network thus freeing valuable space for

communication. By 2025, chip stacks with embedded liquid cooling are expected. In the future by 3D and minimal power consumption supercomputers may shrink to the size of a sugar cube.

Today supercomputers use 10000 times more energy than brain with 20W. Some optimists infer by scaling up chips stacks even biological efficiencies can be reached by 2060. For sub-10 nm structural innovation this may not help due to the physical limitations for complex 3D structures (the distance between electrodes becomes 10nm or less, which means thinness of 5nm or less for storage electrode and dielectrics). With the optimization of the 3D cell storage capacitor and array transistor DRAM, downscaling to the sub-10nm regime is anticipated, nevertheless patterning technology as etching, and lithography will become critical and the productivity of these technologies remains a major concern.



Pic. 3: Planar and 3D (Intel)

Chipmakers are in the process of moving from traditional planar transistors. Intel introduced these 3D transistors and is now shipping them widely. Leading foundries, such as GlobalFoundries, Samsung, and Taiwan Semiconductor Manufacturing will switch to 3D with the next generation.

The chip industry has made it a priority to keep up the pace ensuring that manufacturers can continue to build and release new product families using a new process every 18 to 24 months, thus leaving no time to explore design optimization to cut down on power or boost performance.

In few years, chipmakers may face a struggle with wiring as they attempt to push chip density down past the 10-nm generation. Each copper wire requires a sheath containing barrier material to prevent the metal from leaching into surrounding material, as well as thick insulation to prevent it from interacting with neighbouring wires. This thickness limits. The thrust for smaller DRAM cells will face great technological and economical challenges because of severe charge leakage and calls for non-charge-based memory devices.

2.4. Emerging computing devices

The basic architecture has remained unchanged for decennia. With the introduction of multi-core systems, redesign became inevitable leading to reduced power consumption, the minimization of wasted cycles, and bandwidth.

The rapid evaluation of emerging memory technologies as MRAM and ReRAM in combination with logic devices would allow more flexibility in circuit design, and faster revision and product

cycles. Post NAND devices are studied using the technology of ReRAM a resistive material acting as the memory element and with a control element acting as the switch, Ta₂O₅/TaO_x bi-layer structure offering 10¹² cycles of endurance and a 10 years retention time with fast program and erase pulses in the order of 10ns are promising R&D targets.

One of those promising devices is the STT-RAM (spin transfer torque magnetoresistive random access memory). This promising technology uses the MTJ (magnetic tunnel junction) tunneling for resistive storage and MgO as tunnel barriers. MRAM means that the devices change resistance under magnetic influence built of ultra small magnetic sandwiches of magnetic and non-magnetic materials; they are very dense, very cheap, and durable requesting no permanence power on. It is likely that we will see Spin Transfer Torque Magnetostatics (STT MRAM) and ReRAM in next 5-10 years period.

A further prospect is that PCM (Phase Change Memory) memory will replace flash storage, because PCM chips are fast (1-2 nsec respond times) and low cost in production.

2.5. Lithography

Whether Moore's law will continue depends on technological developments, especially in the critical areas of innovation lithography tools, especially for extreme-ultraviolet (EUV) lithography technology, using short-wavelength light sources to scale feature sizes below 10nm.

