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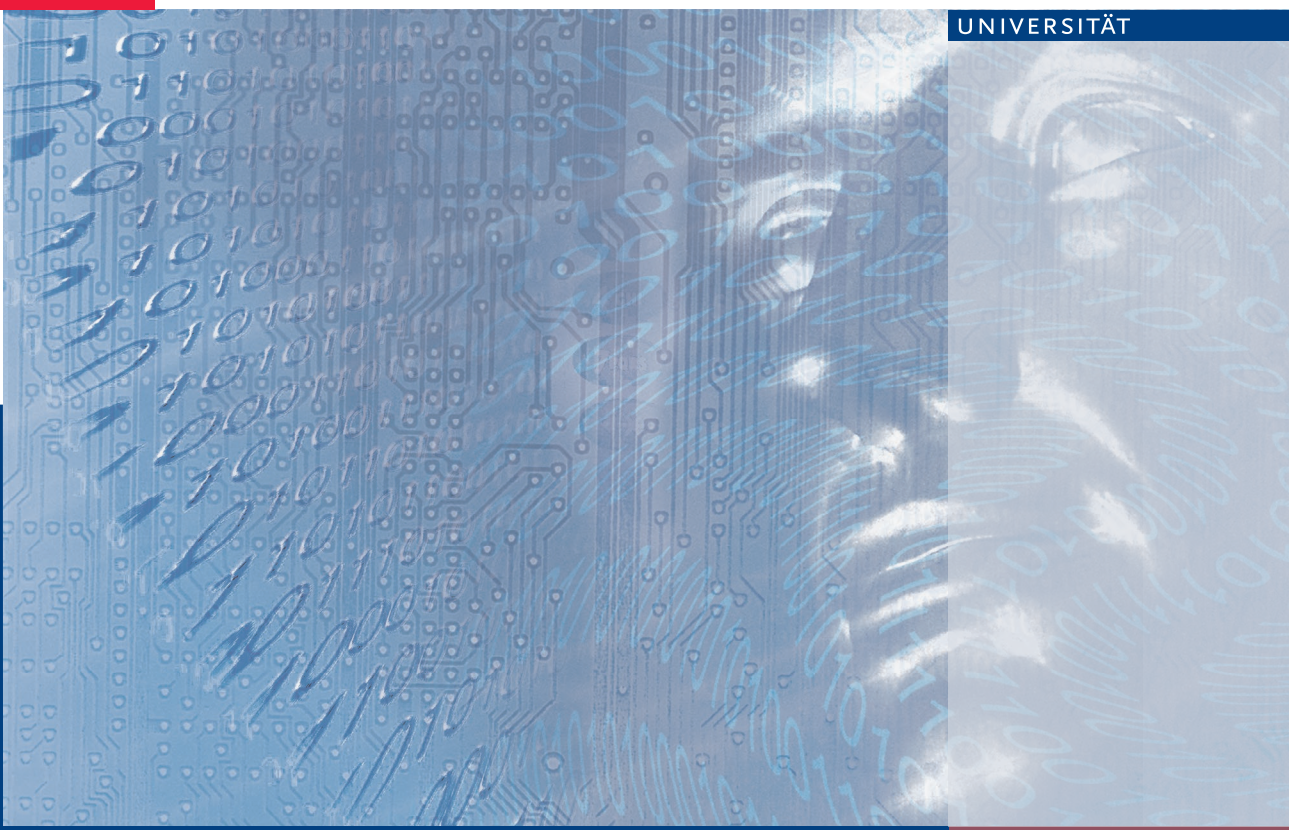

SCHRIFTENREIHE INFORMATIK
46

DOUCEK PETR ■ CHROUST GERHARD ■
OŠKRDAL VÁCLAV (EDITORS)

IDIMT-2017

Digitalization in Management, Society and Economy

25th Interdisciplinary Information Management Talks,
Sept. 6–8, 2017
Poděbrady, Czech Republic

JKU
JOHANNES KEPLER UNIVERSITÄT LINZ

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Podebrady

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The Conference IDIMT-2017
took place September 6–8, 2017
in Poděbrady, Czech Republic

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6 locations of IDIMT Conferences (1993 - 2017)

A hearty welcome to the 25th IDIMT Conference!

We have come a long way from the first IDIMT Conference in 1993 in Kubova Hut[1], which was initially not even called IDIMT! Since then we have made continuous improvements and our conferences have consequently grown. We began originally with 13 speakers and participants in 1993 (see Fig. 1) . In in 2017 we can welcome 44 papers with a total of 92 co-authors, with approximately 90 participants, and a programme which needs two parallel streams. In these 25 years we have published approximately 800 papers, comprising9200 pages created by 1300 co-authors! We are proud of the way IDIMT has developed!

[1]Chroust, G. and Doucek, P., editors (1993). *Information Management Workshop 93, Kubova Hut, Czech Republic*. Univ. of Economics Prague & J. Kepler University Linz, Austria 1993, ISBN 3-902457-06-6

Our yearly conferences were located in various picturesque villages/cities of South Bohemia, up to now in 6 different locations (see heading of this paper):

- 1993 - 1994: Kubova Huť
- 1995 - 2002: Zadov
- 2003 - 2007: České Budějovice
- 2008 - 2012: Jindřichův Hradec
- 2013: Praha
- 2014 - 2017: Poděbrady

More details of IDIMT's impressive history can be found in the follow-on paper of these proceedings. An even more extensive history will be published separately as hard copy and e-book[2].

The overall orientation of our conferences varies slightly from year to year. The topics of the individual sessions and the number of accepted papers reflect the current interest shown by authors and participants and can thus be seen as a good regional indicator forthe future. When you look at the programme, well organized by Antonin Pavlíček and Lea Nedomová, you will find the names of many people who loyally return year after year. We are a big family!

'Digitalization' will be one of the focal points of this year's conference. It will have a great impact on the creation of new innovative business models and will trigger new challenges for information technology. It will, however, at the same time create new dangers for cyber security. The impact of ICT on all levels of society and business, including the labor market, is a constant topic of IDIMT. The growing influence of Artificial Intelligence and Smart Systems shows itself in several submitted papers.

On the other end of the spectrum we find a increasing concern for the physical and psychological well-being of humans: topics are concerned with mitigation of and relief from the various dangers and risks humans run into due to aging, migration, and natural catastrophes. E-Health is an important keyword. The good and the bad effects of Social Media will also be discussed.

The program itself offers a large variety of topics. This year we have chosen:

- Digital Economy
- Innovation, New Business Models and Strategies
- Crisis Management
- Social Media
- e-Health
- Digital Single Market Innovation
- Cyber Security
- Corporate and ICT Performance Management
- Smart Systems Everywhere – Intelligence, Autonomy, Technology and Society
- Industry 4.0 And Enterprise Information Systems

[2] G. Chroust, P.Doucek, L. Nedomová: 25 Years of IDIMT: A History of Continuity and Change, Books on Demand, Norderstedt, Germany, 2017 (hard copy and e-book).

Employing a two-step submission procedure and a blind review process we have accepted 31 submitted plus 13 invited papers. The authors have come from 10 different countries: Austria, Czech Republic, Denmark, Germany, Ireland, Italy, Romania, Russia, Slovakia, and Ukraine.

Each session is organized by a Session Chairperson and traditionally starts with a keynote, followed by papers providing additional points of view. At the end of each session there is a 20 minute often heated discussion. Due to the interdisciplinary exchange of thoughts these discussions seem to be one of the focal points of the IDIMT- Conferences.

Since 2000 a special highlight has been *Christian Loesch*'s overviews of global technical, economic and/or business developments. This year he will be describing how ICT Industry and R&D are trying to overcome/circumvent the limits of market and technology growth. For the occasion of the 25 year celebration of IDIMT we have collected his 18 presentations (since 2000!) and republished them as a separate book[3].

Another tradition and highlight is the afternoon/evening excursion, excellently organized by Petr Doucek and his team. It has offered the visit to various culturally impressive vicinities followed by a hearty and very plentiful dinner in a typical Czech inn. This year we will be visiting Mlada Boleslav, a city dating back to the 10th century, offering a royal castle, a Škoda museum and a modern Škoda factory.

The preparation and realization of IDIMT 2017 would not have been possible without the support of diverse organizations and persons. Therefore we would like to thank the following for providing the organizational infrastructure.:

- the University of Economics Prague for the project IGA 409017,
- the Faculty of Informatics and Statistics of University of Economics, Prague, and
- the Johannes Kepler University Linz.

Our further thanks go to:

- *Petr Doucek* for chairing the Organizing Committee, for arranging the conference location, the hotels and the greatly appreciated evening event,
- *Antonín Pavlíček* and *Lea Nedomová*, for organizing the program, the reviews, keeping contact with all involved speakers, reminding the authors,
- *Václav Oškrdal* for arranging and assembling the selected papers into the proceedings,
- *Lea Nedomová*, for her support in performing the necessary administrative tasks,
- all Keynote Speakers, speakers and contributors of papers,
- all members of the Programme committee and the Session Chairpersons for soliciting contributors and creating an interesting and compact programme,
- 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 2017 Petr Doucek

[3] C. Loesch and G. Chroust (eds.): The Evolution of ICT and its Industry - An 18 Years Journey through the ICT World, Books on Demand, Norderstedt, Germany, 2017 (hard copy and e-book).

Our reviewers

We want to express our special thanks to the reviewers of the IDIMT 2017 Conference:

Klára Antlová
Georg Aumayr
Josef Basl
Jan Čapek
Ondrej Částek
Radim Čermák
Gerhard Chroust
Roman Danel
Radoslav Delina
Petr Doucek
Roman Fiala
Jana Hančlová
Jan Havlík
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A SHORT JOURNEY THROUGH 25 YEARS OF IDIMT CONFERENCES

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Keywords

Historical retrospective, IDIMT, information management, anniversary, conferences

1. When it all began …

The IDIMT-Conferences were born out of the changes in the political landscape in the 1990s. The Iron Curtain had fallenand scientists from neighboring countries, having been separated for a long time by insurmountable border fortifications, were able to contact one another easily again. Both in Austria and in the Czech Republic there was a strong desire to re-establish contacts and cooperation.

The history of IDIMT Conferences begins with PetrDoucek, a young student from the Department of Systems Analysis of the University of Economics, Prague, deciding to undertake his foreign study assignment at the Johannes Kepler University Linz, focusing on project management and software engineering.

In Linz the shortly appointed professor, Gerhard Chroust, with the new department of "Systems Engineering and Automation" was the perfect match for the study. After having successfully finished his study in Linz, Petr returned home in late 1992 to discuss the results at home. His department as a result decided to establish further cooperation between the two departments. The former head of the department and Vice-rector for Research and Development at the University of Economics, Prague, Professor Jan Ehleman, supported this proposal.

The best approach proved to be in the form of a conference. At a historical meeting at the Johannes Kepler University at the end of 1992 all participants proclaimed a common interest in working together and commencing with common research and development work. For Gerhard Chroust this was also one of the first scientific contacts for his institute. Thus a win-win situation for both parties arose. Additional Support came also from

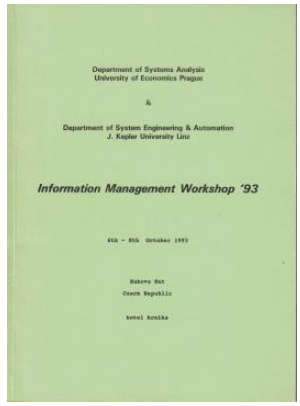
- Professor Leo Vodáček, Expert of management science at University of Economics,
- Associate Professor Prokop Toman, University of Economics,
- Professor Ernest Kulhavy, the former Vice Rector of the J. Kepler University, and
- the ‚Austrian-Czech Republic Action Programm‘ with some financial support.

Jan Ehleman

Leo Vodáček

2. Kubova Huť (1993, 1994)

The financial means were very limited for both organizations, therefore the small hotel Arnika in Kubova Huť in the Šumava Mountains (Bohemian Woods) was chosen for the first (**1993**) conference. It was approximately at the same distance from to Prague and Linz and offered a reasonable price level.



Cover 1993

Whilst arranging the conference we took great care to ensure a balance between Austrian and Czech participation with respect to the number of participants, the number of papers and the number of session chairs. English was chosen as the conference language.

The Czech side was particularly interested in issues of transition from the old economy to a Western-type economy and Science. The Austrian side contributed technical and managerial know-how for enterprises. This first conference was a great success, despite the small number of 14 participants (Chroust and Doucek, 1993). The decision was thereupon taken to continue with a yearly conference.

Kubova Huť

The **1994** conference was held in the same place. Due to longer preparation time and more experience, it was already a fully fledged conference with 23 papers from 29 co-authors resulting in proceedings of 233 pages. And we already had contributions from neighboring countries: Germany , Hungary, and Poland. Petr Doucek coined a new conference name: “Interdisciplinary Information Management Talks” (IDIMT), the name we still use. The professionalism of the conference was also documented by publishing the proceedings in the Book Series of the Austrian Computer Series (Chroust and Doucek, 1994).

3. Zadov (1995 – 2002)

Lunch at Hotel Olympia

Due to restoration work in Kubova Hut we moved in **1995** to Zadov, a well-known tourist and skiing center at the foot of the mountain Churatov. We spent 8 consecutive years in hotel Olympia, watching the growth of professionalism and quality of both our conference and of the hotel.

1997 we enhanced the conference by adding invited speakers : Prof. Franz Pichler from the

Kepler University Linz and Prof. Jareslav Vlcek from the Technical University Prague. The (pleasant) problem of receiving too many good papers but at the same retaining sufficient discussion time forced us to adopt a new conference scheme: each session is started with a keynoter introducing the subject, followed by shorter presentations supporting (or opposing) the introduced subject. This new structure has proven to be very helpful until today.

For **1998** we changed the publisher. Gerhard established a new Publication Series "Informatik" at the Trauner Verlag, Linz, which published not only the IDIMT proceedings but also those of other conferences. Today (2017) a total of 46 volumes has appeared in this Series.

By use of modern computer technologies we have improved our submission process by using e-mail in **2000**.

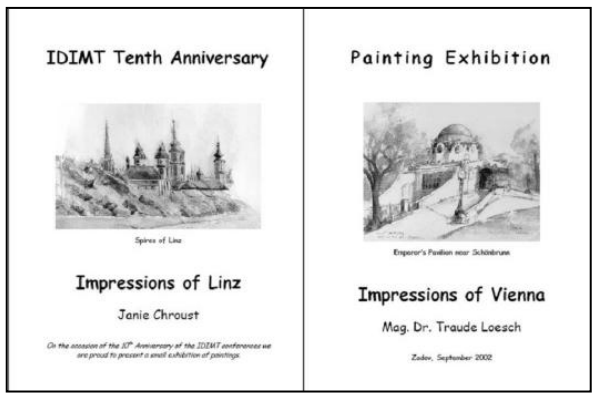
IDIMT 2001

It was also in this year when Christian Loesch held a lecture on 'Ethics, Enforcement and Information Technology' providing a broad overview of the societal impacts of technology. This was a great success and we decided to invite Christian every year to deliver a special lecture on the wider aspects of the information industry in general.

Christian W. Loesch

This year (2017) we are publishing a separate booklet with all his 18 lectures (Loesch and Chroust, 2017)

On our tenth anniversary in **2002** a special arrangement was chosen. The conference was divided into two parts: The first part was held in Prague and was organized for PhD students of the conference under the auspices of the former Rector Associate Professor Jaroslava Durčáková. She invited all participants to a private reception and a visit to the Charles University Prague - the oldest University in Central Europe. During the 'regular' second part of IDIMT in Zadov, selected PhD students presented the results of their PhD-day. PhD-days remained a feature of our conference for several years.



Art Exhibition 2002

We also offered a cultural event: Janie Chroust and Traude Loesch presented a small exhibition of paintings from Linz and Vienna at the hotel in Zadov.

4. České Budějovice (2003 – 2007)

An organizational problem at the hotel in Zadov forced us to find a new location for **2003.** The PVT-hotel in České Budějovice, a picturesque city was chosen. Catering was organized in the near-by restaurant Metropol. We stayed there for 5 years.

In **2004** the proceedings of IDIMT was given a new, more impressive cover layout by Trauner Publishers which we kept until now.

In **2006** we invited our PhD-students, who met one day before the actual conference, to investigate a truly European issue: discussing the advantages and disadvantages of studying abroad during or immediately adjacent to one's PhD-studies (Doucek et al., 2006)

IDIMT founders (G. Chroust, P. Doucek, J. Ehleman)

Celebration the 15th IDIMT Conference

2007 was the year of the 15th anniversary. We challenged our PhD-students to conceptualize a EU-project in which all students should be able to contribute with their research.

A bus tour to visit beautiful Ceský Krumlow together with a lively celebration dinner also honored IDIMT's anniversary. It was from then on that an excursion to a different, culturally interesting location became the rule as a social event.

5. Jindřichův Hradec (2008 – 2012)

2008 brought a change of location. In order to overcome the growth of IDIMT and the limited capacity of the PVT-hotel, Petr Doucek, after considerable effort, found an adequate location in Jindřichův Hradec, a significant imperial city between 1200 and 1700, with an impressive castle, a remarkable market square, a small historical town center and a prominent church, situated on a beautiful lake. We stayed in the Grand Hotel on the Main Square, later in Hotel Concertino. We continued the successful PhD-day concept from the previous year.

2009 saw a major step in our scientific recognition: the proceedings were included in the American scientific database Web of Science (CPCI-S - Conference Proceeding Citation Index- Science) operated by Thomson Reuters (Thomson-Reuters, 2012). As a result all IDIMT proceedings from 2004 onward are included in this world-known scientific database. It also provided us with useful statistics about our conference.

Excursion to Slavonice (2009)

The IDIMT conferences have become more attractive. In **2011**, in order to accommodate the increased influx of papers and to give younger scientists a chance of publication, we accepted four posters which were been presented briefly during the conference.

20 year cake

In **2012** we celebrated our 20th anniversary. On this occasion, besides publishing the regular proceedings we also offered a booklet with a history of IDIMT. It contained extensive information on all our conferences and included also all 11 invited lectures by Christian Loesch (Chroust and Doucek, 2012).

6. Prague (2013)

In **2013** we joined forces with the CONFENIS 2013 conference in a joint and parallel conference in Prague. We achieved some synergetic effects by listening to some lectures of the parallel conference. And we all had time to enjoy beautiful Prague, including a boat trip on the Moldawa. For the first time we also used the conference administration system EasyChair for paper submission.

Prague, Charles Bridge

7. Poděbrady (2014 - ?)

Lunch in Poděbrady

In the following year (**2014**) we returned to a smaller, quieter place, to Poděbrady, a traditional spa-city, but with a long history, founded in the 13th century and having considerable political importance in the 14th to 16th century.

2015 brought a pleasant but inconvenient surprise. We received too many good papers to accommodate them in our classical organisation: 58 papers with 113 co-authors yielding an all-time high of 519 pages of proceedings. On the spot we had to decide to run the conference in two parallel streams. This decision was made easier due to the fact that in the course of the last years we had observed a strong trend from technological/managerial topics to much 'softer ' topics such as the impacts of ICT on society and humans plus its consequences. To some extent this is now also reflected in the two streams.

The 5 front covers

This year (**2017**), our 25th anniversary, we are also celebrating in Poděbrady, and for this purpose are publishing two additional books: one containing the detailed history of the IDIMT conferences adorned by pictures documenting our long and very successful history (Chroust et al., 2017) and a second book containing all (now 18) lectures held by Christian Loesch (Loesch and Chroust, 2017).

8. Looking back

Looking back over these 25 years, the conferences have not only proved to be scientifically successful, as the list of proceedings shows (see below), they have also resulted in many new friendships having developed during IDIMT: The ample discussion time in each session and the excursions was a major contributor.

G. Chroust,V. Svatá,P. Doucek

A remarkable fact is that a high percentage of participants return again every year. We are very proud that 3 of the 14 participants of the 1993 conference still continue to be regular participants of the IDIMT Conferences and have attended almost all Conferences from 1993 until today. They are Petr Doucek, Gerhard Chroust, and Vlasta

Svatá.

Thank you for your loyalty and support!

We want to thank all our session chairs, session organizers, speakers and reviewers and especially the Organizers and Editors of the IDIMT Conferences (see below).

Manfred Beneder

Gerhard Chroust

Petr Doucek

Christian Hofer

Susanne Hofer

Christoph Hoyer

Jan Klas

Lea Nedomová

Václav Oškrdal

Antonín Pavlíček

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Summary of the IDIMT Conferences 1993 –2017:

year	Au-thors	Pa-per s	Pages	Conference chairs and editors	Date of Conference	Location
1993	14	13	151	Gerhard Chroust, Petr Doucek	6.-8.Oct.	**Kubova Huť**
1994	27	23	233	same	9. -11.Nov.	same
1995	33	25	228	same	8.-10.Oct.	Zadov
1996	30	21	215	same	16.-18.Oct.	same
1997	35	30	320	Susanne Hofer, Petr Doucek	15.-17.Oct.	same
1998	39	27	390	Susanne Hofer, Manfred Beneder	21.-23.Oct.	same
1999	46	34	424	same	02.-03.Sept.	same
2000	48	32	440	same	20.-22.Sept.	same
2001	45	29	397	Christian Hofer, Gerhard Chroust	19.-21.Sept.	same
2002	38	24	350	same	11.-13.Sept.	same
2003	38	24	310	same	10.-12.Sept.	**České Budějovice**
2004	31	23	304	same	15.-17.Sept.	same
2005	30	22	313	Christoph Hoyer, Gerhard Chroust	14.-16.Sept.	same
2006	45	29	364	same	13.-15.Sept.	same
2007	38	27	383	Christoph Hoyer, Gerhard Chroust, Petr Doucek	12.-14.Sept.	same
2008	53	33	455	Gerhard Chroust, Petr Doucek, Jan Klas	10.-12.Sept.	**Jindřichův Hradec**
2009	61	42	423	Petr Doucek, Gerhard Chroust, Vaclav Oškrdal	9.-11.Sept.	same
2010	62	42	397	same	8.-10.Sept.	same
2011	64	42	393	same	7.-9. Sept.	same
2012	57	37	400	same	12.-14.Sept.	same
2013	83	45	403	same	11.-13.Sept.	**Prague**
2014	84	40	413	same	10.-12.Sept.	**Poděbrady**
2015	113	58	519.	same	9..-11.Sept.	same
2016	94	41	463	same	7.-9.Sept.	same
2017	93	45	480 (est.)	same	6.-8.Sept.	same
	1300	**807**	**8649**	**TOTAL**		

Sponsors of IDIMT 2017

INVITED CONTRIBUTION

ICT BEYOND THE RED BRICK WALL

Christian W. Loesch

CWL0001@gmail.com

Abstract and Introduction

It would be difficult to overstate the impact of Moore's Law. It is all around us, in the myriad gadgets, computers, and networks that power modern life. However, the winning streak cannot last forever. For all phenomena of exponential growth, the question is not whether, but only when and why they will end, more specifically: would it be physics or economics that raises the barrier to further scaling?

Physics has been our friend for decennia ("Dennards Law") has now become the foe of further downscaling. In spite of all doomsday prophesies since the ´80s, we will reach, thanks to the ingenuity of physicists and engineers, the famous red wall only within the next five to ten years and it might be a second an economic wall. The third wall may be a "power" wall, not just for the well-known power problems also for a other reasons, as the proportionality of system failure and power consumption.

Some sort of "Moore's law" can also be found in the software area, as at operating systems doubling in size every new generation or as a law of diminishing returns or leading to the increasing reluctance to accept new hard and software generations?

On the request of many we look on the emerging long term options rather than at the immediate and mid-term scenario.

We will review how ICT Industry is performing and trying to meet these challenges and preparing adequate strategies. The variety of responses is stunning and ranges from Memristor, QC, cognitive computing systems, big data, to graphene and the abundance of emerging fascinating applications which will impact our life.

Processor productivity, bandwidth, number of transistors per chip, upgrades in architecture, continue to increase further causing increasing demand on processor communications, bandwidth and transmission speed on the chip and worldwide networks.

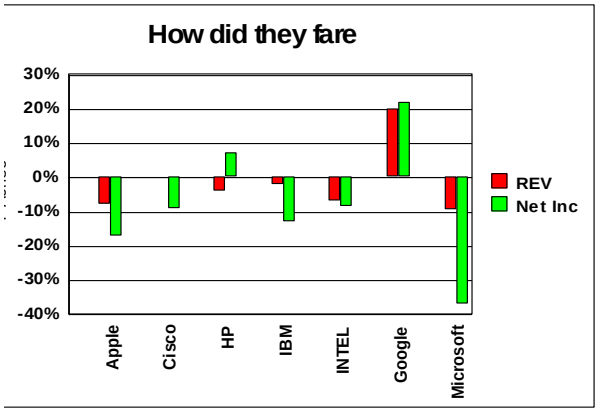
1. Economy

We will review how the industry fared. Since most 2016 results will be published too late for the printing press, we will to cover them in our session but based on latest results.

2017	Brand	Category	2017 ($M)	change	2016
1	Google	Technology	245,581	+7%	1
2	Apple	Technology	234,671	+3%	2
3	Microsoft	Technology	143,222	+18%	3
4	Amazon	Retail	139,286	+41%	7
5	Facebook	Technology	129,800	+27%	5

Source: Marketing BrandZ

Revenue and income can only give a very vague picture, but they are providing an overall impression how some key players of the industry performed in the 2015/2016 timeframe.



2. Technology

Moore's "Law" has been a synonym for faster cheaper processing power. Key contributors have been and are in a two to three years rhythm:

- Performance + 30% operating frequency at constant energy
- Power - 50% energy / switching process
- Area size reduction -50%,
- Cost -25% wafer and up to -40% scaled die

However since the end of Dennard scaling more than a decade ago, doubling transistor densities have not led to corresponding higher performance By 2020 feature size will be down to just a few nanometers leading to the transition to the economically more attractive vertical scaling

ITRS names three applications areas driving innovation:

- High performance computing
- Mobile computing
- Autonomous sensing & computing (e.g. IoT)

The quest for an alternate technology to replace CMOS has come up with no serious contenders in the near future. "Little room left at the bottom ".

STT technology is today's research focus. Advantages range from lower footprint, reduced writing current by one or two orders of magnitude and full scalability. STT MRAM may be the low hanging fruit we are waiting for, with spin orbit torque technology on the horizon

2.1. Nanotechnology, atomic and molecular

Nanotechnology breakthroughs pave the way for the ultra-small.

Recently published research papers highlight these as:

Single-molecule switching, which could lead to molecular computers, the discovery of two hydrogen atoms inside a naphthalocyanine molecule that can do switching, means storing enormous amounts of information and the idea of a computer comprised of just a few molecules may no longer be science fiction, but exploratory science. Such devices might be used as future computer

chips, storage devices, and sensors for applications nobody has imagined yet. They may prove to be a step toward building computing elements at the molecular scale that are vastly smaller, faster and use less energy than today's computer chips and memory devices. The single-molecule switch could operate without disrupting the molecule's outer frame. In addition to switching within a single molecule, the researchers also demonstrated that atoms inside one molecule can be used to switch atoms in an adjacent molecule, representing a rudimentary logic element. [Meyer G., IBM Zurich Research Lab]

2.2. Graphene

Graphene has become one of the most shining materials for the scientific community and a popular candidate for IoT and flexible electronics;

At present information processing is split into three functions with different types of material:

- Information processing: Si- transistor based
- Communications: Compound semiconductor based, as InAs, GaAs, InP by photons
- Information storage: Ferromagnetic metals based.

Such a division is not very efficient. Graphene triangular quantum dots (GTQD) offer a potential alternative; there is a special class of nanoscale graphene, triangular with zigzag edges meeting all three functions.

One atom thin integrated graphene circuits pose many problems to be resolved as controlling size, shape and edges with atomic precision or that graphene FETs suffer from the lack of a large band gap, therefore generating a band gap without sacrificing the mobility remains the greatest challenge for graphene. [Technology Innovation, Kinam Kim and U-In Chung Samsung advanced Institute of Technology, Giheung, S. Korea], [A. Güclü, P.Potasz and P. Hawrylak, NRC of Ottawa, Canada]

These atom thick 2D materials could lead to a new industrial revolution for the post Si era, atomically thin tunnel transistors offer transparency with comparable performance, 2D providing wider bandwidth and cheaper integration with Si for data communication but will take five to ten years to reach the marketplace due to problems of material quality and integration. [Sungwoo Hwang et alii, Graphene and Atom-thick 2D Materials, Samsung advanced institute of technology, Suwon, S. Korea]

In view of the fact that 38% of energy consumption in data centers (2009) copper interconnects of devices between and on chips. Substitute Cu by optical interconnects resulting in a 1000-times lower attenuation could be another promising technology. [D. Stange, Jülich, R. Geiger PSI Villingen et alii., Univ. Grenoble, Z. Ikonic, Univ. Leeds UK]

2.3. Racetrack

IBM claims that its racetrack storage technology to store data in magnetic domain walls is reaching market maturity within the next years. The expected performance is impressive:

- Data stored in magnetic domain walls
- 100 times more storage than on disk or flash
- Fast r/w in a nanosecond

2.4. The Memristor

According to the original 1971 definition, the Memristor was the fourth fundamental circuit element, forming a non-linear relationship between electric charge and magnetic flux linkage. In 2011 Chua argued for a broader definition that included all two-terminal non-volatile memory devices based on resistance switching. But broader definition of Memristor could be a scientific land grab that favors HP's Memristor patents. Back to the ´60s date first description of Memristor, Today are many implementations under development.

Memristor change their resistance depending on the direction and amount of voltage applied, and they remember this resistance when the voltage is removed. Most memory types store data as charge, but Memristors would enable a resistive RAM, a nonvolatile memory that stores data as resistance instead of charge.

Memristors promise a new type of dense, cheap, and low-power memory.

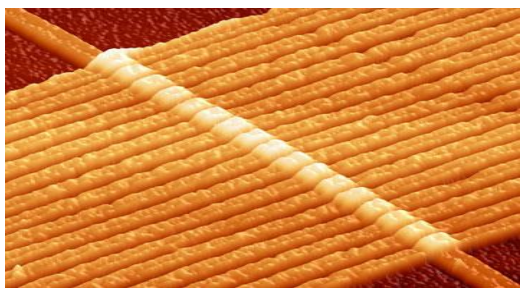
What are the potential advantages of the Memristor?

- Density > hard drives
- 100GB/cm² -> 3D 1000layers = 100TB/cm³
- 100x faster than flash memory (5/2012)
- 1% of energy and works up to 150 C (Ge_2Se version)

One Memristor has equivalent logic function to several connected transistors means higher density and uses up much less power.

In 2010, HP labs announced that they had practical Memristor working at 1ns (~1 GHz) switching times and 3 nm by 3 nm sizes. At these densities, it could easily rival the sub-25 nm flash memory technology.

A major problem is how to make large numbers of them reliable enough for commercial electronic devices. Researchers continue to puzzle over the best materials and way of manufacturing them.



Memory fabric (HPE Labs)

3. Future Generation Computing

3.1. "The Machine"

HPE is developing "The Machine", the largest R&D program in the company's history in three stages, of which it is unveiling the first. In the second and third phases the company plans to move beyond DRAM to test phase-change random access memory (PRAM) and memristors, over the next few years. HPE assigned 75% of its human R&D resources to this project. The Machine still has not arrived completely; HPE is providing a peek at progress so far.

A prototype has been on display at *The Atlantic*'s: Return to Deep Space conference in Washington, D.C., featuring 1,280 high-performance microprocessor cores, each of which reads and executes program instructions in unison with the others, with access to 160 terabytes (TB) of memory. Optical fibers pass information among the different components.

The Machine is defined by its memory centric computing memory driven architecture i.e. a single, huge pool of addressable memory." A computer assigns an address to the location of each byte of data stored in its memory. The Machine's processors can access and communicate with those addresses much the way high-performance computer nodes.

HPE's X1 photonics interconnect module laser technology replaces traditional copper wires with optical data transfer between electronic devices. [Hewlett Packard's Silicon Design Labs in Fort Collins, Colo. Enterprise.

3.2. Cognitive Computing, Neurocomputing and AI

IBM is taking a somewhat different track in its efforts to develop next-generation computing, focusing on neuromorphic systems that mimic the human brain's structure as well as quantum or another approach can be found in Microsoft's Cortana Intelligent suit.

Potential applications range from face detection, AI machine learning and reasoning, Natural language processing, predictive maintenance, to risk detection to Diagnostics or forecasting future sales (up to 90% correct).The impossibility to maintain current knowledge is could be addressed by IBM's Watson.Knowledge degrades so fast that Hi-Tecemployer as GooglespaceX etc are focusing less on qualification but on logic thinking, problem solving and creative thinking. AI is not programming computers but training them.

What is a cognitive chip? The SyNAPSE chip, introduced in 2014, operates at very low power levels. IBM built a new chip with a brain-inspired computer architecture powered by 1 million neurons and 256 million synapses chip. It is the largest chip IBM has ever built at 5.4 billion transistors, and has an on-chip network of 4,096 neurosynaptic cores. It consumes 70mW during real-time operation, orders of magnitude less energy than traditional chips.

The TrueNorth Chip or the SpiNNaker chip of the Univ. of Manchester is comparable endeavors.

Below are some characteristics of cognitive systems aim to fulfil:

- Adaptive
- Interactive
- Iterative and helpful.
- Contextual

They may understand, identify, and extract contextual elements such as meaning, syntax, time, location, appropriate domain, regulations, user's profile, process, task and goal. They may draw on multiple sources of information, including both structured and unstructured digital information, as well as sensory inputs (visual, gesture, auditory, or sensor-provided).

Neurocomputing, often referred to as artificial neural networks (ANN), can be defined as information processing systems (computing devices) designed with inspiration taken from the nervous system, more specifically the brain, and with particular emphasis in problem solving.

"An artificial neural network is a massively parallel distributed processor made up of simple processing units, which has a natural propensity for storing experiential knowledge and making it available for use." [Haykin S., Neural Networks and Learning Machines, 1999.]

The first neural networks were already presented in 1964, attempting to mimic the logic process of the brain. Brains are good at performing functions like pattern recognition, perception, flexible inference, intuition, and guessing, but also slow, imprecise, make erroneous generalizations, prejudiced, and are sometimes incapable of explaining their own actions. Cognitive Computing is progressing impressively. Deep learning, pattern recognition, matching photos (97,5 %) or language translation may be found everywhere in five years.

Four areas expect to benefit especially:

- Nanotechnology (Biotechnology)
- AI
- Genetics
- Robotics

3.3. A short Introduction to the Quantum World

Quantum physics is with us in our everyday life. No transistor would work without it.

Erwin Schrödinger, who developed quantum theory's defining equation, once warned a lecture audience that what he was about to say might be considered insane.

The famous double slit experiment should serve as an introductory first step into this world.

Will discuss these two phenomena to give a first clue to the world of quantum physics:

- Superposition
- Entanglement

From a physical point of view, entangled particles form only one entity (one single waveform instead of two) and locality of a particle is an illusion. These particles have a probability of presence that stretches out infinitely, with their local position of very high probability of presence as "particles". Entangling means merging different waveforms into a single one, but which has several local positions of very high probability instead of one, like having a single particle (one single waveform), but with several centres of mass instead of one.

"Observing" one of the high-probability locations of entangled particles modifies this single probability cloud, which also determines the "state" of the second high-probability location of the other entangled particles).

Entanglement and Superposition cause qubits to behave very differently from bits. A two-bit circuit in a conventional computer can be in only one of four possible states (0 and 0, 0 and 1, 1 and 0, or 1 and 1), a pair of qubits can be in combination of all four. As the number of qubits in the circuit increases, the number of possible states, and thus the amount of information contained in the system increases exponentially.

Many various approaches are currently under development. Researchers favor currently qubit design, based on superconductors microchip-scale circuits made of materials that lose all electrical resistance at very low temperatures. Thanks to the Josephson effect, electric currents flowing around tiny loops in such circuits can circle both clockwise and counter clockwise at once, so they are perfect for representing a qubit. Within few years R&D efforts have increased Qubit lifetimes by a factor of 10,000, that is maintaining their state for around 50 - 100 μsecs, and reducing the error rate. [Martinis]

3.4. The Quantum Computer (QC)

The idea of QC is to store values of 2^N complex amplitudes describing the wavefunction of N two-level systems (qubits) complex amplitudes and process this information by applying unitary in formations (quantum gates), that change these amplitudes in a precise and controlled manner.

Building the first real QC is an estimated to be a 10 B$ project. What could be the "killer applications" justifying this effort?

Scientists spent already several years looking for an answer, an application for quantum computing that would justify the development costs. The two classic examples, code-cracking and searching databases, seem not to be sufficient. QCs may search databases faster, but they are still limited by the time it takes to feed the data into the circuit, which would not change.

A much more promising application for the near future could be modelling of electrons in materials and molecules, something too difficult even for today's supercomputers. With around 400 encoded qubits, it might be possible to analyse ways to improve industrial nitrogen fixation, the energy-intensive process that turning unreactive molecules in air into fertilizer. This is now carried out on an industrial scale using the 120 years old Haber process, which uses up to about 5% of the natural gas produced worldwide. A quantum computer could help to design a much more energy-efficient catalyst. Another "killer application" might be searching for new high-temperature superconductors, or improving the catalysts used to capture carbon from the air or from industrial exhaust streams. "Progress there could easily substantiate the 10 billion." [Troyer].

Which will be potential QC areas?

- Design of drugs
- Supply chain logistics
- Material science (properties, as melting point etc. design of new metals)
- Financial services
- Cryptanalysis

However, veterans of the field caution that quantum computing is still in the early stages. The QC will rather appear as coprocessor than as stand-alone computer. The development is in a phase that compare to Zuse in 1938. In 5 years special application superior to today's computers with TP access may appear. [R. Blatt]

3.5. IoT

Market potential estimations range wide between: Cisco 20 -50 billion or IBM 20 bio devices.

Optimists have reason to be encouraged. More than 120 new devices connect to the Internet every second. McKinsey Global Institute estimates IoT could have an annual economic impact of $3,9 trillion to $11,1 trillion by 2025.

However, several short term obstacles to be fixed:

- Missing Standards.
- Speed requirements to be resolves by transition from 4G to 5G (license auction 2017/18).
- Address space (transition from IP4 to IP6 on its way).

The growth of the IoT, combined with the exponential development of sensors and connectivity, will make it more challenging to provide power to untethered devices and sending nodes. Even with

long-life battery technology, many of these devices can only function for a few months without a recharge.

The arrival of the quest for an electric car has is additionally emphasizing the problem, but the 800 km reach may not come before 2020.

Energy harvesting increasing performance of energy transducers and the decreasing power requirements of ICs may bridge the gap. [A. Romani et alii, Nanopower Integrated Electronics for Energy harvesting, conversion and management, Univ. of Bologna, Italy]

Both consumers and the media are fascinated by IoT innovations that have already hit the market. With short time, some IoT devices have become standard, including thermostats that automatically adjust the temperature and production-line sensors that inform workshop supervisors of machine condition. Now innovators target more sophisticated IoT technologies as self-driving cars, drone-delivery services, and other applications as:

- Large structures (bridges, buildings roads)
- Adv. personal sensors (breath analysis)
- Logistics
- Crop monitoring
- Pollution
- Tracking from kids to dogs and shoes etc.

Up to now the adoption of IoT is proceeding more slowly than expected, but semiconductor companies through new technologies and business models will try to accelerate growth.

3.6. Fiber

Replacing copper by optical connections within and outside the computer, increasing connectivity and the exponential growth of information will put further emphasize the development of data transmission.

The longer the light travels, the more photons will scatter off atoms and leak into the surrounding layers of cladding and protective coating. After 50 km, about 90% of the light will be lost. To keep the signal going after the first 50 km, repeaters were then used to convert light pulses into electronic signals, clean and amplify them, and then retransmit them.

The British physicist D. Payne opened a new avenue, by adding and exciting erbium atoms with a laser; he could amplify incoming light with a wavelength of 1.55 μm, where optical fibers are most transparent. The erbium-fiber amplifier enabled another way to boost data rates: multiple-wavelength communication. Erbium atoms amplify light across a range of wavelengths, a band wide enough for multiple signals in the same fiber, each with its own much narrower band of wavelengths.

The classical way to pack more bits per second is to shorten the length of pulses. Unfortunately, the shorter the pulses, the more vulnerable they become to dispersion and will stretch out traveling through a fiber and interfere with one another. Techniques previously developed, dubbed wavelength-division multiplexing, along with further improvements in the switching frequency of fast laser signals, led to an explosion in capacity.

Together, quadrature coding and coherent detection, with the ability to transmit in two different polarizations of light, have carried optical fibers to allowing a single optical channel to carry

100Gb/s over long distances, in fibers designed to carry only 10 Gb/s. Since a typical fiber can accommodate roughly 100 channels, the total capacity of the fiber can approach 10 Tb/s.

4. Redirection: Applications and Lateral Developments

The plethora some of these developments rising on the horizon stretch from

- Photovoltaic with 500% of today's capacity and 1/100 thickness
- Water-purification
- Medicine:

Some facts and figures:

- 14000 illnesses and 5000 publications/week.
- Improved scanning can achieve 80%-90% hit rate in mammography.
- "Chirurgical Intelligent Knife" (distinguishing malign from non malign areas)
- Improved diagnostics: "The first time right" envisions future medicine to be predictive, personalized and precise [Zerhouni E., US NIH, 2006]
- Intelligent prosthetics
- 3D printing of drugs or simple organs
- Lab on a chip (biofluid evaluate plasma and bio markers)
- Anti-bacteria nanoparticles.

We mentioned the information avalanche. Watson, as covered previously is a possible answer and avenue to be followed, as learning machine, without internet connection, trained to understand meaning of words, "Super Google "may answer questions before you realize you have it".

5. Summary

We have been perusing the scenario in view of approaching the red brick wall and beyond we found a plethora of developments and emerging technologies and applications.

- In spite of longstanding doomsday prophesies since the ´80s, thanks to the ingenuity of physicists and engineers, we will reach the red wall only within the next five to ten years. There may be a second wall an economic wall due to unjustifiable investments reached earlier. Many believe a third wall may be a "power" wall, not just for the well-known power problems but for the proportionality of system failure and power consumption.
- Future technologies ranging from STT to graphite and future computing from "The Machine" to Quantum Computers, Cognitive Computing, Neurocomputing , AI and Watson.
- The effects of "getting physical" by direct connecting computers increasingly to the physical world around, integrating all types of devices from keys to sensors, tags etc.
- The evolution of human knowledge has been accelerated by storing and sharing information. The amount of data will reach 44 ZB in 2020, the number of Internet-connected devices 50 B in 2020 (doubling every two years). Handling these is by far

exceeding the human capabilities, so we have to entrust them to automated systems, thus raising questions about the future ethical, security or privacy concerns.

- The social impact of Industry 4.0 is estimated to create two million jobs, although it might destroy seven million jobs (in Germany) and by 2030 will affect up to 50% jobs as well as job and skill requirements worldwide.
- The trend of shifting emphasis to applications and designing for people (not enterprises)

The impact of these developments and its lateral ramifications on the business environment, on future products and their investment priorities cannot be underestimated. Politics is evaluating perusing ideas as basic income or machine tax to avoid loss of elections by angry voters. These developments will not only model the future scientific scenario but even more the future economic development, education requirements, social evolution and thus our lives. The outlook is exciting; the rate of progress will continue to provide better tools that will enable the development of even exponential better tools.

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SESSION A: DIGITAL ECONOMY

DIGITAL ECONOMY

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Digital economy, trends in ICT, Smart technologies, smart cities

Abstract

Contribution presents new trends in transformation of global economy on its way from the economy of goods to economy of knowledge. Based on respectable author´s works analysis are presented facts about new main trends in information technology penetration into business. The process of changes in data collection, transmission, warehousing, analysis and its interpretation is called digital transformation and its impact is visible in changes in business models and business administration. This contribution wants to provoke to contribute results of Your research work in several further selected essential trends - (1) business trends, (2)smart cities concepts and strategies, (3) Internet of Things, (4) Sharing economy and (5) impact of ICT on management and on human resources management.

1. Introduction

After a queue of regularly sessions “ICT Impact on Economy and Innovation”, which have been included into the IDIMT conference program in 2011, evinces the topic a little change (Novotný, Doucek, & Fischer, 2016; Fischer, Novotný, & Doucek, 2015). This year, we are focused more on digitalization of global economy a new trends, which are appearing around us and which are ready completely change our lives.

The digital economy now permeates countless aspects of the world economy, impacting sectors as varied as banking, retail, energy, transportation, education, publishing, media or health. Information and Communication Technologies (ICTs) are transforming the ways social interactions and personal relationships are conducted, with fixed, mobile and broadcast networks converging, and devices and objects increasingly connected to form the Internet of Things. (OECD Digital Economy Outlook, 2015).

The digital economy is sometimes called the Internet economy, the new economy (Kelly, 1998) or Web economy. But some economists assert that the digital economy is more advanced and complex than the Internet economy, which, under one definition, simply means economic value derived from the Internet (Hanclova, & Doucek, 2012). Additionally, the term "digital economy" is not synonymous with earlier terms used to describe the technology-driven changes happening in 20th century economy, such as "information economy" and "network economy." The first step in this trend is visible by Peter Drucker (1992)…. “**has become the foundation of the modern economy**” as we have shifted ”**from an economy of goods to a knowledge economy**”. Further progress has been realized by increasing networking thanks to Internet connection and also thanks to **changes in business models using this new information technology**. This period is called by

authors as digital transformation. What does the word digital really represents for this period? While there is no common definition available we would like to apply the three main attributes of being digital provided by (Dorner, & Edelman, 2015):

- creating value at the new frontiers of the business world,
- creating value in the processes that execute a vision of customer experiences and
- building foundational capabilities that support the entire structure.

Consequently, digital transformation stands for the overall processes in order to get digitally mature. There are often presented by different authors (f. e. Zimmermann, 2016) following four pillars of digital transformation:

- value creation structures, where we observe emerging structures such as networks and ecosystems (Sudzina, Pucihar, & Lenart, 2011),
- value creation processes comprising, e.g., open innovation, mass customization and the new purchasing process based on Online media and social networks (Bohmova, & Malinova, 2013; Pavlicek, 2014),
- products and services, where information goods can be freely reconfigured independent of context or infrastructure and where physical products can be enhanced by digital means,
- infrastructure such as technical, market services, and market platform infrastructures.

2. ICT Trends in Digital Economy

Thanks the digitalization of all activities are visible new trends in this time period. The first visible trend is in corporate business and it is related to e-everything époque. Further selected trends for this session are smart cities concepts, internet of things, sharing economy and impact of ICT on management and on human resources management. The aim of this contribution is to highlight these five essential aspects for discussions on IDIMT session.

2.1. Business trends

ICT and their implementation in economic practice are changing both existing process models and actual business models. The changes in these models are analyzed by major consulting and advisory companies. Also the Massachusetts Institute of Technology IT has developed a respective approach in cooperation with Deloitte (Kane et al, 2015). Beyond those broad models there are also models focusing on specific issues such as electronic invoicing processes (Cuylen et al., 2015, Delina, & Pridavok, 2013) or electronic procurement (Versendaal et al., 2013; Delina, & Sukker 2015; Johansson et al., 2016). Models focusing on new business models pertain in particular to the concept of industry 4.0 as e.g. presented by Basl & Sasiadek (2017). This concept is also reflected in a new concept of socially responsible development (Pavlíček, & Doucek, 2015), which then reflects in the concept of Smart Cities (in paragraph 2.2).

2.2. Smart Cities

The primary goal of a Smart City is to find a concept that makes it possible for cities to ensure sustainable growth, an excellent quality of life, safety and efficient use of energies. As mentioned by (Lombardi, Giordano, Farouh, & Yousef, 2012), these dimensions can be fulfilled in the following areas:

- **Smart economy** – public expenditure on research and development, expenditure on education, GDP per capita, unemployment rate;
- **Smart mobility** – local accessibility, (inter)national accessibility, availability of ICT infrastructure, cycle path network, bike-sharing system, mortal injuries and CO_2 emissions;
- **Smart environment** – CO_2 emission generation, efficient use of electricity, efficient use of water, area in green space (parks), greenhouse gas emission intensity of energy consumption, urban growth and sustainability, proportion of recycled waste;
- **Smart people** – participation in life-long learning, patent applications per inhabitant, the percentage of population with a university education;
- **Smart living** – proportion of the area for recreational sports and leisure use, number of public libraries, total amount of loans, museum, theatre and cinema visits;
- **Smart governance** – number of universities and research centers in the city, on-line information availability, percentage of households with Internet access at home, criminality.

Aim of this trend in ICT is to evaluate ambitions of different concepts of smart cities and to present independent researches in this area at the session. These contributions should reflect smart city concepts from various cities, which cloud be split into two categories (for Czech conditions) – large cities with more than 150.000 population (Prague, Ostrava, Brno and Plzeň) and small cities with lower population. There will be welcomed analysis and comparison in order to get typical (core) functionality and approach to smart city problem solving in the Czech Republic. Based on this analysis is expected to identify trends in this area and to compare it with world ones.

2.3. Internet of Things

Internet of Things (IoT) market forecasts show that IoT is already making an impact on the global economy. While estimates of the economic impact during the next five to ten years vary slightly (IDC estimates USD 1,7 trillion in 2020 (IDC, 2016), Gartner sees a benefit of USD 2 trillion by that time (Gartner, 2015), and McKinsey Global Institute predicts growth of USD 4 trillion to USD 11 trillion by 2025 (McKinsey Global Institute, 2015), there seems to be a consensus that the impact of IoT technologies is substantial and growing. Although a significant impact already exists, Gartner notes that both IoT and the business models associated with it are immature at this point (Gartner, 2015), hence the huge transformation that the economy – and maybe even society as a whole – will face from the Internet of Things is still to come.

Trend in the form of Internet of Things (IoT), is very expected especially in the area of utility supply, but also in other specific branches – connected e-health, smart products, intelligent gateways, smart transportation etc. General ICT disruption in our world through IoT brings with it new questions (IEC, 2017):

- Which key capabilities are offered by existing IoT architectures and which limitations and deficiencies can be identified?
- Are existing capabilities sufficient to make envisioned new applications such as Smart Cities real? If not, which additional or enhanced capabilities are required? How should a Smart and Secure IoT Platform look?
- Are existing technologies sufficient? If not, do we only need appropriate enhancements and adaptations of existing technologies to meet the requirements of tomorrow’s applications? Alternatively, do we also need new technologies?

- Which international standards are already established or are currently under investigation? Which, if any, additional standardization efforts are needed to support IoT applications?
- Who should identify the requirements for – and define, publish, and maintain – new standards?
- What should the role of the International Electrotechnical Commission (IEC) be?

The IoT phenomenon could be realized only with increasing role of normalization in this area with especially accent on security realization (Sonntag, 2017).

2.4. Sharing Economy

In the last century, owning things was the marker of the middle class. Those who had more money could own more things. But as manufacturing became less expensive, the barrier to owning a great deal of stuff was lowered (Fischer, & Vltavská, 2012; Manďák, 2015). Today, many people living at or below the poverty level own plenty of things, but it isn't a good indicator of their relative wealth (Šimpach, & Langhamrová, 2014). Where Baby Boomers and Gen Xers might have had shelves and shelves dedicated to books, magazines and music in their homes, today we can fit the same amount of media and more onto the pocket-sized computers we anachronistically still call phones. (Hamari, Sjöklint, & Ukkonen, 2015).

In the future, we may own much less and share much more. And if we do, it will all be down to big data. (Marr, 2016)

What experience do You have with sharing economy? Some new examples and research related to conditions of Your home country are invited to be presented at the session, but not descriptions of very wide known cases (Uber, Airbnb etc.). Contributions with vase studies and research related to topics like Freelancing, Co-working, Car sharing, Peer-to-Peer lending, Fashion, Sharing resources and other services are welcomed.

2.5. Impact of ICT on Management and on Human Resources Management

Human resources are very important for every organization. All organizations want to employ high-quality and able workers and acquire them at the lowest possible cost. Organizations have several recruitment options. The effectiveness of each option depends on many factors, and therefore organizations must also monitor the current situation on the labor market.

The Czech Republic currently has the lowest unemployment rate in the entire EU. The typical ads on work portals no longer work. Organizations are receiving fewer CVs for the positions posted on work portals. Lately, the behavior of job candidates has considerably changed with the arrival of social networks. The sharing economy and the start-up boom also had a major impact. Organizations are switching from a reactive approach, where they only processed the response of candidates from posted ads, to proactive and direct contacting of job candidates through social networks or recommendation programs. This approach to searching for job candidates focuses mostly on passive candidates, where 45% of them is open to new job offers. All these reasons are changing the current situation on the labor market and the recruitment method and technique, and organizations must respond to them.

It is social networks that could become an effective solution to the current situation since they are no longer used only for fun. Organizations can use them for commercial purposes as well. Not only for paid ads or job ads but also as a supplementary recruitment tool to obtain information about the professional and private life of job candidates, in particular their references and work experience. It is because social networks and technologies surrounding them can provide additional information

that is not included in a job candidate's letter of motivation or CV. They can also help to verify whether or not the already obtained information is true. This recruitment method brings out questions regarding handling of information about job candidates which was obtained on social networks. The answer can be partly found in Czech laws, specifically in Act No. 101/2000 of Coll., on personal data protection and an amendment to some laws, in the EU's General Data Protection Regulation and in the rules of a specific social network.

Another question is whether or not it is ethical to use social networks to obtain additional information (Sigmund, 2015). In the case that an organization finds inappropriate content, such a fact reduces a candidate's chance to be hired. The entire issue of verifying and finding information can be looked at using different contradictory perspectives of ethics, e.g. Deontology of Immanuel Kant and Utilitarianism. The use of publicly available information on social networks for the purposes of recruitment is thus defendable both from an ethical and legal point of view. However, an organization that tries to hack social network accounts, etc. no longer acts ethically and moves to the criminal law area. It would mean that an organization acquires explicitly private information and in fact commits a crime.

Social networks also follow the current situation on the labor market and have started to skillfully adapt to it. The largest ones, such as Facebook, LinkedIn and Twitter, have developed new tools for an effective interconnection with the labor market (prepared based on Bohmova, 2017).

Another aspect of the digital economy is an increase or decrease of the importance of ICT professionals in practice, which reflects in their wages in the budget sector and in the business sector. More detailed analyses of these trends are available e.g. in (Doucek, Nedomová, & Maryška, 2015; Matejka, & Vltavska, 2013). The implementation of ICT in practice also has a direct impact on labor productivity, depending on the level of their penetration into the economy (Sixta, & Vltavská, 2015; Manďák, & Nedomova, 2014; Fischer, &Sixta, 2009).

3. Conclusions

ICT and their expansion in regular life bring new trends that improve life. In the business sector, ICT mainly change business models and provide for a faster data exchange as well as for new channels of communication or even a new logic of data flows and processes. The application of ICT also reinvigorated the concept of sustainable development, which has now shifted to the concept of Smart Cities where ICT are to enhance the quality and comfort of life, in particular in urbanized areas. In small, non-metropolitan agglomerations, this trend is mainly reflected in resource (energy) savings and in monitoring select processes or phenomena – traffic offences, the fight against crime, efficient use of energy and water, etc.

The Smart City trend includes another trend in technology, i.e. the inter-networking of new devices (the so-called Internet of Things). Its main goal is to monitor phenomena or the state of things based on information regularly transmitted from relevant devices into the center where this information is evaluated. The rapid increase in data volume and communication will lead to an additional increase in demand for the storage and quick availability of data, i.e. a higher demand for cloud data storage, its size and response time. This will result in bigger demands for data security as a whole (Svatá, 2014).

The integration of ICT into the economy, which means quick availability of data, also changes the behavior of economic entities. This results e.g. in a sharing economy. We expect this trend to keep expanding at least in the very near future.

However, let's not forget that the impact of technologies is not only a technocratic matter. The human society must be developed in a harmonized manner, and therefore let's not forget the moral

and ethical dimension of new technologies and the entire penetration of ICT into the economy (Sigmund, 2015).

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RELATION BETWEEN JOB AND THE CONTENT OF STUDY OF ICT STUDENTS IN THE CZECH REPUBLIC

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Keywords

ICT students, job, work at study, EUROSTUDENT survey, logistic regression

Abstract

The aim of the paper is to find the factors influencing the relation of study content and job content for the Czech students of higher education institutions who work during their studies. As in previous research works related to the position of the Czech ICT students and graduates at the labor market and their perception, ICT and non-ICT students are compared. While the relation between study field and current job of non-ICT students is influenced by several factors including social and demographic ones, for the ICT students there are just two significant factors identified by the logistic regression used as the main tool: financial situation of their parents and frequency of the paid job during study. ICT students who work during the whole study period more frequently work close to their study field comparing to ICT students who work just from time to time. Similarly, students from well-financially-situated families more frequently have a job related to their study.

1. Introduction

Students and graduates of the ICT study programs at the Czech higher education institutions (hereafter: HEIs) and their position at the labor market are the objects of several recent research studies using different methodologies and different data sources. Doucek et al. (2011) use the data from employers and examine the requirements laid by the employers on the ICT graduates. Marek et al. (2016) deeply analyze the ICT HEIs' graduates at the labor market in terms of their wages using data from Information System of Average Earnings (ISPV). Fischer & Vltavská (2013) analyze the differences in graduates' unemployment rate between ICT and non-ICT graduates using data on unemployment from the Czech Ministry of Labor and Social Affairs. Finally, using data from EUROSTUDENT and DOKTORANDI Survey, the perceptions of ICT and non-ICT students at the labour market are compared (see Vltavská & Fischer, 2014 for undergraduate students and Fischer & Vltavská, 2015 for PhD students).

Generally, students of the Czech HEIs very often work at study (Fischer & Lipovská, 2014). It is partially caused by the fact that there is very low level of the state financial support of HEIs' students and there are just two significant sources for covering their study costs and mainly the living cost during studies. During studies, students receive majority of income from their current job and from their parents or partners.

There are two different views on working students. On one hand, students with practice during study easily find their job after graduation. On the other hand, there is a crowding-out effect and the time spent by study (at school or at home) is substituted by the time spent in work. Working students issues are the subject of several workshops, e. g. the Eurostudent Researchers Forum held in Vilnius, 2017[4]. The practice is more useful when its content is closely related to the study program.

The aim of our paper is to find the factors which influence the relation between study content and job content, both for ICT students and for non-ICT students as the control group. Firstly, the data source (EUROSTUDENT Survey) and the key descriptive statistics are presented, secondly the methodology is introduced and finally the results are described.

2. Data and Methodology

The analysis is based on the data from EUROSTUDENT VI survey which was conducted by the Ministry of Education, Youth and Sports (hereafter: Ministry) during spring 2016. This survey was intended to all Bachelor and Master students from public, state and private HEIs who studied Czech study programs and who are not abroad for the mobility and who actually are not interrupting the studies. Nevertheless, not all HEIs participated in the survey (see MŠMT, 2016). After the cleaning and checking the data we got 16,653 respondents that are used for all analyses. These data were weighted according to the structure of students based on the Ministry statistics hence the results can be generalized to the population of students in the Czech Republic.

The purpose of this paper is to find the factors that influence the relation between the content of the study program and current paid job of students. The best way how to evaluate such relationship is using the logistic regression. As the dependent variable (How closely related is/are your paid job(s) to the content of your study program?) has more than two answer categories we choose multinomial logistic regression as the most suitable statistical tool. We predict the probability of the occurrence of outcome Y knowing value of independent variables X_{ni}. In the simplest form the equation becomes (Field, 2009):

$$P(Y) = \frac{1}{1 + e^{-(b_0 + b_1 X_{1i} + \ldots + b_n X_{ni})}},$$

where $P(Y)$ refers to the probability of Y occurring, e presents the base of natural logarithms, b_0 refers to the constant, $X_{1\mathrm{i}},\ldots, X_{\mathrm{ni}}$ present predictor variables and $b_1,\ldots, b_{\mathrm{n}}$ are attached to that predictors. The parameters are estimated using maximum likelihood method.

We use goodness of fit and other tests for the validation of the model (e.g. Hosmer-Lemeshow test, Pseudo R-squared and Wald test). For all formulas see Field (2009).

3. Results

For the purpose of this paper we take into account only students from ICTs study field based on the International Standard Classification of Education ISCED-F 2016 (UNESCO, 2014). Moreover, we concentrate only on students who studied full-time and who are younger than 30 years as based on the survey results part-time students and students older than 30 years are very specific in terms of

[4] https://eurostudentblog.wordpress.com/2017/04/17/erf-presentations-students-working-alongside-their-studies/

their relation to the labor market. Table 1 presents the structure of students both ICTs and all regarding the main factors we are interested in. ICTs full-time students are mainly males (82.4 %) in the age category 22 to 24 years (45.6%) who studied bachelor program (71%), comes from both secondary education with Matura (35.2%) and grammar schools (57.8%). Their parents have higher education (56.6%) and they are in the average category of the financial situation (48.2%). These students did not work prior entering higher education (63%). On the other hand, they have a paid job during the current lecture period (63% during the spring 2016). If they have the paid job it is very closely or somehow closely related to the content of their studies (66.1%). On the contrary, the structure of all Czech full-time students younger than 30 years looks differently. Czech students are mainly females (57.3%), younger than 24 years (84.7%), mainly studying Bachelor program (62.7%). They came from both type of grammar schools (30.5% from 4 years, 30.2% from 6 to 8 years). As ICTs students they come from families with higher education background (51%) with average or somewhat well-off situated parents (49.7% and 36.5% respectively). They did not work prior entering higher education for the first time (62.8%). All Czech students mainly work from time to time during current lecture period (38.8%) and the work is not at all closely related to the content of their studies (34.9%).

Table 1 Descriptive statistics, ICTs and all full-time students younger than 30 years, %

Variable		ICTs	all
Gender	Male	82.4	42.7
	Female	17.6	57.3
Age category	Up to 21 years	41.5	36.7
	22 to 24 years	45.6	48.0
	25 to 29 years	12.9	15.3
Study program	Bachelor	71.0	62.7
	Master	29.0	37.3*
Type of secondary education	Secondary with Matura	35.2	29.4
	Follow up courses	0.1	0.5
	Lyceum	6.4	7.7
	Grammar school (4 years)	22.3	30.5
	Grammar school (6 to 8 years)	35.5	30.2
	Higher professional school	0.5	1.7
Highest educational attainment of parents	No higher education (ISCED 0-4)	41.7	47.7
	Higher education (ISCED 5-8)	56.6	51.0
	I do not know	1.7	0.3
Paid job(s) prior to entering higher education for the first time	Yes, I worked continuously for at least one year without interruption and at least 20h per week	3.7	5.2
	Yes, I worked continuously for at least one year without interruption and less than 20h per week	8.9	11.1
	Yes, I worked, but less than one year	24.4	20.9
	No, I did not work prior to entering higher education	63.0	62.8
Paid job(s) during the current lecture period	Yes, I work during the whole lecture period	40.7	38.8
	Yes, I work from time to time during the lecture period	22.3	27.1
	No, I don't work during the lecture period	37.0	34.1

How closely related is/are your paid job(s) to the content of your study program?	Very closely	38.7	20.5
	Somehow closely	27.4	18.4
	Average	11.9	13.0
	Not very closely	7.5	13.2
	Not at all	14.5	34.9
How well-off financially do you think are your parents compared with other families?	Very well-off	3.8	5.2
	Somewhat well-off	35.8	36.5
	Average	48.2	49.7
	Not very well-off	10.9	7.6
	Not at all well-off	1.3	1.0

Source: EUROSTUDENT VI ; Note: * Master for all students covers short (2 years) and long (5 to 6 years) programs

Table 1 depicts that not all categories have enough answers thus we join some answers. For the secondary education of students we decided to regroup the answer categories into three: grammar school (4 years), grammar school (6 to 8 years) and other secondary education which refers to the rest of the secondary education. Moreover, we regrouped the answers on financial situation of parents into three categories: (somewhat) well-off, average and not well-off. Further, we took into account only students who know the educational background of their parents.

We prepared analyses separately for all Czech students (tables 2 to 4) and ICTs students (tables 5 to 7). Firstly, we consider all variables from table 1. From our point of view, they mostly influence the decision of students having a job and more concrete having a job which is related to their studies. The dependent variable presents the relationship between paid job and content of current study program with reference category 'Not at all'. All results use 5% level of significance.

3.1. All Czech students

Employing likelihood ratio tests we can state that all variables are needed in the model (table 2). Table 3 presents all Pseudo R-Squared statistics and depicts that the model explains more than 13.8% of the variation in the output (see Nagelkerke R Square). This low value indicates that there are more factors behind the relationship between selected variables and paid job than we have got from the survey. Table 4 presents the final results of the model.

Table 2 Model fitting information, all Czech students

	Model Fitting Criteria	Likelihood Ratio Tests		
Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	9425.344			
Final	8233.968	1191.377	56	0.000

Source: Authors' calculation

Table 3 Pseudo R-Squared, all Czech students

Cox and Snell	0.132	Nagelkerke	0.138	McFadden	0.046

Source: Authors' calculation

Table 4 Multinomial logistic regression, 'How closely related is/are your paid job(s) to the content of your study program?' all students

	Very closely	Somehow closely	Average	Not very closely
Type of secondary education				
Other secondary	1.014	.961	1.167	0.872
Grammar school (4 years)	0.809**	0.822*	1.012	0.667***
Grammar school (6 to 8 years)	-	-	-	-
Highest educational attainment of parents				
No higher education (ISCED 0-4)	0.598	1.496	0.553	1.548
Higher education (ISCED 5-8)	-	-	-	-
How well-off financially do you think are your parents compared with other families?				
(Somewhat) well-off	1.798***	1.693***	1.581***	1.132
Average	1.333*	1.208	1.272	1.067
Not well-off	-	-	-	-
Age category				
Up to 21	0.645***	0.590***	0.871	0.936
22 to 24 years	1.162	1.008	0.908	1.181
25 to 29 years	-	-	-	-
Gender				
Female	0.425***	0.501***	0.709***	0.802**
Male	-	-	-	-
Paid job(s) during the current lecture period				
Yes, I work during the whole lecture period.	2.571***	1.480***	0.923	1.019
Yes, I work from time to time during the lecture period	-	-	-	-
Paid job(s) prior to entering higher education for the first time				
Yes, I worked continuously for at least one year without interruption and at least 20h per week	0.792	0.815	0.888	1.185
Yes, I worked continuously for at least one year without interruption and less than 20h per week	0.786	1.054	1.356***	1.037
Yes, I worked, but less than one year	1.149	1.137	1.201	1.216*
No, I did not work prior to entering higher education	-	-	-	-
Study program				
Bachelor	0.412***	1.359*	1.512*	1.291
Master (2 years)	1.124	2.605***	2.713***	1.387*
Long master (5 to 6 years)	-	-	-	-

Source: Authors' calculation; Note: Odds ratios, reference category Not at all; *0.05, **0.01, ***0.001

Table 4 shows that very closely related job and content of study program is mainly influenced by previous secondary education, financial situation of their parents, gender, age category, study program and job during current lecture period. Students whose parents have (somewhat) well-off

financial situation have more likely job very closely related to the content of their studies (1.798 times) than the ones whose parents are not well-off financially situated. Students who work during the whole lecture period have more likely very closely (2.571 times) related job to their study program than the one who work only from time to time. On the other hand, females have less likely than males' closely related job to their study program (0.425 times). Further Master students (2 years) have more likely somehow closely or in average related job to their studies than long master study program students (2.605 times, 2.713 times respectively). Students whose job is in average related to the content of their studies more likely worked prior to entering higher education continuously for at least one year without interruption and less than 20 hours per week than students who did not work prior entering higher education (1.356 times).

3.2. ICT students

For the ICT students' analysis we were not able to use all explanatory variables as not all variables could be used as the model would be statistically insignificant. Thus at the end we have only two explanatory variables – periodicity of a paid job during current lecture period, financial situation of parents. Therefore, the relationship between current study program and paid job refers to the dependent variable with the reference category 'Not at all'. Financial situation of parents and periodicity of a paid job during current semester stand for explanatory variables. Using likelihood ratio tests we can state that both variables are needed in the model (table 5). Table 6 presents all Pseudo R-Squared statistics and depicts that the model explains more than 15.1% of the variation in the output (see Nagelkerke R Square). Table 7 presents the final results of the model.

Table 5 Model fitting information, ICTs students

	Model Fitting Criteria	Likelihood Ratio Tests		
Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	213.220			
Final	117.706	95.515	12	.000

Source: Authors' calculation

Table 6 Pseudo R-Squared

Cox and Snell	0.143	Nagelkerke	0.151	McFadden	0.053

Source: Authors' calculation

Results show (table 7) that ICT students who work during the whole lecture period have more likely very closely related job and content of their studies (6.554 times) than the one who works only from time to time. Students with well-off financial situated parents have this chance in comparison with the one with not well-off situated parents 2.745 times higher.

Table 7 Multinomial logistic regression, 'How closely related is/are your paid job(s) to the content of your study program?' ICT students

	Very closely	Somehow closely	Average	Not very closely
Paid job(s) during the current lecture period				
Yes, I work during the whole lecture period.	6.554***	3.904***	1.595	2.396*
Yes, I work from time to time during the lecture period	-	-	-	-
How well-off financially do you think are your parents compared with other families?				
(Somewhat) well-off	2.745**	2.009	2.623	6.834**
Average	1.926	1.431	4.260**	2.091
Not well-off	-	-	-	-

Source: Authors' calculation ; Note: Odds ratios, reference category Not at all; *0.05, **0.01, ***0.001

4. Conclusion

While the relation between study field and current job of non-ICT students is influenced by several factors including social and demographic ones, for the ICT students there are just two significant factors identified by the logistic regression used as the main tool: financial situation of their parents and frequency of the paid job during study. ICT students who work during the whole study period more frequently work close to their study field comparing to ICT students who work just from time to time. Similarly, students from well-financially-situated families more frequently have a job related to their study.

Our results contributes to the conclusions of recent research papers focused on the impacts of the social-economic family background of HEIs' students on the entrance rate to the system and to the chances at the labor market. Generally, the Czech higher education system is still strongly socially selective (Fischer & Lipovská, 2013; Matějů et al., 2009; OECD, 2016).

The Czech Republic has been on the first countries which realized the 6th wave of the EUROSTUDENT survey. After completion the survey in other countries, the position of the Czech students (both ICT and non-ICT) within the EU will be analyzed in terms of the work-study dilemma and the impacts to the chances and positions at the labor market.

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REGULATION OF CYBER SECURITY IN THE BANKING SECTOR

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Keywords

Cyber security, security management models, security functions, banking environment, risk management,

Abstract

Extensive use of information systems and information technologies in regular practice and in particular in the banking sector has led to its critical dependency on these systems and technologies. This is why it is necessary to protect these systems and to model the risks that threaten them. Two main approaches are currently in use – analytical and empirical. The analytical approach is based on a "Good Practice" technique, while the empirical approach uses the technique of sharing information about resolved security incidents. The article analyzes the basic principles of both approaches and assesses their suitability for the banking sector. The analysis result shows that it is necessary to combine both approaches in order to successfully manage information security in banks.

1. Introduction

As the dependency of the financial sector on its information systems and information and communication technologies keeps growing (IS/ICT), so do the risks of using them. The risks of using IS/ICT are classified as operational risks (e.g. in Svatá, Fleischman, 2011, Teplý, 2012, Karam, Planchet, 2012). These risks mostly stem from using IS/ICT in regular operations and in the support of an organization's primary and secondary processes. Since IS/ICT became crucial for the functioning of the banking market, its failure or limited functionality represents a critical factor for the entire sector. This is why it is important to manage the risks connected with its ownership and use (Sonntag, 2016).

It is important to point out that cyberspace is intensively used because it makes it possible to provide banking services more cost-effectively (banks have considerably lower operating costs) and in better quality for bank clients (faster and easier access to accounts without any time and spatial limitation). It means that banks are forced to run cyber risks and cannot preventively avoid them (Capek, Hola, 2016).

In practice, it means that banks and their regulatory authorities must run and carefully assess and measure cyber risks (NIST, 2010, NIST, 2012, Doucek, 2008). In view of this fact, necessary security controls are implemented so that the functions of banks in cyberspace would not be seriously threatened (Doucek et all, 2011). In other words, necessary preventive controls are implemented. At the same time, it is necessary to ensure that banking services have the ability to

detect and respond so that bank experts would have the necessary information about the current state of banking services and would be able to adequately, timely and correctly respond.

The goal of the article is to compare the two different approaches to security management models – empirical and analytical. Both approaches are used nowadays and the evaluation of their strengths and weaknesses shall help to choose one of them in setting up an organization's information security management system and follow-up risk management system. Both approaches are usually combined, in particular in the banking sector, which means that some areas are modeled based on empirical approaches and other ones based on analytical approaches.

2. Security Management Models

There are essentially two approaches to information and cyber security management**. The first approach involves risk analyses based on "good practices"** (it could be e.g. ISO 27005, NIST 800-30 rev 1, NIST 800-37, ISO 27015, Octave, Cramm) and relatively exhaustive risk models. Security controls are then implemented to reduce an unacceptable level of risks. **Banking regulations have so far much more preferred the analytical approach.**

Risk management in the banking sector is discussed e.g. in (Bits, 2002) that describes in detail the methods of management and their impact on the running of a bank both from an organizational standpoint and from the standpoint of conventional protection of assets as well as the factors that this conventional protection does not cover completely or at all.

The second approach involves the current development of cyber security and is based mostly on the need to handle cyber security incidents (Rippl, Teplý, 2011). Requirements and recommendations focus on creating CSIRTs (Computer Security Incident Response Team) or CERTs (Computer Emergency Response Team) and a major part of this concept is based on sharing experience with solving incidents (Veber, Nedomová, Doucek, 2016) and on follow-up optimization of existing security controls. The major sources include e.g. ISO 27035, ISO 27032 or many recommendations for organizing CSIRTs/CERTs e.g. (CERT, 2017). **This concept can be collectively referred to as an empirical concept.**

2.1. Basics of Using Analytical Models

Risk management in cyberspace represents an important element of banks' protection. Cyberspace represents an essential environment of every bank that connects it with the surrounding world (Basel, 2001). The principles of behavior in cyberspace are not left up to the discretion of the communicating parties but are formulated by the states or the groups of states and regulated by laws (in the Czech Republic, it is e.g. Act No. 181/2014 of Coll., on cyber security). They are then implemented by special public administration authorities. In the Czech Republic, it is the National Security Authority. However, it holds true that every cyber security system is as strong as its weakest link, and therefore having good laws is not sufficient; the security and management of risks in cyberspace must be handled on all levels, including risk modeling and increasing the security awareness of practically all employees in organizations.

Many different groups wishing to meet a lot of business or regulatory requirements are interested in an organization's risk management. The implementation of different risk management tools and procedures often leads to oversaturation of, and chaos in, risk information. In this connection, IS/ICT plays an irreplaceable role for the two following reasons:

1. IS/ICT integrates different functional areas in an organization and thus has the potential to also integrate risk assessment activities across the entire organization; and

2. Working with information thus reduces the probability of poor quality information in an organization, including wrong information about risks.

This is why it is necessary to also protect actual IS/ICT. Its protection can avert not only direct losses (financial, material, personnel, etc.) but also indirect or intellectual property losses (a company's goodwill).

The basic principles used in analytical models are shown in Fig. 1, where risk is formulated as a function, the parameters of which are impact, threat and vulnerability.

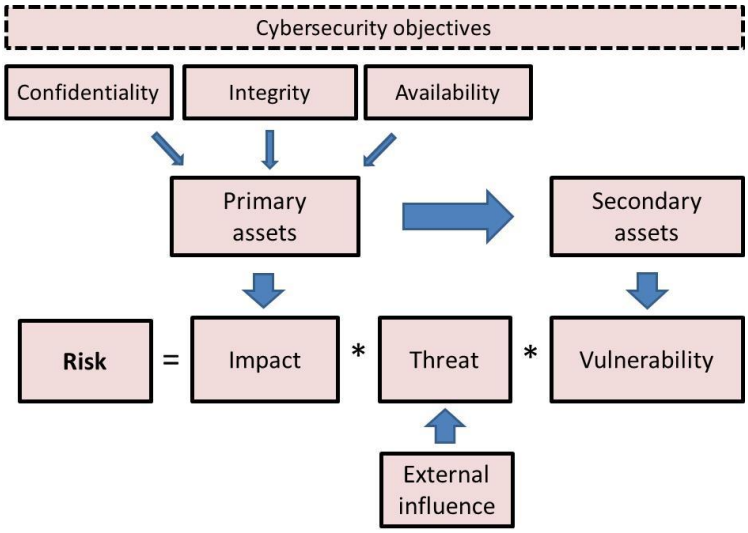

Figure 1 Basic principles of analytical models

In the form of functional dependency, the situation can be described as follows:

$$\text{Risk} = f(\text{Impact}, \text{Threat}, \text{Vulnerability}) \quad (1)$$

and variables presented in (1) are also secondary functions of:

- Impact - function of Primary Assests,
- Threat - function of External Influence Factors,
- Vulnerability - function of Secondary Assests.

The basic parameters of risk management are determined by other elements. The easiest is to determine threats where the primary determinant is an external influence, such as a natural disaster (e.g. flood, earthquake, etc.) or a social factor (e.g. threat of the enforceability of the law or a social perception of criminality, especially "white collar" criminality, etc.).

The figure shows that the assessment of impact and vulnerability parameters is closely connected to another important element of analytical models that focuses on assets management. Lately, the need to distinguish between primary and secondary assets is being emphasized and closely relates to the necessity to effectively manage risks because the impact parameter is considerably affected by primary assets and by the assessment of the importance of primary assets in view of the basic parameters of information security, such as confidentiality, integrity and availability (e.g. the size of damage depends on which information was disclosed or lost when a laptop was stolen or which information is unavailable at the time of decision-making). On the other hand, the vulnerability parameter is determined by secondary assets that fundamentally help to protect information (e.g. the loss of a laptop with properly encrypted disks does not jeopardize the confidentiality of stored information). This shows that risk management and assets management very much overlap and support each other.

Information security objectives represent the last important element used in analytical models. This element is designed based on changes in the definition of information security risk. The original definition[5] more or less referred to the areas linked to risk parameters and related assets. The new concept of risk[6] is linked only to the achievement of information security objectives, and therefore these objectives are integrated in the analytical model.

The formulation of appropriate information security objectives (described in detail in COBIT5 for Information Security) leads to the effective implementation and high harmonization of security rules. Significantly different controls are often implemented if a risk is closely connected to an asset. It is because the main determinant is the asset and the risks related to the asset. In practice, it often happens that assets with similar confidentiality, integrity and availability characteristics have very different information security controls because a model without objectives does not steer anybody toward similar comparisons.

On the other hand, the strong focus of the entire risk management model on information security objectives results in a high level of harmonization of information security controls between similar assets. If something is similarly significant, it is then logical that the protection objectives shall be identical and thus information security controls shall be identical or at least similar or easily comparable. This aspect represents a major simplification for all persons participating in information security.

2.2. Basics of Using Empirical Models

The empirical models of security management are based on the ability to effectively assess major incidents that could negatively affect information security and to effectively respond to such incidents. This approach requires the implementation of basic preventive controls of information security as well; however, it does not use "complicated" risk modeling but instead relies on existing experience with effective protection of cyberspace, which is called "**baseline security**." Baseline security emphasizes different information security controls (e.g. user identification and authentication, access authorization management, the monitoring of activities of information system users, SIEM – Security Information and Event Management, etc.).

Baseline security requires the creation of operating capabilities that assess operation events on a daily basis and are able to effectively detect suspicious events or security incidents and to respond in a timely and purposeful manner and thus completely eliminate any potential negative impact. Such operating capabilities require the formation of specific teams of security experts that are called CSIRTs or CERTs.

Contrary to analytical models that create information security from "the top down," i.e. from information security objectives to models of their threats in the form of information security risks, the empirical approach tries to build security from "the bottom up," based on the systemization and generalization of operation experience, which mostly has two basic reasons.

The first reason lies in the fact that the used analytical models are complicated. In many cases, descriptions are created for regulatory authorities and operation teams are not able to handle them. Moreover, these descriptions do not have the sufficient level of technical details necessary for an effective transformation of analytical models into operating capabilities. For instance, the importance of secondary assets that partly resolve this problem was emphasized for the first time in

5 The possibility that a certain threat shall take advantage of the vulnerability of an asset or a group of assets and shall cause damage to an organization.

6 The impact of uncertainty on the achievement of objectives.

connection with business continuity management (BS 25777). This risk management concept was recommended in 2010, but it is rarely used in practice.

The second reason is the fact that the existing analytical models are very rarely compared to operation practice. It is because of the complexity or the rather incompatible concept of the used models as well as because of the limited interconnection of activities between the teams in charge of analytical or empirical processes.

Lately, the requirements of regulatory authorities have been emphasizing more and more the need for empirical models. The concept of cyber security is mostly about the fact that the states or other supervisory authorities need to have information about major information security incidents and important entities are obliged to provide information about security incidents to the competent centers that generalize such information and are able to formulate specific technical recommendations. We could mention for instance that based on the assessment of cyber-attacks in the Czech Republic in 2013 (DoS attacks), the recommendations emphasized that operators should not flood routers with packets that are apparently fake and should set up gateway elements in such a way that these fake packets would be dropped and thus would not complicate other entities' security.

Ideally, an analytical model is created structurally as well as in consideration of the architecture that is consistent with the viewpoints of technical operation teams. In such a case, information may help operation teams' decision-making in solving emergencies. It is also necessary to regularly compare empirical experience with the analytical model and to effectively reflect such experience in the parameters of the analytical model.

Based on the level of compliance of the analytical and empirical model, we can classify information security incidents as follows:

- Category A – the security incident was predicted by the analytical model and its manifestation is in full compliance with the predictions (i.e. expected damage, threat frequency and the efficiency of information security controls) – an ideal situation;
- Category B – the security incident was predicted by the analytical model, but its manifestation is not in compliance with the predictions (i.e. expected damage, threat frequency and the efficiency of information security controls);
- Category C – the security incident was not predicted by the analytical model and must be added to the analytical model.

3. Conclusion

The performed analysis shows that the two models are not used evenly and that one of the mentioned approaches to information security prevails in regular operation. The analytical approach describes in detail and models potential risks. If linked to the objectives of security policy (i.e. information security), this approach can very well ensure the comparability of controls with respect to individual assets or their groups. On the other hand, empirical models are based on sharing experience with handling security incidents. These models include mechanisms that, based on the impact of current threats, obtain experience with information security in the future. Therefore, they work based on the principles of a learning organization.

The goal of our analysis is also to propose an approach combining the advantages of both approaches. The proposed approach shall stem from an initial analysis of risks, using an analytical model approach, and shall include empirical model mechanisms created based on experience with handling incidents and incorporated into the initial analytical model. We shall especially try to

interlink both models by means of KRIs – key risk indicators – that can be common for both models. KRIs must be linked to the defined structure of risks that shall be identified by the analytical model. In terms of the PDCA model (Plan – Do – Check – Act), it means that the analytical model shall be dominating in the planning and improvement phase.

The set-up KRIs shall make it possible to easily interlink the analytical model with the empirical model since the set-up KRIs are mostly monitored by the tools (e.g. SIEM, ServiceDesk, etc.) that are used by CSIRTs/CERTs. The use of KRIs shall allow these teams to better focus on information security objectives and thus to better systematize and use operation experience obtained from the empirical model. It means that the empirical model shall be very much used in the "do and check" phase of the PDCA model.

4. Acknowledgement

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IS THE SHARING ECONOMY UNFAIR COMPETITION AND SHOULD IT BE REGULATED?

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Keywords

Sharing Economy, Collaborative Consumption, Carpooling, P2P

Abstract

The paper discusses the topic of sharing economy. In the introduction, the assumptions of sharing are described and the factors for increasing range of sharing economy are introduced. The second part is devoted to theoretical concepts of sharing economy. The principles of collaborative consumption are described. The related terms (access economy, P2P, circular economy, swarm economy) are defined. The next chapter focuses on key segments and key players in sharing economy. In the last chapter, the question "Is Uber an unfair competition and should it regulate it, or not?" is answered in case study of Uber, the player, who represents controversial approach to "carpooling", similar to Airbnb in accommodation segment.

1. Introduction

The principle of "*sharing*" and "*sharing economy*" is nothing new, and with some exceptions, we can say that in human society it occurs from time immemorial.

Its assumptions are:

- the existence of a product (good or service);
- willingness to provide this product to another user by its owner;
- the existence a subject which is interested in this product, free of charge or for a fee.

Retail loans, leases goods or the provision of services are common among all groups of people, especially among family, neighbors, acquaintances, etc. The advantages of a sharing economy are its flexibility, ease of operation, low transaction costs and lower risk.

The main difference between "normal" and "sharing" economy is the owner of the product uses this product in sharing economy too; the consumption is sharing between an owner and a customer.

The current development of a sharing economy is determined by following factors (Veber et al., 2016):

- the development of modern information and communication technologies (which leads to the development of professional applications that allow sharing, but between unknown entities at large distances, i.e. outside the closed family or neighborhood community);

- the shift in lifestyle and value system (especially for the younger generation) which is much less beholden to the ownership of things and prefers the enjoyment of life;
- the desire to discover something new and to get experience in an unusual way, which is perhaps a defiance of traditional models to satisfy needs.