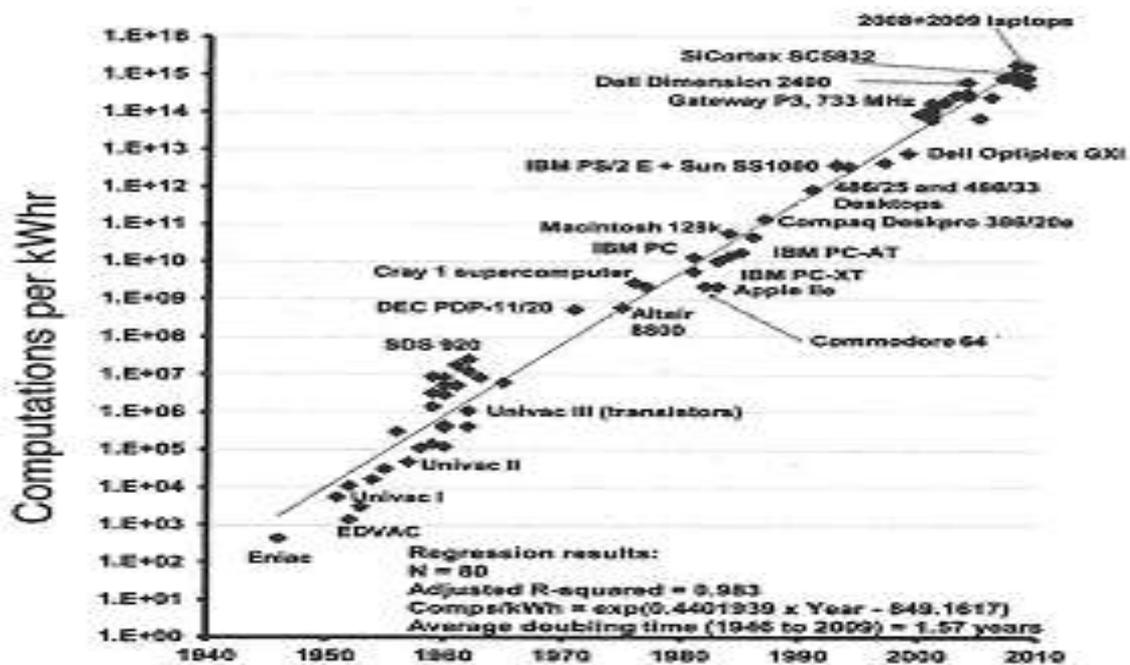
Lithography is an important potential source of productivity improvements in semiconductor manufacturing. An opportunity to improve is to increase the wafer size. This explains why several companies are working toward semiconductor wafer sizes of 450mm wafers.

However, complex lithography approaches like multipatterning carry a high price. As a result, the percentage of corporate capital spending allocated to lithography rose to an estimated 24% for 2010–15 from less than 20 % in 2000–05. Per-layer costs and accompanying complexity levels are exploding for double and multipatterning. For instance, moving to 22nm with double patterning, from 32nm ArF immersion, could double the number of process steps per layer, depending on the product, and raise costs per layer by 50 percent. This could lead to a breakdown of Moore's law as the cost advantages of scaling disappear.

A technological innovation that could overcome these challenges is extreme-ultraviolet (EUV) lithography. This technology uses new light sources with a wavelength of 13.5nm. The industry expects EUV to reduce per-layer costs because fewer steps will be needed. Double patterning, for example, can require more than 30 patterning steps per layer, but EUV will likely need just 10, with resulting cost-per-layer advantages estimated to be as high as 35 percent. In addition, EUV promises to deliver node sizes of 10nm and below.

EUVL is not production ready because of unsolved technical issues, as the lack of a light source with sufficient power and stability, fast resists, defect-free and high flatness masks. However, recent developments suggest the industry is moving to make EUV commercially feasible.

Scalability of the power efficiency is a crucial feature. The picture below shows that computation/kW follow a pattern similar to Moore's law hand with the decrease of the printed feature size.



Pic. 4: Moore's law for computation /kW, ASML

Another technical option DSA (Directed self-assembly) has shown progress but defectivity and positional accuracy still needs to be improved considerably but seems to be possible.