On the other hand, transactions and use of products through a sharing economy are far less regulated, which providers and recipients like more. However, here are some limitations of a sharing economy:

- it raises legitimate concerns for people especially in terms of safety, hygiene, respecting the agreed terms of the transaction, the complaint process, the recovery of damages etc.,
- people are unwilling to share their property with others; currently we are talking at least 50% (PWC, 2015);
- a competitive alternative exists to entities offering distribution and the use of the products in the traditional way;
- less regulation may lead to partial or full denial of the revenue from these activities and thus to non-compliance with tax obligations.

2. Theoretical background of a sharing economy

Sharing requires a noncompetitive (no rival) consumption if goods. Noncompetitive consumption can be divided into: (1) parallel (multiple individuals can simultaneously use products); and (2) serial (more individuals can use products not at the same time, but gradually over time).

We can assume that the increased attention paid to the sharing economy may be caused by just "private sharing" that is, the sharing of goods in private ownership. It has have the character of goods of serial noncompetitive consumption and it is provided for a fee. In this case, these private products become collective goods and we are talking about group sharing.

From a macroeconomic perspective:

- Sharing clearly contributes to increasing the efficiency of resource allocation (for example, in reducing the environmental burden and better use; this leads to a need for fewer goods while maintaining the level of consumption).
- Synergy effects arise due to sharing, which can lead to many savings and the acceleration of various activities both at a macroeconomic and at a microeconomics level (the business sector).

The term *sharing economy* means sharing goods by different users whose financial expenses are shared in their financing with the owner (Vorlíček, 2016). The other definition is “the sharing economy is a socio-economic ecosystem built around the sharing of human, physical and intellectual resources” (Matofska, 2016). It includes the shared creation, production, distribution, trade and consumption of goods and services by different people and organizations” (Felson, Speath, 1978).

For many users it may be more convenient to access goods and services by sharing than by ownership (Veber et al., 2016). The assumption for this are:

- You can share something, which is in excess of what has a greater capacity than the owner is able to use, e.g. products, facilities, skills and time.
- The customer (the consumer, the user) needs exist only for a short time.

- It is preferable to sharing over traditional methods of distribution and the use of goods. These advantages can be of an economic character (it's cheaper), but can also have different characteristic such as the experience, diversity, etc.
- Shared services may be used if there is sufficient capacity for sharing, there is a rapid and reliable communication channel for the contract, or the security of the transaction exists.

Collaborative consumption is an alternative term to define the economic and social activities; for these activities it is true that online transactions underlie them. This could be defined as "those events in which one or more persons consume economic goods or services in the process of engaging in joint activities with one or more others" (Guarda, 2016) or as the concept including "traditional sharing, bartering, lending, trading, renting, gifting, and swapping." (Botsman, Rogers, 2010). The differences between collaborative consumption and a sharing economy is not for people clear, for example, only 27% of Americans have heard of this term, but they are generally not able to distinguish the term sharing economy (Olmstead, Smith, 2016). Airbnb, Zonky or eBay are typical representatives of it.

In this context, we are talking about P2P (peer-to-peer, person-to-person). The concept originated in computer science; peer-to-peer networks are used for direct data sharing without an intermediary. The term is used for financial loans (*P2P lending*); in its pure form it would be a loan directly between people without the participation of banks. At present, there is an alternative to financial loans, which combines the role of banks and the sharing economy. Among the providers and applicants for money enters intermediary that through a software platform connects those two entities. This provider (usually for a fixed fee) assesses the credibility and ability to repay the loan applicant.

The more accurate term for sharing economy could be the term access economy. According to Eckhardt and Bardhi (2015), a sharing economy is not about sharing (in today's concept). If actors of the distribution of goods and services do not know each other, they are not sharing in the true sense of the word. The consumer here pays a fee for allowing access to the goods or services to someone else. Netflix or Spotify are typical representatives of an access economy (they order an access to media content), or Zipcar (it order an access a car).

The term *circular economy* emphasizes the reuse of products more than sharing. At the same time, it explains that the repeated use has a beneficial effect on the ecology, which means a better use of materials and energy embodied in the products (Guarda, 2016). For example, Yerdle Recommerce is company who "makes it easy for brands to buy back and resell used items." A *swarm economy* is based on the weakening of the forces of big players. Classic traders are not needed due to today's electronic communications. A swarm economy is built on massive decentralization and overcoming traditional economic models (Falkvinge, 2013). There are many other terms (except for the above mentioned) with the same or similar meaning as a sharing economy, such as: *peer economy*, *collaborative economy*, *gig economy, on-demand economy*, etc.

3. The segment of sharing economy and key players

The elements of a sharing economy can be found in various sectors of the economy today. For example, the server collaborativeconsumption.com currently operates more than 1,300 subjects in these areas and sub-categories (Collaborative Consumption, 2017):

- children – babysitting, clothes, gear, toys;
- electronics – appliances, cameras, laptops, stereos, tablets;
- entertainment – books, games, movies, music, video games;

- equipment – machinery, pets, photography, sport equipment, tools;
- fashion – accessories, clothes, make-up;
- food – cooking, dining, garden, produce, social dining, takeaway;
- home – appliances, art, furniture, tools, utilities;
- learning – language, skills, textbooks;
- leisure – camping, experiences, photography, sports, tours;
- luxury goods – accessories, clothes, sports,
- money – crowdfunding, currencies, insurance, investing, lending, loans, payments;
- pets – boarding, equipment, walking;
- spaces – garden, home, land, office, parking, retail, storage, venues, work;
- tasks – cleaners, couriers, errands, freelance, personal assistant, repairs, talent;
- transport – bikes, carpool and rides, cars, motorcycles and scoot, parking, taxis;
- travel – accommodation, experiences, guides, host or tours.

In connection with this, it is necessary to describe two terms. First, *freecycling* is the giving away of unwanted products from the household, such as furniture, electrical appliances, or clothing. Secondly, a *Local Exchange Trading* (LET) *system* means a local community of people who mutually assist with various services, particularly associated with the repair or reconstruction of housing. These people do not pay each other for services and they are registered into community work units. Within these units, the people exchange work that is recorded as credit.

An important area is *tourism*. The accommodation server *Airbnb* is very famous (this server was established in 2008, and today it annually uses more of the 160 million tourists). Frequent unreported income from accommodation leads in some destinations to restrict its services (e.g. in Berlin from May 2016, you can rent a room only, not the entire house or apartment). The company *PrivCo* estimated the market value of Airbnb for 25 billion US dollars. Similarly, a *car sharing*, for example *Zipcar*, is also very popular in tourism (Zipcar was sold by its owners for 500 million US dollars in 2013. Another common car sharing service is *DriveNow* in Munich which has 300 cars for free use (a digital key is necessary), but a fixed charge is paid per minute of ride). Another concept which was in other cities is *bike sharing* (typically this service is free). Furthermore, a different concept is *carpooling*, which was originally founded as a substitute service for hitchhiking. Now it is a close alternative to a conventional taxi, however, the only the service provider is a citizen who offers their free time capacity as a driver and their vehicle. Since 2009, *Uber* has been the dominant player in this area (now they operate in 66 countries, in more than 500 cities, and they have more than 7000 employees). The company *PrivCo* estimated the market value of Airbnb for 51 billion US dollars. Dozens of cities restrict this service (in order to circumvent the standard requirements to operate a taxi service). An important area is the *online marketplace* where goods and services can be sold or rented without any intermediary, which is used typically by locals (except the not very wellknown *Sharetribe* that operates in 190 countries).

4. Case study: Is Uber unfair competition and should it be regulated?

Traditional distribution models must respect a number of regulatory conditions. There are (1) distribution conditions, (2) hygienic and safety conditions, (3) conditions for consumer protection, (4) conditions of professional competence, and (5) tax conditions.

For example, the conditions for operating a taxi service are passing a test of professional competence, obtaining a license, registering vehicles and persons performing the function of a driver, passing a test from the topography, controlling the taximeter and others. On the other hand, the conditions for the Uber driver are lower (except uberBLACK). Uber weives himself from any liability: "Company Uber is not responsible for any damages, undertaking or loss arising from … using services … or any transaction or relationship between you and an independent provider." (Uber, 2017). For driver registration Uber requires only: citizen's card or passport, driving license, no criminal record, free trade license for passenger transportation, tax registration (VAT) and record from the driving point system; and for vehicles: under 10 years of lifetime, 4 doors, at least 5 seat belts, good technical condition, not cut off in the past and vehicle insurance. Other conditions are determined by service type: uberPOP (the vehicle is not a taxi), uberSELECT (only selected vehicle types and age) and uberBLACK (black sedan, only selected vehicle types and age, the vehicle is a taxi, but without obligatory taximeter, leather seats, passing a test from the topography for a driver).

The main benefits for customers are: (1) low price compared to a standard taxi, (2) user-friendly approach (easy-to-use application; driver evaluation (rating) after ride), (3) feeling of safety (rides without cash, driver evaluation (rating), driver photo before boarding), (4) anonymity (customer and driver telephone numbers are hidden from each other). On the other hand, the enforceability of compensations in case of problems is low (security risk). The next problem is how to find each other. The vehicle is not labelled as a taxi, and in busy places, it could be difficult to find it. That is the "price" at a low price. The question is who is a typical customer of Uber? It is a person (1) who does not have a good experience with classic taxis, (2) who is using modern technology (ordering by cell phone, riding without cash etc.), and (3) foreigners (Geršl, 2016), (Vrbů, 2015).

The important question is profitability for drivers. As Geršl (2016) calculated, the driver receives (in average) 160 CZK per hour (this amount also includes the amortization of the vehicle). The financial disadvantage is obvious for full-time drivers, on the other hand, occasional drivers (women care for younger children, early retirees, free occupations, hobbies) can increase their budget.

Uber is seen as an unfair competition, several states (e.g. Italy) or cities banned Uber in their territory (Hamburg, Frankfurt, Düsseldorf, Barcelona, Brno) or Uber voluntarily withdrew from the market (Denmark, Hungary). Arguments go into violation of legislation, specifically an absence of taximeters, no special concession for drivers, topography exams, etc. (Rhodes, 2017), (Idnes, 2017).

The question is whether this legislation is outdated, as Uber claims. Is it necessary to have a taximeter if GPS navigation and subsequent applications are more accurate? Probably not. Is it necessary to pass the topography exam if perfect online navigation exists? Probably not. Does the customer require a special license for drivers? Alternatively, is the customer willing to give up this requirement with the benefit of a lower price? Are the customer rights restricted? If so, why is Uber so popular with customers? Is it necessary to protect the customers from these risks? Are the customers insane? If yes, so it could be necessary to protect the customers in other areas more than now. In the context of these sentences, Uber is seen as a typical competitor and the fights against Uber is seen as typical barriers of entering into market.

5. Conclusion

Although a sharing has always been, it is undisputed that a sharing economy is a phenomenon of today's times. Its development is largely due to the development of information technology. This development allows connecting unknown people to each other. Therefore, the development of modern technology has made it possible to find a niche on the market. Of course, these new players

in the market try to keep their competitive position. The case of platforms such as Uber, Zonky or Airbnb is questionable. Most of the services provided over these platforms do not fully fulfill all elements of a sharing consumption, there are built on the traditional provision of accommodation, financial, and taxi services. However, these industries are regulated and barriers to the entry are created. This fact leads to a higher market price. New technologies create a space for price reduction and new companies provide services similar to traditional ones, but sometimes at the border of legality. Can we get it wrong in a market economy? Probably not. What with it? One solution is to ban these services, because some conditions are not keeping. The second solution of this situation is adaption the law to new conditions. Moreover, it is not important whether it is a sharing economy or not; the reaction of this phenomena is necessary.

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SESSION B: INNOVATION, NEW BUSINESS MODELS AND STRATEGIES

INNOVATION AND DIVERSITY

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Keywords

Diversity, innovation, academic-industrial collaboration, Framework for AIC, science park

Abstract

The impact of cultural, gender, or organizational diversity on organizational performance has been in focus particularly since the acceleration of globalization in 1990s. In this paper, we concentrate on effects of diversity brought by academic-industrial collaboration. We used and extended the AIC Framework proposed in (Ministr & Pitner, 2016) towards diversity and enriched a former study showing the encouraging and distracting factors of AIC primarily on the example of CERIT Science Park at Masaryk University. Then we take one case study of AIC between university and an SME located in the Science Park, both collaborating on contractual research for major electricity distribution and transmission system operators. We will show how the collaboration works and identify aspects of diversity are the most influential in AIC.

1. Diversity in academic-industrial collaboration

The impact of cultural, gender, or organizational diversity has been in focus particularly since the acceleration of globalization in 1990s. In the same period, innovation processes have been studies as background for a) business sustainability and b) reason for academic-industrial cooperation/collaboration (AIC). Some authors, such as Bassett-Jones (2005), Gassmann (2001), Danel et al (2013) or Silverberg et al (1989) already tackled the relation between diversity in innovation into consideration. We extend it further in the context of academic-industrial collaboration where we find specific diversity aspects, such as different values.

Intuitively, one may see that within any model of AIC, diversity plays a key role as it is inherently part of any relationship between business entities and academia, since both expose diverse organizational types, (sometimes) diverse values and different driving forces, as we showed in (Ministr & Pitner, 2016).

For detailed identification of opportunities and threats, e.g. as inputs into a detailed SWOT, we proposed an *AIC Framework* (Ministr & Pitner, 2016) enabling identification of encouraging and discouraging factors for a concrete AIC case in three dimensions.

In this paper, we enrich our Framework with the impact of diversity to show whether and how the diversity will influence AIC. We see the following main notions of diversity:

- *Cultural diversity* (Cox & Blake, 1991)
- *Organizational diversity* (Kondra & Hinings, 1998)
- *Domain diversity*
- *Value diversity* (Jamieson & O'MARA, 2000)
- *Employee diversity* (*Ø*stergaard, Timmermans & Kristinsson, 2011)

Many of them are thoroughly studied over the years, since the beginning of 1990s and the acceleration of globalization at the latest.

2. Case study

2.1. Design of study

To show the extension of the AIC Framework towards diversity, we developed an enriched version of the former study showing the encouraging and distracting factors of AIC primarily on the example of CERIT Science Park at Masaryk University. Primarily, we introduce CERIT Science Park and companies located in its premises. Then we take one case study of AIC between university and an SME located in the Science Park, both collaborating on contractual research for major electricity distribution and transmission system operators. We will show how the collaboration works and identify aspects of diversity are the most influential in AIC. It will get us ready for proposing an extended AIC framework in the next chapter.

2.2. Introduction of CERIT Science Park

Masaryk University established CERIT Science Park as own instrument for fostering long-term cooperation in applied research as well as entrepreneurship mainly in ICT and related fields (Pitner & Ministr, 2014). Science Park is in a proximity to the Faculty of Informatics (FI-MU) which was established in 1994 as the very first specialized faculty of its kind in the Czech Republic. Its establishment drew upon decades of experience gained in Mathematical Informatics at the Faculty of Science. Today, with more than 2200 students, the faculty offers a wide range of degree programs at Bachelor, Master, and Doctoral levels. The industrial cooperation is led by the vice-dean for strategy and external relations and has its own administration unit. The scientific collaboration between the Park and Faculty of Informatics (or ICT at Masaryk University in general) is managed by a scientific director of CERIT Science Park. For more details about academic-industrial collaboration in CERIT Science Park, see (Ministr & Pitner, 2015).

Let us now update the profile of the academic-industrial collaboration emerging from the Faculty of Informatics in relation to CERIT Science Park. We will then extend the Framework we proposed in

(Ministr & Pitner, 2016) to encompass multi-dimensional notion of diversity we encounter in the Park.

CERIT Science Park currently rents office spaces and provides infrastructure and other services to 20 companies. Firms located in CSP are classified as follows:

- *Origin* – while 15 firms are local, 5 have foreign roots and/or are active (also) abroad.
- *Legal category* – most of the companies are business-profit-oriented ones – either *společnost s ručením omezeným* (company with limited liability, Ltd) or *akciová společnost* (stock company). Minority (2) are non-profit entities such as *družstvo* (cooperative) or *spolek* ("eingeschriebener Verein").
- *Space allocated* – majority of companies (13) occupy medium-large space, typically one or two rooms, 2 are large and the rest (5) small.
- *Formal cooperation* with FI – two firms are Strategic partners in AIP, 4 belong to the Partners category, 4 companies are SME Partners, and half (10) of the companies are not yet formal partners within the Association of Industrial Partners with Faculty of Informatics. [Not being formal partners does not automatically mean there is no collaboration but there is no long-term formal goal-targeted partnership.]
- *Previous cooperation* – 3 companies are startups originating in research, 3 have already intensively collaborated with the university in R&D and/or educational activities, 2 have tight personal connections to university via students or alumni, one company cooperated mostly for the HR purposes (hiring students), and the rest (11) have only sparse contacts to university.

2.3. Collaboration profile in our case

As the main source for our case study, we took a case of AIC, where academic institutions collaborate with industrial partners inside and outside of CERIT Science Park in the electricity distribution business. The collaboration setup consists of three subjects – a research lab within the University oriented to applied research in critical infrastructures, namely smart grids (we will further denote it as LAB). Then, a spin-off SME (further referred to as SME) acts as a closely collaboration entity providing together with the university high added value R&D-based services for electricity distribution or transmission system operators (further referred to as CORP), one of which is always the third partner in the collaboration model.

The three collaborating entities are different in size, business model, main source of revenue and many other characteristics. As the collaboration runs mostly only with specific units of the electricity distribution operator(s), we will focus only on them. The collaborating teams are, however, still relatively diverse.

2.4. Diversity dimensions

The case showed us the following dimensions of diversity occurring and having an impact in AIC:

- *Domain diversity* – primary domain of LAB is research and education; SME and CORP is profit making though from diverse sources of revenue (R&D work vs. electricity distribution).
- *Cultural diversity* – organizational culture differs among LAB, SME and CORP mainly depending on the primary business goals. LAB as an R&D entity is open in its nature, fast publication of results is a necessity in contrast to SME and CORP that are focused on

keeping their IPR secret. On the other hand, LAB is usually not so strict in time management of deliverables since researchers have more flexible opportunities for valuation of their results – if not published at one venue, it can still be published at another one.

- *Business context diversity* – while LAB competes internationally to get its research results published, CORP is usually oriented just at the local market, and SME is again in the middle – primary orientation to domestic market, but with some opportunities abroad.
- *Language diversity* – while at the CORP as well as the SME, the teams are composed of 100% local, Czech speaking experts, at the LAB (university) the environment is language diverse thus enriching the experience but impeding smooth communication is a local Czech language which is the only acceptable at CORP. SME stays in the middle – English is a not a barrier for communication for them, however, it is not a real necessity as there are no employees not speaking Czech.

2.5. Impact of diversity

We have identified the dimensions of diversity in our case. We now concentrate on diversity as cause of positive and negative impact in AIC. The following dimensions together with some measures to evaluate its impact have been proposed.

- *Trust* – as mentioned by Szabo, Ferenc & Pucihar (2013), the trust is a key factor for innovation and prosperity. However, trust is often *endangered by diversity*, though this might be a purely subjective factor.
- *Competitiveness* – Cox & Blake (1991) studied impact of diversity (racial and gender is primarily taken into consideration but can be extended to other diversity categories) onto costs, creativity, marketing perspectives, resource acquisition, problem-solving and flexibility. It has found both positive and negative impacts, such as potential increase of flexibility induced by diversity, which also unlocks creativity.
- *Performance* – Hubbard (2004) introduced Diversity Scorecard to measure the impact of diversity on organizational performance.
- *Efficacy* – Sargent, L. D., & Sue-Chan, C. (2001) support the hypothesis of increased efficacy when working groups are diverse.
- *Company culture* – Dwyer, Richard & Chadwick (2003) claim that company culture is both factor influencing diversity and influenced by diversity.

3. Diversity-extended AIC Framework

As we have collected the dimensions of diversity we typically encounter in AIC, we now will try to apply the framework introduced in (Ministr & Pitner, 2016) extended with these diversity dimensions (Pawliczek et al, 2015). The framework consists of three dimensions representing:

1. *Driving forces* – on one side of this dimension there are *motivations and benefits*, as well as their opposites: *obstacles*, *controversies*, and other *distractors*.
2. *Values* – on one side, there are shared values of the academic-industrial cooperation while on the opposite side there are values being in *contradiction*, i.e. where a *conflict of interest* between the academia and industry appears – reaching the (positive) value on one side means loss on the other.

3. *State* – reflects presence or absence of formal structures influencing industrial collaboration such as formal regulations, collaboration agreements, supporting organizational structures.

This structure proposed in our former paper represented either *coherence* between academic- and their industrial partners in case of *motivating forces, shared values,* and *present structures*. In the opposite case, *tension* in case of predominantly *discouraging forces, conflicting values,* and *absent structures*.

We extend the AIC Framework with the *impact of diversity*. The results are shown in Table 1.

Table 1. Diversity-extended AIC Framework at CERIT Science Park

Dimension	**Positive**	**Negative**
Diversity-related driving forces	**Motivating**	**Discouraging**
For researchers	*Global competitiveness* – diversification of research approaches, methods, comparison with experience brought from abroad is a valuable if not a prerequisite to stay competitive in research.	Some *business-related risks* such as contractual risks, IP or NDAs can be more difficult to grasp in diverse research environment (e.g. due to legislation) than in uniform (purely local/national) research environment.
For businesses	*Language diversity* – International research environment brings opportunities to seamlessly investigate and compare business approaches abroad, particularly from non-Czech and non-English-speaking countries where the diversity in research teams can contribute or even enable in-depth investigations to be performed when e.g. legal frameworks which are nation-specific, are involved. New opportunities to become involved in *research community* incl. international *projects (H2020)*	*Language diversity* – diverse environment means more overhead in communication in AIC, primarily the native speakers from companies find it cumbersome to speak with non-native speakers (mostly in English in ICT). Outputs for industry are frequently required in local language. Coping with diversity requires new *processes* or even *roles* to be established, eg. intl. research project management.
Diversity-related values	**Shared**	**Conflicting**
For researchers	Diverse, international research teams bring yet *undisclosed perspectives of further exploitation* (e.g. publication) of results gained during the AIC.	*Global research interests* imposed by internationalized research teams may be different than those required by (local/national) industry.
For businesses	*All aspects seen from international perspective* ensure the approach and solutions emerging from AIC research are correct and globally competitive.	*Local vs. global views* – there is often an inner (undisclosed) conflict between local views frequently inherently imposed by (local) industry in contrast to global science brought by diverse international research teams

		into the game. *Time schedules* conflict more frequently in a diverse environment mostly at least due to higher overhead (longer communication, higher risks of misunderstanding) in contrast with fixed and tough schedule in business.
Diversity-related state	**Present**	**Absent**
For researchers	Support for *international* research activities, *basic support for AIC*	Research processes, management not fully ready to cope with issues induced by diversity (fully bi- or multilingual environment, rules applicable in diverse environment, in-calculation of increased overhead,…)
For businesses		*Missing structures for inclusion of more diversity* – already collaboration of industry with academia is too diverse *per se*.

4. Managing diversity in academic-industrial collaboration

Lessons learnt from our case can be summarized as follows:

- Diversity can bring added-value into the AIC by giving international perspective to industry research, opening innovative ways to valuate research and disseminating results among new communities. It contributes to keeping the industrial research competitive and prevents repeating mistakes encountered elsewhere. It discovers new opportunities such as international projects and collaboration.
- Negative aspects of diverse environment are mainly language and cultural diversity requiring additional overhead to eliminate negative impact on delivery time schedules and sometimes also quality. Appropriate process measures and rules must be introduced, see Kaiser & Prange (2004) and Syed & Özbilgin (2009). Also, additional effort must be devoted to production of results that are "collateral" in the sense of primary goals of AIC, such as scientific publications vs. contractual research deliverables.

5. Conclusion

We extended our previously proposed Framework for identification of driving forces, shared and distracting values, missing and present structures in academic-industrial collaboration with diversity. We applied it in a case of specific contractual research collaboration in the domain of energy distribution where the university collaborates with companies from CERIT Science Park and external corporations. It showed the Framework is applicable and brings a detailed insight and reflection of issues encountered in AIC. It helped to take the opportunities and prevent or eliminate risks impose by diversity in AIC.

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INNOVATION OF THE INFORMATION MANAGEMENT IN COMPLIANCE MANAGEMENT AREA

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Keywords

Compliance management system (CMS), process, activity, Segregation of Duties Matrix (SoD), Deming PCDA cycle

Abstract

Innovation of the information system on field Compliance management represents the extension of the functionality by help the tools and procedures which implement the juristic, ethical and others necessary rules in the company. Although Compliance management is often integrated into a variety of processes (finance, quality, etc.), it should keep its independence in the organization. The article describes the process structure of Compliance management containing the Deming PDCA cycle, the properties and utilization of the Segregation of duties matrix tool in the Compliance management system. The process of creating a Compliance management system is illustrated by a specific case study.

1. Introduction

Companies that want to be successful in the economic competition in the long term should maintain a culture of integrity and compliance and duly consider stakeholders' needs and expectations (Bazsova et al., 2015). Integrity and compliance are therefore not only the basis but also an opportunity for a successful and sustainable organization. Compliance is an outcome of an organization meeting its obligations, and is made sustainable by embedding it in the culture of an organization and in the behaviour and attitude of people working for it. Compliance management should, while maintaining its independence, be integrated with the organization's financial, risk, quality, environmental and health and safety management processes and its operational requirements and procedures. (ISO 19600, 2014). The legal aspect of Compliance

management plays a significant role and has become the main reason of Compliance management creation. In particular, the 3 main following documents contributed:

- American law *Sarban-Oxley* that deals with transparency and accountability for accounting information of organizations and formulates requirements for how to record, track and report financial information (Doucek et al., 2011). This law also implements a framework COSO (Committee of Sponsoring Organizations of the Treadway Commission) that understands the internal control as a process involving both management and other staff of the organization (Bazsova, 2015). The effectiveness of the organization can then be assessed by COSO in three categories, depending on whether the owners and management of the company have reasonable assurance that:
    - understand the extent to which the company's goals are met;
    - the published financial results of the company are credible;
    - achieved the compliance with applicable legislation.
- British law *Bribery Act* that that covers the criminal law relating to bribery and corruption in the UK.
- Output document *BASEL II* of the Basel Committee on banking supervision which is focused on dealing with risks in banking. This standard has primarily impact on banking information management (Tvrdikova, 2007). The BASEL II framework is structured into three pillars:
    - *Minimum capital adequacy* that formulates the rules for calculating the required capital and the risk measurement method. This pillar covers credit, market and operational risk.
    - *Supervision process* that strengthens supervisory powers, and on the basis of the risk profile, the bank regulator sets the limits for the capital adequacy of individual banks.
    - *Market discipline* that sets out the requirements for providing information about the risks of banks and financial institutions to the public.

The above mentioned documents have contributed to making organizations more legal for their employees. If the organization fails to show sufficient effort in receiving the control and preventive measures against the criminal behaviour of its employees then this organization becomes responsible for such behaviour (Danel, 2016).

Compliance management system (CMS) is a modification of the Information Security Management System (ISMS) which is based on Deming PDCA cycle and is extended by supporting activities. CMS consistency with other management systems (se figure 1) is based upon the continual improvement principle (plan, do, check, act) (Danel et al., 2012).

Support activities are iterative by all steps of the PDCA model, and the organization should provide appropriate support within the CMS lifecycle.

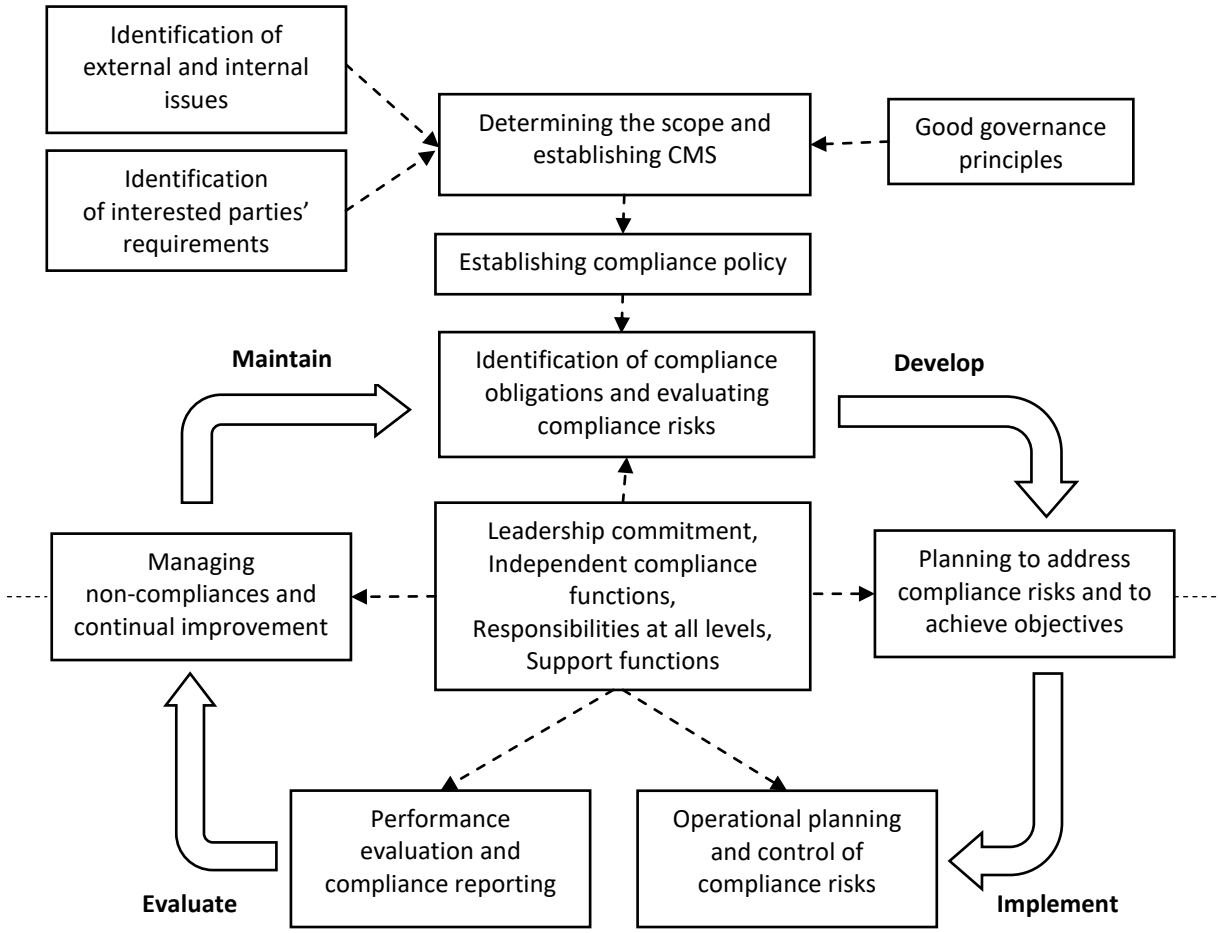

Figure 1: Visualisation of Compliance management system. Source: (ISO 19600, 2014)

2. Segregation of Duties Matrix (SoD) tool

SoD is a key element of internal financial reporting that is designed to prevent and minimize employee error or fraud (Stone, 2009). The basic principles of this authorization concept are:

- *sequential separation* (two signatures principle) that represents the division of work activities so that one employee does not perform critical activities that would allow fraudulent behaviour (for example the user should not have the rights to create vendors and to enter new orders into the system);
- *individual separation* (four eyes principle) that is based on controlling work activities and workers themselves. This principle is used in cases where certain activities cannot be separated and must be performed by one person. The principle then uses the tools as supervisor control and approval, monitoring critical indicators or metrics, or monitoring user activity (Maasen, Schoenen & Werr, 2005);
- *spatial separation* (separate action in separate locations);
- *factorial separation* (several factors contribute to completion).

When applying this methodology, it is also necessary to think about the structure of the organization itself, which should divide the job positions into sub-circuits and define the field

of activities of individual financial reporting staff at the outset already in beginning (Pitner & Ministr, 2015). In practice, we can meet three divisions (sometimes named as towers):

- *Purchase to Pay* (PTP) includes supplier-related activities;
- *Record to Report* (RTR) includes activities over the main ledger;
- *Order to Cash* (OTC) includes customer-related activities.

The outcome of this authorization concept is the SoD matrix (see figure 2), which declares collision activities that pose a risk in case if the same person can perform these activities. All risks should be described in detail, and the impact of these risks on the organization should also be determined. The complex SoD matrix usable for enhancing the security of the information system is made up of four layers based on the general authorization concept of this system (Vilamova et al. 2016). The SoD matrix is therefore divided into four layers:

- function / activity;
- transaction code;
- authorization object;
- the value of the authorization object.

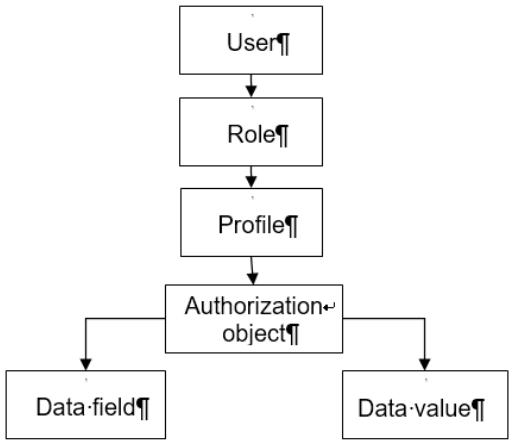

Figure 2: Authorization concept. Source: according (Maasen, Schoenen & Werr, 2005)

2.1. Function and activity

In this layer, the individual processes defined by the management are evaluated, which are subsequently logically transferred into the information system environment to the level of each activity (Chuchrova et al., 2016). At this level, there is an initial assessment and risk assessment of financial reporting. This layer also identifies pairs of activities that constitute a potential risk of corruption or unlawful behaviour in the case of one person. An example of such activities may be the above mentioned creation of suppliers and the placing of new orders in the system.

2.2. Transaction code

Information systems mostly operate on a transaction basis which represents individual activities. In this layer, we find ourselves in a situation where two transactions stand against each other, allowing one person to perform inappropriate risk activities (Chaplyha, 2016). If the user has the authority to these transactions, this is the first signal of possible abuse, and the risks and impacts that this represents for the organization need to be evaluated.

2.3. Authorization object

Authorization objects are the cornerstone of the authorization concept of the majority of information systems. From the SoD point of view, it should be noted that for example, through the authoring object is set up to perform a specific activity such as viewing, deleting, or creating of the data items. Through the object is also defined access to data depending on the transaction. In this layer are deeper explore permissions for individual transactions and collisions which are already based on the combination of transaction A plus of the given authorization object versus transaction B plus of the given authorization object.

2.4. Value of authorization object

This layer provides a comprehensive and in-depth view of the risk situations that may arise in information system. The individual authorization objects are supplemented with data fields and their value (Danel & Repka, 2015). For example, the value of the authorization object determines whether a user can make through the given transaction the changes or deletions of data, or can only look at data, etc.

Simply put, it is no longer true what is valid for first layer about conflict transactions. For example, if a user has been set an authorization object with a view-only value for a given conflict transaction, then this is no longer a conflict, because the user can create orders but is no longer able to create a vendor master record. The creation of a complex SOD matrix of collisions in practice, which is declared in the fourth layer and covers all the activities of the organization, is very laborious and difficult.

2.5. Construction of SoD matrix

Mostly, the SoD matrix is created separately for individual particular areas (towers) of the organization: Purchase to Pay (PTP), Record to Report (RTR), Order to Cash (OTC) and groups, which contains processes related to system administration. The following steps are used to construct the SoD matrix (see picture 3):

- on X and Y axes are gradually applied to the individual activities;
- activities are then divorced into transactions, authorization objects and their values;
- Finally, the pairs of critical activities are marked.

Sub-circuit	Function /activity	*Create Sales Orders*	*Change Customer Master Dat (General View)*
Order to Cash	*Create Sales Orders*		
	Change Customer Master Dat (General View)	X	

Figure 3: Example of collision identification in a SoD matrix. Source: (own)

3. Case study

The basic CMS model is typically divided into three main levels, such as access security, operational safety and data security (Hanclova et al. 2015). The Faculty of economics of VSB-Technical University of Ostrava participated on the solution the project of increasing the security of information in terms of security of access to the information system in a larger company. The organization establishes the following four roles with CMS:

- *Business Process / Data Owners* (BPO) which responsible for the implementation and integrity of organizational process data with respect to the information system;
- *Compliance management* where are employees who help administrators implement internal business rules, evaluate access risks, and suggest alternative controls due to SoD collisions;
- End users who use their authorization to execute transactions and use other system functionality;
- Administrators of information system which are in charge of following the instructions from BPO and Compliance management.

3.1. Requirements of innovation CMS

Based on an analysis of the current status, the framework requirements that should be met within the compliance management innovation are defined:

- enhanced collision control on authorized objects,
- the possibility of simple analysis of individual employees;
- the ability to easily define rules;
- intuitive operation;
- the possibility of defining one rule for multiple systems;
- portability of the application for another system.

One of the weaknesses found in the analysis of the current solution was the SoD matrix-based collision control process only for transactions that represent user operations. Often, the transaction only allows display permissions, which should not be a conflict with another transaction. Thus, it was agreed that such rules and procedures would be defined to ensure conflict control not only at the transaction level but also at the level of the authorized entity.

3.2. The CMS innovation implementation process

Innovation was implemented in the following stages:

- *Creating SoD matrix and risk definition* that includes the following actions:
    - determination of critical activities in defined areas (towers as OTC, PTP and RTR);
    - transaction assignment, authorization object, and data field values;
    - determination of collisions;
    - risk definition.
- *Design and fulfil the database*:
    - creating a conceptual model using the ER diagram;

    - obtaining data from the SoD matrix and the current information system.
- *Creating a User Environment - Program Applications.*

All of the stages of innovation described above had to be carefully consulted with the individual user role groups defined in the CMS as recommended Pedersen & & Sudzina (2012).

4. Conclusion

Based on the experience of implementing the CMS innovation project, the authors of the paper refer that it is possible:

- to increase the overall level of information security in the organization;
- to enhance the efficiency of processes that check compliance with the organization's rules and authorization authorizations for the information system users.
- to reduce of the likelihood the occurrence damage (the Business process owner estimated for our solution that for not intentional damages is probability trend from 0,9% to 0,6% and for intentional fault from 0,15% to 0,05%).

The quality and robustness of the CMS created and implemented is lower than, for example, in the case of specific company tools (such as Deloitte, which costs around 400,000 CZK), but the main functionality of the implemented tool is identical with these solutions.

The implementation of the CMS innovations is also gaining the potential of the organization in litigation. At the same time, the outputs and tools of the CMS can serve as evidence in any disputes and claims relating to employee data manipulation.

The solution will be further developed according to the requirements of owners of CMS processes

5. Acknowledgement

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MOTIVATION IN THE STUDENTS´ START–UPS

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Keywords

Start-ups, Students entrepreneurship, Entrepreneurship, Innovation, Motivation, Data mining method, Family businesses

Abstract

The article brings results of the international survey about the motivation of students to start their own business after graduation. The questionnaire was realized in fifty different countries from more than 1,000 universities. Universities have been recently seen as institutions providing learning and resources of new entrepreneurs. However, we think that family background is also very significant. It is the part of the source where young entrepreneurs find the experience, skills and motivation. Therefore, we analyzed the student's family background and the motivation to start their own business. As a tool, we used data mining methods. In our research, we can see that the family background is very important, it contributes to the decision to establish the new entrepreneurship; family represents a source of information, advice and inspiration.

1. Introduction

University graduates have enormous potential for innovation and economic development. Mobilizing them for entrepreneurial careers, enhancing their entrepreneurial skills, and providing support for business start-up are important, and often also the new tasks for higher education institutions that are only now fully recognized.

Launching new enterprises is always big challenge. Today, we can see a lot of new opportunities of new businesses especially on Internet, but still, it is a long way from a strategic intent to a successful execution. Therefore, a lot of universities support their students to learn how to establish and improve their entrepreneurship ideas. The Technical University of Liberec also started to develop the student's ability to think about the future entrepreneurship and to start to realize their ideas. Since 2015, the Faculty of Economics Technical University of Liberec has been organizing an annual competition for the best university start up.

During the competition, the students are developing their entrepreneurship ideas together with experienced managers from different companies. During the whole year, the students obtain experiences with establishing business model according Osterwalder (2002). This Osterwalder's business model is based on the most common patterns, based on concepts from leading business thinkers. The most frequent business model is usually based on free IT services and the profit is produced by internet marketing. This year another popular area of start-ups is food processing connecting with health, or different types of deliveries. During the whole year of the university competition, the students achieve very valuable tacit knowledge from experienced business managers from famous successful companies. Tacit knowledge is defined as skills, ideas and

experiences that people have in their minds, it is not codified, not easy to express it and it plays important role in promotion of enterprise innovation. The students are guided through the whole competition, so they can obtain very important feedback from them.

The student's contribution to entrepreneurship could be seen (Giglio, 2016) in big ability of creativity, close friendship, team spirit, enthusiasms, courage to risk, high ability of using new information and communication technology etc. On the other hand, very often the successful entrepreneurs mentioned that they learned a lot of from their own failures. The research report published on the web (CB Insights, 2016) mentioned the next biggest problems of start-ups caused by:

- poor knowledge of customers preferences and the market,
- cost issues, wrong financial plan,
- disharmony in team,
- legal issues,
- no market need,
- wrong business model or unconvinient strategy,
- poor product etc.

Another reason why the students are thinking about their future activities or entrepreneurship is the background from their families. This article brings some results of the investigation about the background of the student's plans of their future decisions to start their own business or to become an employee. The structure of the article is as follows: next part explains the methodology of the research, the third part brings the results and finally we discuss the actual problems of student's entrepreneurship, family business and the future development of our research in this area.

2. Methodology

In the literature about the student entrepreneurs, we can find the studies investigating student entrepreneurship in the contextual perspective and motivation (Geissler 2013; Walter et al. 2013, Ministr and Pitner, 2016). All mentioned researches bring evidence for the relevance of context on entrepreneurial intentions, without, however, being able to analyze determinants of subsequent start-up activities. These studies also suggest that students are affected by other determinants such as family background because students have no or little industry experience.

What is the motivation of the decision during the establishing new businesses especially between the students? Therefore, the Faculty of Economics Technical University of Liberec became a member of long-term research project about the context of Students Entrepreneurship (GUESSS). Its purpose is to grasp the entrepreneurial intent and activity of students using a geographical and temporal comparison.

The first survey wave took place in 2003, and the seventh one has started in spring 2016. The project leadership is in the hands of the Swiss Institute for Small Business and Entrepreneurship at the University of St. Gallen (KMU-HSG) in Switzerland (represented by Prof. Dr. Urs Fueglistaller). The responsible project manager is Prof. Dr. Philipp Sieger who works at the University of Bern in Switzerland. In the project, there are national teams in fifty participating countries, which are responsible for enlisting universities for this study. The link to the online survey is sent out by the participating universities, ideally to all of its students. In the Czech

Republic, we have the data from 9 universities, there are 3,040 respondents (see Antlova, Rydvalova, 2016).

In 2016 the participation in project was accepted by the 50 countries, more than 1000 universities, and 122,509 students who completed responses. The questionnaire had ten sections (15 pages), about the university environment, motivations and goals of students entrepreneurships and lives, the society where the students live and parents businesses. In this article, the authors are concentrating just how the background motivates students to establish their start-ups. The whole study has 26 pages (more details are in Antlova, Rydvalova, 2016).

How do individuals decide to become entrepreneurs and learn to make optimal entrepreneurial decisions? In the literature, we can find a lot of information about the motivation towards entrepreneurship (Bergman, 2016, Guoa, 2016). One of the factors is individual's prior experience. Another factor could be the model from family background with entrepreneurial activity or the level of education. In the questionnaire, the factors which formulated the motivation are: university and family context, social and cultural context and personal context (see Figure 1).

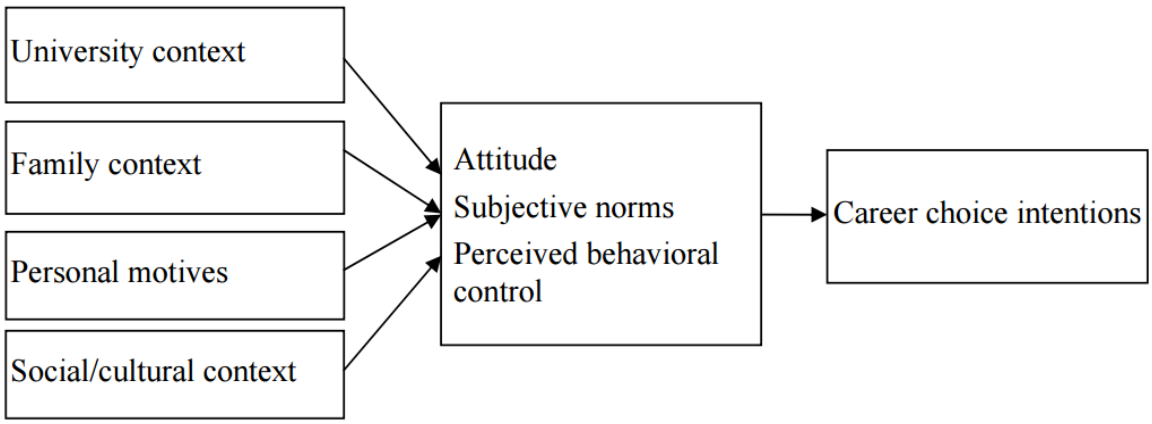

Figure 1: Source: http://www.guesssurvey.org

3. Data and Results

The research results demonstrate that out of a total number of respondents, 9% of students run their own businesses and 22% of students intend to start their own business after graduation. We also analyzed data from the structure questionnaire by data mining methods. Data analysis is performed in the program IBM SPSS Modeler and IBM SPSS Statistics. Complete the data matrix contains 120,503 rows and 274 fields (columns). There are, however, several null values (these were deleted). The Spearman and Pearson coefficient of correlation was used. The value of correlation between selected pairs of variables showed significance at the 5% level. The correlation was calculated for the questions whether the students run or intend to establish their own business whether their parents (or one of them) have their own enterprise to see the background of their motivation.

When we look on the family background – we can see that when parents have own businesses the numbers of students is higher when we compare it with the students whose parents are not entrepreneurs. It means that 14% of students have also own business and 28% of students plan to have own business. In case where family members are not entrepreneurs, just 6% of students have their own business and 18% of students plan to start their own business in the future (see Tab num.1).

Table 1: Family of student's background

	Students have the own business	Students plan to have own business
Parents who are not entrepreneurs	6%	18%
Parents who are entrepreneurs	14%	28%

Figure 2 brings some interesting information about the distribution according to the countries from questionnaire (again these are the students whose parents have the own businesses). We can see the differences in the countries so the cultural influence is very strong. Especially in the development countries (in Europe) young students prefer to be employee than to start their own business. Therefore, so many activities supporting start-ups are established in many universities in Europe (also supporting by EU: Start-up Europe Comes to Universities).

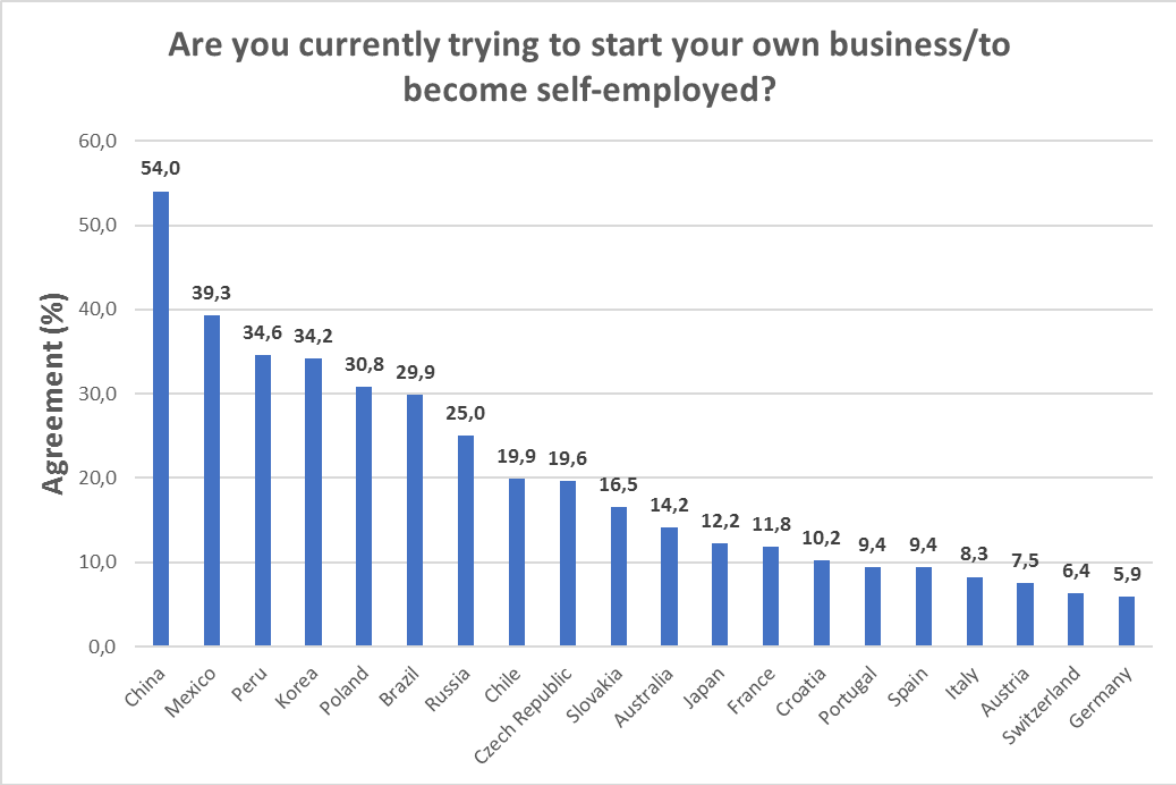

Figure num. 2: Students entrepreneurs or intending to start (with family background)

4. Interpretation of results

Small and medium enterprises including the family businesses play a key role in regional development and employment; therefore, eminent attention should be essential. The Czech Republic like other post-communist countries has some specific problems with the development of private enterprises. These entrepreneurial traditions, especially in family businesses, were discontinued by the process of nationalization of businesses, liquidation of private business and introduction of central planning of the economy after World War II.

We can see that some specifics of family business can cause different problems when we compare them with un-family companies. These differences can be seen in:

- Governance (in the centre of the firm is family - formally or informally/directly or indirectly influencing the firm)
- Factor of economic and non-economic sustainability or long-term family income (stability) as well as family satisfaction, this is the reasons of reinvestment into the company
- Transfer among generations is connecting with the sustainability over the life time of the enterprise and also is connecting with the family relationship
- Business goal orientation or competitive strategy – it is quality, long reputation, long-term relationships
- Company climate it can be described as familiarity, trust, cohesion, involvement, commitment, engagement, enthusiasm, informality
- Satisfaction of internal and external stakeholders (mainly family, clients, employees, local community)

For a family business, a significant overlap between family and business elements is typical. In the area of financing the development of family business, family´s own capital is more often used in comparison with equity. In this connection, we can speak about the so-called patient capital. In the area of income tax, there can be, therefore, considered the possibility to reduce taxable profits based on the interest of one´s own capital, so as in the case of interest on equity.

Historically, the university environment was perceived mainly as research and educational, nevertheless, with the development of the society it is crucial to expand its role to entrepreneurial. At the Technical University of Liberec, therefore, the Student Business Club has been established with the aim to help students with the transformation of their entrepreneurship ideas into real life. Apart from this activity, it is also necessary to improve presented studying programmes including entrepreneurship. The results of the survey demonstrate that the family background is very significant and therefore the specifics of the family business should be also included in teaching programmes.

The report on family businesses in Europe (Niebler, 2014/2210(INI)) states that it is necessary to support and educate the entrepreneurship activities at the universities. In the Czech Republic, there can be found some courses oriented at the specifics of family entrepreneurship.

5. Conclusion

The research project of the Faculty of Economics Technical University of Liberec (“Family business – solutions to social and economic disparities of municipalities”, reg. number TD03000035) is focused on the problems of family businesses especially on the continuation. The young generation is not very often ready to continue the business. In this project, we can see that it is not also easy to statistically express the family business percentage representation among other companies because they are not statistically identified in the Czech Republic. It can cause the problems in some European support projects or in legislation.

Our paper contributes to a better understanding of student motivation of the entrepreneurship. We can see that the family background is very important; family represents a source of information, advice and inspiration. In future development we want to compare different countries, to find the reasons for these big contrast (China 54% and Germany 5, 9%), and to analyse different areas of entrepreneurship.

6. Acknowledgements

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INNOVATION OF QUALITY CONTROL DURING COAL SALES

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Keywords

Quality control, coal sales, SAP R/3, treatment plant information system, innovation, ash-meters

Abstract

The article deals with quality control in sales and shipping of coal in OKD. To support the effective management of coal treatment plants in the past, OKD deployed information and control systems of treatment plants by ATP Soukup. The technical resources deployed within these systems allow collection of data on quality also during production. This allowed design and creation of applications that innovate the process of quality control so that the production is more efficient. The applications calculate weighted averages of the quality parameters, allowing continuous monitoring of the performance of long-term contracts. During sampling and laboratory analysis for commercial purposes it is also possible to check results with online measured quality parameters from production and thus timely prevent delivery of nonconforming product to the customer.

1. Introduction

Black coal mined in the Czech Republic must be treated prior to shipment to customers so that its quality parameters meet the demands of customers on quality. Achieving the required quality parameters is essential for the economic performance of a mining company (mining in the Czech Republic is done by OKD a.s.).

Coal quality control is carried out in DMCQ laboratories (Department of Management and Control of Quality), which in the case of OKD form an organizational part of the operation of coal treatment plants. The laboratory analyses coal samples taken with relatively high precision; but the analysis is time consuming and the results are usually not available during the technological process, often only after loading coal into railway cars. The main purpose of laboratory analysis is to determine the quality parameters of shipped coal for commercial purposes. The customer receives them as „reports on fuel quality“, which are then the supporting documentation for delivery notes and subsequent invoicing (Danel et al, 2013).

In the first half of the 90s of the last century, all coal treatment plants in the Czech Republic were gradually equipped with sensors, automatic control of the main technological nodes (flotation, treatment in a heavy liquid, treatment in jigs, flocculation of sludge, sorting processes, dewatering and homogenization). Subsequently, the coal treatment plants were also equipped with control information systems (by ATP Soukup s.r.o). Over twenty years three generations of the systems have been gradually deployed, the latest of which is still used today (Danel, 2009).

2. Problem definition

In the past, the management of the treatment plant did not have sufficient information on coal quality during production in order to be able to make interventions to the state and course of the treatment processes (Rozehnal & Novák, 2016), (Shakhovska, 2016). The control was done mostly based on the experience and results of analyses of inter-process checks of manually collected samples of coal from different nodes of the technology. In extreme cases coal was loaded for transport by rail, which did not reach the quality required by the customer. This could even lead to arbitration and in case of customer-identified discrepancies to financial recourse for breach of contract and therefore to economic losses for OKD (Kozel & Chuchrová, 2015).

For that reason, the treatment plant executives began to request that support for the management of quality parameters be part of the automation and implementation of information systems (Ministr & Pitner, 2014). Particularly significant was the request of managers from the plant Darkov which began to use a selective extraction - separate transport and storage of coal suitable for coking (UVPK) and energy coal (Vilamová et al, 2016). The treatment plant Darkov also initiated treatment of coal mined at other locations with different quality properties (Hančlová & Ministr, 2013).

3. Used Method

Based on the requirements of treatment plant managements, an analysis of the business processes in the treatment plants Darkov (Karviná), Lazy (Orlová) and ČSM (Stonava) has been conducted. The existing processes were studied by an analyst residing at individual workplaces, through interviews with management of treatment plants and with technologists the control procedures at the dispatching control were determined and activity of the quality control department was monitored. The analysis was also performed at the level of process control of loading, shipping and sales, including the processes at OKD subsidiaries that provide sale and transport of coal (OKD Doprava, now AWT and BOS a.s.).

The analysis indicated that the treatment plants, even as part of the same company, are managed by different procedures and the continuity of some processes differs significantly. The different management methods and different business processes are due to the following:

- Individual treatment plants have different treatment technologies
- The topologies of treatment plant operation differ
- Various capacity of input and output containers (while Mine Darkov has considerable capacity allowing sophisticated sorting of coal by quality already at the entry, at ČSM has this capacity is minimal and thus, for example, the possibility to utilize selective extraction is considerably limited)
- Various quality composition of the extracted coal (e.g. ČSM focuses exclusively on treatment of UVPK)

The output of the analysis was proposal of partial solutions that are designed to progressively improve the efficiency of management of quality parameters of coal during treatment and shipping.

4. The Solution of Computer Support for the Control of Coal Quality Parameters

The first stage was design of software for recording of laboratory measurements of the quality of the coal samples. It was a standard Windows application with data stored in a relational database of a Microsoft SQL Server. The added value of our software solution for the DMCQ department is the possibility of calculating a weighted average of quality parameters (average relative to the volume of delivery; the objective is to eliminate distortion of the average by outlier values of loading of small volume).

The weighted average of quality parameters of ash content in the dry matter Ad is calculated by the formula:

$$A^d = \frac{\sum_{i=1}^{n} A_i \cdot m_i}{\sum_{i=1}^{n} m_i} \quad [\%] \qquad (1)$$

Where:

- n number of loaded customers
- A_i average content of ash for customer [%]
- m_i total weight of coal loaded for customer [t]
- d index indicating the anhydrous state of fuel
- i=1 to n customers

The requirements for the outputs defined by managers of the treatment plant and mine was the possibility of a user selection: customer - assortment - period; while the period can be selected from week, decade, month, quarter, half year and progress since the beginning of the year. The weighted average of progress since the beginning of the year is an important figure from the perspective of strategic management, because these values should correlate with the value requested by customers in the basic contracts (contracts with wholesale customers concluded for one year). A significant deviation signals the mine management a potential problem with long-term quality assurance.

Given the large variability of options for user filters for displaying weighted averages, a specific solution has been proposed which consists of three layers. The first layer is the data stored in the database, i.e. raw data from the laboratory. The second layer is the application itself written in Visual Basic, which allows viewing of data from the database, including the print of reports on the fuel quality, shipping notices and transport notes. The third layer is reporting created with Crystal Reports software with custom filters, meeting the above requirements for outputs in the form of weighted averages. The weighted average is - according to the user's choice - dynamically generated using the patterns stored in the report definition. The calculation of averages is therefore always updated before displaying and it reflects the latest data in the database. If a change of the calculation formulas of weighted averages is necessary, these formulas are updated only in the definition files without need to recompile the application or modify the database.

In Figure 1 we see output - report of weighted averages for UVPK coal - Summary for 2002. This data is from the plant of the Darkov mine; ten year old data are shown in order to protect the trade secrets.

OKD, a.s.
Důl Darkov, vnitřní organizační složka nezapsaná v obchodním rejstříku

Jakostní parametry odbytu roční

Rok: 2002 *úpravna:* UK 1 *progres od:* 1.1.2002 *do:* 31.12.2002

U V P K

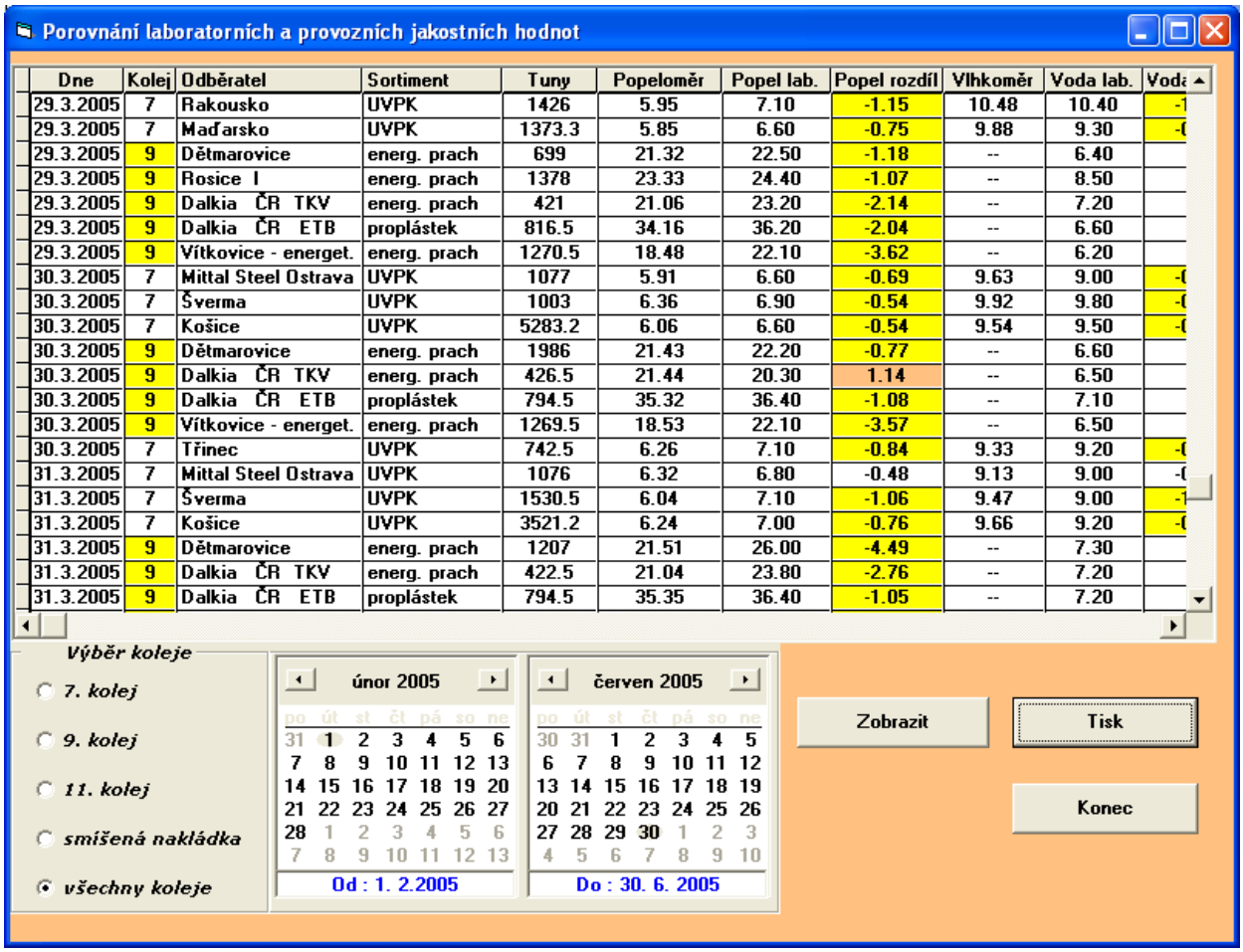
Odběratel	Tuny	Wtr	Ad	V daf	SI	dil. b	Sd
Mittal Steel Ostrava a.s	907 041,9	9,7	6,6	27.3	6.0	62	0.43
Svoboda	90 370,6	10,5	6,7	27.4	6.0	64	0.42
Šverma	396 678,8	10,5	6,7	27.3	6.0	64	0.42
Košice	715 081,7	9,9	6,9	27.4	6.0	62	0.43
Rakousko	352 627,0	9,9	6,8	0.0	6.0	65	0.43
Maďarsko	163 912,2	10,6	7,1	27.4	6.0	63	0.42
Třinec	205 730,9	10,5	6,9	27.3	6.0	62	0.42
Polsko Petro-Carbo	2 500,0	9,6	7,3	27.5	6.0	58	0.43
Polsko Inter Bau	5 000,0	9,9	6,5	27.5	6.0	63	0.43
Polsko Lubstal	2 250,0	9,8	6,7	27.0	6.0	72	0.41
Polsko Petro Carbo Ch	7 500,0	9,7	6,7	27.4	6.0	66	0.41
Polsko Carbo-Holding	11 250,0	9,6	6,6	27.3	6.0	59	0.43
Polsko Piec-export	46 250,0	9,7	6,6	27.4	6.0	62	0.42
Polsko System Trading	9 943,0	9,6	6,4	27.4	6.0	62	0.42
Polsko Carbo-energia	5 000,0	9,6	6,6	27.5	6.0	69	0.43
Polsko Morava Chem	7 500,0	9,4	7,0	27.3	6.0	56	0.42
Šverma np	4 259,0	7,9	5,0	27.1	6.0	53	0.43
Svoboda np	112 125,8	7,5	5,2	27.2	6.0	54	0.42
Polsko Forkom	1 250,0	9,5	6,5	27.4	6.0	63	0.40
Polsko-Proximus	13 750,0	9,6	7,0	27.3	6.0	66	0.41
	3 060 020,9	**9,9**	**6,7**	**27.3**	**6.0**	**63**	**0.43**
Celkem UVPK:	**3 060 020,9**						

Figure 1 The weighted average of quality parameters from the Darkov plant for 2002, loading UVPK coal

The company ATP Soukup s.r.o. implemented an information system in the Darkov plant which allows sampling of data from sensors and therefore also from the continuous ash-meters placed on conveyors (in OKD these are ash-meters from Enelex Chvaletice, http://enelex.interneto.cz/aplications/detail/127/) and hygrometers (Berthold); this opened the possibility of further computer support of management and control of quality parameters of coal during production. The information system was extended by an application that shows the personnel in the control room of coal shipping the requested quality from the contracts (data is transmitted from the sales information system of OKD) and the current average of ash content and moisture of the currently loaded coal. This information helps to prevent loading of coal with a significant deviation of quality.

For the chief technologist of the treatment plant and management, we have designed and deployed an application that allows comparing measurements of ash content from the DMCQ lab with values from the ash-meters from the information system of the plant. Application uses colouring to indicate significant differences in measurements from both systems for a particular customer. The differences may have several causes. If at a certain time differences relate to most customers it may signal impaired function of the continuous ash-meters. They operate on the principle of measurement of loss of radiation passing through the bed of coal on the conveyor, which is dependent on the layer thickness and the ash content (Cierpisz, 2009). Upon commissioning the device the factory setting of the conversion of measurements to ash content is calibrated, but over time there is a shift in the calibration curve and the device has to be recalibrated against a standard (Arad, Cierpisz & Arad, 2007). Our application allows detection of any shift in the calibration curve.

Another possible cause of differences in measurements is the condition visible at the output in Fig. 2. For one customer of energy coal dust (Dalkia) the application indicates a significant difference in ash content (greater than 1%). The technologist of the treatment plant or the production manager can in this case begin to address the problem source. The cause can be for example incorrectly collected samples for laboratory measurement.



Dne	Kolej	Odběratel	Sortiment	Tuny	Popeloměr	Popel lab.	Popel rozdíl	Vlhkoměr	Voda lab.
29.3.2005	7	Rakousko	UVPK	1426	5.95	7.10	-1.15	10.48	10.40
29.3.2005	7	Maďarsko	UVPK	1373.3	5.85	6.60	-0.75	9.88	9.30
29.3.2005	9	Dětmarovice	energ. prach	699	21.32	22.50	-1.18	--	6.40
29.3.2005	9	Rosice I	energ. prach	1378	23.33	24.40	-1.07	--	8.50
29.3.2005	9	Dalkia ČR TKV	energ. prach	421	21.06	23.20	-2.14	--	7.20
29.3.2005	9	Dalkia ČR ETB	proplástek	816.5	34.16	36.20	-2.04	--	6.60
29.3.2005	9	Vítkovice - energet.	energ. prach	1270.5	18.48	22.10	-3.62	--	6.20
30.3.2005	7	Mittal Steel Ostrava	UVPK	1077	5.91	6.60	-0.69	9.63	9.00
30.3.2005	7	Šverma	UVPK	1003	6.36	6.90	-0.54	9.92	9.80
30.3.2005	7	Košice	UVPK	5283.2	6.06	6.60	-0.54	9.54	9.50
30.3.2005	9	Dětmarovice	energ. prach	1986	21.43	22.20	-0.77	--	6.60
30.3.2005	9	Dalkia ČR TKV	energ. prach	426.5	21.44	20.30	1.14	--	6.50
30.3.2005	9	Dalkia ČR ETB	proplástek	794.5	35.32	36.40	-1.08	--	7.10
30.3.2005	9	Vítkovice - energet.	energ. prach	1269.5	18.53	22.10	-3.57	--	6.50
30.3.2005	7	Třinec	UVPK	742.5	6.26	7.10	-0.84	9.33	9.20
31.3.2005	7	Mittal Steel Ostrava	UVPK	1076	6.32	6.80	-0.48	9.13	9.00
31.3.2005	7	Šverma	UVPK	1530.5	6.04	7.10	-1.06	9.47	9.00
31.3.2005	7	Košice	UVPK	3521.2	6.24	7.00	-0.76	9.66	9.20
31.3.2005	9	Dětmarovice	energ. prach	1207	21.51	26.00	-4.49	--	7.30
31.3.2005	9	Dalkia ČR TKV	energ. prach	422.5	21.04	23.80	-2.76	--	7.20
31.3.2005	9	Dalkia ČR ETB	proplástek	794.5	35.35	36.40	-1.05	--	7.20

Figure 2 The output of the application for comparison of the coal ash content from the DMCQ laboratory and the continuously calculated ash content from continuous quality sensors in the plant information system; data from plant Darkov for the first half of 2005

5. Information System of the Treatment Plant Darkov

Figure 3 shows a conceptual model of the system - data inputs relating to the quality of coal. The treatment plant operates two independent information systems – plant IS and the DMCQ department (laboratory) IS.

The ERP system SAP R/3 runs company-wide and is closely linked with the treatment plant systems (Pawliczek, 2015). The IS system of the treatment plants takes data about the concluded contracts (quality requirements) from the SAP system and then sends information about the realized production and shipping back to the SAP system.

In addition to continuous ash-meters the treatment plants in OKD are also equipped with quick-analysers of quality from the Polish company WILPO (Katowice). These analysers enable automated analysis of the ash content, moisture, sulphur, and determining the calorific value with

near-laboratory accuracy within about 5 minutes. The device has a computer with a local database, and can be networked. The WILPO analysers also provide data that can be used for quality control; the essential issue here is the purpose and the part of the technology where they are deployed. The problem is that each OKD treatment plant uses them in a different way (e.g. the treatment plant Darkov uses them for process control, whereas treatment plant ČSM for measuring the output of the plant), making it impossible to design a universal solution. An extensive use is also limited by the cost of the devices. Our solution uses the data from the WILPO analysers according to application requirements, mostly in the form of display of data from the internal database to the operator in the control room and also to the management.

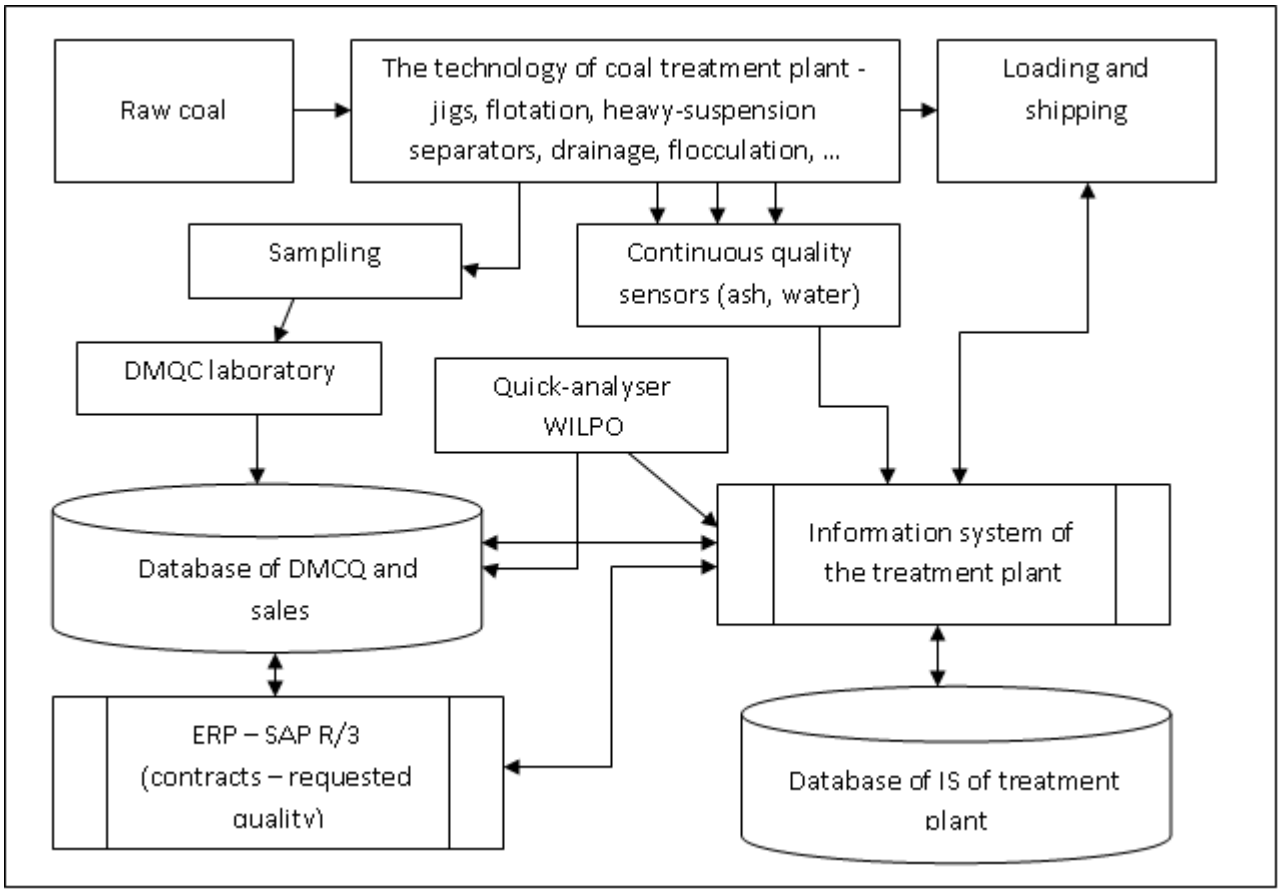


Figure 3 Conceptual diagram of the treatment plant Darkov

The system for DMCQ, together with quality control and display of balance reports also generates and prints reports on the quality of fuel, creates documents for OTK (Department of technical inspection), prepares of data for business organization and presents results to management of the treatment plant and the mine.

6. Discussion of Results

Our proposed solution was deployed in the treatment plant Darkov and later partially also in the treatment plant ČSM. In both cases there was an interconnection of three systems - laboratory, treatment plant and the ERP system. To support the plant management it is essential to understand the goal of management. Part of the professional community, publishing articles on automation in mining, presents the management of a treatment plant as control of traffic flow and storage capacities. Our concept of treatment plant management is all about quality control (quality parameters) of coal.

Currently, the mining activity in OKD is being attenuated. For this reason it is necessary to operate the mining so that the company is working effectively. The proposed system is part of an effort to make the best economic value of the mined coal.

7. Conclusion

When designing applications for the information support of quality control, we initially met with little interest from management of the treatment plants. After the test run, however, the plant executives gradually started to use the system. This tool provides them with important information for management, in particular the possibility to detect deviations from the desired condition even during production. In 2001-2003 OKD centralized sales operations and integrated local sales offices and shipping into the central dispatch in Ostrava. These organizational measures simplified some business processes, united the used management practices and also unified information inputs and outputs. So far, however, there is no complete interconnection of all systems, and the systems used in laboratories are not uniform. Since 2006, the activities in some mines are being attenuated together with reorganization measures; therefore it was not possible to propose a universal solution for all black coal treatment plants in the Czech Republic. The solutions are customized to the situation at a particular treatment plant; we can however say that the two most important treatment plants in OKD - Darkov and ČSM - have the tools for quality control at such a level that it would be possible to implement the ISO 9000 quality management standards.

Research in the field of information support for the management of treatment processes is now underway in the design of using RFID technology for material flow management on conveyors (transport automation of UVPK, energy coal and gangue to the appropriate storage space). Another area of research is use of artificial intelligence to support the dispatching management.

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PESTLE ANALYSIS AND ITS IMPACT FACTOR AS AN INNOVATIVE IT APPLICATION IN INDUSTRIAL ENTERPRISES

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Keywords

Innovation, PEST Analysis, PESTLE Analysis, System Support for Decision Making, Strategic Management, Managers, Strategic Analysis, Business environment, Industrial enterprises, University, Collaboration, Focus groups

Abstract

Innovations implemented into production are one of the important prerequisites for achieving the required competitiveness of enterprises. However, these innovations must necessarily be based on strategic management of businesses, which is often eliminated by the lack of high-quality information from the business environment. Therefore, the research team from the Institute of Economics and Management Systems HGF VŠB-TUO in cooperation with industrial companies creates an innovative support system for managerial decision-making in industrial enterprises. Part of the system is also PEST analysis, which represents one of the input analyses for business managers. The article shows how the team has incorporated the PEST analysis and its clear outcomes into a complex system.

1. Introduction

In strategic management, it is necessary to evaluate the business environment, to monitor the development of macroeconomic conditions, to map them and to evaluate how they impact on our corporate successes. Every business is affected by the character of the surroundings in which it is located and in which it operates. (Li, 2016) However, innovation and ever-increasing demands on information literacy and related digital environment requires new perspectives and approaches when working on strategic management. (Corallo, 2007) New directions and innovations in business in the field of strategic management were dealt with in an article: *New Directions in Strategic Management and Business Ethics.* The authors summarize the knowledge about business and about new directions of management in today's environment. (Elms, 2010)

The macroenvironment contains factors (influences or powers) that act on the microenvironment of all active market participants, but with various intensity and impact. The macroenvironment, which is common to all microenvironments and businesses as well, creates the generally valid conditions under which businesses operate in the country. (Zuzák, 2011) The practical use of macroenvironment analysis, namely PESTLE analysis, is used in the article *„Life cycle, PESTLE and Multi-Criteria Decision Analysis of CCS process alternatives".* (Fozer, 2017)

2. Theoretical basis of PEST analysis

PEST analysis is an analytical technique used to strategically analyse macroenvironment of an organization and is used to identify external key forces that create opportunities and threats to the organization. Therefore it is sometimes used as an input for the SWOT analysis. Because these are factors that cannot be influenced by the company in any way, they need to analyse these factors, identify their importance and direction, use them to their advantage, and adapt their behavior to current developments. (Zuzák, 2011)

PEST is the acronym of the initial letters of various types of external factors.

- P - Political - the existing and potential impact of political influences.
- E - Economical - impact and influence of local, national and world economy.
- S - Social - the projection of social changes within the organization.
- T - Technological - impacts of existing, new and advanced technologies.

2.1. Variations of PEST analysis

This analysis of the macro environment is very dynamic tool. The most basic version is the PEST analysis, but under the pressure of the current marketing needs, many offshoots groups are being created. In the UK is more often possible to meet the SLEPT analysis, which adds the letter L as the legal or legal environment. But that is already contained in original PEST analysis under political environment P. Currently the letter E as Environmental was added as well, giving us PESTEL or PESTLE analysis from the SLEPT analysis. Also the environment was already included in the original PEST analysis, again under the letter P and also under a T or technological factors, as for example in the Czech Republic, there are regulatory measures on minimum efficiency for newly builded power plants to achieve, which by its nature falls into both categories. Furthermore, there is also a STEEPLE and STEEPLED analysis which adds Education and Demographic factors that are in the original PEST analysis included under social factors. The most recent form has STEER analysis or Socio-cultural, Technological, Economic, Ecological, and Regulatory factors, of which the letters socio-cultural replace the original social and environmental, and regulatory factors replace the original political factors. (Marmol, 2015)

2.2. Academic-industrial collaboration

Mutual cooperation between universities and industrial enterprises can achieve innovative outcomes thanks to the synergy resulting from this cooperation. On the one hand, there is a professional potential of the staff and students at the university with knowledge of the theoretical background and, on the other hand, industrial enterprises that are generally characterized by high fixed costs and therefore innovative practices in other areas can bring them an increased competitive advantage. Long-term cooperation between schools and businesses also brings mutual knowledge, trust and the possibilities of verifying innovations in practical operations, etc. Among the successful cooperation of the research team from the Institute of Economics and Control Systems HGF VSB-TUO and industry, belongs system for management decision support, which is mentioned in this article or other publications of authors and is currently being developed. (eg. Chuchrová 2016, Kozel 2015). At the same institute there is the transfer of innovation to industry, but there is also the transfer of business requirements to the competencies of future graduates, and there is mutual cooperation in modifying the content of the study according to the specific needs of the enterprises (see Danel 2015, 2016).

The authors of this article also collaborate with teams from other faculties or universities that have also achieved positive outcomes of academic-industrial collaboration in the past. The colleagues from the Faculty of Metallurgy and Materials Engineering helped enterprises, using sophisticated analytical procedures, to evaluate the energy demands of individual metallurgical technologies (Janovská, 2012) or to find an optimal combination of financing and utilization of production capacities (Kutač, 2013). The colleagues from the Faculty of Economics focused on small and medium-sized enterprises and one of the results of their mutual cooperation was, for example, published research results confirming the upward trend in the use of management information systems in innovative enterprises (Hančlová, 2013). As the highest degree of academic and industrial cooperation (Minister, 2014) can be considered a case where the school and the enterprise act as a combined ecosystem, which includes infrastructure, organizational and other measures to support their mutual cooperation.

2.3. SGS Research Project

SGS Research Project No. SP2017 / 17 The creation of a system for the analysis of the internal and external environment of industrial enterprises follows two previous projects of the research team, which aim to gradually build an innovative analytical tool to enable industrial managers to make proper decision-making. The aim of the research team from the Institute of Economics and Management Systems of the HGF VŠB-TUO in cooperation with industrial companies is to create a subsystem for internal and external environment analyses this year. Specifically, these are analyses of company resources, value chain, analyses of external environment and subsequent analyses based on the synthesis of both environments.

The first step towards the goal of the project was to conduct a group interview with 20 top managers of selected industrial companies in the Moravian-Silesian Region. The purpose was to find out what data and information the managers use in strategic management and planning. It was noted, that at present, the problem is not with obtaining data, but the ability to organize them appropriately to make strategic decision-making applicable and effective. In addition, the knowledge of the analyses of the company's surroundings was investigated. Managers most often agreed that they know PEST analysis. According to their experience, their practical implementation is either too subjective or does not lead to concrete and accurate outputs. Participants of the focus groups agreed, that they would need a systematic solution that leads managers to compile the analysis up to the evaluation itself. The basic requirement is clear graphical output, which gives a clear and comprehensible message at first glance.

The solution on which the team is working is therefore standardized and is part of a system of strategic analyses that is gradually being fulfilled. Individual analyses can be quantified by query tables and then processed into visualized graphical outputs. Verification of the functionality of the system takes place on real data of industrial companies.

3. PESTLE analysis in SW application

PESTLE analysis is clearly a qualitative analysis and cannot be unambiguously quantified and simplified. Each field is related to other macroeconomic conditions and have a completely different impact on the business. Therefore, this analysis is quantified only with very superficial results, and the resulting values serve only as input into further analyses. Therefore, this SW analysis is configured rather as a template that guides the user how to proceed with the macro analysis and offers outputs in the form of graphically modified and well-arranged tables.

3.1. PESTLE analysis procedure

The PESTLE analysis input screen is fully functional and the user can choose which parts of the analysis to look at. This image works as a learning example as well. The top bar gives the user a choice of basic file scripts. The "Info" script tells you what is the screen for, the "Back" script returns the user to the list of available market analyses. The "Help" button guides you through the individual analyses and the last "Menu" button allows the user to switch to the analyses offered by the software. Visualization of PESTLE analysis refers the user to the appropriate templates. The grey arrow indicates the direction the user should follow - the user can only fill some of the factors and perform only PEST analysis using this function. The green field refers to the input table for the environment, see Fig. 1. The grey field refers to the output from the PESTLE analysis, which is the predefined table in Fig. 4.