2.6. Technological cross fertilization and lateral empowerment

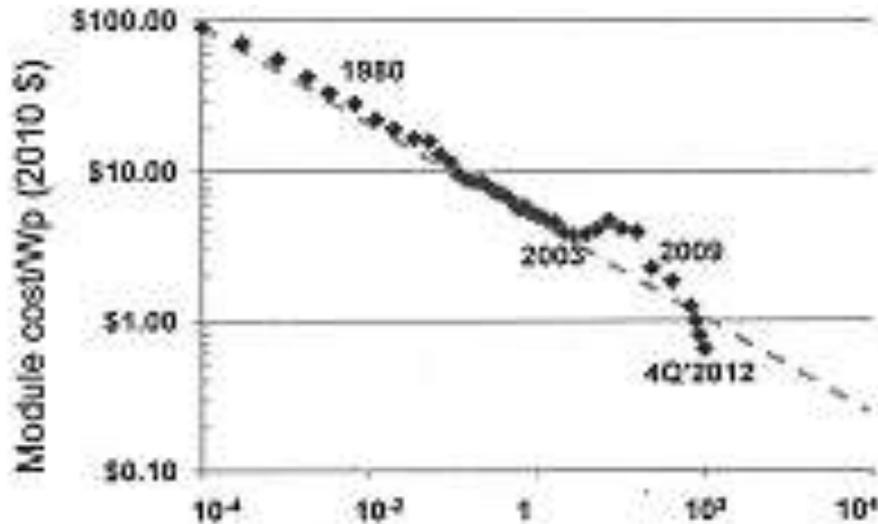
Advanced materials will allow spintronics, III-V and even graphene based integration into Si devices and also integrating Si into electro photonic ICs, enabling energy saving devices, solid state lightning, and power electrics and on-chip optical connections among others.

This technology transfer will insert new power and opportunities collaterally into areas as health, energy and medical applications ranging from ultra fast DNA sequencing, medical imaging devices, low cost - high efficiency light sources etc. These applications may conquest a significant part of the future semiconductor market and change the market in the coming decade, as not long ago the portable devices did.

2.6.1. Solar cells

This industry has grown over 25% in recent years with crystalline Si solar cells are holding 90% of the market. The current efficiency for cells and modules is in the range of 13- 21 % (presently the highest cell efficiency demonstrated is 24,7% at Univ. of NSW) but this could not be commercialized due to the high wafer and process cost.

The most urgent task is resolving economic i.e. issues lowering investment cost and reaching grid parity.



Pic. 5 : Silicon Photovoltaics , Appl. Mat. Inc.

2.6.2. Silicon technology and photonics

Future Exascale systems, as multicore systems, will require high speed and energy efficiency. This means extending optical interconnects from rack to rack of today to tomorrow's board to board and further to chip-to-chip interconnects i.e. enabling Si photonics integration for Exascale computing, realistic 3D and holographic images.

Since the computational power of processors continuously nearly doubles every year, Ultra fast Nanophotonics Devices for Optical Interconnects have become an intensive research target. To match the power of processors, the related bandwidth demand the single channel bit rate must increase 20 fold every decade in all major electrical and optical interconnects and interfaces. The core networking speed must increase 100-fold in the same period, which requires a five-fold increase in the number of channels per link.

Even the modern 10GB/s copper based links become too bulky and power consuming thus making a shift towards optical interconnect necessary. Modern supercomputers as the IBM blue Gene Power 7 systems and others employ about 5 million optical links each operating at 10Gb/s to reach 10 petaflop. The number of optical links/per supercomputer increases hundredfold every 3 years, so its performance will be defined by optical interconnects.

2.6.3. Advanced Si based image sensors

Another trend is the 3D image capturing capability, providing depth information along with the image by time-of-flight technology. IR emitted by a camera and reflects back; by measuring light travel time, it is possible to calculate depth information. Unfortunately, the trend for as many pixels as possible means smaller pixels and therefore more cross talk and a signal to noise ratio decrease.

2.6.4. Si technology and health

Healthcare has benefited immensely from Si technology in the past years. The current line of thinking in medicine is called 4Ps (predictive, preventive, personalized and participatory). Here does ICT again come in. Examples are devices monitoring potential of health risks or improving medical diagnostic imaging. A key requirement is ultra low power vital signal sensing for ECG, blood pressure, glucose level etc. The discussed ICT developments would support improved

medical imaging, ultrasound on Si, X ray detectors on Si, direct conversion of X rays into electrical signals, needing less radiation or third generation DNA sequencing.

2.6.5. The Mobil Optical communication

Optical NW delivers today 98% of telecommunication traffic today, in the last 20 years transmission capacity increased by a factor 1000, but to meet the future demand another thousand-fold increase over the next 20 years will be required. Transmission speed defines NW transmission capacity, the NWs bandwidth requirements are determined by its load architecture and protocols. The development of intelligent NWs might help to reduce the NW s traffic load but the demand for NW capacity will soar further. Nevertheless, projections promise that optical communications could to meet the challenge.