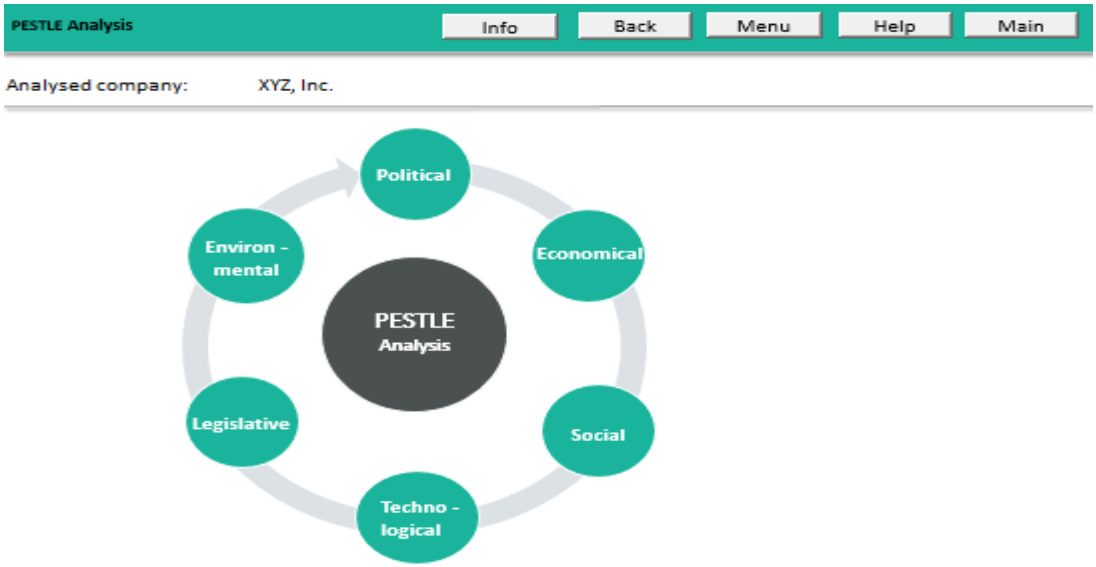

Figure 1 PESTLE Analysis Input Screen

In figure 2, in column 2, there are predefined fields that guide users, which factors play a role in this environment, and the user can be inspired by them or use them directly. The factors chosen by the user are shown in column 3 and are also the factors that appear at the PESTLE analysis output. The fourth column serves for a deeper description of the factor. Fifth column evaluates the IMPACT factor, ie the impact of the given factor on the analysed business. The user evaluates the factors with points of minus 10 to plus 10, where -10 means that the factor has a big negative impact on the business, and -1 means that the business factor has a weak but negative impact. The opposite is + 10 when the business factor has a positive significant impact and +1 when it comes to the impact of a positive but small character. Those factors that have a zero effect - they do not affect the user's business, user does not enter into column 3. Then the average for the given macroeconomic area is calculated.

POLITICAL ENVIRONMENT				
1.	2.	3.	4.	5.
s. n.	Factors influencing the political environment	Choose which ones affect you	How do they affect you?	Impact
1	Government stability and likely changes	Government instability	The Czech political environment has long been characterized by a regular alternation between the left and right governments and a very fragile division of positions in the Chamber of Deputies between the Left and the Right. Since the establishment of an independent Czech Republic, only two governments have completed the four-year term, when the mandate of the last of them, the CSSD, expired in 2002.	-3
2	Bureaucracy	Bureaucracy	State bureaucracy is a major obstacle to the development of construction companies.	-10
3	Level of corruption	Abuse of subsidies	A major problem for the construction industry is the abuse of subsidies from European funds, the publication of tailor-made tenders for individual interested companies.	6
4	Tax Policy (Prices and Incentives)			
5	Freedom of the press			
21	Laws regulating environmental pollution			
22	Regulations			
23	Subsidy			
24				
25				
			Mean	-2
			Scale : -10 to + 10	Update chart

Figure 2 Input table

In the last line of the input table is the "Update Chart" button, which must be pressed after defining all relevant factors to generate the current graph without zero values, Fig. 3.

Figure 3 Political environment

3.2. Outputs from PESTLE analysis

Partial outputs are generated separately in individual environments. These are the impact factor graph and the descriptive table. The total outputs from this macro analysis are displayed on the PESTLE analysis input screen. The first output generates a table with factor names, so it is necessary to name the factors correctly when defining them. The table also provides an average impact factor assessment for a given area.

Another output of PESTLE analysis is the spider map of the average ratings of individual macroenvironments (Fig. 5). The user has a quick and visual overview and he can see in which macroenvironment he will probably experience the greatest difficulty and which one needs to be used to increase their profits.

The final output of this analysis is the generation of partial charts for individual areas for better comparison. The user will then know which of the factors to pay attention to and which to use for better performance (Figure 6). A uniform benchmark is established, so the comparison of factors and their impact is objective.

POLITICAL	ECONOMICAL	SOCIAL	TECHNOLOGICAL	LEGISLATIVE	ENVIRONMENTAL
Government instability	Tariffs	Shopping habits	Basic infrastructure level	Discrimination Act	Attitudes towards the promotion of the production of energy from renewable sources
Bureaucracy	Labour Code	Social layers	Speed of technological changes	Intellectual Property Law	Climate changes
Abuse of subsidies		Lifestyle	Incentive technology		
-2	2	-1	-1	4	3

Figure 4 PESTLE analysis resulting table

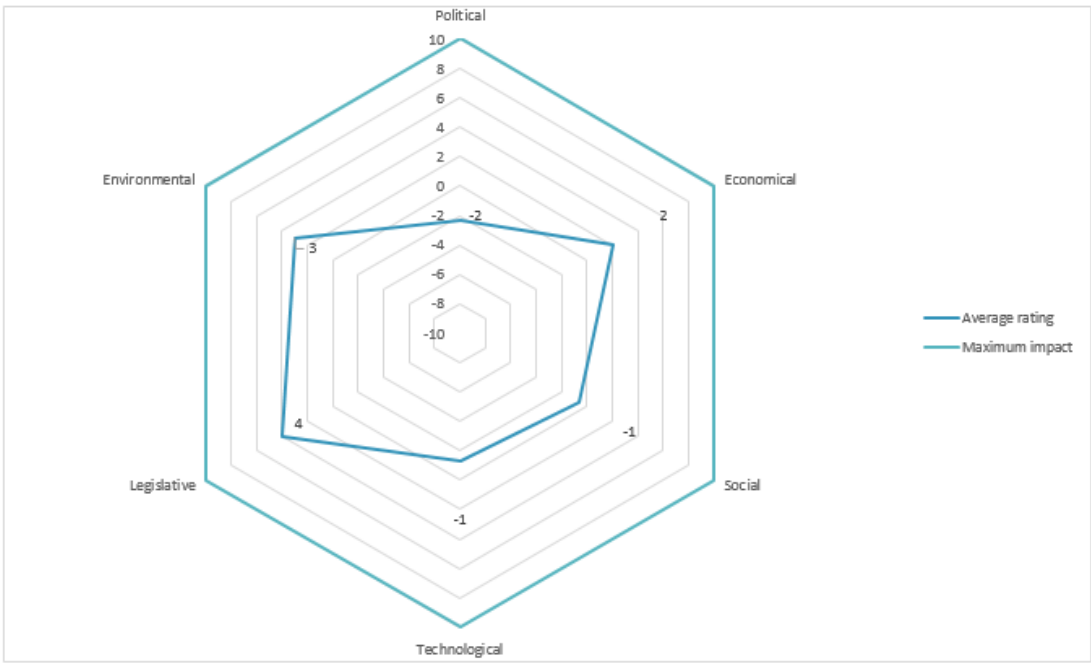

Figure 5 Spider map of the average rating of macroenvironment

4. Conclusion

The importance of strategic management was reflected in the early millennium due to the negative effects of the global economic crisis. Businesses that have strong strategic management were able to get out of a negative situation much faster. The company's external environment includes factors that have an effect on the microenvironment of all active market participants, but with various intensity and impact. Timely identified positive and negative impacts of business environment development help increase its competitiveness.

The article shows an example of innovative academic-industrial collaboration that helps managers in conducting the proper strategic management in industrial enterprises. In order to efficiently and continuously evaluate environmental factors, a SW application containing templates and measurable outputs is prepared for this environment. Thanks to the long-term cooperation of both parties involved in the project, the individual requirements of the managers are reflected in the concrete form of a complex system for processing strategic analyses, and especially in the outputs

of the analyses carried out, in order to be definite and clear and to help the managers in their correct orientation and decision making.

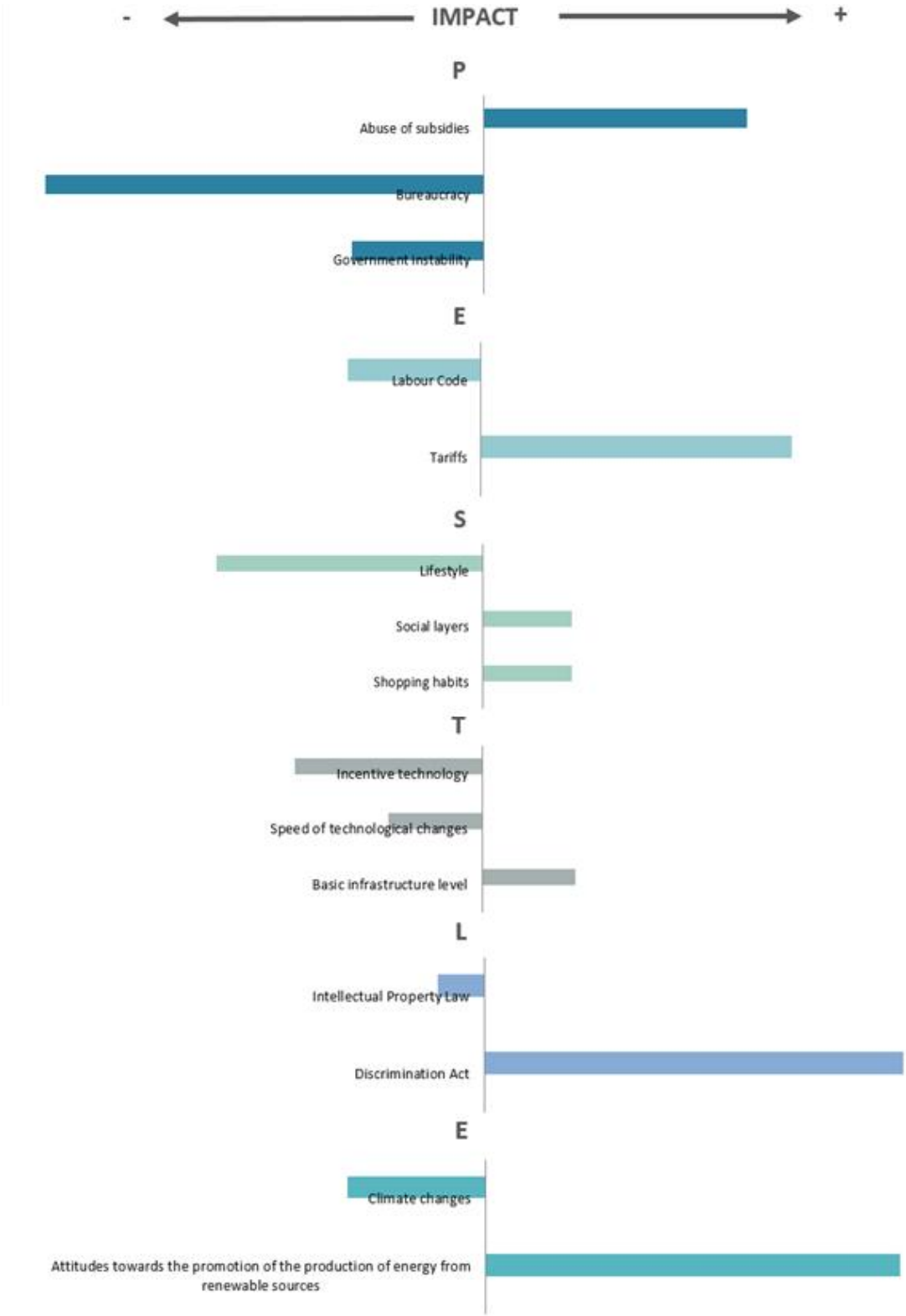

Fig. 6 IMPACT PESTLE graph

5. Acknowledgement

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SESSION C: CRISIS MANAGEMENT

CO-OPERATION IN MANAGING THE MIGRATION FLOW IN AUSTRIA 2015 AND 2016

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Keywords

Migration flow, displaced persons, information exchange, interoperability, co-operation

Abstract

In 2015 the migration movements reached an unprecedented peak in several European countries such as Austria since the period after World War II. Involved stakeholders such as national authorities or NGOs were overstrained with the number of displaced persons reaching their borders. Limited information exchange and insulated operational pictures turned out to be major challenges of involved authorities, NGOs and grassroots movements. This paper provides relevant basic insight into the development of migration movements since 2010 and analyses the requirements for different types of stakeholders from Austria and Germany expressed in order to improve future management of refugee flows.

1. Introduction

In the second half of 2015 several European countries, including Austria among several others, were confronted with considerably larger migration flows compared to other movements that took place in precedent decades. One indicator for the extremity of developments is the number of asylum seekers. In 2015, about 88,300 persons applied for asylum in Austria, a three times higher quantity compared to 2014 (BMI, 2015). Many stakeholders, including the authorities and NGOs, were overstrained with the number of displaced persons and the density of the migration wave and several other facets of these developments. In one of the hot phases of the mass movement of persons seeking refuge in October 2015 improvement of information exchange was declared as a

priority to be tackled (EC, 2015). Leaders representing the countries located at the Western Balkans Migration Route agreed on managing the migration flows together and on implementing a permanent exchange of information via contact points among other measures in order to facilitate the support of refugees and to provide necessary shelter and rest. In 2015, approximately 600.000 persons were travelling through Austria (Medien-Servicestelle, 2015) in pursuance of reaching their final destination and their envisioned country of asylum application in Europe.

A multitude of measures encompassing political agreements as the one stated above with states along the so-called Western Balkans Migration Route as well as controls and barriers at federal border crossings led eventually to a reduction of the number of migrating people in 2016. As a consequence, 6,480 asylum applications were counted in Austria in the first quarter of 2017, a decrease of 55% compared to 2016 (Medien-Servicestelle, 2017). Nevertheless, the number of asylum seekers remained extraordinarily high. This is underlined by about 42,000 asylum applications in Austria in 2016 (BMI, 2016). In order to make this challenge faced by different European states comparable, we normalized the yearly number of pending applications of asylum seekers of selected countries (UNHCR, 2017) by the number of inhabitants (see Figure 1-1). As one can see the numbers of pending applications relative to the number of inhabitants were and still are not equal in the different countries. Sweden had approximately 16 pending asylum applications per 1,000 inhabitants and Austria about 9, whereas the majority of member states faced two or less pending applications per 1,000 inhabitants in 2015. For Sweden this was the year with the highest number of pending applications, but this was not the case for countries such as Germany. It can be seen that Germany needed to manage more pending asylum applications in 2016 compared to 2015. It has to be considered that the number of pending applications does neither reflect the number of new applications per year, nor the number of accepted asylum applications or the transit of persons (the transit number was specifically an issue at the beginning of the migration flow). The number of pending applications reflects parameters such of interest of asylum seekers in a host country and capabilities to manage the asylum applications.

The data on migration provided by UNHCR demonstrate the international dimension of this development (UNHCR, 2015). In 2015, 65.3 million forcibly displaced persons were counted on a global level, among them 21.3 million refugees, 40.8 million internally displaced persons and 3.2 million asylum seekers. Figure 1-2 shows the development of the number of refugees from 2010 to 2016 in the states that hosted the highest numbers of refugees worldwide in 2016 (UNHCR, 2017), it has to be noted that the 2016 data were taken from mid-year trends from June 2016.

When comparing the number of refugees that arrived in the first five host states Turkey, Pakistan, Lebanon, Iran and Ethiopia in 20157 with the numbers of refugees hosted by European countries (according to UNHCR definitions, excluding Turkey), it becomes apparent that about 12% were hosted by European countries whereas the top five countries hosted about 43% of a total of about 16.1 million refugees worldwide. Management of migration flows was nevertheless a considerable challenge for European stakeholders in the past and can be expected to require substantial resources and initiatives both on national as well as European level in the coming years, too.

7 Comparison were made for 2015, because data from 2016 are based on mid- year analysis

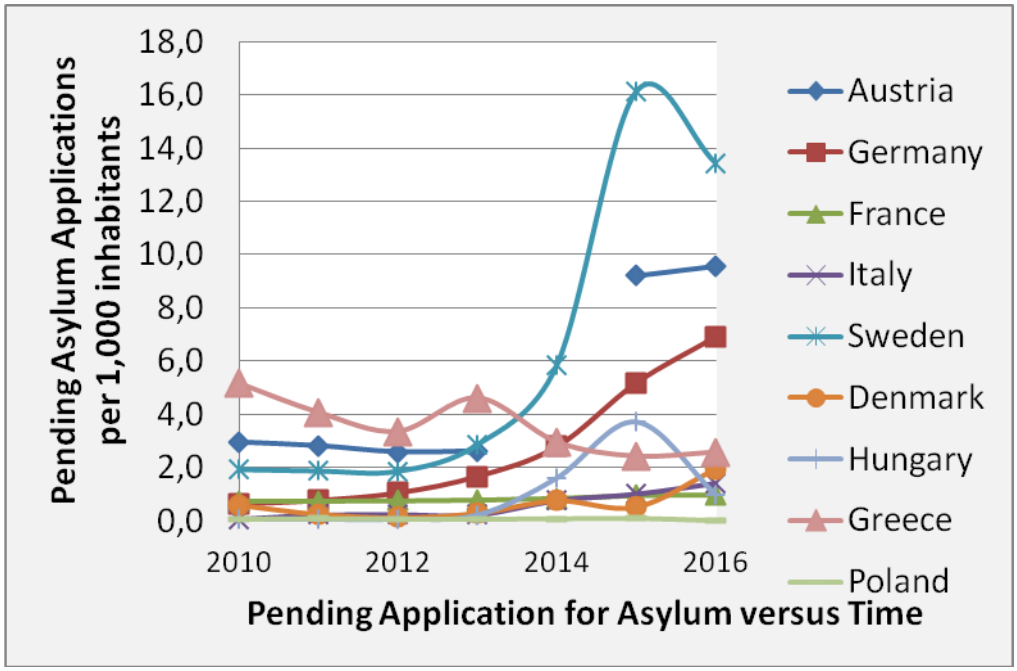

Figure 1: Normalized number of pending application of asylum per 1,000 inhabitants of selected European countries from 2010 to 2016 (UNHCR (2017), for Austria no data were available for 2014)

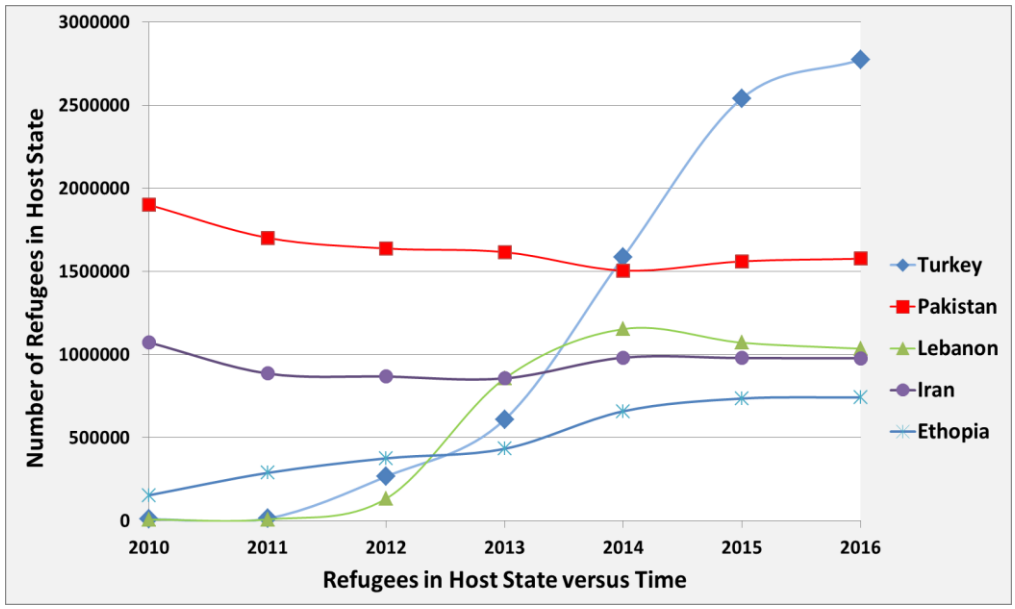

Figure 1-2: Absolute number of refugees from 2010 to 2015 in the countries hosting the highest number of refugees in 2016 (UNHCR, 2017)

2. Methodology

In order to identify and analyse problems and requirements related to the refugee flow in Austria and Germany, two types of interviews were conducted in the years 2015 and 2016. On the one hand, systematic, quantitative interviews were performed with formal organisations. On the other hand, a qualitative questionnaire was developed and applied to analyse activities of informal, partially ad hoc created organisations involved in the handling of the migration movement.

2.1. The data models and the applied tool

The quantitative part of the interviews was performed using the inventory developed in the frame of the FP7 project EPISECC (FP7-SECURITY, grant no. 607078, see also Neubauer et al, 2016). The purpose of the inventory is to provide information on the quality of the management of past crisis and disasters with focus on information exchange. This type of information was used to help developing an optimized architecture of a platform for information exchange (Common Information Space, CIS) between stakeholders active in the domain of crisis management encompassing also actors managing the refugee flow. The CIS proposes a new information sharing paradigm allowing stakeholders such as local emergency management authorities an automated sharing of information with other participating organizations in a machine readable way. Stakeholders are usually managing their processes with ICT tools of different kinds. The CIS can bridge the gaps between these different ICT tools what results in the situation that the organizations collaborating via the CIS can remain using the tools they are familiar with. The only prerequisite to take part in the CIS and get connected to any other participant is the onetime adaption of a CIS interface for the own ICT tool, the so called adaptor (see Zuba et al, 2017).

In order to ensure that adequate information will be available, a four step process was applied to set up the inventory. Basically, stakeholders were consulted to identify relevant questions on crisis and disaster management with focus on information exchange. In addition, a data model was developed. It is composed of multiple areas of information, such as processes, disasters or tools (Huebner et al, 2015). Such areas consist of substructures, ensuring that all relevant information from stakeholders can be integrated (for further details see Neubauer et al, 2016). This data model was the basis for the development of an online questionnaire.

In parallel to the structured interviews conducted using the EPISECC inventory, we enriched that quantitative data through more qualitative information. With impressions and effects of the (as of the time of this writing still ongoing) migration crisis fresh in the public consciousness, we conducted interviews with members of grassroots movements that evolved with the goal of helping refugees. Such emergent forms of self-organized initiatives have been observable since the wake of the first wave of refugees arriving in Central Europe during 2015. These interviews were of a semi-structured nature. This means that we defined a set of questions to be answered during all interviews, but allowed to deviate from these guidelines (in a reasonable manner) for the sake of the flow of conversation for limited time, before steering it back to the predefined questions. The order of questions was allowed to vary. Enabling participants to talk more freely provided us with the option to investigate emerging topics in detail in case they fitted to the theme of our guidelines and contributed to the research questions. With regards to these research questions, the parts of our interview guidelines relevant for this paper consist of the following general topics (paraphrased):

- Handling of internal communication and collaboration, including necessary roles, communication tools, communication channels used as well as decision making processes and
- external communication and collaboration, pertaining to their contact with other grassroots initiatives or formal organizations, including (again) their communication channels and tools as well as on how the contact was established and finally, the perceived quality of communication and collaboration.

Analysis of the resulting materials is still ongoing – however, we believe that even the preliminary outcomes of these interviews can shed further light on the information exchange between entities in refugee management by adding a new perspective: that of relatively new and recently formed organizations, consisting of volunteers rather than fulltime professionals.

2.2. Data provision - selection of types of interviewees

The focus of the investigations performed by applying the EPISECC inventory was set on the performance of different types of stakeholders during the management of the refugee flow in 2015 and 2016. In this context, it is necessary to find criteria on how to distinguish between different types of actors in crisis and disaster management and in the management of the refugee flow. In short terms, one can differentiate between employment, formal volunteer engagement and informal volunteer engagement (for details see Neubauer et al, 2013). In case of the interviews performed with the inventory we investigated the challenges that were faced during the migration flow management of 2015 and 2016. In total, 55 interviews were performed with stakeholders from 18 countries using the inventory, more than 75% of the interviews with employees from governmental organizations. Out of these 55 interviews, 10 were related to the management of the refugee flow in Austria. 60 % of these interviews were performed with employees from governmental organization, 30 % with employees from NGOs and in one case with a representative of a company acting as contractor with an authority. In addition to the interviews performed with Austrian stakeholders some additional interviews with German stakeholders were performed, too.

In contrast to our quantitative interviews, the interviewees for our qualitative, semi-structured interviews were members of volunteer organizations that have emerged in response to the increased influx of refugees. Such emergent, self-organized communities of volunteers are not unusual in reaction to extreme events and are often the first to react. Our participants were board members of their respective communities and organizations, i.e. involved in one way or another, in the decision making process of the initiative. To identify and engage participants, we conducted a survey of news articles, online social media and online information platforms. Inclusion criteria for the selection of potential participants were

- the initiative is concerned with supporting refugees,
- the initiative (or at least one contact point thereof) is located in eastern Austria (to enable face-to-face interviews) and
- the initiative is based on voluntary work and as such relies on the support of volunteers.

We contacted a total of 32 representatives of initiatives, 9 of which responded and agreed to participate. The participants that agreed to take part in the interviews were board members of their organizations or otherwise included in the decision making process. The interviews were conducted in the timeframe of July through October 2016. An audio recording was done of each interview (with the explicit permission of the participant) to be transcribed for analysis at a later point.

3. Results

3.1. Requirements expressed by Austrian stakeholders

The requirements expressed by Austrian stakeholders in late 2015 were mainly related to interoperability requirements. The problems described in 2015 are often caused by the lack of processes for information exchange between different organisations. Border crossing communication turned out to be a main challenge, where border can mean frontiers between states, regions but also different type of organisations. Limited communication is one of the factors leading to an limited operational picture, in particular on the number and the time of arrival of refugees at critical locations such as border crossings. In addition, during the peaks of the refugee flow public communication networks‘ disposability was also limited on a local level due to the significant increase of communication and information exchange, leading often to network

congestion. Significant problems arose in providing shelter for the large number of daily arriving fugitives. Apart from needs shown in Table 3-1, challenges related to waste management, unification of processes and co-ordination of ad hoc volunteers were expressed.

In 2016, the general situation changed substantially in Austria. In March 2016, the so-called Western Balkans Route was closed, therefore the migration flow moved to western routes (predominantly the „Brenner Route“ leading from Italy to Austria). Organisations adapted to the challenge, e.g. by establishing the position of a refugee co-ordinator in many organisations. Moreover, new processes to manage refugees were introduced. Several organisations active in 2015 were not involved in managing the flow of the refugees in 2016, anymore. Nevertheless, stakeholders still highlighted multiple areas where improvements are recommended (see Table 3-2)

Processes were adapted in 2016, nevertheless a lack of adequate cooperative tools such as platforms to exchange information and partially as consequence, a lack of communication and of a common operational picture was still pointed out. Taking into account the political decisions in the wake of the high tide of the migration movement in October 2015 and the call for fast implementation and optimization of communication and data exchange (EC, 2015), the interoperability on national level – but also cross border – was not yet installed or experienced on a practical, operational level. In case of new waves of thousands of refugees per day, some organisations expressed the need for tools allowing prediction of the number of incoming refugees. Such an operational picture might be based on the combination of data from sources such as satellite data or data from both conventional and social media. Short term prediction (with a horizon of approximately 2-3 days) is considered as one of the main requests.

In relation to these requirements, preliminary evaluation of qualitative interviews with volunteer initiatives have shown that the lack of adequate cooperative tools between organisations is also perceived among these grassroots movements. While internal information exchange and collaboration happens via well-known and widely adapted ICT channels such as online social networks (e.g. Facebook) or instant messaging services (e.g. WhatsApp) and appears to work well, communication with other intiatives or formal organisations was another matter. When it came to collaborating with formal organisations (both NGO and governmental organisations), interviewees most often stated unclear or frequently shifting points of contact in larger organisations with untransparent internal structures to be a problem for them, which lessened the quality of information exchange. For participants this apeared to be especially exasperating because they often had to rely on information from these formal institutions (such as some governmental offices). Regarding their exchange with other grassroots intiatives, statements varied. Some participants stated that they simply were not aware of other volunteer organisations in their area. Others stated that information exchange happened on an informal level or on a personal level between members of organisations, but was not coordinated with any board members.

Table 1: Predominant requirements expressed by Austrian stakeholders involved in the migration flow management in 2015

Interoperability related requirements 2015
More efficient communication
Lack of information on number of incoming and outgoing refugees, operational picture
Requirements related to technical solutions 2015
Public communication system resistance
Software solution to manage location of refugees

Table 2: Predominant requirements expressed by Austrian stakeholders involved in the migration flow management in 2016

Requirements 2016 in Austria
Cooperative tools on • border crossing level • for GO and NGO cooperation
Network with international refugee managers to get an operative picture in early stages
Better information for potential refugees on situation in Europe – wrong picture exists
Better control of refugees and asylum seekers, more consequences related to their lack of will of cooperation

3.2. Requirements expressed by German stakeholders

In Germany, interviewees from several authorities demanded especially for more personnel, since the workload reached alarming stages not only during the peak of the refugee crisis in summer/ autumn 2015. Also in connection with that peak-period, the organizations involved indicated an incomplete operational picture lacking a prediction or at least a reliable estimation of the amount of incoming refugees and additional information such as age (adult, unaccompanied child or adolescents), gender, origin, religion, traveling route etc. The missing of this information is mainly caused by an inadequate information exchange beyond organizations and borders. Together with a short medical screening on the basis of the previous inhabitancy and route, this information would support the preparatory activities and processes at registration sites and intermediate camps in general. Moreover, on the basis of this information strategies for avoiding or harmonizing conflicts within the group of refugees could be elaborated in advance. For this purpose, mechanisms or technologies to identify potentially critical developments in groups (e.g. by analyzing trajectories and velocities for groups) would be beneficial. A short or mid-term prediction of incoming refugees would also allow for a more efficient coordination of transport means and accommodation.

For all interviews it has to be pointed that the requirements described above summarize the opinion of the interviewees and do not reflect the opinion of the authors, necessarily.

4. Discussions and conclusions

Both the results obtained by applying the EPISECC inventory as well as the semi structured interviews demonstrated a lack of cooperative tools and of information exchange between different types of stakeholders that are active in the management of refugee movements. Formal as well as informal organizations involved in the management of refugees expressed such needs. Apart from requirements related to information exchange and improved operational pictures several other requests were expressed from the Austrian and German stakeholders encompassing improved management of means of transportation, early medical screening and improved management of refugee camps. In spring 2016, the flow of refugees decreased in Austria as well in other European countries; this trend seems to continue in 2017. Since 2015, federal organizations set up procedures and measures on how to control the flow of refugees such as closing of the Western Balkan route and both governmental organizations as well as NGOs adapted their processes since 2015. Nevertheless, the lack of cooperative tools was still expressed in 2016. In general, concern related to the lack of an operational picture was stressed. Moreover, the need for solutions allowing short and middle term predictions of refugee movements was pointed out by formal organizations. One major issue outlined shows that, in accordance with the given legal framework, data of migrating

persons have to be secured and processed appropriately for logistics and security reasons (BMI, 2017). In addition, the optimization of organizational tasks for a basic support of refuge seekers in agreement with local governmental organizations and NGOs represents another priority.

Taking into account the multiple limitations of the prediction of political, economic as well as environmental developments (including effects arising from climate change or failure of political agreements, e.g. the agreements between Turkey and the EU) in the multiple crisis regions of the world such as Syria, Iraq, Eritrea or Somalia, European stakeholders need to prepare for potential future migration waves. The fundament for improved management of future movements of refugees and asylum seekers are adequate political agreements encompassing border crossing co-operations. In case such agreements are reached, specifically designed technical solutions such as platform for information exchange, command and control systems as well as prediction tools can support the implementation of such agreements.

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MULTIPLE TYPES OF SENSOR DATA; CHALLENGES AND PERSPECTIVES FOR AN OPERATIONAL PICTURE FOR RESPONSE TO CRISES WITH MASS INVOLVEMENT

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Keywords

Crisis management, multiple sensor data, holistic data use, mass involvement, enhanced operational picture, ethical and societal challenges, information exchange, interoperability

Abstract

Taking into account the experience of the recent past and anticipating future developments, crises with mass involvement require the availability of holistic data sources. Such data have to be integrated into the crisis management procedures to gain the necessary, full-scale operational pictures for an efficient, timely, and sustainable response by the teams in the field and on strategic levels. Migration movements, but also challenges of planned or un-predicted mass gatherings and their potential escalation have been identified by experts and responsible organizations as scenarios in need for more detailed and stratified data than just quantitative data, counts and flow

analyses. Learning from past developments and practice examples it becomes clear, that additional, multiple types of sensor data can and should be taken into account and integrated. This is a growing requirement to complement, further diversify and structure the operational picture for the targeted and qualified crisis management delivered by response units and public bodies.

In addition to this, the early preparation of further care and support of potential casualties or refuge seeking people can be facilitated by more detailed and enhanced sets of data. Thus, special needs, targeted assistance in emergencies, but also security related issues like the separation of rivaling groups can be facilitated. Due to the inclusion of multiple types of sensors like audio data, chemical sensing, digital meta-data or enhanced pattern detection and processing adding up to commonly used visual sources, the tackling of blind spots and weaknesses in current crisis management can be supported. Besides the inclusion of data and information extracted from multiple sensors, an optimized exchange of targeted information between stakeholders was identified as the second pillar for improving the operational picture.

1. Different Sources of Sensor Data in Crises with Mass Involvement and their Limitations

In current dynamic crises with mass involvement (as described by Özdamar (2015)), for which the migration movement of the last years reaching Europe can be seen as a representation, a solid but also restricted set of data sources is used by some organizations to support and facilitate a rough operational picture. In most cases visual/optical, sometimes also audio channels and derivations of movement patterns or acceleration data are included. To a certain degree and taking into account the question of the timeliness of data, they enhance the overview in the response phase, but also support simple predictive patterns and models for limited early warning systems.

Partially well-established practice approaches include the use of large-scale satellite or aerial data (e.g., Tellman et al. 2015). Additionally, visual data provided by different types of optical sensor devices offer different spectra of visualization (see e.g. Van Westen 2000, Domenikiotis et al. 2002). They can be sensibly included to enhance the overview of critical or escalating events. They are also verifying, upgrading and supporting the common intelligence delivered by physical eyewitnesses or sensors at the site of the event. Whereas they are conveyed either by traditionally qualified in-house sources generated in field missions or by digitally facilitated sources like citizen-sensing or crowdsourcing (see Rainer et al. 2016) this additional set of data can overcome current obstacles. Thus, remote and inaccessible areas, hostile climate or weather conditions, unclear and instable situations, or additional hindrances for common visual contact can be tackled and questionable information can be verified or to a certain extent objectivized.

Examples for the inclusion of additive data, sensors, and data sources supporting the creation of an enhanced operational picture are at this time developed and validated in several security research projects. The recently finalized study EBeCa, the currently running WatchDog (both funded and financed in the course of the national KIRAS security research programme by the Austrian Federal Ministry of Transport, Innovation and Technology, see sections 2.1 and 2.2) and several other national and international approaches will be outlined to show their added value for crisis management.

Although some few data sources and selected sensor data is already well verified and established either for small scale, everyday use of emergency management or already for the inclusion into the crisis management processes, section 2 elaborates on specific examples, the occurring gaps and needs. Technical exchange of this information as well as the legal and ethical framework settings

are consolidated and facilitated only on a very basic level, if they are considered and installed at all by the end-user organizations, regional, national, or international regulations.

In this regard the mig.data-approach (see section 4), showing exemplarily an inclusive, holistic source and sensor approach contributing to the basis of a planned research project, will be outlined. The showcase of an enhanced exchange of multi-source data among relevant stakeholders for the timely and efficient handling of crises with mass inclusion or events prone to develop to this scale can stand as feasible example.

2. Data Collection and the Challenge of Interoperability – Enhancing the Operational Picture by Sharing Information

The collection and discrete use of some selected sensor systems is already a good and common practice in some organizations. Given the necessary legal, ethical, and organizational frame for the collection of different types of data – not to forget the discrimination between individual-related and anonymous information – there exist several examples that outline, how and under what restrictions data can be used to enhance security and to (potentially) feed into a holistic operational picture. In addition to these factors, the question, potential, and obstacles of an information transfer to other relevant stakeholders is pointed out in the following sections.

2.1. Visual and Audio Data Sources in Security Contexts

2.1.1. The Concept of the Study EBeCa: Visual and Audio Sensor use

EBeCa, the project on the "Evaluation and monitoring of the launch of Body Worn Cameras. Response analysis, societal perception and recommendations for accompanying measures regarding the launch for police use in Austria" was conducted by the Agency for European Integration and Economic Development in cooperation with the Austrian Federal Ministry of the Interior in the years 2015-2016 (EBeCa 2015). The study – funded by the national security research programme KIRAS by the Ministry of Transport, Innovation and Technology – showed the strengths but also the limitations of the use of visual and audio data gathered under a strict legal regimen in a pilot test among the Austrian police.

EBeCa focused on the socio-cultural, proactive monitoring and support of the test use of Body Worn Cameras (BWCs) also known as "body cams" or body worn video systems in the Austrian police context (Rainer, Levy 2016). This innovative technology, which records official acts of police officers, has been tested and implemented in other countries (e.g., USA, UK, and Germany) since more than ten years. Trials of BWCs were recently also conducted in Austria due to the demand for even greater transparency and better documentation of actions.

Figure 1: BWCs in the Austrian police context (Copyright MoI (BM.I): Alexander Tuma)

Apart from the legal prerequisites addressed by an initiative for an amendment of the current law by the Federal Ministry of the Interior, the use of this assistive documentation technology required thorough counselling and research on social and ethical considerations as well as on communication aspects. Expectations, fears, and acceptance-screening of all involved groups was a key focus, considering examples of the broad population, the law enforcement officers, their superiors, and ethical experts.

The study EBeCa started with a comprehensive desktop research on international experience reports and findings on the use of BWCs in order to carry out an evidence-based evaluation of this innovative technology in use. In general, state of the art results reveal a rather positive attitude adopted both by citizens and police officers towards the use of BWCs. The review of recent literature on this topic (Goold 2002, Zimmer 2011, Stanley 2013, Wilmink 2015) resumes main positive effects of the implementation of BWCs in police work as follows:

- reduction of the crimes, due to the open and visible recording of facts,
- less violence against police officers,
- more convictions at an early stage, more confessions in advance,
- fewer false accusations due to video and audio recording,
- less public costs due to video and audio recording (court, lawyer, police costs)
- enhanced perceived security by citizens,
- acquisition costs for the cameras are profitable in a short time.

Less aggression creates a safer environment, both for police officers and civil society. Moreover, studies show that wearing BWC improves the self-confidence and reliability of the wearer.

On the other side, the effectiveness and efficiency of the security measure is permanently contested in the light of the overall debate on (video) surveillance and data protection issues, as well as regarding the question whether "typical conflicts" such as hate crime or domestic violence, which often occur spontaneously and emotionally, can be reduced by using BWCs.

After the analysis of the data available on the international state of the art regarding BWC, the EBeCa project conducted a preliminary study and a pilot test run in Austria to collect empirical values regarding the use of BWCs. This data lined out the perspectives of all three identified stakeholder groups: participating law enforcement officers, officers on police leadership level, and the civil society.

For the empirical relevance of the trails, three test situations were used in EBeCa for monitoring purposes in narrative and qualitative terms. Different basic conditions refer to possible, typical utilization scenarios for BWCs in the daily work of police officers. The scenarios describe situations with mass involvement (e.g., demonstrations, crowd gatherings in sports or cultural context), critical situation during the patrol duty, as well as cases of domestic violence.

In accordance to the findings from international reports, the result from the preliminary field study in Austria show a predominantly positive attitude towards the use of BWCs among all stakeholder groups. Most respondents considered significant factors of the technology acceptance analysis, such as openness, curiosity, technical experience, or usability, as positive. All stakeholder groups see the most significant strength of BWCs in the protection of the acting officers and other involved parties against unjustified accusations.

Nevertheless, some of the first-line test users within the police, as well as participating representatives of civil society, feel little informed regarding the implementation process of BWCs in the police context. Negative perceptions are related to financial issues, considerations regarding the total surveillance by the state, data protection and misuse, as well as to additional stress, caused for the first-line practitioner. On the other hand and in addition to the mentioned issues, the managing police level evaluate the weaknesses in the technical field (e.g., image quality or perspective constraints).

During the test phase, respondents clearly emphasized and confirmed the previously outlined strengths of BWCs: the protection of involved people, objectification, traceability, evidence management and monitoring, prevention of violence, and transparency. It was also reported that the potential of de-escalation during the use of BWCs was higher than expected. The weaknesses indicated refer to data protection, permanent monitoring of police officers, and increased administrative work. Regarding the successful implementation of BWCs in the Austrian police practice, stakeholders pointed out the demand of a defined legal framework, trainings for the implementation process, as well as high usability and user-friendly devices.

2.1.2. Further Results of the Data Inclusion surveyed by EBeCa

Other results of the project focused on concrete recommendations for a future requirements-optimized implementation of the technology, specially tailored to the target group of the national police force. They consist of practical outputs such as concepts for accompanying measures or training and communication checklists. This specific material supports the subsequent implementation of the BWC technology.

The generally positive attitude of all stakeholders groups involved in EBeCa towards the innovative technology on BWCs constitute a great potential for the acceptance of the system as well as for the further implementation of it in the Austrian police context. This favorable attitude was recommended to be supported by transparent communication measures (see also Miller et al. 2014). This would facilitate keeping both, the first-line users and the civil society, well informed with regard to expected technological improvements and developments on the level of public authorities and law enforcement agencies.

As EBeCa gathered with an overview of good practice examples of everyday use in international security and response organizations, taking advantage of these partially validated and useful sources of data can be found in police use as well as in disaster management as outlined by Backfried et al. (2013). Up to the current date, the inclusion of all of these outlined positive factors are not in full scale actively installed in scenarios with mass involvement. Additionally to the primary, BWC-technology-specific data gathering prone for small scale interventions, documentation units are currently used to gather footage from vantage points in dynamic and

complex scenarios with mass involvement like demonstrations or big scale events. This data is still mainly used for retrospective use specifically as evidence in lawsuits or to tackle unjustified accusations (see e.g. Sherman 2013).

The gathering of visual and audio data and their transmission in (near) real time to support an integrated operational picture at a command and control center was thus not surveyed in the EBeCa-approach. The question of the current feasibility and integration possibilities due to pending questions on technical, legal, and ethical issues as well as financial aspects has to be considered when debating the extension of use of visual data in complex scenarios with mass involvement and data sharing and exchange for an enhanced operational picture.

2.2. Additional Optical Sensor Sources and Data Distribution in Security Contexts

2.2.1. The Concept of the WatchDog project: Additive Optical Data and Data Distribution Models

In addition to the focused, but thus also limited data gathering approach of EBeCa, the project WatchDog represents the virtual and literal example of a more holistic, enlarged view on potentially escalating and dynamically changing situations with mass involvement.

The cooperative research and development project "WatchDog. Mobile communication and multi-sensor solution for security and risk management for outdoor areas and object security" was started under the lead of Joanneum Research by a consortium combining technology and sociology research institutes in tight cooperation with relevant governmental end users and NGOs in the year 2016 (WatchDog 2016). The key to an optimized operational flow of command and successful management of different risk situations consists of an innovative, semi-autonomous and autonomous permanent 24/7 time-optimized generation of a situational overview. In WatchDog – funded by the national security research programme KIRAS by the Ministry of Transport, Innovation and Technology – a concept for a mobile communication and multi-sensor solution for security and risk management for outdoor and object security is elaborated, tested and evaluated. The goal of WatchDog is the development of a multi-sensor system for security scenarios that is self-sufficient and independent from currently common communication infrastructure to enable the support of time critical decision processes.