2.6.6. Neuromorphic devices

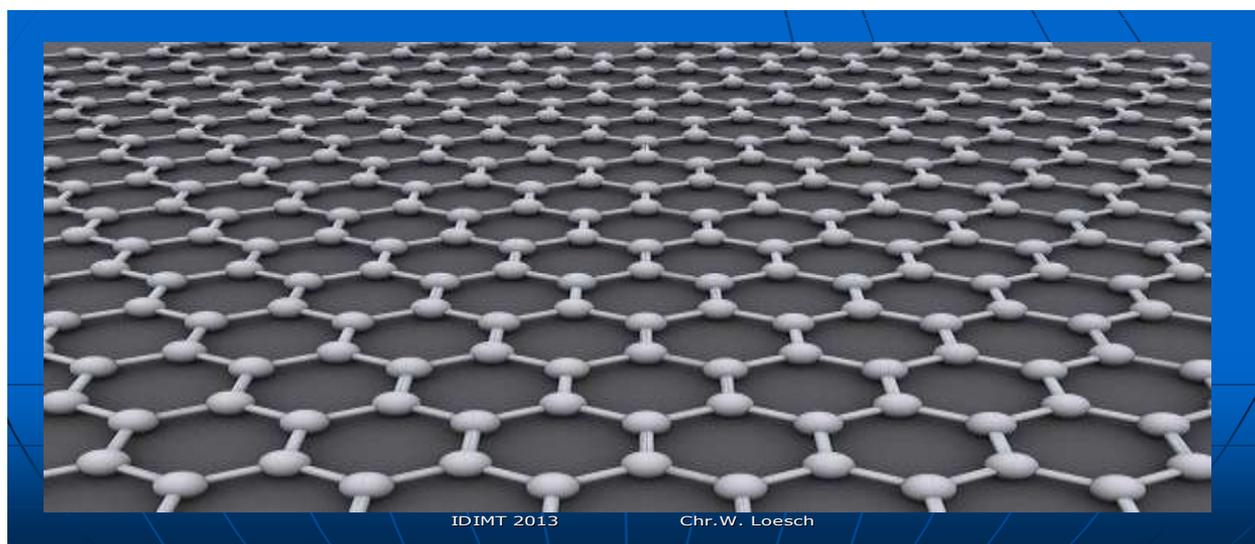
The expression Neuromorphic devices refers to analog/digital VLSI devices and programs that allow mimicking neural system for perception, control sensory processing and decision-making. Neuromorphic VLSI chips mostly use an integrate and fire spiking neuron model, computing from inputs in the sub-threshold area and emit sparse high voltage pulses for cell-to-cell communication.

Problems are still the unavoidable transistor variability due to fabrication process, wiring large numbers of neurons a N neuron chip requires N^2 wires for independent paths to be fully connected, or the implementation of synapse (biological structure passing signal from one neuron to another) and its updating. A special feature is that the “synapses weight” can change over time so that the brain learns.

2.7. NANOTECHNOLOGY from Nanotubes to Graphene

As discussed in preceding sessions, nanotubes have a plethora of outstanding properties ranging from less energy needed to change the state, to its superiority in dissipating heat due to its higher thermal conductivity, leading to more and denser chips.

However, there are other materials comparable even more attractive as graphene.



Pic. 6: Graphene layer

2.7.1. Graphene

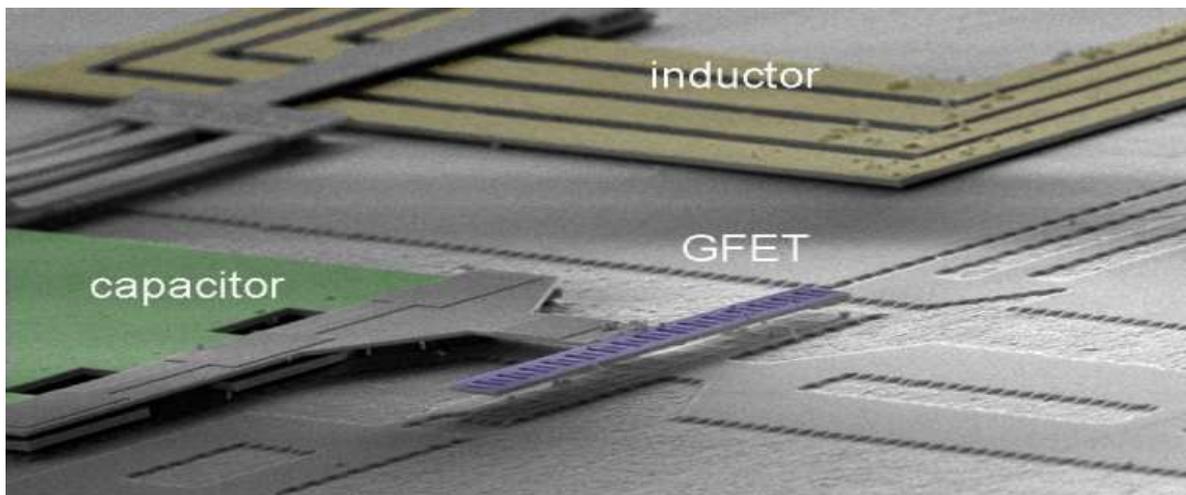
Information processing consists of three functions, realized with three classes of material: processing with Si transistors, communication with photons using compound semiconductors (mainly InAs, InP and GaAs) and storage with ferro-metals. Such a subdivision is inefficient and by the dependency on some rare materials as In exposed in the long range. Graphene and in particular graphene dots may offer an alternative. There exists a special class of graphene triangular quantum dots with zigzag edges, which fulfill all three functions, needed.

Graphene can be used as an improved but already existing device, but with the additional properties of graphene triangular quantum dots and the possibility of integrating electronic, optical and magnetic functionalities at a single platform thus creating a carbon only IC. Again developing control over size, shape and edges with atomic precision will be a challenging task.

Graphene well known for its strength and conductivity can also convert IR into electrical signals (photodetectors). Conventional photodetectors on Ge convert only a limited range of wavelengths according to their energy band but graphene has no bandgap this means that all wavelength are suitable, additionally it is cheaper as Ge and easier to incorporate into chips. However, today it is not very efficient needing a 50-100 fold improvement.

Another graphene-based application emerging is the graphene-based wireless transmission module.

IBM created a wireless module out of graphene which could transmit on a 4,3 GHz frequency.



Pic. 7: GFET, Source IBM

IBM added a GFET onto an integrated circuit thus enabling this circuit to transmit. This could be a prototype of a high performance, ultra compact and cheap communication system.

3. Further Trends - a Scenario

3.1. Consumerization of business technology (Megatrends at CES 2014)

- Wearable computing
- Seamingless integration into daily life
- Moving away from wrist and face

- Health and fitness gain popularity
- Increased focus on design for better user appeal
- Contextual computing (predictive computing)
- Mobile as high priority and wearables as next phase
- IoT (Internet of Things)

3.2. Quantum Computing

Responding to many questions and after many years of hope and promises, a review of the state of QC (quantum computing) may be appropriate. The idea of QC is to store information in the values of $2N$ complex amplitudes describing the wave function of N two-level systems (qubits) and process this information by applying unitary transformations (quantum gates), that change these amplitudes in a precise and controlled manner.

The value of N for a useful machine is estimated to be in the order of 10^3 or more. ($2^{1000} \sim 10^{300} \gg$ number of protons in the universe). This means that 10^{300} continuously changing quantum amplitudes must be followed closely and the random drift caused by noise, gate inaccuracies, and unwanted interactions etc. suppressed. Fault tolerant computation using error-correction may provide the solution to the problem.

The “threshold theorem” says that once the error/qubit/gate rate falls below a certain value ($\sim 10^{-6}$ to 10^{-4}) indefinitely long quantum computation becomes feasible. Theorists claim that the problem of quantum computing error correction can be solved, at least in principle, and physicists and engineers need only find good candidates for qubits and an approach to achieve the accuracy required by the threshold theorem so all hopes rely on the threshold theorem.

Another question is the applicability of quantum information processing. Large QCs may be able to address special tasks only as factoring cryptographic system (but cryptography that not depending on factoring cannot be broken). It appears that the simulation of strongly interacting quantum system is the meaningful application of QC systems.