The intensive involvement of first responder groups, application-oriented industrial partners, responsible representatives from the BM.I (Austrian Federal Ministry of the Interior) and BMLVS (Austrian Federal Ministry of Defence and Sports) as well as an international expert board ensures focused, practice-oriented alignment of research tasks and a scenario oriented development of prototype solutions.

2.2.2. Focus, Use Cases and Requirements of the WatchDog approach

A targeted analysis of the requirements focuses on the following application scenarios:

1. monitoring of transit and border areas
2. monitoring of industrial facilities and critical infrastructure
3. monitoring as part of security tasks in urban areas and public events
4. camp protection under humanitarian missions of the Federal Army

The following figure provides an overview of an exemplary WatchDog backup scenario for the monitoring of border areas and in transit zones.

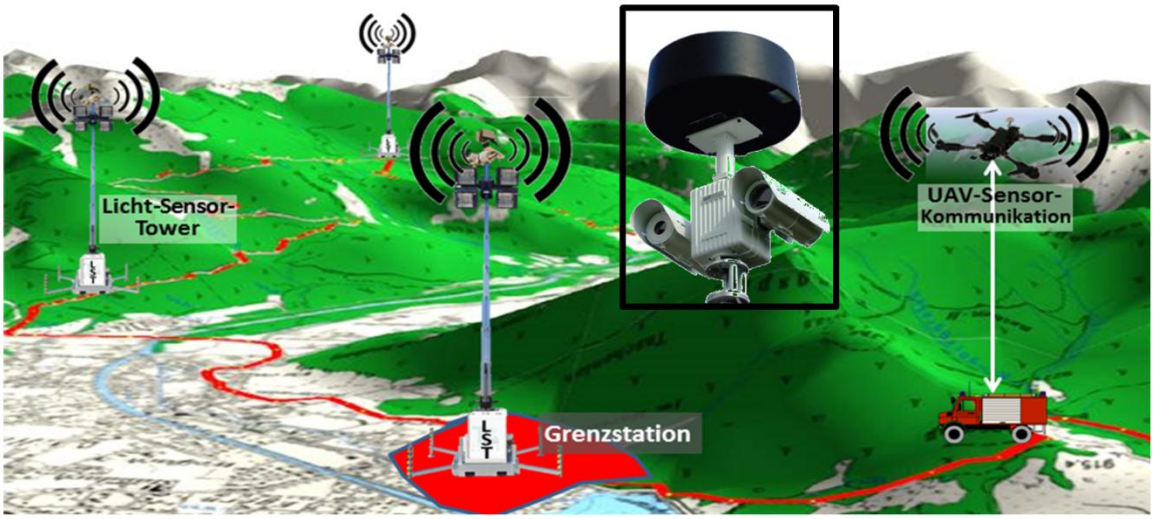

Figure 2: The WatchDog model for collecting multiple sensor data in areas with mass gatherings – example of border security

Different, often very dynamically changing security situations and the required efficiency in human resources, increase the demands on emergency and security services, as well as relief organizations at the same time. The recent past has shown this incisively with the problems at the borders as part of the international refugee situation, as well as critical developments of security situations in frame spontaneous events and planned events (sports events, cultural/music festivals, large New Year's Eve parties, etc.).

Therefore, WatchDog develops a flexible, mobile telescopic mast system, an energy and communication self-sufficient multi-sensor system concept adding up to the current state of the art in the automotive sector according to Hasch et al. 2012. The system will allow an efficient support of different large scale security scenarios. Thus, the integration of optical and thermal sensors as well as an innovative, but focused radar module is intended while excluding additional, highly specialized applications as Armbrecht et al. 2011 or Ash et al. 2014 outline. This selection and combination allows the development of multi-sensor-based analysis methods and management modules to account for a near-real time generation of a situation overview to support operation command and time-critical decision-making.

In the context of the defined sensor concept, the integration of radar data is used as an essential feature for the assessment of the situation and provides important motion information, especially in critical lighting conditions and at night. Therefore, the joint analysis of these sensor data will enable improved and more stable results in object detection and motion analysis. For flexible operation, the concept relies on innovative, energy-independent mobile telescopic mast systems equipped with the WatchDog communication and sensor modules. Innovative, LED-based lighting systems and speakers can be integrated to support security measures. A further essential part to optimise the support of the operational management for ground teams is the decentralized data access, an optimal group- and roll-oriented data distribution and standardized interfaces for a simple data integration in existing systems.

The aimed solutions in WatchDog will enable a near real-time situation picture, supporting the common operational picture to provide targeted information for the security management. Therefore, they increase the safety, security, and timely provision of the affected people. This underpins the importance of the generation of evidence

3. Gaps and Needs – Perspectives not (yet) provided in current Crisis Response

3.1. Need for Improved Information Sharing

A predominant requirement in multiple domains of crisis and disaster management as well as other security domains such as management of migration movements is improved information exchange. Nowadays, collaboration between stakeholders such as authorities, first responders, or military services is still predominantly based on face-to-face meetings, email messages, telephone calls, paper charts, fax messages, and in several cases proprietary electronic systems. The typical process of information-sharing is often limited and a common operational picture is hampered by the fact that they involved stakeholders have potentially complementary pieces of information available, but only take partially advantage from the option of sharing their information and thereby enhancing their operational picture. It has been shown by systematic analysis of the management of about 50 past European disasters that 34% of stakeholders' requirements for improved disaster management are related to improved interoperability. This was by far the most frequently type of expressed request, followed by request for technical solutions and resources, 15% each (Neubauer et al. 2017).

Several challenges have to be faced to reach optimized information exchange. Aside linguistic barriers, the lack of common taxonomies is often impeding optimized exchange of information. Stakeholders insist on using their own IT tools due to practicability reasons as well as prevention of disruption of their procedures and processes. In practical terms this means, that they are not ready to use additional tools specifically designed to exchange information. A new information sharing approach that arose from this situation is the paradigm of a common information space (CIS).

A common information space allows information exchange of different IT tools of entities in an automated way and enables stakeholders to continue to use their own tools with their specific user interfaces. To make this "seamless" information exchange possible, an approach is the development of an adaptor to the CIS for each of the IT tools connected to the CIS. Beyond the challenge to exchange information between different IT tools, there is need to ensure mutual understanding of messages. Understanding is frequently hampered by the fact that organizations often have different concepts with proprietary terms leading to limitations in understanding. This stresses the request for solutions for semantic interoperability in order to map concepts from different taxonomies. Due to the evident and well documented current situation expressed by response organizations and their leading staff (see section 4), a need for an enhanced operational picture for sensing early signs or even prediction of movement of masses was expressed (e.g. Neubauer et al., 2017). This reactive type of sensing of potentially critical masses and their flows can only contribute to a very rough and undifferentiated picture of the involved people, their socio-cultural constellation, and thus their specific vulnerabilities and needs to be covered. Provisions and preventive measures, prone to minimize certain dangers or risks can result in a timely and more precise, granular picture. This could contribute to a sustainable management of scenarios that were overwhelming or at least not sufficiently oriented on the dynamic and dynamically changing requirements of the moving masses.

The integration of a broader set of relevant data represents an imminent challenge. These novel or not yet sufficiently included sources and sensor types as well as the implementation of a bigger, selectively used pool of reliable jigsaw pieces have the potential to constitute the holistic and necessary knowledge of the scenario.

3.2. Inclusion of Additional Sensors and Data Sources in Small Scale Scenarios

Another example of the inclusion of sensors and data sources up to date not broadly used in the mentioned crisis scenarios is the use of analytical outputs of chemical sensing. As shown in a recent

research project and current pilot test, DHS-AS validates the detection of persons in a scenario of smaller scale. The project DHS-AS, "Detection of human signatures to detect smuggling", was started in 2016 under the lead of the University of Innsbruck and is funded by the national security research programme KIRAS by the Ministry of Transport, Innovation and Technology (DHS-AS 2016).

This project aims for the development of a portable device, which combines a gas sensor system for detection of trace volatile compounds characteristic for humans and an infrared camera to measure the person generated heat. The gas sensor system detects similarly to the dog's nose a "chemical fingerprint", composed from volatiles compounds, which are emitted by the human body through breath, sweat, skin, urine, and faeces. The applied sensor system has short analysis times of few seconds allowing a frequent and continuous sample collection and thus measurement of concentration gradients required for odour based searching scenarios. The prototype developed will be validated in field trials together with the partners at the Austrian Federal Ministry of the Interior and the research department of Johanniter Austria and optimized for future connectivity to current systems.

The planned portable system may open up completely new perspectives for different search and rescue scenarios. They can be used in situations with the involvement of groups, multiple persons or for individual search. These scenarios of trapped or hidden persons can appear after natural disasters like earthquakes, explosions or terrorist bomb attacks, as well as for searching illegal immigrants in in vehicles and vessels, which provide the danger of suffocation due to the lack of ventilation and oxygen.

Having derived an improved operational picture from multiple types of data sets, the impact can additionally be improved by enhanced sharing relevant and thus selected information with other stakeholders involved in the management of moving masses. Such collaboration models and inclusive approaches have very high potential in trans-national scenarios such as in border crossing areas as recent research showed, with a different focus on the examples of electronic health data transfer (www.konfido-project.eu, Naddeo et al. 2017) and railroad traffic (Maly, Schöbel 2009).

4. Initiatives and Approaches to Include Multiple Sensors and Exchange Data

4.1. Research Initiatives related to an Extended Exchange of Data

The mentioned recent initiatives show ways on how to include data received from sources like chemical sensing, additional visual and spectral sensors, satellite technology, as well as pattern and movement analyses to enhance a holistic picture. Current approaches are not only retrospective or reactive alone, but pro-active and consider specific needs and inherent structures of the moving groups. As outlined, they are not yet rolled out to harvest the full benefit of the data for supporting a (near) real time operational picture. This situation led to multiple research initiatives, both on national as well as international level. The project WatchDog and other research projects in the pipeline e.g. the mig.data-approach show the importance of the inclusion of multiple different sensor sources to provide novel perspectives.

For instance, demonstrators of such a CIS were developed in several European research projects. The focus of these CISs' differed considerably. In the frame of the FP7 project EPISECC, "Establish a Pan-European Information Space to Enhance security of Citizens", the developed CIS allows message exchange of stakeholders with specific focus on the response phase (EPISECC 2017). The use of adaptors allows seamless interconnection of proprietary IT solutions. In the case of EPISECC key terms of the messages can be semantically enriched (see Figure).

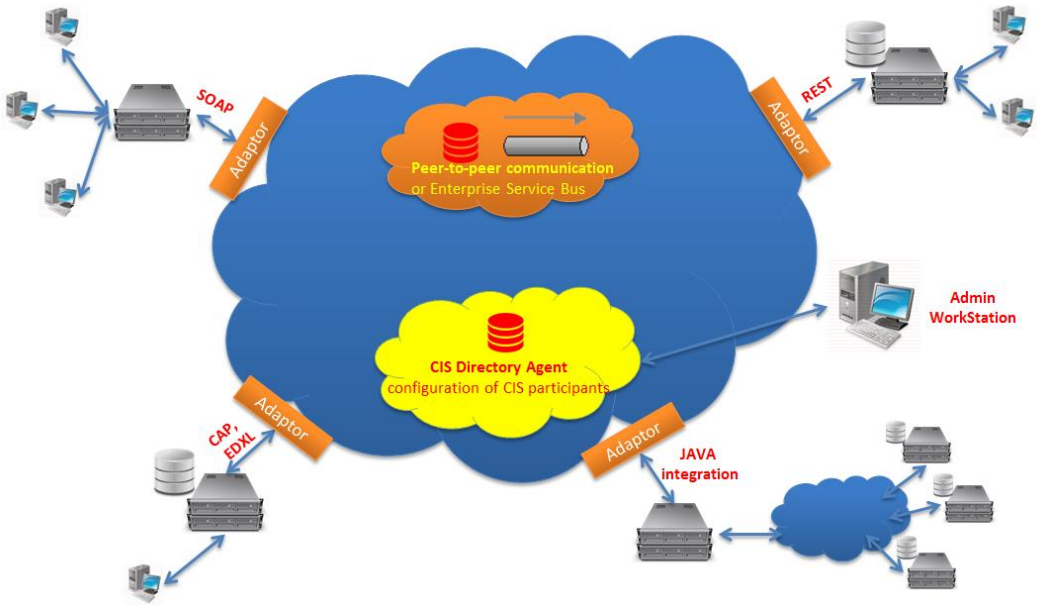

Figure 3: Concept of a Common Information Space from the FP7 Project EPISECC (EPISECC 2017).

In contrast, the CIS developed by the FP7 project team of SecInCore (Secure Dynamic Cloud for Information, Communication and Resource Interoperability) supports information sharing and retrieval for preparation activities (SecInCore 2017). Other projects were focusing on adaptation of communication technologies like Redirnet (Emergency Responder Data Interoperability Network) (Redirnet 2017) or integration of different types of legacy systems as SECTOR (Secure European Information Space) represents (SECTOR 2017). The Austrian national project INKA (Interoperability between Civil and Military Organisations in Catastrophe Management) allows exchange of information between civil and military command and control systems (INKA, (2017)). Improved information sharing is a predominant requirement, relevant for multiple areas of crisis management, including management of mass movements. The type of information encompasses messages as well as sensor data and information extracted from multiple types of sensors.

4.2. The Relevance of Information Exchange for Managing Mass Movements

A major challenge for European governmental organizations as well as NGO's is the management of the refugee flows that reached a peak in the second half of 2015 for the time being. It has been shown that the stakeholders on all levels had to face a lack of information on ongoing refugee movements (see Neubauer et al. 2017). Thousands of refugees reached different European borders and confronted stakeholders with hardly manageable challenges. It turned out that both established border-crossing information-exchange between stakeholders as well as early detection of refugee flows are main requirements to enable better management of movement of displaced persons. Taking into account the hardly predictable political, economic, as well as environmental developments in the multiple crisis regions in the world, such as Syria or Eritrea, it is highly recommendable to support stakeholders to be better prepared for managing future refugee flows. Such initiatives need to ensure both seamless, borders crossing information exchange as well as improved operational pictures on ongoing and expected refugee movements. In order to realize optimized information exchange, the use of concepts of information platforms such as the CIS developed in EPISECC or SecInCore and the adaptation to the specific requirements of the management of migration movements. Looking at an enhanced operational picture allowing short and middle term prediction of movements all relevant sources of information need to be combined. Such data encompass satellite data, organizational data from authorities, as well as data from

conventional and social media in form of reports and statistic. Based on these types of data on migration movements as well as push and pull factors a data model needs to be developed allowing retrospective evolution of operational pictures as well as short term and middle term forecasts of migration movements.

4.3. Enhancement of the Operational Picture via the Combination of Additional Sources, Data Exchange, and Process Development

Another innovative approach currently in evaluation to be funded is the mig.data-model that aims at connecting the mentioned data gathering via multiple sensors with the necessary procession, learning process, and sharing of information among relevant stakeholders. This approach originates from the requirement analysis and needs assessment among NGOs and Austrian national stakeholders after the big migration movement of 2015 and 2016. It multi-disciplinarily addresses the problem that authorities and other involved actors are still partially lacking relevant information on the overall operational picture of ongoing and expected migration movements.

This operational picture was also only shared in a limited way between states and stakeholder organizations. Based on heterogeneous information of migration movements and push-/pull-factors basing on satellite data and organizational data from authorities as well as conventional and social media in form of reports and statistics, a model and a demonstrator for an enhanced operational picture is going to be developed. This demonstrator will deliver actual respectively retrospective operational pictures and forecasts of expected migration movements. This operational picture can be shared on-demand on an inter- and inter-organizational basis via standardized interfaces.

Complementary to that, an e-learning concept will foster suitable training measures for working on the operational picture monitor. To receive the required adequate information level, data sources as well as relevant push/pull-factors are identified and brought together via Extract-Transform-Load (ETL) processes regarding a harmonized data model, which is based on standards to further push interoperability in this field. These ETL processes go along with a logical combination and, as far as possible, refinement of data regarding overall quality improvement. The derived operational picture will be complemented with geo- and context relevant information and in the end, will be visualized and interactive rehashed for the respective stakeholder groups.

As sustainable result, the mig.data approach delivers an extendable model to calculate and forecast migration movements and the necessary ETL-processes for generating data as integrative part of a developed and validated demonstrator, together with the appropriate e-learning concept for supporting the stakeholder during mastering migration movements as the following figure shows.

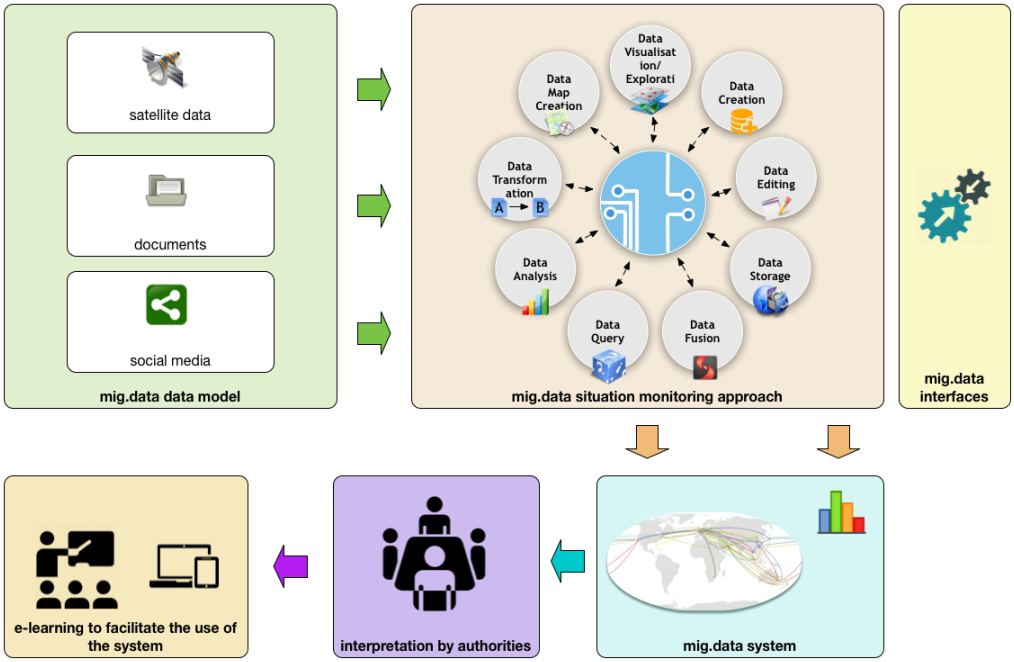

Figure 4: Overview of core elements and process steps contained in the mig.data approach

Finally, the benefit for all involved groups – users from authorities, NGOs, but also migrating groups – is a targeted, efficient, and timely possibility for the preparation of provisioning and support measures. Situational security and stable structures for the first care and handling of mass movements can thus be supported to a bigger extent than before.

5. Open Issues on the Legal, Ethical, Societal and Technical Side

These new types of models, sensors, and data to be included to a pool of selectively used data raise also new questions and requirements. Adding up to the technological challenges to be handled in the development, pilot, and roll out phase, several open issues evolve on the legal, ethical, and societal side. On the technical side, data security and transmission of partially enormous quantities of potentially sensitive data have to be solved in accordance with the organizational, operational, and last but not least financial possibilities of governmental and non-governmental stakeholders.

Questions regarding data protection, human rights, gender and diversity aspects have to be weighed and in-depth surveyed in dependence with the potential benefit of the enhanced security and safety of groups. Specifically the legal compliance with national and international law has to be considered and is besides the social and ethical acceptability of these systems a key factor for further research and in the last consequence for the practical implementation.

The monitoring through visual sensors like the EBeCa study exemplarily showed for BWCs represents a rather critical issue from the data protection point of view. In accordance to all regulations, police officers equipped with BWCs are required to mark on their uniforms while using BWCs. However, police officers don´t have access to the recorded materials. The processing of the recordings is carried out by a responsible office on management level, who decides whether the recorded material is important or not.

Compared to CCTV equipment, which is fixed in a certain place in the public space, BWCs are worn directly on the body. The main focus of CCTV lies on space control, while BWCs concerns the control of the situation and actors in place. The awareness of the fact being monitored, even if the device remains switched off, is theoretically more pronounced in the latter case.

Findings with critical or even pessimistic statements outline the possible negative impact of the utilization of BWCs on the relationship between citizens and the police. Since the monitoring camera is always present, even if it remains switched off, it performs control on the behaviour of individuals involved in critical situations. The permanent monitoring as well as the pressure of conformity are impacts which could increase the gap between police and the civil society (see Miko 2010, Silvestru 2012).

Even more pressing are the legal, ethical and technical questions to be considered in the research and development project WatchDog (see section 2.2). Due to the enlarged focus of the data gathering and sensor application via semi-autonomous and autonomous devices and the aspired multi-sensor solution, issues like data protection, security of transmission, the legally and ethically correct use of the system in different scenarios are key to create a practice oriented and in the further consequence also acceptable and applicable system.

The subjective feeling of diffuse threat in the host population that has developed specifically among persons living near critical borders in the course of the mass movements in 2015/16 as elaborated by Bourbeau (2015) is one of the factors to be closely surveyed. Besides a lack of information and the doubt of the governmental ability for sufficient preparation, management, and protection of exposed areas, the question of the acceptance of the local population – but even more so of the migrating persons – have to be taken into account. The subjective feeling of security/insecurity is also interlinked with cognitive aspects like the cost/benefit-ratio, the emotional and also the conative acceptance of surveillance technology as de Buitrago (2017) shows.

Additionally, gender issues as well as cultural and socio-psychological aspects are evidently of high impact for a complex solution as the WatchDog-approach but also for the other technology examples outlined in this paper. In regards of the project DHS-AS it can be seen as crucial to include the possible cultural and socio-psychological background of smuggled persons. When they are confronted with the chemical sensor, it might resemble a weapon and thus being considered severely threatening which can lead to over-reactions, non-compliance with the authorities, or traumatisation. In general the perspectives of male and female users of technology have high relevance for the successful and targeted research and development. In addition to that, the point of view of the subjects of this data collection are to be considered and respected. The specific reactions of the different genders as summarized by Gilbert (2010) have to be respected and included accordingly into the successful R&D-cycle.

Thus, in all of the presented, technology-focused projects like WatchDog, a thorough analysis of these aspects from the perspectives of all of the involved parties – official stakeholders, local residents and the individuals of the secured “masses” – has to be conducted.

On the level of data exchange and forwarding of requirement-focused, multi-source information, as outlined by the project examples of EPISECC and also the mig.data approach, these aspects have to be included and researched on a meta-layer. The systemic and procedural framework of the organizations meant to interact fluently in crises with mass involvement have to be taken into account with their individual needs, strengths and current technical, human, and infrastructural layout. Besides the early inclusion of the end user perspective and their specific requirements in this highly complex and dynamic field, these practicalities have to be taken into account additionally to the legal and ethical acceptability of innovative solutions. Only by combining all of these prerequisites and pre-conditions, solutions prone to be adopted broadly – as the trans-border and trans-disciplinary issue requires – can evolve from these inclusive, scientific approaches (see Conley 2011).

6. Conclusion

Rounding up the additional possibilities and the potential of an inclusion of novel sensor data and extended data exchange it becomes obvious that, besides the already existing data streams, much more is possible and needed for generating an enhanced operational picture for the response to crises with mass involvement. As exemplarily shown via several current research projects or singularly successful implementation show cases, the end users in governmental and non-governmental stakeholder organizations explicitly state the need for enhancement in information exchange and a holistic, timely, validated, and requirement-focused information basis.

Up to now, only a limited selection of the diverse spectrum of available sensor types is used in the domain of crisis management. Due to this current restriction, multiple data sources are not yet tapped to be included into a holistic and potent operational picture in scenarios with mass involvement and dynamic development. Thus, not only technological research in order to develop more and useful sensors for data gathering, but above all the inclusion of multi-use approaches of current and perhaps already validated and included data sources in other fields is vital. It has to be highlighted that the aspects of the efficient management, requirement-focused selection, and safe transfer and inclusion of data, but also the exploitation of novel data sets for innovative solutions are core elements for the optimization of an evolving, overall operational picture.

Besides the relevant, mostly quantitative basic information in scenarios with mass involvement, that were partially already implemented by national authorities, these additional data sources can contribute to filling gaps and enhance a fluent ongoing process chain. Data adding up to simple head counts or stream analyses can help to prepare sufficient shelter, support, and infrastructure pinpointing the requirements of the moving persons. Thus, for example the specific needs of vulnerable groups like children or elderly can be taken into account in a timely manner. Also, special patterns for the set-up of support structures or shelters dividing rivalling or culturally adverse groups can be prepared timely and thus conflicts or unrest can be minimized.

Additionally, by involving multiple data sources and sensors, the operational picture is less prone to disruptions, better validated, more stable and not depending on single channels, that can be easily blocked or that are not always available due to the environmental conditions, such as flooding. Apart from this beneficial potential of the inclusion of multi-sensor data in an enhanced crisis management, the processes lying behind have to be identified, analysed, and openly discussed for the different structures of the end-user organizations. Aspects in regards of human resources and training, an adequate cost-benefit ratio, evidence based findings for the validity and stability of the inclusion of innovative sensor data will be vital for a successful development towards the enhancement of an operational picture.

Last but not least, if not properly addressed, these legal, ethical, but also gender- and culture related issues, expectations and fears represent a high risk that the internationally evident positive effects of the combination of different data sources, information, and the selective exchange are overlain by negative representations. Lack of information and of responsiveness to these concerns and expectations may result in a negative attitude towards a new technology and thus hamper the acceptance of potential users. Thus, it is necessary to bring together in an early stage the perspectives of the potential first line users in local or national authorities, NGOs, and additional relevant stakeholders and experts as well as the broad view of the population and the migrating groups as well.

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DETECTING PEOPLE BEING TRAFFICKED OR SMUGGLED VIA THE SENSING OF TRACE VOLATILES

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Keywords

Gas sensing, volatile compounds emitted by humans, illegal immigrants, smuggling of people, trace gas detection

Abstract

The trafficking and smuggling of persons to Europe have reached epidemic proportions in recent years. This does not only put a major strain on European resources, but puts at risk the health and lives of the people being trafficked or smuggled. Furthermore, security personnel are unable to cope with the high influx of people illegally entering Europe. There is thus a current demand for rapid analytical systems that can detect people who are hidden or locked in special containers.

The key objective of the DHS-AS project is the development of a portable device for the rapid detection of volatile chemicals that can provide a chemical fingerprint for the presence of humans. That fingerprint combined with an infrared camera to look for the heat signature of the presence of humans provides an extremely powerful technology to combat the illegal movement of people. This detection of volatiles coming from humans is similar to the way a dog detects the presence of buried people. Our planned sensor system will be trained to recognize humans by detecting trace gases released from skin, sweat, and urine or in breath.

The backbone of the system we are proposing to achieve this is an aspiratory ion mobility spectrometer. Preliminary measurements show that this instrument has sufficient sensitivity for detecting volatiles coming from humans. To enhance selectivity, a newly developed aldehyde sensor will be integrated, which will be characterized and tested with gas mixtures. The prototype instrument will then be trained to detect the presence of humans through trials with volunteers to provide human samples that contain the volatiles of interest (from urine, breath, sweat, etc.) Measurements of the surrounding air, containing air pollutants and fragrances, will be also undertaken to understand the effects of confounding factors. The prototype instrument will be validated in field trials with the partners, namely the Austrian Federal Ministry of Defense and Sports, the Austrian Ministry of Interior and Johanniter Unfall-Hilfe. The instrument will be designed in such way that allows for connectivity to currently used detection systems.

1. Introduction: Demand on human tracking systems through increased migration

In order to escape from conflict, violence and poverty, in the last 2 years millions of people have escaped from their homelands to Europe, often via the Mediterranean route. According to recent

reports, nearly 1 million of these refugees have already been registered in Germany [1]. Smugglers support this migratory movement by bringing refugees to Europe on boats, in trucks, vans and small buses often receiving high financial gain. Smugglers support this migratory movement by bringing refugees to Europe on boats, in trucks, vans and small buses often receiving high financial gain. Trafficking involves ongoing exploitation and abuse and the dangers for the migrants are substantial. In attempting to reach Europe via the Mediterranean Sea, between 2000 and 2015, more than 30,000 refugees are believed to have drowned or died from hypothermia and starvation [2]. Transport by road can be as dangerous for a refugee. For example, on the 27th of August, 2015 on a motorway between Neusiedl and Parndorf, Burgenland, Austria, 71 migrants were found to have suffocated in a refrigerated truck.

Despite all the abuse, exploitation and dangers, according to the trafficking report of the Federal Criminal Police Office (Austria Presseagentur, APA), the number of persons picked up during their flight has increased tenfold since 2013 [3]. The detection of smuggled/trafficked persons is therefore of considerable importance not just to protect European borders, but also in terms of the humanitarian aspect in order to rescue people from life-threatening and degrading situations.

Many search and rescue teams rely increasingly on specialized technical tracking systems. In Austria, and partly also at an international level, search operations are currently carried out primarily with the help of CO_2 sensors, which can only be used in trucks with tarpaulins (no closed structures). In addition, infrared cameras and occasionally X-rays are used. Although dogs are still the better choice for the quick detection of entrapped people [4], because trained dogs can quickly search ruins and track the human scent, they are limited in their abilities, basically because they get tired after about 30 minutes of intensive search. Moreover, they can become stressed and frustrated if they are unsuccessful [5]. Furthermore, there are significant costs in training and using a dog. Therefore, there is a demand for development of sensitive detectors, which can recognize the human smell and thus, support or replace dogs.

2. Methodology

2.1. Chemical fingerprint based on emitted gases

The human body emits hundreds of volatile organic compounds (VOCs) through breath, sweat, and skin [6, 7]. In addition, volatile substances excreted by urine and faeces are characteristic for humans [8]. This includes specific volatiles such as acetone, isoprene, acetaldehyde, ethanol, methanol, ammonia, 2-pentanone and sulfide compounds. In addition to these common compounds, and according to new research results, aldehydes such as hexanal, octanal, nonanal, and decanal, are also emitted from human skin [6, 7]. In addition to ammonia, human urine also contains several aldehydes [9].

The combination of these volatiles produces a human chemical signature that can be detected at trace quantities. For locating or tracking people the pattern of characteristic volatiles needs to be determined. Once this is achieved, this opens up completely new possibilities for different search and rescue scenarios, such as after natural catastrophes (earthquakes), explosions or terrorist attacks, as well as for use in searching for illegal immigrants being smuggled into Europe.

A number of recent studies suggest that the chemical analysis of the air in small enclosed spaces should give concrete indications of humans being present, which could significantly improve the success rate of search and rescue operations [10, 11]. Owing to the fact that the concentration of many volatile compounds of interest is at trace levels, their detection places high demands on the analytical technologies. Furthermore, whilst laboratory based instrumentation can detect VOCs at

trace quantities, these are not of use in the field. Miniaturization of the technologies to provide portable analytical devices is important for on-site application.

Ion mobility spectrometry (IMS) is a particularly promising analytical device. IMS is mainly used in homeland security applications for the detection of warfare agents and explosives as well as drugs. However, this technology has also proven itself useful in several civilian applications [12-14]. Advantages of the IMS technique with regard to detection of VOCs emitted by humans is its robustness, cheapness, portability, ease of use and high sensitivity for real-time rapid detection (seconds) of VOCs. The short analysis times of the aspiration IMS allow a frequent and continuous sample collection. [15]

Whilst VOCs such as ketones and ammonia can be detected with high sensitivity (down to a pg / L level), the compact aspiration IMS cannot detect other key volatile signatures associated with aldehydes. Thus the planned human odor tracking system will combine an aldehyde sensor with the IMS, thereby considerably expanding the analytical capabilities of the instrument.

2.2. Integrated gas sensor system and heat imaging camera

The planned portable device combines an infrared (IR) camera and different gas sensors, among them the aspiratory IMS, and metal oxide semiconductor and field-effect transistor sensors, which are integrated in a transport box together with a lithium-iron phosphate battery, a control unit for the sensors, the IR camera and a communication module. The key components of the prototype instrument are illustrated in figure 1. The sensor system will be connected via wlan to a smart phone and/or tablet.

The IR camera is located at the end of an extendable sampling tube. Different IR cameras were tested in order to determine which is the most suitable. Weight and size, response time and spectral resolution were important factors taken into account for selection.

The housing containing the key components of the device is water resistant and can be combined with a back-pack carry system (figure 2 (a)). The gas sample is collected from the end of the extendible tube (figures 2 (b) and (c)). Through a specially designed sampling system, including inert tubing, dust separator and pump, the gas sample is transported to a gas sensor system For sealed containers with only one plug hole for condensed water, the sampling tube can be exchanged for flexible thin tubing, which enables the gas sampling directly from the container.

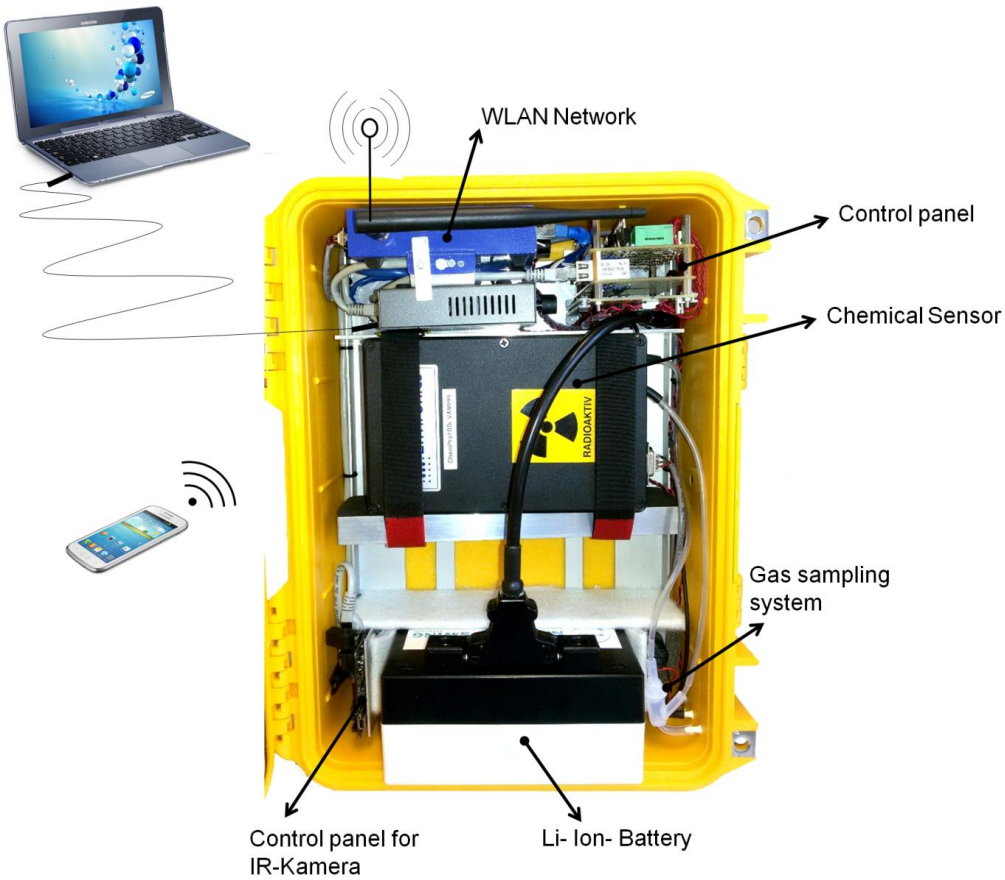

Figure 1: Set-up of the key components of the prototype instrument. The chemical sensor is the aIMS referred to in the text.

Figure 2. Portable prototype showing (a) the water resistant container and back-pack carry, (b) the extendable sampling tube and (c) the combined system in operation.

During analysis air is pumped continuously into the IMS cell, where the air molecules are ionized by the ^{241}AM-ion source. Ion-molecule reactions with trace VOCs produce signature ions which are spatially separated according to their mobilities (which are determined by their mass, charge and collisional cross section) to be detected as a current pulse. The higher the mobility of an ion the earlier it collides with an electrode. To operate in either positive or negative ion mode, the polarity

of the electric field is reversed in cycles typically lasting about 1 second. A histogram of ion current at each electrode is used to represent a spectrum. The histogram pattern produced provides the fingerprint, without the identification of the individual compounds. Figure 3 shows a histogram representing a typical “breath - fingerprint” measured by the aIMS.

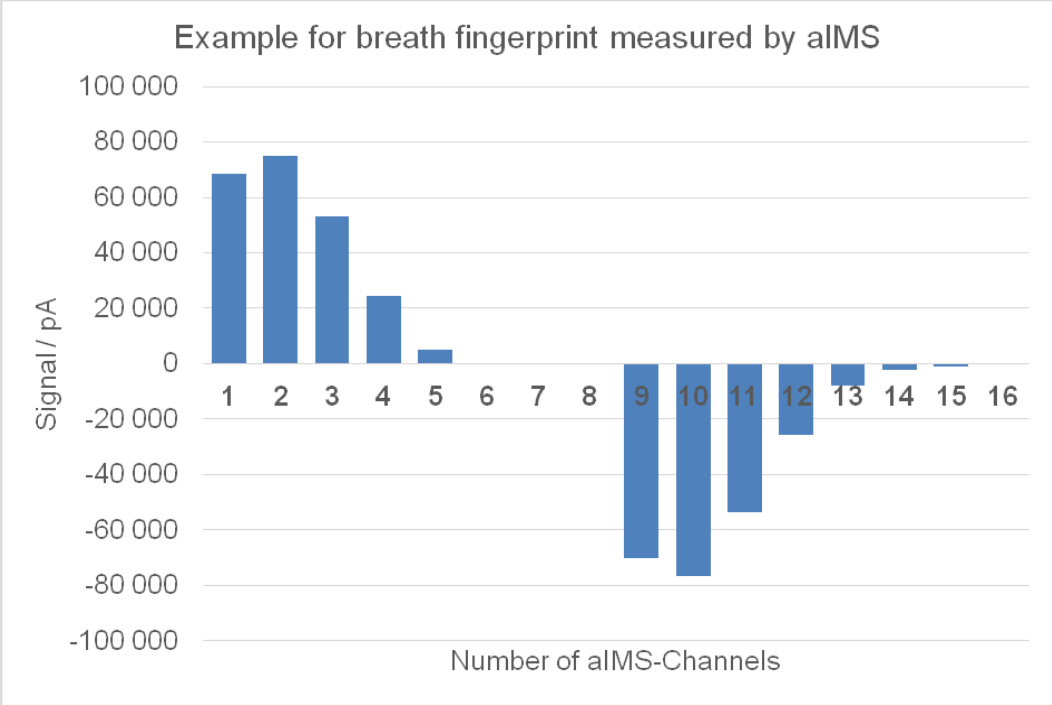

Figure 3: Example of a breath pattern measured using the aspiratory IMS. The numbers 1-16 on the x-axis refer to electrodes and shows switching between negative and positive modes.

The gas composition of human emission samples and also the surrounding air is extremely complex. Thus the unambiguous assignment of VOCs that are coming from humans is challenging. Hence the proposal is to work with chemical fingerprints rather than to try to identify individual volatiles. For this a calibration system will need to be developed to regularly monitor the accuracy and sensitivity of the instrument.

The basic mechanism of the aldehyde sensor is the oxidation of the aldehydes to the corresponding acids. The oxygen consumption is measured electrochemically. The selectivity for aldehydes with low (1-10) carbon numbers is possible by the use of a specific porous polytetrafluoroethylene membrane, the composition of the working electrode and the electrolyte, and the applied voltage across the electrode. The aldehydes are oxidized at the anode. The electrons produced by the oxidation of aldehydes are consumed at the cathode. According to test measurements by Obermeier et al., acetaldehyde and a mixture of different small-molecule aldehydes (C1-C10) with good sensitivity down to the lower ng / L range can be detected [16].

3. Preliminary Results

In order to train the sensor system for recognition of diverse odors, different human samples, such as urine, breath, sweat, blood from several volunteers have been measured and characterized with the sensor system and other analytical devices for comparison (e.g. with different mass spectrometers). Additionally, selected air samples demonstrating the surrounding air in a closed room, such as indoor and outdoor air at different locations, air above various packaging materials and food products have also been analyzed.

With help of the "Random Forest" method human and non-human samples were easily distinguished. Sensitivity and specificity are statistical measures of the performance of a binary classification test. The Sensitivity (also called the true positive rate or probability of detection) measures the proportion of positives that are correctly identified as such. The specificity (also called the true negative rate) measures the proportion of negatives that are correctly identified as such. The sensitivity and specificity were both around 0.8. The area under curve (AUC) of a receiver operating characteristic (ROC) curve was determined as 0.8998 (Figure 4). The random forest method performs by using leave-one-out (LOO) cross-validation, ensuring a better quality for sensitivity and specificity by guaranteeing the difference of the training set and sample set. Figure 4 shows an exemplary case for ROC curve calculated from the samples collected mainly under laboratory conditions, but the general shape is expected to be similar for the practical applications. The "working point" can be selected according to the required specificity in the field during a search scenario.

In the DHS-AS project the extension of the current "fingerprint database" with additional samples involving more volunteers and samples are planned. Therefore a specific field testing will be carried out with the help of the Austrian Ministry of Defense and Sports (Bundesministerium für Landesverteidigung und Sport) and Austrian Ministry of Interior (Innenministerium).

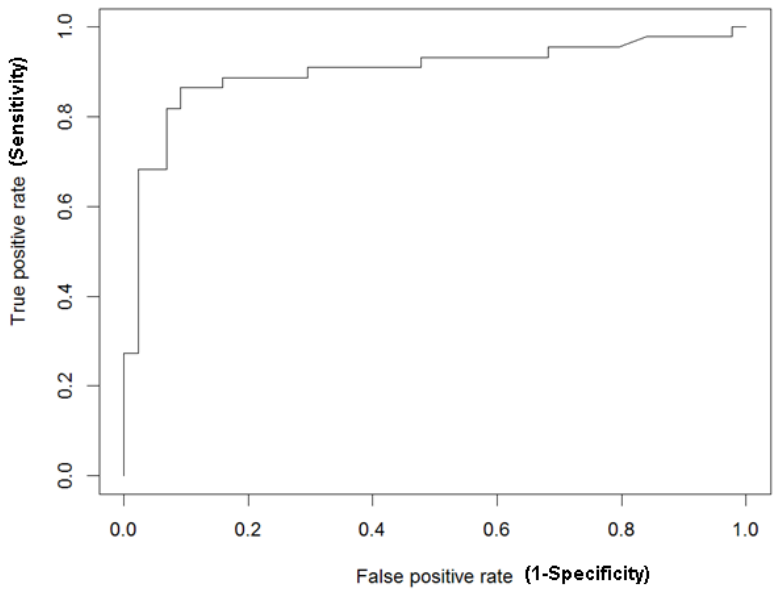

Figure 4: Receiver operating characteristic curve for which the AUC was determined to be 0.8998 using a "random forest" classification technique.