During the last 20 years, many unfounded promises have been made and people became saturated by frequent announcement of “breakthroughs”, all the tenure positions in QC are already occupied, the proponents are getting old and less zealous but literature activity remains very high.

3.3. AI - the Era of Modesty?

Since 1952 when Turing asked the his famous question, new slogans as formal logic, connectionism, neuronal NW, genetic programming, statistical interference, fuzzy logic etc. came up but hopes were disappointed. The expectation level may have been too high.

It would be misleading to expect a big AI moment in history, rather it may rather become gradually a part of everyday life (appliances, devices, transport and will become connected to the internet).

However, investments as Google acquisition of Deep Mind for 400 mioBP or IBM’s 1Bio\$ Watson efforts prove the ongoing attention and determination to persue this R&D direction further.

3.4. Cognitive Computing

Cognitive computers have a number of characteristics different from today’s computers. One is that they learn patterns and trends. They no longer require reprogramming by humans for all the tasks

we want them to do. Secondly, cognitive systems interact with people in a much more natural way. They understand our human language, recognize our behaviours, and fit more seamlessly into our work–life balance - and that will change how humans and computers interact. Will IBM’s Watson usher in as a platform to help with decision-making? Watson has a lot to learn, this may be exactly the point. The system learns patterns, learns outcomes, and learns what sources to trust. Some journals, some doctors, are more accurate than others are.

How does the latest Watson compare to its predecessor? Three times as fast and about a quarter the size of the original system. Some through hardware optimization but as well the underlying learning algorithms became more efficient. However, compared to the human brain there is still a long way to go: The Jeopardy!-version of Watson utilized 85,000 W of power to compete with two humans, but the human brain uses about 20 W of power for much more. Computer chips inspired by human neurons can do more with less power. This leads to field of Neuroelectronics, the quest to make smarter computer chips.

In the 1990s, Mead and his colleagues had shown that it is possible to build a realistic silicon neuron. That device could accept outside electrical input through junctions that performed the role of synapses. It allowed the incoming signals to build up voltage in the circuit's interior, much as they do in real neurons. If the accumulated voltage passed a certain threshold, the silicon neuron 'fired', producing a series of voltage spikes that travelled along a wire playing the part of an axon, the neuron's communication cable. Although the spikes were 'digital' in the sense that they were either on or off, the body of the silicon neuron operated in a non-digital way, meaning that the voltages and currents were not restricted to few discrete values as they are in conventional chips. The project used “Spaun”, a design for a computer model of the brain that includes the parts responsible for vision, movement, and decision-making. Spaun relies on a programming language for neural circuitry developed at the University of Waterloo in Ontario, Canada. A user just has to specify a desired neural function for example, the generation of an instruction to move an arm, and the system will automatically design a network of spiking neurons to carry out that function.

3.5. Additional Social Impacts - Digital Dementia

Apart from the impressive developments of ICT and social NW there do neurologists as M. Spitzer highlight some phenomena, worth attention:

Many of us have witnessed indicators as:

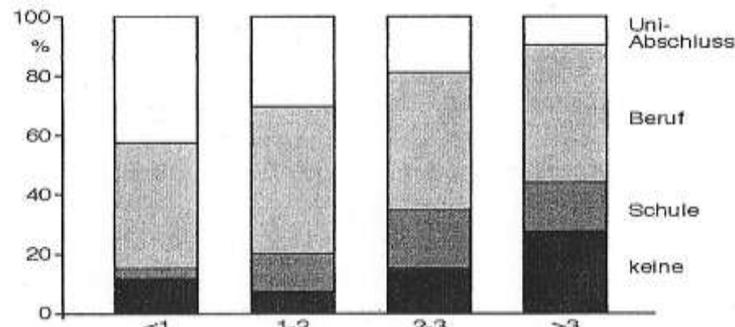
- People calculating 2+8 with a pocket calculator,
- NASA’s “inch vs. cm disaster”, leading to the loss of a satellite,
- News speakers short of distinguishing between mixing of Mio and Bio,
- Time spent on PC at home vs. reading and calculation skills.
- Performance in spatial orientation and social response.