4. Discussion and Conclusion

This project is in collaboration with the Austrian Federal Ministry of the National Defence and Sports and the Austrian Federal Ministry of Interior and the Austrian Johanniter Unfall-Hilfe. This intersectoral approach provides important input into the application oriented research taking into account social and ethical issues. Importantly it ensures that the developed portable device is designed according to user requirements and can be adapted for use with technologies currently used in the field.

With our proposed sensor, a considerable improvement in the selectivity and specificity of the detection of volatiles is expected. It is in the field that issues associated with extreme environmental conditions will be fully tested, providing an improved understanding of the accuracy associated with this new detection system.

Based on the increased number of test measurements and field experiments, biostatistical analyses using different classification procedures will be investigated in order to find the most effective method for the detection of humans through their VOC signatures. All measurements will be used to compile a signal database (as a training set), which provides a basis for the analysis software.

The control of the device, data analysis, and then visualization will be developed for interfacing to a smart phone and/or tablet via wlan.

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SESSION D: SOCIAL MEDIA

CROSS CULTURE DIFFERENCES ON FACEBOOK

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Keywords

cultural differences, Facebook, social media, Germany, Russia, Czech Republic, Kazakhstan, Hungary

Abstract

The paper examines university students' behavior and stereotypes on Facebook. The aim of the study is to find out particularities in Facebook use based on cultural differences. The research analyzed Facebook profiles of students from five different countries: Hungary, Germany, Russia, Czech Republic and Kazakhstan and find out the similarities and differences in the usage of Facebook. Hofstede's national cultural dimensions for selected countries were taken as an independent variable and authors performed the data analysis focused on 11 aspects of Facebook users' behavior. The research examined 250 student Facebook profiles in total (50 from each country) and found significant differences in the online behavior, not all of which can be attributed to Hofstede.

1. Introduction

Social media are an inseparable part of modern life, their popularity, and with it, the influence they have in society is beyond dispute. We use them in every aspect, such as personal relationships, work (Boehmova & Novak, 2015) or entertainment (Sudzina, 2013) and life without them is hardly imaginable. Although they did not exist twenty years ago, they have become one of the most important means of communication of the modern era. Facebook recently announced that it has over 2 billion monthly users (Facebook.com, 2017). This makes its "population" larger than that of China, the US, European Union combined. Especially young people use Facebook to keep in touch with their friends, family or acquaintances. However, Facebook does not serve only for the communication between two individuals over chat. With possibilities such posts on the wall, status updates, live streams or shared pictures and links, people managed to address a wide spectrum of users and engage in public communication (Vondra, 2015). The social media are so important, they should be taken into formal education plans (Hanclova & Doucek, 2011). The way people from different countries use Facebook is very specific and is influenced by cultural differences.

The development in ICT field is very fast and drives the performance of the modern economy (Oskrdal, Pavlicek, & Hubacek, 2011). However, the global reach of new ICT technology does not mean, that the cultural differences disappear. The aim of the study is to examine features of Facebook users from different cultural backgrounds. The analysis thoroughly evaluates how students present themselves on Facebook, what kind of information they share and how much the sense of privacy influences their behavior. The analysis reveals particular features and stereotypes

that Facebook users from different countries have formed. The goal of the analysis is also to compare how much the cultures across the world resemble or differ in using Facebook.

2. Literature review

People use Facebook for different reasons, however, there are several primary aspects that affect the people's motivation to use it. Nadkarni & Hofmann, S. G. (2012) detected two main reasons of Facebook use: the willing to affiliate and want for the self-representation and promotion. Zhao et al (2008) claim that people are using Facebook to construct the personality they are willing to be represented in social media. According to Sheldon (2008), people spend time on Facebook to maintain the existing connections and to build new ones.

For examined countries, according to www.internetworldstats.com, the percentage of using Facebook significantly varies. Hungarians turn out to be the most active users of Facebook out of all five analyzed countries - 51,8% of Hungarians are registered on Facebook by the end of 2016. The second place takes the Czech Republic with 42,7% users from the total population, and Germany is on the third place with 35,7%. As can be seen, despite significant differences in the percentage of Facebook use, European countries form a group of countries using Facebook actively enough. On the other side of the spectrum is Kazakhstan with 8,1% and Russia with 7,5%. This gap can be explained by the late arrival of Facebook in both countries and huge popularity of "VKontakte" social media.

Speaking about self-representation in social media, we have conducted our research on the article of Abdullah AliAlassiri, Mariah Binti Muda and Rahmat Bin Ghazali from the University Technology MARA in Malaysia and by Ubani Charles Ahamefula from the National University of Malaysia in Malaysia (2014). In the study were mentioned different reasons for using self-presentation. The first reason is to allow social interaction. The second reason is to get favor and social rewards and the third reason is self-construction. The authors described also different types of self-presentation. But the major fact is that people use self-presentation to impress other people or institutions. Authors formulated seven different types of self-presentation and mentioned the expressions of these types. The different types of self-presentation are self-promotion, exemplification, modesty, intimidation, self-handicapping, ingratiation, and supplication. These perceptions were based on a study from Jones and Pittman (1982) but the authors decided to add two types more. The next point in this research is to identify the dominant forms of self-presentation. These five different styles are called ingratiation, self-promotion, intimidation, exemplification, and supplication. Each of these styles has an impression, behavior and a risk of self-presentation. The concept is used for people they would like to satisfy their intended need for interacting with other users. (AliAlassiri, Binti Muda, Bin Ghazali, Ahamefula, 2014)

For the social network site part in the research, the authors focused on Facebook. The reason for these is that Facebook is more representative than other social networks because Facebook is the most famous and also most used social networks in the world (Facebook.com, 2017). (AliAlassiri, Binti Muda, Bin Ghazali, Ahamefula, 2014)

The study shows that self-perception and self-awareness could be different. People use the social networks to better represent themselves. The reader of Facebook profiles and status updates has the task to check what reality is and what a representation is.

Due to differences in cultures themselves, use of Facebook in different countries is also having some specific features. Numerous research papers and articles are devoted to examining and revealing those cultural differences. The comparative study of German and US students performed by Karl et al. (2010) with regard to posting different types of information on Facebook revealed

that US students were more likely to post indiscreet content than German students. In the research conducted by Vasalou et al. (2010) it is stated that UK and Italian Facebook users find the group activities more important, moreover, Italians spend the time on Facebook playing games. However, in comparison with US users, European users (from Greece and France) pay less attention to status updates and photos than US users.

Continuing the Facebook photo topic, the study of cross-cultural differences between Facebook photos of American and East Asian users (Huang & Park 2013) has shown that the last tend to retouch their Facebook photos more than their American counterparties. The facial expressions on East Asian users' profiles pictures tend to be less intensive in comparison with the facial expressions on Americans' profile pictures.

A significant source of information for this research is the article written by Elmasry et al. (2014), in which the authors examine cross-cultural differences in Facebook use of people from USA, Egypt, and Qatar. The research revealed that the most significant points which vary between the stated countries are self-disclosure and content of wall posts. Facebook users from the Middle East tend to disclose less information and share political information (one of the reasons for that is Arab Spring, which took part in the early 2010s), while American users care less about self-disclosure, more open and the content of their posts is more entertaining by nature.

Self-disclosure is defined as what individuals reveal about themselves to others, including thoughts, feelings, and experiences (Derlega, et la., 1993). Self-disclosure is a simple approach to communication that involves sharing information about yourself, about your past, present, emotions, and thoughts. People decide by themselves how big part of their private life do they want to share with others. Self-disclosure have positive effects on interpersonal relationships because it is the process of making oneself known to others in an intentional way. It can differ based on age, gender, religion, subculture, and the circumstances within which an opportunity to self-disclose presents itself.

Lots of studies over the years have also shown that people from various countries with different cultures have differing self-disclosure patterns.

Within the individualistic cultural context, Facebook users in Europe (Hungary, Germany, Czech Republic, and Russia) disclose themselves differently from those in Kazakhstan. The boundary of privacy controls how much should be disclosed to others. Comparing to the people in individualistic culture, people in collectivistic cultural has lower self-disclosure (Marshall, 2008). The study shows us that that the European students disclose more than the Kazakh students, and this difference may be contributed to the consequence of cultural value. As to the self-disclosure to close friends, Kazakh people disclose less personal information through the Facebook to other people than Europeans does.

Culture is a significant predictor of self-disclosure in social networks. Europeans disclosed more than Kazakh; because they have more photos, friends, status/non-status updates than Kazakh students have on their profile pages. European students reveal themselves more directly than Kazakh students and are more likely to provide information about their origin, present residence, and self-ascribed identity on personal Facebook pages.

One's number of friends and activity on Facebook, such as updating one's profile and browsing other profiles, has some effects on privacy behavior (Lewis, Kaufman & Christakis, 2008), (Sigmund, 2014). The privacy setting associated with the online communication and the number of friends. Our research about Hungarian, Russian, German, Czech and Kazakh students reveals that profiles with lots of friends tend to be much more forthcoming with their personal information, it can be defined by the fact that the users' completion of profile fields is positively associated with

more friends, perhaps because such information encourages the development of ties based on shared experiences (Lampe, Ellison & Steinfield, 2007).

2.1. Hofstede's cultural dimensions

Unfortunately, we have not found any literature devoted to the cultural specialties of Facebook use by Czech, Hungarian and Kazakh users, however, we can make some suggestions based on the Hofstede national cultural dimensions (1980). These dimensions are:

- Power distance. It expresses the attitude of the society towards the inequality in the country. If the country has higher power distance, its citizens to more extent not accept and expect the uneven distribution of power and otherwise in case of lower power distance.
- Individualism. If the country has higher individualism score, they take care only of themselves and their family. Opposite situation is called collectivism.
- Masculinity/Femininity. Masculine societies appreciate individual success and achievements more. Feminine ones appreciate life quality and caring.
- Uncertainty avoidance. Countries with high uncertainty avoidance are more voluntaristic - they try to control the future in every possible way. People in those cultures are characterized by risk aversion and reluctance to change something. Countries with low uncertainty avoidance are fatalistic - they prefer to let the future happen and not be prepared for everything.
- Long term orientation. Countries with low long term orientation rely on traditions and established patterns and countries with high long term orientation are usually more open to changes.
- Indulgence. Countries with low indulgence have worse control of their impulses and desired and countries with high indulgence have better control of their impulses and desires and are called “Restrained”.

Table 1: Hofstede's cultural dimensions for selected countries

Cultural dimensions	Power distance	Individualism	Masculinity/ Femininity	Uncertainty avoidance	Long-term orientation	Indulgence
Germany	Low	High	Masculinity	High	High	Low
Czech Republic	Relatively High	Relatively High	Masculinity	High	High	Low
Russia	Extremely High	Low	Femininity	Extremely High	High	Very Low
Hungary	Low	High	Masculinity	High	High	Low
Kazakhstan	High	Low	Masculinity	High	High	Low

As can be seen, the countries differ from each other by power distance, individualism and masculinity/femininity. We expect that countries with high individualism will have approximately the same number of friends as the countries with low individualism (mainly because Facebook is

not the most popular platform among Russian and Kazakh people, who tend to be collectivists. The information disclosure is expected to be worse in individualist countries, however, in masculine countries who approve personal success the disclosure of employment history is expected to be higher. We also expect that in the countries with lower power distance the nature of the posts and status updates will be more devoted to the politics.

3. Methodology

To carry out the analysis, we chose five distinctly different countries: Hungary, Russia, Germany, the Czech Republic and Kazakhstan. Germany represents a Western European nation which has a rather modern approach and is one of the most prosperous countries in Europe. The Czech Republic and Hungary are representatives of central European nations, Russia accounts for Eastern Europe. Russia is a significant country for the research as the online social media vKontakte was created here. In consequence, Russian social media users frequently replace Facebook with vKontakte. The last country, Kazakhstan is part of Central Asian nations. Kazakhstan has a particular place in the research in sense of diversity as well. It is the only country where people commonly practice two different religions: Islam and Christianity.

The research has been conducted with help of native speakers – students from respective countries attending the course of New Media at the University of Economics, Prague.

A content analyses of Facebook pages was carried out in order to examine the similarities and differences in Facebook content amongst German, Russian, Kazakh, Czech and Hungarian students. Content analysis is amongst the most important research techniques in the social sciences, analyzing texts, images, and expressions that are created to be seen, read and acted on for their meanings. So it is a quantitative media research method for studying and retrieving meaningful information from documents (Riffe et al. 2005).

Representative university from each country was chosen: Saint-Petersburg State University, University of Applied Sciences Zittau/Görlitz, Nazarbayev University, located in Astana, Kazakhstan, University of Ostrava and Corvinus University of Budapest. A total of 250 (50 from each university) randomly selected public student Facebook profiles were examined.

The original reason of this study was to examine how university students used Facebook. The researchers designed a coding sheet which consisted 22 variables. That was the basis of the content analysis. With this coding sheet, the researchers could examine the cross cultural differences of the students. The coding sheet was designed to examine a different kind of Facebook contents like status updates, links, pictures etc. Other variables also can be found in the coding sheet: gender, birth year, the total number of Facebook friends, employment history, religious affiliation, relationship status (see the appendix for the full coding sheet). The data about students were anonymized to protect the privacy rights of study subjects.

It is proved that people from different countries tend to use Facebook in different ways and for the different purposes. Elmarsy (2014) found significant cultural differences in Facebook use among the students from Qatar, Egypt, and USA. Brailovskaia & Bierhoff (2016) revealed the differences in Facebook activities between Russian and German users. Therefore, we suppose that cultural differences play a significant role in the Facebook use by people in different countries.

4. Results

The first researched aspect of students' behavior on Facebook is whether they share their date of birth or prefer to keep this information private. The findings show that Hungarian students came out as Facebook users who are the most willing to fill the date of birth (98%) in their profiles. We can observe a similar tendency within Czech students who like to share information about their birth as well (86%). University students from Russia and Germany had same results which revealed that the majority of Facebook users do not mind sharing information about the date of birth. However, Kazakhstan turned out to be the most conservative and reserved country. 64% of researched university students were rather restrained and did not mention the date of birth in their profiles.

Table 2: Publicly available information on Facebook

	Public birth day		Real name		Employment history		Friends lists	
	Displayed	Hidden	yes	no	Displayed	Hidden	Displayed	Hidden
Hungary	49 98%	1 2%	50 100%	0 0%	27 54%	23 46%	39 78%	11 22%
Germany	37 74%	13 26%	50 100%	0 0%	25 50%	25 50%	45 90%	5 10%
Russia	37 74%	13 26%	37 74%	13 26%	35 70%	15 30%	32 64%	18 36%
Czech Republic	43 86%	7 14%	49 98%	1 2%	23 46%	27 54%	41 82%	9 18%
Kazakhstan	18 36%	32 64%	47 94%	3 6%	13 26%	37 74%	38 76%	12 24%
Totals	184 73,6%	66 26,4%	233	17	127	123	198	52

Birth-day: $\chi 2$ (2, N = 250) = 55.665, p < .001

Real name: $\chi 2$ (2, N = 250) = 38,248, p < .001

Employment: $\chi 2$ (2, N = 250) = 20.101, p < .001

The lowest rate of real name disclosure among five examined countries demonstrate German Facebook users. The obtained result once again reflects the individualism of German users, who refuse to let strangers in their personal lives. The highest percent of disclosure is observed among Hungarian and Russian users. The overall result among all five countries shows high rates of name disclosure. We think that the reason for it is the willingness to be found by prospective friends (this is much easier to do knowing a person's real name).

The highest percentage of users with hidden friends' lists is observed in Germany. This phenomenon can be explained by the fact that German people have the tendency to individualism and are not willing anybody to intrude in their private life. Users from Kazakhstan also tend to hide friends lists, which is not consistent with our initial suggestion that due to low individualism Kazakh users will have open friends´ lists. Moreover, the average number is Facebook friends of Kazakh users is the lowest. We suppose that this can be explained by the low penetration of Facebook in Kazakhstan and preference to "VKontakte" social media. Russians have the third lowest number of friends presumably because of the same reason. Users from the Czech Republic

have the lowest number of friends among European countries. Our suggestion was that it should have been German users who have the lowest number of friends due to high individualism, however, Czech users outplay them in this aspect. Users from Hungary have the biggest number of Facebook friends on average.

As expected, the highest percentage of employment history disclosure we can observe among the German users of Facebook. This result is consistent with the notion that the German culture is masculine and German people pay great attention to the personal success and achievements. The least percentage of employment history disclosure can be seen among Kazakh users, which is not consistent with the view of Kazakhstan as a country with high masculinity. Moreover, the perception of Russia as the country with high level of femininity is not fully confirmed when taking into account employment history disclosure - the Czech Republic, which is perceived to be quite masculine country, has a lower percentage of the disclosure.

Table 3: Relationship status

	Single	Relationship	Engaged	Married	It's complicated	Open relationship	Widowed	Separated	Divorced	Not listed
Hungary	3 6%	8 16%	0	0	0	0	0	0	0	39 78%
Germany	8 16%	13 26%	3 6%	2 4%	0	0	0	1 2%	0	23 46%
Russia	7 14%	3 6%	1 2%	2 4%	0	0	0	1 2%	0	36 72%
Czech Republic	8 16%	14 28%	2 4%	4 8%	0	0	0	0	0	22 44%
Kazakhstan	1 2%	3 6%	0	0	0	0	0	0	0	46 92%
Totals	27 10,8%	41 16,4%	6 2,4%	8 3,2%	0	0	0	2 0,8%	0	166 66,4%

$\chi 2\ (6, N = 250) = 49.905, p < .001$

The table above shows the results of relationship status that university students filled in Facebook profiles. The findings that are extracted from our data analysis came out for all universities more or less identical, except two universities: in Kazakhstan and Hungary. Students from these two countries seem to be more conservative concerning sharing information about relationship status than the rest of the researched Facebook users. 78% of students in Hungary did not mention the relationship status in their profile and even more, students who did not want to share their status were in Kazakhstan (92%). Contrarily, the Czech Republic and Germany seem to be countries where students share publicly information about their relationship. The Czech Republic happens to be a country with the most open approach. The research discovered that only 44% of students did not state the relationship status.

Russian students have the tendency to keep the relationship status off their Facebook profiles. On the other hand, those students who mention the status prefer to use various categories to describe specifically the nature of their relationship. In comparison with Hungarian university which has rather similar results, students who mentioned their status limited themselves only for categories "Single" and "In a relationship". The similarity in choosing categories that define the character of relationships can be found within Kazakhstan and Hungarian university.

Table 4: Number of posts

	Posts in last 30 days		Avg. # of posts per person
Germany	230	30%	4,6
Czech Republic	135	17,6%	2,7
Russia	100	13,07%	2
Hungary	219	28,6%	4,38
Kazakhstan	81	10,5 %	1,62
Total	765	100%	

According to the Table 4 we can see that the total amount of posts being posted during last 30 days is 765 and almost 60% of these posts were made by German and Hungarian students, and the highest average number of posts per person has Hungary (4,38 posts per profile), this can be described by the fact that Hungarian students have the highest average number of friends (992), and Kazakh students who have the lowest average number of friends (137) respectively have the least number of posts (1,62 post per profile). Results also show, that Kazakh students also have the lowest number of posts related to personal activities, only 4 (2%) posts out of a total number which is equal to 321 and this can be explained by the fact that Kazakh internet users are more likely to post news through another social network vk.com.

5. Conclusions

The research clearly demonstrated the differences between Facebook usage in Germany, Czech Republic, Russia, Hungary, and Kazakhstan. A typical example of this is the specification of the birthday. The majority of Hungarian Facebook users publicly announce the birth date to Facebook. On the other hand, only 36% of users from Kazakhstan publish the date of birth. This difference is also visible when publishing images on Facebook. The study found that users from the Czech Republic publish most of the photos. Users from Kazakhstan publish the fewest of all photos. An exception is the statement of religion. The majority of all countries do not publish any religion on Facebook.

An assumption, that Russian and Kazakh users behave themselves on Facebook in similar ways have also been confirmed. No significant differences have been observed during the entire research with exception of the indication of the employer's history. In Russia, 50% publish an employer history, in Kazakhstan, it is only about a quarter of users.

German and Hungarian users behave on Facebook in similar ways, even thou there are some cultural differences. For example, Hungary publishes their date of birth on Facebook. On the other hand, Germans give their relationship status more to Facebook. 26% of Germans do not use their real name on Facebook. However, all Hungarian users give their real name to Facebook.

Even though Germany, the Czech Republic, and Hungary belong to the high individualism countries, while Kazakhstan and Russia belong to the collectivist countries, this does not reflect on the number of friends and profile information disclosure. The differences in the number of friends on Facebook are not related to individualism or collectivism. With an average of 992.31 friends,

Hungarian users have the largest number on Facebook. The smallest number of friends has users from Kazakhstan. Russia and Germany have about the same number of friends. The Czech Republic is ranked 4th with the number of friends.

The masculine countries are Germany, Czech Republic, Hungary, and Kazakhstan. Only Russia is assigned to the feminine countries by Hofstede. Whether a country is masculine or feminine does not seem to affect the Facebook behavior.

There was not observed the difference between countries with a low power distance (Germany and Hungary) and high power distance ones.

In general, the study has revealed that there are cross-cultural differences between Germany, the Czech Republic, Russia, Hungary, and Kazakhstan. However, these differences cannot always be clearly explained with the cultural dimensions of Hofstede.

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AVAILABILITY OF SOCIAL INFLUENCERS: MARKET BARRIERS ON THE SUPPLY SIDE

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Social influencers, social media, e-commerce, affiliate programs, market with social influencers, online marketing

Abstract

Social influencers represent a frequently discussed topic in online marketing and there is no exception that well-known companies and brands spend large amounts of money to purchase their services. Conversely, small and medium-sized businesses do not use this type of marketing strategy at all, even though with an appropriately defined system of rewards, the cooperation with social influencers does not necessarily have to be associated with high costs. The following paper explores the possibilities of partner affiliate programs and their use in the context of collaboration between social influencers and small businesses in e-commerce. The main objective is to identify barriers to this market segment - both in terms of the demand (companies, entrepreneurs) and the offering side (social influencers).

1. Introduction

E-commerce is constantly on the rise. According to recent statistics for 2016 (Tyinternety.cz, 2017), the turnover from online sales in the Czech Republic rose by 24%. The share of e-commerce in total retail trade rose to 9%. Research among Czech users also showed that 60% of them shop online several times a year, the average value per one order is 1,432 CZK (54.7 EUR) and the average annual spending per person is 7,730 CZK (295 EUR).

Along with this growing phenomenon (Falk, Hagsten, 2015), the importance of the web page content increases as well (Felix, Rauschnabel, Hinsch, 2017) since it is the text and relevant content that attract visitors to the site. The source of this generated traffic (from where the visitors come) represents a key factor that needs to be monitored. Traffic sources may be divided into the following categories: Direct (page address written by the user directly into the address bar of the browser), Organic Search (traffic resulting from search sites), Social (links posted on social networks) and Referral (traffic leading from other websites).

Traffic coming from Organic search and Social is relatively largely described in the theoretical literature. Most corporate websites focus on these two sources of traffic (McIntyre, 2015; Kautz et al, 1997). The partial aim of this work is, however, to point out potential sources of the commercial traffic belonging under the category Referral. This type of traffic source is usually very challenging to manage (Kautz et al, 1997), and therefore small Web sites do not work actively with this source. On the other hand, in the e-commerce domain, referral source are considered to have a significant

marketing potential especially in partnership with a chosen social influencers who, through links on their sites generate traffic to a partner website, which leads to higher orders and sales.

2. Theoretical framework

Before we get to the possibilities of increasing the share of traffic from the source Referral, let's have a look at the traffic sources Organic Search and Social. In connection with these traffic sources, researchers often speculate which of these sources is more efficient and which should be taken into greater consideration. Proponents of Search Engine Optimization (SEO) argue that Organic Search has greater value because it is classified among the long-term sources of traffic and ensures the steady flow of website visitors (Žilinčan, 2017). On the other hand, supporters of social media argue that most traffic and potential customers stem from social networks, where users search for the most interesting news and information from their environment and the world (Muller et al, 2016).

Direct source of visitors is not generally subjected to deeper analysis since this traffic comes from regular site visitors who have the link bookmarked in the browser, or write it manually into the address bar (Hall, 2016).

2.1. Advantages of the traffic source Referral

Let us now focus on the traffic source Referral. The building of the back links is, like SEO, part of the long-term strategy. Apart from this similarity, back links share one more thing in common with SEO – they belong among the off-page parameters. During the indexation of web pages, off-page parameters have the same importance as on-page parameters (Fiorini, Lipsky, 2012). A large number of relevant links is by the search algorithms considered as a sign of credibility of the site, which is one of the benefits of this traffic source (Heiler, 2015).

Backlinks do not build trust only when it comes to search algorithms, they build it also in the eyes of customers. A long time ago, it has been proven that customers are in the selection of goods on the Internet heavily influenced by the recommendations of a third party (Senecal, Nantel, 2006). This effect is further multiplied if the third party is represented by someone they know and who they consider credible. So, if social influencer is referring to a sales site, there is a better chance that the site visitor will make a purchase, which is the main advantage of this traffic source (Uzunoglu, Kip, 2014).

For the same reason, commercials use celebrities since they are perceived by the society as opinion leaders (Choi, Reid, 2015). The advent of social networks created space for another group of opinion leaders known as social influencers – individuals that have a large number of followers on social networks (Forbes, 2016). For social influencers, it is characteristic that they are usually popular in a narrower group of followers that is restricted demographically or by areas of interest (Francalanci, Hussain, 2016).

2.2. Social influencer selection criteria

In terms of establishing cooperation with social influencer the following factors, in particular, are taken into account: *the number of fans* who follow the influencer, *the level of fans´interest regarding the contributions* (comments; symbols for the expression of interest, such as thumbs up, heart, etc.), *the frequency of posts* on the main communication channel, eventually the connection of the primary communication channel with other social networks (Wang et al, 2015; Subbiano et al, 2013). Matching the topics of contributions shared by the influencer with the corporate image

the enterprises wants to communicate represents another key factor when choosing a social influencer is (Smith, 2010).

Cooperation with social influencers not only increases website traffic but also has a positive effect on building customer trust. Despite all the previously described advantages of cooperation with social influencers, they are not used on a larger scale and their services are implemented only by large firms and well-known brands. The main objective of this paper is to explore possible reasons of this unavailability of social influencer for small businesses and to identify the barriers to this market.

3. Hypotheses and methodology

Barriers to the social influencer market can be divided into two groups according to the origin of the obstacle:

- barriers on the demand side (ie. part of the companies)
- barriers on the supply side (ie. part of the social influencers).

Let's first look at the barriers on the demand side and make a deeper analysis of their main causes. Research focusing on bloggers as a group of social influencers showed that companies in the search for cooperation on this market choose the influencer primarily based on his prestige (Wang et al, 2015). Along with the influencer´s reputation, however, increases also *the price of his services* and thus, for small businesses, famous bloggers become unaffordable.

The questionable reputation of social influencers represents a second important factor leading to the formation of barriers on this market. Research has shown (Pavlíček, Pechar, 2012) that people are willing to share very personal information on social networks. In the case of social influences, this trend can leads to extremes because competition between social influencers is intense, creating thus more pressure on the originality and frequency of their contributions. Many influencers (especially those less professional) therefore resorted to sharing shocking posts revealing their privacy, secrets, etc. (Bickard et al, 2015). This method may be effective in the short term, but in terms of establishing a long-lasting cooperation, it constitutes a significant obstacle for the businesses.

Distrust of small entrepreneurs in the social influencers is, with regard to the above-described reasons, understandable. However, this paper will further investigate the barriers that lie on the supply side and that prevent to establish cooperation between social influencers and small enterprises.

Room for the reduction of price paid for the influencer services exists. Although, the tariffs of the greatest social influencers are very high, services of influencers with a smaller impact, but with a specifically targeted group of followers, are available on the market in a sufficient amount. Since the cooperation with social influencers in the form of sales commissions (ie. affiliate programs) operates on the basis of win-win (Olsen, Christensen, 2015), it is expected that the cooperation will increase the influencer´s social status which will as well help the demand side.

3.1. Formulation of the hypotheses

The aim of the pilot study among social influencers, which was carried out by the author of this paper and in which 81 respondents took part, was to survey the Czech and Slovak market with social influencers and analyze their attitudes to potential cooperation with business in order to reveal possible causes of the barriers to this market.

The results of the pilot study showed that a large part of Czech and Slovak social influencers (38; 46. 9%) does not know how the rewarding systems (specifically the affiliate programs) exactly work.

Based on this finding, we formulate the first hypothesis to be verified in the following research:

H1: Social influencers are not sufficiently informed about the possibilities of affiliate programs and do not know how and where to establish affiliate partnerships.

Preliminary research has also shown that 64 of respondents (79%) prefer social influencer barter system of rewards (goods in exchange for a written/filmed review) rather than partner commission system.

Based on these results we postulated the second hypothesis:

H2: Social influencers have no faith in the commission system of remuneration

in other words, they fear the lack of remuneration for the work executed and the taken risk of failure.

The third hypothesis is based on the long-term observation of the domain of social influencers:

H3: Social influencers have a low sense of self-worth.

The latter hypothesis is related to the creation of supply from the part of social influencers, who according to this assumption do not know their price, and therefore they do not offer they services on the market.

3.2. Methodology

Based on the highlighted hypotheses, a questionnaire was compiled containing thirteen questions – eleven mandatory and two optional. Eight questions were directed to confirm/refute the hypotheses, remaining questions were designed to collect identification and classification data about the respondents.

The main research questions were:

1. Mark all the channels you use on the Internet to spread your posts.
2. As a manager of these channels do you have a business partnership with a brand/company?
3. Are you actively looking for information on how to make money through social media?
4. Are you actively trying to reach potential business partners?
5. What do you think of rewarding with affiliate programs? (Multiple choice question)
6. Are you interested in establishing a partner with a commission?
7. Do you think you have enough quality to establish a business partnership?
8. Are you working with at least one of these analytics tools: Facebook reports, Youtube statistics, Google Analytics?

The questionnaire was created using Google Forms and its distribution at the early stage took place through Czech and Slovak social influencer communities of interest (personal, lifestyle, beauty, fashion, food, books, fitness, travel, hobbies, and culture ...).

Due to the nature of the data, descriptive statistics methods were used to evaluate the questionnaire. The research results were processed via Google Forms and also through Microsoft Excel.

4. Results

The request to complete the questionnaire was distributed in the first stage to approximately 500 social influencers, another 100 respondents were addressed in the second phase of the data collection. The total response rate was 12.5% (75 respondents).

The research results showed that social influencers are interested in cooperation with business partners – 60 of surveyed social influencers (80%) said they would like to establish such a partnership or that they already had such an arrangement.

Regarding the confirmation/refutation of the hypotheses, the results were as follows:

Research has shown that only less than half of social influencers, namely 25 (41.7%), actively seeks information about how to use social media to earn extra money. On the other hand, the results indicated that most of the respondents know what their options are. To the question of whether the respondents wanted to establish cooperation with a partner in the form of sales commissions, only 5 (8.3%) of respondents answered "*Yes, but I do not know how to find such partnerships*", see figure 1: *Focus on remuneration in the form of sales commissions*.

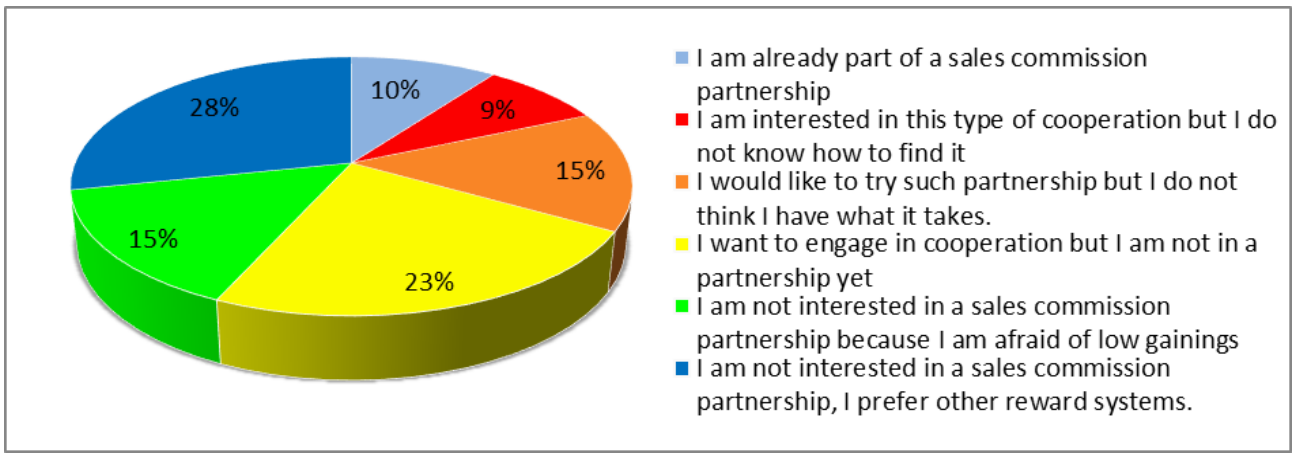

Figure 1: Focus on remuneration in the form of sales commissions

Based on this finding we rejected hypothesis H1: *Social influencers are not sufficiently informed about the possibilities of affiliate programs and do not know how and where to establish affiliate partnerships.*

Based on Figure 1, we may also deduce that more than half of respondents (35; 58%) are not interested in a commission reward system due to: the preference of other (safer) forms of cooperation (17; 28%), fear of low earnings (9; 15%) or they are interested in the partnership but they do not believe they would be able to earn this way (9; 15%).

Another interesting perspective is represented by the distribution of answers to the question in which respondents were asked to choose from one to three statements that best describe their opinion on affiliate programs. The option "I do not believe that a sufficient number of customers would come to the affiliated site and thus that the commission would be high enough" was chosen by more than half of respondents (namely 32; 53.3%). Even though 22 (36.7%) of respondents believe that the commission system is a good way to earn extra money, 19 (31.7%) of respondents still think that it is a precarious form of remuneration, see figure 2 *Opinions of social influencers on remuneration in the form of commissions.*

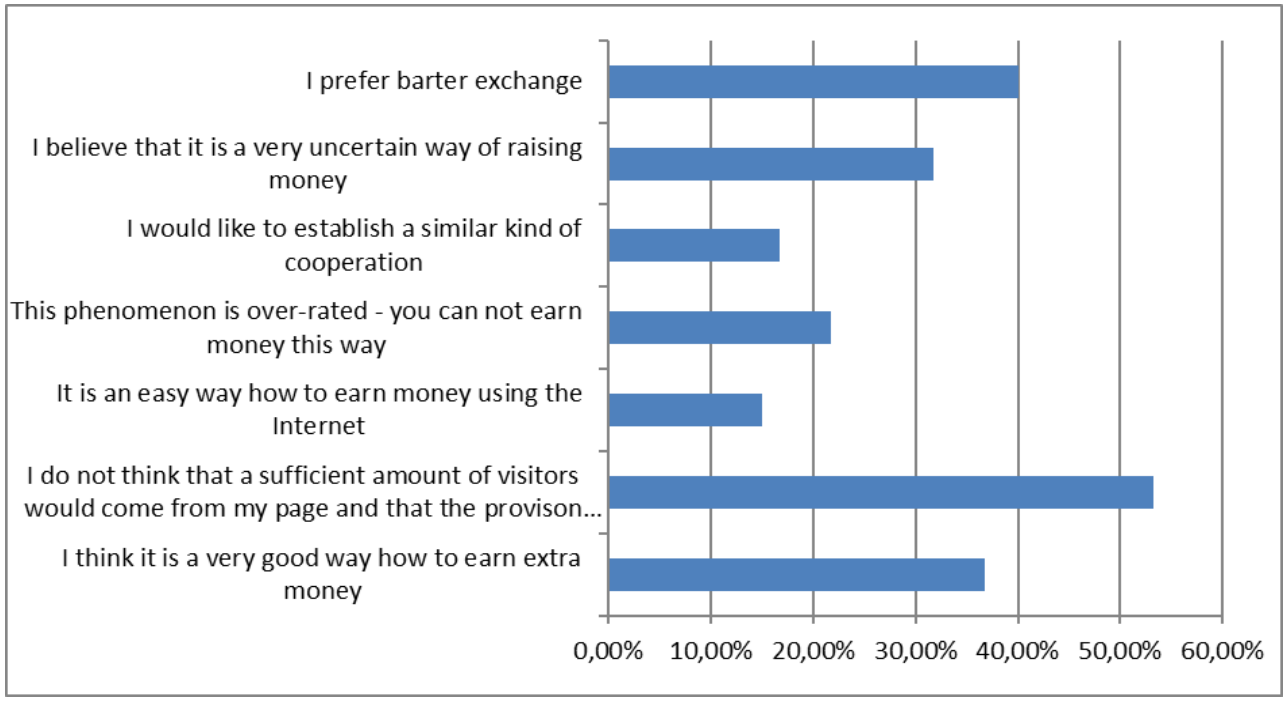

Figure 2: Opinions of social influencers on remuneration in the form of commissions

Let's now have a closer look at the collected data. If we apply basic data filtering we may see that out of the 34 social influencers, who responded that they would appreciate the opportunity to establish a commission based partnership and who therefore had a positive attitude to this remuneration system, 27 (79.4%) of them replied that they did not believe that they can earn enough money with affiliate programs or they prefer a more secure form of reward.

Based on these results we can conclude that, in the majority, the social influencers have a negative attitude toward affiliate programs, which thereby confirms the hypothesis *H2: Social influencers have no faith in the commission system of remuneration*.

In order to verify the last hypothesis *H3: Social influencers have a low sense of self-worth.*, respondents were asked a simple question, namely whether they think they have something to offer to potential business partners. Overall, 60 of the respondents (80%) answered positively. The research was also focused on the analysis of proactive behavior of social influencers. We may assume that if social influencers have a high sense of self-worth, they will actively look for such opportunities. In this case, the results showed that out of the 60 respondents who answered that they are interested in establishing a business relationship, exactly half of them are actively trying to reach potential business partners and offer them their services.

The above evidence suggests that the lack of self-esteem does not constitute a barrier to the market. Hypothesis H3 was therefore rejected.

5. Conclusions

The research results suggest that the main causes of existing barriers to the market with social influencers (supply side) is the distrust in the commission system. This distrust is based on natural fear of smaller social influencers that traffic from their page won´t be high enough to generate a profit equal to the effort they put in the cooperation. For this reason, social influencers rather choose different ways of remuneration, especially barter trade, which for them represents a certain

level of certainty. The disadvantage of research outputs is that the entire sample being examined is burdened with a large sampling error.

Taking these findings into account one question arises – how to remove this barrier. Research has shown that about two-fifths of influencers actively seek information on how to earn money using social networking. The results showed as well that most of the influencers are aware of the business opportunities they have. Even though it can be assumed that the fear of failure social influencers experience is caused by low awareness which in this case cannot be translated as the ignorance of potential opportunities, but rather as the lack of information on marketing tools that could help social influencers to promote themselves more effectively. Whether this assumption is appropriate or not, however, is a matter of further investigation.

6. Acknowledgements

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INITIATIVE TO SUPPORT USE OF SOCIAL MEDIA FUNCTIONS TO IMPROVE EDUCATION EFFECT

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Keywords

Education, groupware, management, personal management, social media, social networks

Abstract

Social media networks became a natural communication tool used by generation Y. Students in higher education system are mostly members of this generation and they prefer to use social media as the primal system which provide them the functions for managing their personal agendas. Therefore better knowledge and skills in using social media can bring more sophisticated utilization and significant support to effect of education system by providing deeper and practical experience. Findings presented in this paper show how students of selected university program gained benefits from using social media networks and related applications. These benefits are covering team management functions, analytical functions and also possibilities of funding of their coursework projects. Initiative arising from this paper is to bring social media education to be contained in compulsory study basis in study fields that can benefit from its potential like business or social oriented study programs. This can be understood as a setup of new course which will cover functions and possibilities of social networks for professional purposes. There has been studied the relationships of students to certain social media networks and a set of functions student need for their projects. Presented results have been compared with available scientific resources that confirmed the trend of rising importance of social media in communication and a greater potential of their use for education.

1. Introduction

Social media or social media networks became communication standard that broke the boundaries of time and place in communication and allowed communication with anyone with stable access to the internet. People always wanted to use possibilities of internet for their personal contact and self-presentation publishing their status and associations (Donath & Boyd, 2004). In the environment of higher education social media play the role of communication platform with ability to support the performance of students work. They also bring the certain demands for teachers' competencies (Kumar, 2015). Goal of this paper is to present the benefits of social media in higher education. This means the benefits for management and feedback of educational project including both teachers and students point of view. There will be presented students' needs to manage coursework projects and possibilities that social media can provide. There will be presented its significant impact that allows to make study more intense, effective and to go more in deep of taught topics. This paper is trying to setup an incentive to bring social media education to be contained in

compulsory study basis in selected study fields that can benefit from its potential. These study fields are usually connected with marketing or communication practice or social studies. Research question of this paper is: What knowledge about social media networks is needed for students to make better performance of their study. Findings presented in this paper were gained by author and his colleagues teaching practices and continual effort to make improvements on professional study program focused on communication and media production. Observations and action researches were made during three years on 15 courses covering different study content. Courses were attended by more than 150 students in general. Pedagogues supported students in use of social media to bring effect to their study.