The average “Digital Native” of today (with an average of 21 years) has

- sent & received 250.000 emails and SMS’s
- spent 10.000 hours on mobile phones
- spent 5000 hours with video games and
- spent 3500 hours in social NW’s

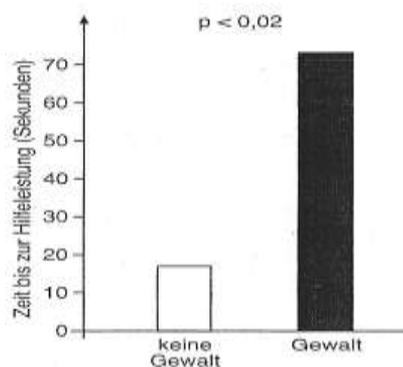
Generally speaking, many young people spend more time consuming digital media than in school.

The picture below shows recent studies proving correlation between times spent watching TV and education level:



Pic. 8: Daily TV consumption (M. Spitzer)

Neurologists warn of these developments as detrimental for the establishment of the cognitive reserve capacity of the brain.



Pic. 9: Videogames (M. Spitzer)

There are also indications of the impact of videogames on behaviour, as the graphic above shows the impact of videos on the reaction time to help other people.

As Huxley remarked in *Brave New World Revisited*, the civil libertarians and rationalists who are ever on the alert to oppose tyranny "failed to take into account man's almost infinite appetite for

In the beginning, the PC user was intelligent, avant-garde, and curious; the picture has changed to a different a game- and social NW oriented clientele.

A key issue remains the influence on the development of the human brains prefrontal cortex.

"The Dose makes the Poison" (Paracelsus 1493-1541)

4. From lessons learned in the past to beyond 2020

A fundamental lessons derived from the past of the semiconductor industry is that most of the innovations of the past ten years revolutionising the technology were initiated 10–15 years before they were incorporated into the CMOS process. Strained silicon research began in the early 90s, high-κ/metal-gate initiated in the mid-90s and multiple-gate transistors were pioneered in the late

90s. This observation generates a simple but fundamental question: “How to identify now what the ICT industry will need 10–15 years from now?”

In the years 2020–2025, we may expect many physical dimensions to cross the 10nm threshold, and when dimensions approach the 5–7nm range, fundamental limits will be reached. We expect new devices like the tunnel transistors, allowing a smooth transition from traditional CMOS to this new class of devices to reach these new levels of miniaturization. By fully utilizing the vertical dimension, and stacking layers of transistors on top of each other and this 3D approach will continue to increase the number of components per mm^2 even when horizontal physical dimensions will no longer be amenable to further reduction.

The “More than Moore” (MtM) concept addresses an emerging category of devices that incorporate functionalities that do not necessarily scale according to “Moore's Law,” but provide additional value to the user. The MtM approach allows non-digital functionalities (e.g. RF-communication, power control, passive components, sensors, actuators, MEMS) to migrate from the system board-level to a particular package-level (SiP) or chip-level (SoC) system solution. By the end of this decade, it might become possible to augment the capabilities of CMOS by introducing new devices to realize some “beyond CMOS” capabilities, without replacing the CMOS functionality totally.

We have tried to re-evaluate the increasing dilemma between technological progress, economic feasibility and the tremendous potential created by ICT's further proliferation into many other fields that may lead to a systemic evolution.

Another R&D avenue would be to re-examine how to get more information into a finite amount of space. The semiconductor industry has thrived on Boolean logic; after all, for most applications, the CMOS devices are just than “on-off” switches. It becomes tempting to investigate new techniques that allow the use of multiple (i.e. > 2) logic states. However, short of reaching the ultimate goal of quantum computing it may be possible to increase the number of states to a moderate level, as 4–10 states as an example, and perhaps, increase the number of “virtual transistors” by two every two years.

During the progress of semiconductor logic and storage products, many other technologies have progressed as well, even though at a slower pace and thus many new capabilities are now available because of these “complementary” technologies. A variety of wireless devices contains examples of this confluence of technologies mentioned above, thus enabling the megatrends as: mobile, sensors, robotics, cloud, and big data etc.

Consumers have become the drivers of the proliferation of products that are “pliable” in the sense of being moulded into unique individual applications for consumers as “Custom Functionality”.

We can look forward to be witnesses to these plethora of fascinating developments or even to be part of it.

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List of Authors

Antal Peter	239	Kirářová Alžbeta	163	Potančok Martin	385
Antlová Klára	29, 339	Klíma Tomáš	103	Prídavok Mojmír	283
Ballon Pieter	115	Kloyber Christian	205	Ranaivoson Heritiana	115
Basl Josef	95	Koliš Karel	87	Rozmajzl Petr	339
Boučková Markéta	321	Král Bohumil	313	Řihová Zora	125
Breiner Kai	213	Kubačka Martin	239	Sasiadek Michal	95
Břehovský Petr	125	Kubát David	21, 37, 221	Semerádová Tereza	
Buchinger Uschi	115	Langer Tomáš	339		21, 29, 37, 221
Čapek Jan	249	Langhamrová Jitka	63	Sigmund Tomáš	191
Delina Radoslav	239	Lisa Aleš	13	Smutný Zdeněk	145
Dorčák Peter	275	Loesch Christian	395	Sonntag Michael	355
Doucek Petr	55	Mandřák Jan	79	Svatá Vlasta	365
Dujčák Martin	283	Maryška Milos	331	Szabo Stanislav	275
Dvořák Antonín	13	Mendonça Manoel	213	Šedivá Zuzana	173
Fischer Jakub	55, 259	Ministr Jan	71	Šimpach Ondřej	63
Foitik Gerry	205	Mrázek Jan	339	Šoljaková Libuše	313
Glanzer Markus	205	Müllerová Michaela	173	Tkáč Michal	267
Hadrabová Alena	13	Nass Claudia	213	Veber Jaromír	103
Hančlová Jana	293	Nedomová Lea	79	Vieira Vaninha	213
Holá Jana	249	Němec Radek	293	Villela Karina	213
Hörmanseder Rudolf	373	Neubauer Georg	205, 229	Vltavská Kristýna	259
Hovorková Iva	29	Novák Richard	153	Vogl Armin	229
Huber Hermann	229	Novotný Ota	55	Vohnout Rudolf	125
Hudák Matej	267	Packová Miroslava	283	Wagner Jaroslav	303, 321
Hykš Ondřej	87	Pavlíček Antonín	135	Weinlich Petr	21, 37, 221
Jager Bettina	229	Pechová Hana	345	Zajarošová Markéta	345
Jäger Markus	373	Petera Petr	321	Žižka Tomáš	45
Janke František	283	Pitner Tomáš	71		
Jašek Pavel	181	Pollák František	275		

IDIMT-2014 **Networking Societies -** **Cooperation and Conflict**

22nd Interdisciplinary Information Management **Talks**

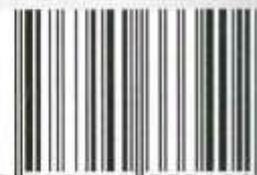
The 22nd annual IDIMT conference is continuing in its tradition as an interdisciplinary forum for multi-national, multi-disciplinary, and future-oriented presentations. It deals with current and future challenges in a world living from and dependent on Information and Communication Technology, reflecting changes in interest and direction.

Humans and Societies are becoming more and more enmeshed in networks and this has a great influence on the societal behavior of individuals and the society as a whole. It is reflected in the permanent transformation of business. We can observe fundamental changes in human interaction and society due to growing use of informational and commercial product networks. This year several areas in which considerable changes have taken place are included in the conference program: social media, the utilization of both the knowledge of Crowds and the resources offered by Cloud Computing, and the resulting eco-technical considerations.

Employing a blind review process we have accepted 36 submitted papers and 7 invited papers, resulting in an acceptance rate of 66% of submitted papers. The authors come from 9 different countries (Austria, Belgium, Brazil, Czech Republic, Germany, Poland, Saudi Arabia, Slovakia, Spain).

Their papers have been organized in 8 different themes:

- Social Media
- Enterprise and Social Networking
- Disaster Management – Caring for Humans
- The Wisdom of Crowds
- Cloud computing: Risks and Chances
- Cashless Society
- ICT and Economy
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