2. Social networks and generation Y

Social media became standard communication platform in actual society. Especially for generation Y it became natural communication tool with great impact on their life, education and future occupation (Wankel, 2009). Social media broke the limits of place and time and became a source of new and reinforced social contact. Social media added to communication new possibilities of personal contacts, advertising, applications, statistics, modeling and data mining for both personal and work situations. There have been also developed functions that are helping users with management of their personal interests and communication. Social media allows selectivity, which can be used in spreading messages to masses or to certain users. This is very powerful tool for advertising. Beside these functions social networks provide possibilities of collaboration and measuring of communication impact also in connection with financial dimension. Communication, storage of data and knowledge, analysis and much more functions can help to do simple project management. Social media has been developed as the augmented communication space that integrates all communications functions. These functions are to inform, to educate, to persuade, to entertain (Hart, 2005) and also to attract (Vondra, 2016). On the other hand combination of communication functions is leading to often disruptions in attention caused by attraction of entertaining content in contrary to intentionally observed. This caused that using some of the social networks bring also inefficiencies which let to their banning during work. Generation Y is spontaneously using social media for communication and also as a basic tool for managing their project. They usually start using social media for their personal agenda and during their university study it is naturally the tool that they take first. It is no surprise that education is included in social media use. Using social network sites in academic environment has proved the better performance of students who used them (Arquero, Romero-Frías, 2013). There has been also discussed the ethics point of view on social media which wants professionalism of its use (Fenwick, 2016). Actual education is facing a challenge of accessibility of infinite amount of managing standards and tools. These sources are accessible online by any internet search engine by students from generation Y. They know about these possibilities but they are sometimes confused which one is correct to use. On the other hand education system in Czech Republic is focused a lot on content education (knowledge) but there is often missing skills education especially basic skills like rhetoric, professional text writing, and management of team, teamwork and analytical or critical thinking which leads more towards research than to intuition. Therefore this paper suggests particular solution teamwork management using social networks.

3. Material and methods

Research question of this paper is: What knowledge about social media networks is needed for students to make better performance in their study. Social media skills are important. If students use them as a basic platform, it would naturally help students with quality of their study.

For understanding of this demand it is appropriate to study:

- relationship of students to individual social networks
- management demands of students for their projects
- set of services and management tools used by students in combination of social media

Students' relationship to individual social networks is essential to identify, which social network is spontaneously preferred to support their personal communication and management needs as well as their academic or work activities. If there is made focus on academic and work activities, we would identify the set of functions that certain social network provide to fulfill students' needs. Following the social networks options there would be present related services and applications that complete students set of management tools. By making overview of these findings it is possible to identify key skills and knowledge that would be taught to students at the beginning of the study due to support their academic work. As mentioned in the introduction, findings presented in this paper were gained by author and his colleagues teaching practice during 3 years on 15 courses and on more than 150 students. By continual development mechanism of study program there has been collected information about use of social media networks and its functions. The mechanism is based on data from study information system, teachers and teacher to students' discussions and action research of implementation new study processes. The research was done by observations, interviews and consultation of processes of students' projects. Research was made in three years on professional study program focused on communication and media production. Main part of the research was done on students project reports that are done in each grade (there have been studied 15 to 20 reports each semester). The reports include description of management of their team project. Students make the reports in teams of 3 to 6 students as a part of their project defense. Outcomes from the research were compared with experience from similar study program on different university. Social networks are primarily communication tools. It is suitable to describe communication functions for better understanding of functions integrated in selected social networks. There are presented functions of communication established by three approaches. These approaches are rhetorical (inform, educate, persuade, entertain) (Hart, 2005), personal needs (physical, identification, social, practical) (Adler, Rodman, 1997) and interpersonal importance (gaining information, revealing, context of understanding, sorting, identification, social needs) (Allyn, Bacon, 1999). Social media networks cover all these functions so they are a great support for fulfilling communication needs. They share the same function as natural communication and add the moment of breaking the barrier of time and place and allow storing communications that passed to remind previous experience.

4. Relationship of students to individual social networks

In this part of the paper there will be described findings about observed students' relationships to social networks. Most common social networks that student uses are Facebook, YouTube, Instagram and Pinterest. Second group of media are media that student use occasionally are Twitter, LinkedIn and Google+. Most of the students have referred Facebook as the default social media that they use in combination with other options for storage of content or in combination with groupware applications. Strong relation of students is held on Facebook which is used by nearly 100% of the students. Facebook serves as the main platform for communication and administration of their projects. Facebook also serves as the data storage by uploading files into group communications for nearly 70% of students. Students referred that they use Facebook as the main communication platform in their private life at the same level as cellular phone. It is also preferred as an alternative of email. If there is a possibility students prefer contact with teacher by Facebook

rather than email. This situation is caused by existence of Facebook Messenger and Facebook Lite that allows integrating Facebook communications into cellular phones on the nearly same level like SMS. By using Facebook students have to care about their personal presentation and are also more used to present their work. When students need any help like advice or fulfilling surveys they start at Facebook which provides reach with their friends and persons that they have in connection. Options of Facebook also allow the organic reach to the social network of connected persons of their friends which leads to gain data from persons that they do not know at all. In case of researched students Facebook serves as the default and complex social network that is mirroring real relationships and communication connections. It provides all of the communication functions to its users. YouTube, Instagram and Pinterest are social networks mainly used by students to look for references or to present their ideas or final audiovisual work. YouTube is mainly used to present students own video outputs (shot videos or case studies) and also for finding references. Another significant use is for education by video courses (including manuals and how to videos). Instagram is used to present mood and photos of students' projects progress using specific project hashtag. Pinterest is used to collect references to visual possibilities of projects and for product inspirations. These social networks are not complex as Facebook, but provide good service for specific needs. Second group of social media networks include Twitter which has limited functionality in comparison with Facebook. Twitter is powerful in focus on short messages but do not provide functions like Facebook that would make it tool for team management. Google+ is seen by students as an unsuccessful Facebook like platform and is used only for reach to Google functions like maps or search engine positions. LinkedIn is professional social network which helps its users to be visible on the labor market. Thus it looks very suitable for students who will soon search their occupations it is used only by third of students in second and third grade. Other social networks that students use are more specific by the area of interest like Soundcloud (music publication and sharing), Snapchat (sending quick short time messages), Tinder (dating). They do not play important role in the intentions of this paper.

In conclusion students have strongest relationship with Facebook which provides them all the basic functionality they need. They use it for communication, storing communication history, sharing of knowledge, sharing and storage of data, making social analysis, distributing surveys and questionnaires and making own action research. Second strongest social network is YouTube which serves students as knowledge database providing them inspirations and education. Other social networks do not play important role except Pinterest and Instagram as the reference boards for visual presentations. Use of social networks for project management is most important in lower grades. In higher grades they are combined with more sophisticated tools and applications in accordance with experience of user. Sometimes they are replaced by team management application or other tool. Students in third grade referred that work management functions have overwhelmed the entertain functions of Facebook.

5. Management demands and services sets

More than 90% of students in third grade referred that work management functions have overwhelmed the entertain functions of Facebook. There was described the relationship of students to most common social media networks. At this time it is appropriate to describe students' needs for managing their personal and school projects based on data from research. Studied students projects are typically communication analysis, new product analysis, marketing analysis, communication, marketing and media campaign strategies and realizations or making of audiovisual or static visual outputs. Observed needs are presented in the following two lists. First list is describing groupware functions that are mostly internal:

- communication with colleagues, both group and individual conversations
- store of previous communications for back up
- administration of team, giving roles and responsibilities
- store of references, links, data, collected and made outputs
- time planning
- to-do lists

The list describes demanded functions of students' information system for managing projects. These functions can be covered by Facebook and in most of the observed situations it is. In many cases there are used some substitutes mostly by students with experience from enterprises or students in fourth or fifth grade. For communication substitutes usually are Slack or Skype. These platforms also store communication history. For administration of team roles and competencies students usually use cloud document with various accessibility or just oral agreement. For storage of data and links Facebook environment is enough until there is need for having large amount of data online. At this point students use Google drive or Dropbox. In accordance students often send links to these cloud services in coursework submissions. Time planning and making to-do lists are excluded from standard social media options. Student use Google spreadsheets, Free version of Trello, Tom's Planner or other similar services..

Second list of observed needs is focused on external activities:

- presentation of outputs, storage of presentations
- analysis and communication with target audience, opinion leaders or influencers of the project
- funding and hiring

Social media networks provide varied offer of presentation opportunities mentioned in previous part of the text (video - YouTube, pictures - Behancé, etc.). By the time of cloud solutions and transforming the classic presentation forms to more audiovisual there is variety of services or storages for students' works depending on media and size of the files. For example video case studies are a new phenomenon in forms of work submissions. Second bullet in the list is important because it represents the ability to work with social media networks potential. This potential is meant by ability to reach a big amount of people in case of analysis or idea or message presentation. These people can be targeted with addressed communication or studied by observation and analysis of measured metrics. This potential is very important for making research surveys, questionnaires or releasing different content and measuring the behavior of audience. Students do not have eligible database of email addresses. For their research papers, students need to reach audience over the sight of their friends and family. When students do some research most common way is to prepare form and publish it via Facebook. Its natural reach in combination with viral spread of message by user's engagement supports the spreading and students are able to get thousands of responses to one form. Observed students normally have from 100 to 3500 responses. Social networks are based on real people so every project presented to the audience has a real social impact which greatly improves the experience of students with project. The most attractive and both responsible part are the possibilities of getting resources. Hiring of collaborators is not so surprising but what really matters is potential in funding of students projects. Funding of coursework students projects is rare and based on weak sponsorship or grant funding. At observed study program it is possible to get extra money from university budget. This money can be in amount about dozens of thousands for whole study program a year. This normally covers innovation expenses and for students projects there is remaining almost nothing. Also external

corporate sponsors are not very open to straightly fund students' projects. In this case social networks are great opportunity to tell people about project nature and content and get sponsors by its public defense and persuasive campaign. In last semester we experienced that two of five coursework projects extended level of 50.000,- CZK of sponsorship of their projects. They got the sponsors from community based financial sources (crowdfunding portals). These prove is highest evidence that normal coursework project should rise to real size with real responsibilities, real budget and real impact. This is very important for practically oriented study programs and education in general. One half of final study projects in third grade include crowdfunding activities.

In conclusion of this part, social media potential has proved several situations that are making experience of students more intense and deep. It demands practical skills from teacher to be able respond well for student needs. But if teacher is able to do it, it should enhance education level to much higher rank.

6. Discussion

By analysis of related articles there has been confirmed the tendency to use social media for educational purposes for almost last eight years. There has been discussed the nature of students from generation Y providing new types of learning and provision from students engagement by creating own and published content (Selwyn, 2012). Relationship of students to social media is same for years confirming Facebook and YouTube as the media with longtime highest impact. They have been also used by students for managing projects and professional activities. There have been discussed the potential barriers of integrity and privacy of social media use but which do not endanger their teaching potential (Moran et al., 2011). In accordance to these articles this paper follows the trend and provides concrete solution of integration of social media networks into the basis of students' curriculum. Outputs of the research presented in this paper described almost same findings about functions and use of social media by students like Wei Zakharov (2016). Her identification of provided functions by social media is shown in following list:

- Communication - used for both managerial and instructional purposes
- Presentation - allow students and teachers to create and show presentations offline
- Collection - allow both teachers and students to house a collection of links to important websites, primary sources, and music and art collections in one place
- Organization - provide Scaffolding, Guided Practice, Graphic Organizers, Timelines
- Collaboration - provide student group work
- Interaction - allow students to grapple with content through tools that require critical-thinking or application of knowledge.
- Research – allow students to deeply explore content through tools by collecting resources, gathering evidence, assembling images, music, or videos.

For fulfilling of mentioned functions there is a need of social media networks and applications combination. These results correspond with findings from this paper. The intention of teaching social media skills as compulsory study basis has been confirmed. Students can use set of social media and related applications as the basic management system. They do not need money to get paid services but can reach their effort. Important note is that by Facebook functionality students are not naturally motivated to connect time planning with reporting hours worked. This has led to worse experience with calculations of prices. By this it is recommended to students to use cost monitoring service even in man-hours like Cost Locker application for example. This should be

also included in the suggested course and proposed by teacher. Beside these findings there has been also observed that social networks ability to make virtual communities lead to establishment of collaboration between graduates, senior students and junior students. This kind of communities based on Facebook groups, pages of Wiki platform are good source of knowledge transfer. On the case studied in this paper there is felt significant difference every year like the knowledge base is bigger and more accessible. Many pedagogues see these communities and students alliances as a threat. Author of this paper would like to propose this situation as the opportunity which helps in pedagogical process. The better knowledge base students have made, it brings to pedagogues possibility to pass some of topics quicker because students have accessible material for their self-study which is also regular part of academic environment. Sometimes well written notes are more valuable to student than sophisticated book that is hardly understood by its author. If the result is the same means getting the correct knowledge, they would be proper study materials and again an opportunity for pedagogues. In general this principle is fulfilling the nature of web 2.0 and social media which is based on content of communication (including education) made by its users.

7. Conclusion

Social media networks became communication standard for generation Y. In particular Facebook has been evaluated as the default communication and management platform for students on communication oriented study field in the environment of Czech higher study. Students in lower grades use only Facebook. In higher grades they combine it with other tools and platforms or replace it with more sophisticated team management systems. Conclusion of this paper is that study fields using teamwork and also focused on education in marketing in the meaning of teaching about real market would establish a seminar at the beginning of the study covering use of social media networks and several related applications for management and better impact of elaborated projects. Social media networks like Facebook and YouTube are natural communication platforms that new coming students know. So they would be also the great starting point for education about more sophisticated groupware tools. Knowledge and skills of using social media are slowly becoming the same level as the soft skills. Employers also expect high engagement of generation Y to the social networks. Benefit of proposed seminar would be felt in students' ability to coordinate and manage the teams and also in ability to use the sources that are available from contact provided by social media networks. This is including analytical insights and gain of funding that allow students to rent tools or pay services to work on project more in depth and with bigger scope which both mean being closer to the practice.

Recommended content of this seminar would be:

- General information about groupware principles, definition of functions
- Social networks and their possibilities to be used as groupware
- Presentation of most frequently used free and available services or apps
- Social networks and their analytical potential (surveys, questionnaires, action research, behavioral analysis), definition and use of its metrics
- Social networks and their funding and hiring potential
- Presentation of most frequently used paid services or apps

Pedagogues would support students in use of social media networks to bring more effect to their projects. Further research following this paper would be a vast statistical survey about groupware functions needed on different study fields. This would lead to more universal model of practical social media network seminar which would be effectively usable also on study fields without

previous deep research. Another question is if it is suitable to teach this seminar on universities. Isn't it late? Maybe there is an opportunity to teach the same seminar on high or elementary schools where students now also work on team projects. Benefit would be the same.

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FROM THE DICTATE OF THE REGIME TO THE DICTATE OF RATINGS AND REACH – STRATEGIES OF CULTURE NEWS REPORTING ON SOCIAL MEDIA

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Social Media, Audiovisual media, Reach, Ratings, Public broadcasting, Culture news reporting

Abstract

The paper analyses culture news reporting in the traditional audiovisual media and in the framework of their social media platforms. Drawing on concrete examples, it tests the hypothesis that continuity, which also carries over into newly-created social media, can be observed in references to culture at the level of Czech nationwide audiovisual media. It backs this up with analysis of the content of video material from news programming between 1958 and the present, which it places alongside data from an analysis of the reach of content on social media.

1. Introduction

The way culture was referred to at the level of Czech nationwide audiovisual media was transformed after 1989. However, continuity may be observed in a number of principles. Each period has its own rhetoric, but its function changes little in everyday practice. Attributes assigned to the official culture subjects reported on functioned as a form of approval in relation to the dictate of the regime. Today editors themselves select these attributes in order to sell them to viewers or users. All that has changed is the words that made the rhetoric current. We have attempted to verify this hypothesis by employing specific examples.

In the course of the research its focus grew to also encompass social media, thanks to the establishment of a new social media department at Czech Television that began displaying a similar pattern at the content level. It can be asserted that a field that initially presented itself to users as a free forum without strategy has gradually become one where editorial principals and strategy are felt. This has led to a paradox, a clash between a free civic forum and media practice. It has become an instrument of the traditional media which must use this platform if they are to keep step with

their viewers and listeners. New strategies are being shaped that, to a certain degree, copy those of the past.

The continuity of approach may be influenced by the fact that the essence of how news is created, and in particular the people who actually create it in the audiovisual and social media, are in large part the same. However, in our research we take this fact as just one among many. With the interconnection of social media and traditional media, however, a space opens up for further analysis on many levels, which, after this initial mapping of the terrain, we would like to build on in further research. The paper's data and conclusions can be regarded as pre-research conducted for an ethnographic exploration.

2. Methods and Materials

The starting point of our research is a content analysis of archival reports. In relation to social media we then consider analytical data intended for the provider itself. An essential fact contributing to the research is that the author works at Czech Television and can utilise experience of both a traditional news department and a social media department. This enables analysis not only on the level of acquired data and acquired footage, but also on the level of everyday practical experience, supported by interviews with others involved, including those who were news editors in the past.

Within the framework of the analysis, we have focused on culture news reporting at Czech Television for a number of reasons. It is the only Czech nationwide station with a separate culture news department and it has just recently established an official social media department. In relation to culture news reporting, the very fact it is a public service broadcaster, as defined by the *Law on Czech Television*, is key. Culture news therefore represents a unique unit in the reporting of an audiovisual media outlet that must give it appropriate space. There is also an advantage is that it is not generally subject to political pressures, or at least they are not its chief focus. Last but not least, continuity of subject matter can be observed. In relation to the archival material we have focused on television news. Televizní noviny (Television News) was broadcast on Czechoslovak Television from 1 September 1958 to 1990. It was followed by the public service news programme Deník ČST (Czechoslovak TV Diary), which was replaced after 1993 by Události (News). Content presented on social media is based on Události's content.

The social media department was set up as a separate entity in the structure of television news reporting in February 2017. Previously, Czech Television's new media division, under which the station's website falls, had delivered its social media content. The department first functioned in trial mode and established contact with news reporters and editors. Its practical involvement with news production can be dated to roughly April 2017, so we have selected the month of April for our research. The department's output appears on the social media platforms of ČT24. We have focused on Facebook (to 28.4, 0:00: 230 453 likes, 218 000 followers), which offers greater room for publishing the station's content than Twitter (to 28. 4., 0:00: 301 129 followers), so the schemata in question may be more clearly followed here. Facebook is the best means of reaching users from among the general public and is not primarily a news source for professionals. The department publishes the same material on Twitter, respectively a selection of it that is relevant in news terms; this is a given of Twitter, which does not allow for long videos and such. By contrast, according to an interview with the head of the social media department Oldřich Borůvka, they themselves use Twitter as a fast source, which is common among all media today, which explains the large number of followers (many don't follow the account out of interest but as a source required for their work). Culture reports are therefore reworked for these networks. The Facebook page contains broader versions of the reports and gets a greater response from users. Data acquired from a direct analysis

of social networks therefore represent undeniable values in which we will look for apparent patterns on which to base further interpretation.

3. Analysis of media content

The initial focus here is on culture rhetoric between 1958 and 1989. We have examined this period as one whole that was subject to greater and lesser degrees of censorship with various rules. Specifically in the period from 1958 to 1968 and then from 1979 to 1989 artists who are referred to in all archival reports are assigned the following attributes:*National artist, Artist of merit, Artist who has served the homeland, Favourite of our working people, Beloved by the people/nation* Research into archival culture reports makes clear that artists referred to in a positive sense are named in connection with the aforementioned attributes. It is just these official state designations, represented by the terms national and of merit, that predominate. A report from 1965 speaks about Jan Werich in the following manner: *The actor Miloš Nedbal and others who remember the Liberated Theatre celebrated in the foyer of today's ABC Theatre an incredible event: the 60th birthday of* ***national artist*** *Jan Werich. Intellectual clown Werich, as he was dubbed by First Republic critics with Jiří Voskovec, has grown from role to role. He himself soon became the theatrical voice of the progressive element of our nation. But* ***national artist*** *Jan Werich doesn't like celebrations. (...)* All of the attributes of period rhetoric can be observed in this text. In 1989 Czechoslovak Television reported on the death of poet Jaroslav Seifert: *At a funeral at the House of Artists in Prague our public bade farewell to a great Czech poet,* ***national artist*** *Jaroslav Seifert, a* ***two-time laureate of the Klement Gottwald Prize*** *and the holder of a Nobel Prize for literature*. The fact that he was a prize recipient was deemed worthy of mention, with the local prize bestowed by the Communist Regime placed above the Nobel Prize. The rhetoric of reports had not changed by 1989, shortly before the revolution. In connection to an autumn music competition, an expert is invited to the studio, again with the assurance that he is an artist of merit, i.e., a person approved by the regime: *The interpretative competition, like the one in Písek, will put to the test not only the quality of the competitors but also teaching work. I would like to ask* ***artist of merit*** *Pavel Štěpán for his comments on musical education. (...)*

After 1989 categorisations of the state authorities were replaced by categorisations of the creators of public opinion, i.e., the media. Today the above-mentioned attributes have been replaced by the following adjectives, which though they have not been officially established have entered media usage: *Legendary artist, Cult artist, Famous/World-famous artist, Award-winning artist* In essence an artist's status is based not on his service to the state, as in the past, but on his general renown and visibility. That general renown needs to be emphasised to grab the viewer's attention. It is thus a kind of synonym for "celebrity". It is a paradox that the word celebrity is, by contrast, taboo on public service television, which by ostentatiously distancing itself from interest in so-called celebrities or VIPs displays its good taste. We can observe these adjectives in the following examples, such as this one from 2010 about the Finále Plzeň festival: *Within the framework of international cooperation a* ***directing great*** *is also present, the* ***world-renowned*** *director Krzysztof Zanussi (...)* and from 2012: *At this cinema in roughly an hour the* ***legendary*** *actor Josef Somr will be honoured with Association of Film Clubs Award on the occasion of the presentation of a digitised version of the* ***Oscar-winning*** *film Closely Observed Trains*. Another example is a report from 2016: *Previously unknown recordings and letters by the* ***legendary*** *actor Jiří Voskovec, which he sent across the ocean to his erstwhile acting colleague Jan Werich in the 1960s, have been released on CD.*

In the reports on Jan Werich and Jiří Voskovec in particular we find a good example of the above-mentioned continuity. In the 1960s version the reporter passes over the fact that Voskovec is in exile and emphasises his appeal to the working people. Post-1989 it was the other way around.

What's more he is a set-in-stone artist of long standing who may be dubbed legendary. Still underlined and emphasised is the fact that the artist has received an award in the past; however, unlike under the previous regime, there is more emphasis on international prizes. In the effort to grab attention, the fact an artist's work is genuinely of high quality remains secondary.

4. Social media content

The continuity of the attributes assigned to artists and the effort to attract users using verified values also applies to social media content. We can observe the same trend in published texts. Let's take the example of a text of a report from 9.4: *Jiří Ornest has died at the age of 70. (...) In 1996 he received the **Alfréd Radok Prize**.* Attributes are also intended to attract in a piece about the sculptor Deacon dated 13.4: *Do you like the statues of **award-winning** Brit Richard Deacon?* Notably, it is not made clear who *bestowed the award* on him and how. We can also observe classic adjective selection in a piece from 22.4: *What's your favourite **cult** Prince song? The **ingenious** musician died exactly one year ago*.

However, further aspects and strategies aimed at grabbing attention come into play on social media. The below outline of content reach for the month of April 2017 confirms what we would expect of social media, which is that visual appeal is more important than verbal appeal. In comparison with regular media, social media content draws on what can be seen (striking photographs, graphics) and employs headlines promising visuals (*more photos in the article* or *check out the link*). A glance at the selection of subjects in April makes it clear that visually interesting ones – more so than is common in audiovisual media – were mainly selected. If a theme was characterised by visual attractiveness it was selected even if it didn't correspond to news values (*Cloud did exist in The Scream*). Attached to pieces are subtitles or infographics that allow for their consumption without sound, which is more accessible for users viewing content on telephones or tablets. In principle this is a step backward. The media is attempting to convey a spectacle to the user via social media because this spurs the biggest reaction. There is no longer an appeal to knowledge (albeit distorted by bureaucratic language – *award-winning*), and analysis suggests reach is greatest when an artist cries on receiving an award.

In this regard it can be stated that the greatest reach may be observed in pieces that fall outside the category of news, meaning photographs and above all videos from behind the scenes or capturing bloopers *(video from Czech Television's costumes dept., video from shoots)*. This is aimed at showing the reporter and the artist as an ordinary person in an ordinary situation. It demonstrates they have the same reactions to situations as the user; they are not as perfect as users know them on screen). At its core, Facebook allows for the creation of a world in which we present ourselves as better or as we would like to be. Video of mistakes by major personalities give the viewer the sense they are on the same level. If the report about the shooting of Toman were accompanied by a video of Jiří Macháček tripping we could expect its reach to multiply.

Table1: Reach of culture subjects (source analysis FCB ČT2, data as of 28.4., 0:00)

	Published	Post	Type	Reach	Reactions
1	1/4/2017, 21:10	Zemřel Jevgenij Jevtušenko	fotografie	28 249	103
2	1/4/2017, 22:25	Bob Dylan převzal Nobelovku	fotografie	44 655	186
3	3/4/2017, 22:55	Nová deska kapely Zrní	video	22 209	81
4	5/4/2017, 22:05	Historické fotografie ve výuce	fotogalerie	68 884	473
5	6/4/2017, 12:46	Zemřela Libuše Havelková	fotografie	229 942	1487
6	6/4/2017, 15:54	Vzpomínka na Havelkovou	archivní video s titulky	168 373	2551
7	6/4/2017, 22:20	Prohlídka barokního hospitalu	panoramatická fotografie	19 564	435
8	7/4/2017, 12:17	Spor o Epopej pokračuje	infografika	20 257	93
9	9/4/2017, 15:50	Zemřel Jiří Ornest	fotografie	73 561	519
10	10/4/2017, 9:45	Kapely na plakátech komunistů	fotogalerie	112 338	792
11	10/4/2017, 17:16	Zemřel režisér Dolenský	fotografie	147 489	1205
12	10/4/2017, 23:15	Natáčení filmu s Jiřím Macháčkem	video	43 504	159
13	11/4/2017, 9:45	Výstava o Židech za normalizace	video a fotogalerie	26 302	76
14	11/4/2017, 14:11	Video z kostymérny ČT	vlastní video	66 576	113
15	11/4/2017, 22:45	Český film v New Yorku	video	27 002	64
16	12/4/2017, 8:24	Spor belgické umělkyně	fotografie	19 302	9
17	13/4/2017, 14:34	Autor sochy býka chce odstranit sochu dívky na Wall Street	fotografie	55 117	163
18	13/4/2017, 22:24	Výstava soch Richarda Deacona	fotografie	25 453	58
19	16/4/2017, 11:35	Padělání uměleckých předmětů	infografika	37 372	16
20	17/4/2017, 15:21	Video z natáčení	video	117 843	1109
21	19/4/2017, 15:15	30 let Simpsonových	fotografie	60 311	626
22	19/4/2017, 17:46	Koncert v soukromém bytě	video	68 535	583
23	19/4/2017, 22:45	Loutkový film podle Hrabala	video	24 345	181
24	20/4/2017, 16:15	Zemřela Jana Dudková	fotografie	22 971	37
25	21/4/2017, 11:25	Přehlídka socialistické módy	archivní fotografie	27 093	43
26	22/4/2017, 22:52	Rok od smrti Prince	archivní video	29 537	72
27	23/4/2017, 9:15	Ročenka architektury	fotografie	49 460	94
28	23/4/2017, 14:07	Odminování památek v Izraeli	video s titulky	63 961	114
29	24/4/2017, 17:05	Varhany do sv. Víta	foto s odkazem	33 037	269
30	25/4/2017, 6:21	Kino na pardubickém nádraží	video s titulky	108 053	674
31	25/4/2017, 10:20	Winternitzova vila se otevírá	fotografie	75 597	723
32	25/4/2017, 11:45	Program MFF Karlovy Vary	foto s textem	17 278	36
33	25/4/2017, 23:15	Oblak na Výkřiku existuje	foto s textem	67 617	266
34	25/4/2017, 24:00	100 let Elly Fitzgeraldové	archivní video	42 572	188
35	26/4/2017, 10:21	New Orleans ruší pomníky s rasistickou minulostí	archivní video	43 879	173
36	26/4/2017, 14:30	Výstava Gerharda Richtera v NG	foto s odkazem na reportáž v archivu	25 697	55
37	26/4/2017, 17:40	Pokračování sporu o Kaplického knihovnu	foto s textem	64 467	301
38	26/4/2017, 23:05	Trilogie Jana Hřebejka	ukázky	82 095	372
39	27/4/2017, 17:32	Heath Ledger neměl deprese	přepis s videem	58 419	234
40	27/4/2017, 21:28	Cimrman v Severní Americe	video s titulky	194 926	1 545
41	27/4/2017, 23:35	Výstava Miroslava Šaška	fotografie	18 229	58
42	28/4/2017, 13:32	Novomlýnská vodárenská věž se otevírá turistům	video s titulky	13 906	29

The functional value is therefore primarily visual and emotional appeal. Analysis shows that the profile of news mirrors trends in personal profiles. The greatest interest is sparked by human and social stories, controversies that affect society, practical and how-to information, or just general cuteness. When we look at all the posts on ČT24's Facebook profile for April the biggest reach was enjoyed by a video about a man with cancer whose care insurers have refused to pay for (24.4 – reach 424 577), an info video about artificial intelligence that became racist overnight (21.4. – reach 156 166) and an interview with Radek Banga in which he discusses threats against his family

(10.4. – reach 336 138). Also a huge hit was World Penguin Day, when a post offered a video of young penguins (25.4. – reach 217 300). For comparison, the finance minister's reaction to the prime minister's call for his resignation had reach only twice as great

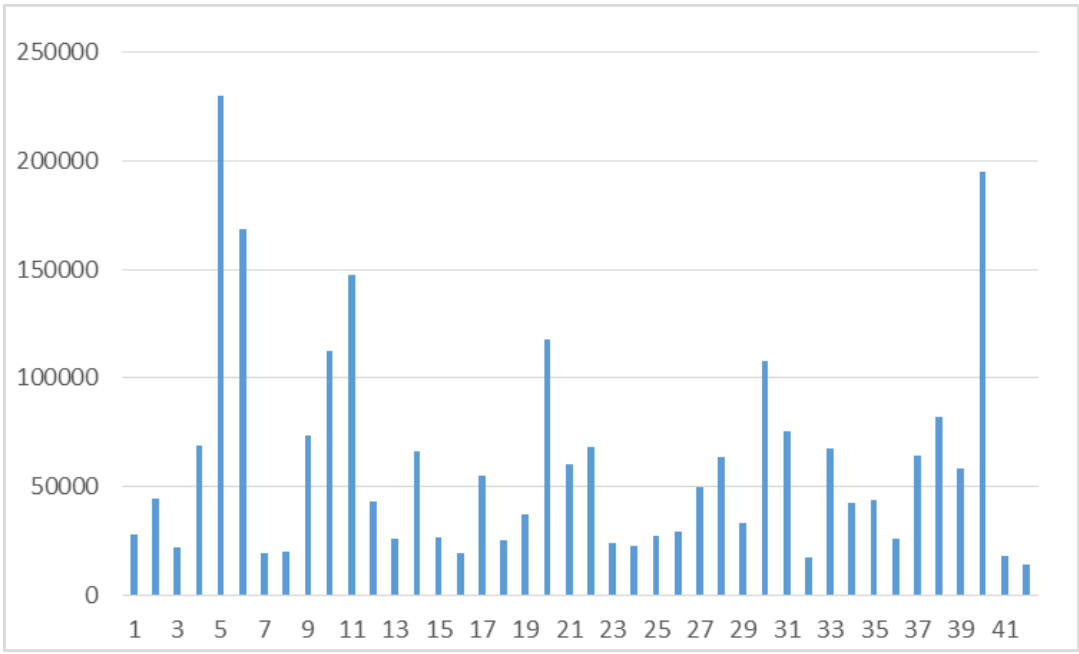

Figure 1: Overview of content per user, graph based on table

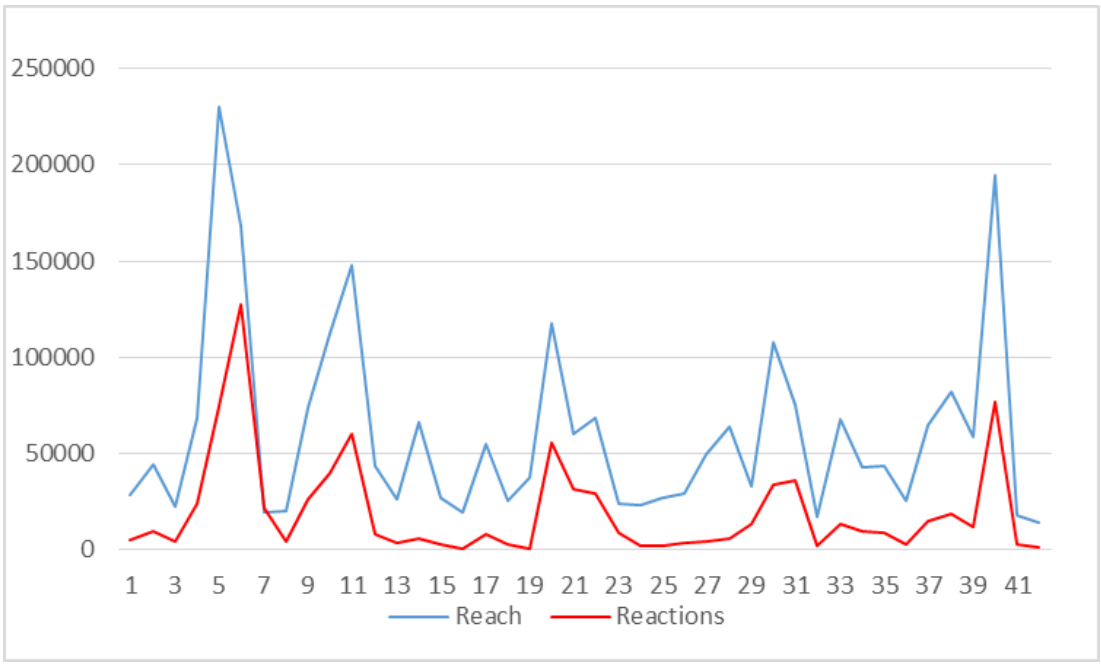

Figure 2: Reach in relation to number of reactions

Editors also adapt to these trends in the selection of subjects in the field of culture news. They choose reports from the regular news agencies relating to famous people (*Bob Dylan, Jan Hřebejk, Bohumil Hrabal, the band Zrní* – always with a corresponding attribute) or to themes centred on a dispute or controversy (*abolition of monuments with racist pasts, dispute involving Belgian artist, Slav Epic spat,* etc.) and not forgetting emotional pieces (this chiefly concerns death, or art reflecting socially or culturally excluded minorities). Selection frequently focuses on anniversaries, which are a pretext for posts with broadly popular arts themes or nostalgic looks back at the past

(*100 years of Ella Fitzgerald, 30 years of The Simpsons, Socialist fashion*). Here we arrive back at human stories, with archival videos and photographs of famous personages, especially in the case of death, enjoying major reach. The biggest reach of an arts story was a post on the death of Libuše Havelková (6.4. – reach 229 942), which the department followed up on with an archival video three hours later (6.4. – reach 168 373). Two other Czech obituaries also had high reach, reports on the death of Jiří Ornest (9.4. – reach 73 561) and the director Dolenský (10.4. – reach 147 489). Both reports featured a striking photograph. The difference in reach may be explained by the fact Dolenský met a tragic death.

The graph (Fig. 2) shows that reach and reaction are only roughly linked. (By reaction, we mean negative and positive, likes, comments and shares). The trends reflect one another only with emotional subjects. With other subjects, reaction is most often sparked by the text (question in headline, fresh controversy and such like), with traditional news values placing second.

Reach of above 50,000, which is the average value on ČT24's profile, can be regarded as a success. In the case of certain arts stories it is lower. But even here successful posts have reach around 100 000. They then repeatedly appear. For instance the second most successful piece in April on the success of a Cimrman play in the US was posted at 21:30 on 27.4 and saw reach of 131 206 within the few hours until midnight that day. However, it had the biggest reach on the Friday evening and during Saturday morning, when its reach grew to 194 926. By contrast, in the case of less successful material about a Gerhard Richter exhibition reach had grown by midnight of 28.4 by only six people from 25 691 and no reactions were recorded. The number of reactions is not taken into account in feedback.

5. The ethics of information in the framework of news organisations' profiles

It may appear obvious that the ethics of information can serve as preventive protection against the mishandling of information. However, they are not broadly applied. In the case of Czech Television's social media, such ethics are set down in the *Czech Television Code of Ethics*, where the focus is on a safe environment with verified information; this does not apply to ordinary contributions from users on the net. The central focus of the ethics of information is on the method of handling information. It is oriented toward applying ethical norms in information practice and attempts to ensure that information is always a favourable factor in influencing the individual and society. The evaluation plane primarily comprises the development of moral values in the field of information, hidden intentions and differences between information theory and practice, the creation of new power structures and the development of ethical conflict in the information field.

Given the practice of social media it follows that the maintenance of one principle may cause a clash with another. Problematic issues surrounding the ethics of information are an example. The open space serves the strategies of public relations, lobbying, advertising or simply manipulative tendencies. The profile of a news programme must to some degree possess the same properties as a person's profile, in order for it not to lose its appeal in the environment in question. At the same time, it must maintain all the characteristics of reputable media. There is often conflict between the right to information and the right to privacy, the right to privacy and the provision of public security, the right to privacy and employers' oversight, business secrets and the public interest, copyright and societal interest, etc. It can be expected that with the expansion of Czech Television's news on social media these questions will be more specifically addressed in the Czech Television Code of Ethics.

6. Oversight bodies

Thanks to the way that reports are created it is clear how oversight works and who decides on media content. Prior to 1989, this involved censorship, at first preliminary and later subsequent, when content was reviewed after broadcast and the editor-in-chief was sanctioned over any transgressions. This naturally led to greater self-censorship by editors-in-chief, who became censors. The technique by which control was carried out in the media is comparable to today's editorial system. In comparison with period of censorship, the chief difference is in what an editor checks for. Prior to 1989, this concerned not just language and formal correctness but above all protection of the state interest and the so-called protection of society's interests. Since 1989, language and formal correctness have remained central. However, other editorial interventions are influenced by the demand to appeal to consumers rather than state interests. Factual correctness has come to the fore in the transformation of media into public service media. Themes are set by a daily agenda and reporters pitch story ideas of their own. Czech Television's agenda setting is influenced by the news values discussed by Walter Lippmann. Alongside this, the selection of the agenda is influenced in large part by the function of public service media.

Social media editors work on a similar broad principle. However, what stands out here is that while the main principle of social media is the fact posts do not have an editor (respectively, everybody is an editor themselves), in regular media active on social media the same editorial system applies to everywhere else, though they are specialists in a given field: social communication. The work of social media editors is limited in comparison to that of an editor of traditional TV news, because in large degree they take possession of content. They choose from a pre-selection (reports selected as part of CT's news agenda setting) whatever has a chance of succeeding on social media. The main task of a social media editor is transferring an attribute of the classic media to social media. In the case of social media outlets' culture news, or respectively of that which we can generally classify as culture news, it is supplemented by other selected themes, predominantly of a magazine or lifestyle type. Their self-censorship differs, however, in that there is immediate feedback in the form of instant ratings. The hypothesis can then be advanced that in the case of social media ratings are not only a criterion, anonymous numbers that drive editorial decisions; rather they represent a direct editorial intervention. The feedback is so fast that it directly influences publishing. All of these aspects stemming from the very nature of social media may be a stimulus to further research.

7. Conclusions, Limitations and Future research

It can be observed that censorship based on state interests and state power has today been replaced by economic interests, meaning ratings. This goes for traditional audiovisual media outlets and their social media activities. Editors seek to comply with editors-in-chief, who try to reach the greatest number of viewers. To do this they select attractive subjects, attempting to sell them to viewers using the above-mentioned attributes and techniques. Research into culture news reporting shows that today content is influenced by the self-censorship of ratings or reach. The viewer, not the regime, is boss. Ratings grow – the number of viewers goes – and the shot expands. The media outlet doesn't adapt to regime criteria but to the broadest possible audience. It expects viewers to be uninformed and in attempting to accommodate them opts for simplicity, tells stories, plays on the emotions, etc. It wants to grab the viewer, to win them over.

This is even more striking in relation to social media content. Editors employ attributes in combination with the rules of presentation on private social media profiles. It is through social media that users acquire news. However, this approach can to some extent be compared to a school based on games. It could, for instance, inform the nation about pollution by using cute penguins.

Whether this will happen is, however, a subject for further analyses. Last but not least, the question arises as to why public service television, which is not financed on the basis of ratings but is funded by licence fee payers, is so oriented toward the audience and not toward the provision of information. But that will be the subject of a different study.

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MODEL OF ONLINE PRIVACY

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Communication privacy management, contextual approach to privacy, harms to privacy, theory of planned behavior

Abstract

People consider online privacy more and more important. However, privacy is a complex issue, which can be treated in many perspectives. We propose a model based on the theory of planned behavior, which includes the three most important approaches to privacy, namely the Solove's identification of threats to online privacy, Petronio's privacy management and Nissenbaum's contextual integrity. The model is especially relevant for social networks environment. The paper includes proposal for the model testing and comparison with other theories of behavior.

1. Privacy

In the modern society, technologies have made worries about privacy very acute. New technological devices are connected through internet and information can be easily transferred for processing purposes. ICTs are able to store, retrieve, analyse and disseminate huge amounts of data. As people use a lot of devices connected on the internet information on them is easily available.

Privacy is a difficult concept, but it is becoming important in online activities (Smith, Dinev, & Xu, 2011) and especially in social networks (Aquisti & Gross, 2006), Dwyer, Hiltz, & Passerini (2007), (Shin, 2010). In the area of online privacy we can differentiate three approaches to it. The first one defines privacy from the contextual point of view, the second one describes the potential harms caused by privacy breakages and the third deals with management of private information.

2. Contextual Approach to Online Privacy

Helen Nissenbaum came with the idea that the notice-and-consent approach which stresses the necessity of clear and fair privacy policies and information practices and presupposes individual's ability to understand all relevant facts and then choose the best option is based on false presuppositions. This approach is based on transparent principles and free choice of the individual. It assumes that this solution gives the user full control over his private information. The second argument in favour of this practice consists in the free market operation which gives freedom to both sides of the trade - to offer and buy goods under known conditions. If the price includes providing private information and the buyer agrees nothing can be objected. The problem with these arguments is that privacy is not the right to have full control over one's private information

and the free market agreement doesn't provide sufficient buyers' protection as many examples of privacy breaches prove. Another problem consists in the fact that providing private information is often a necessary condition for using a service. The price of not using the service is often connected with social, financial or practical harms. The choice is not as free as it may seem. The supply of alternative products is not sufficient. Informing about privacy is not sufficient as well. Privacy policies are usually very long, complicated, full of technical terms, users don't read the privacy policies and even if they do they usually don't understand them. Since 2013, we have been surveying opinions of students on the University of Economics in Prague on various ethical issues. One of the questions asked concerns their attitude to terms and conditions of online services. The results show the proportion of students who don't read the terms increases (from 23% in 2013 to 42% in 2016) and only a small proportion of students always reads and understands them (ranging from 3% to 6%).

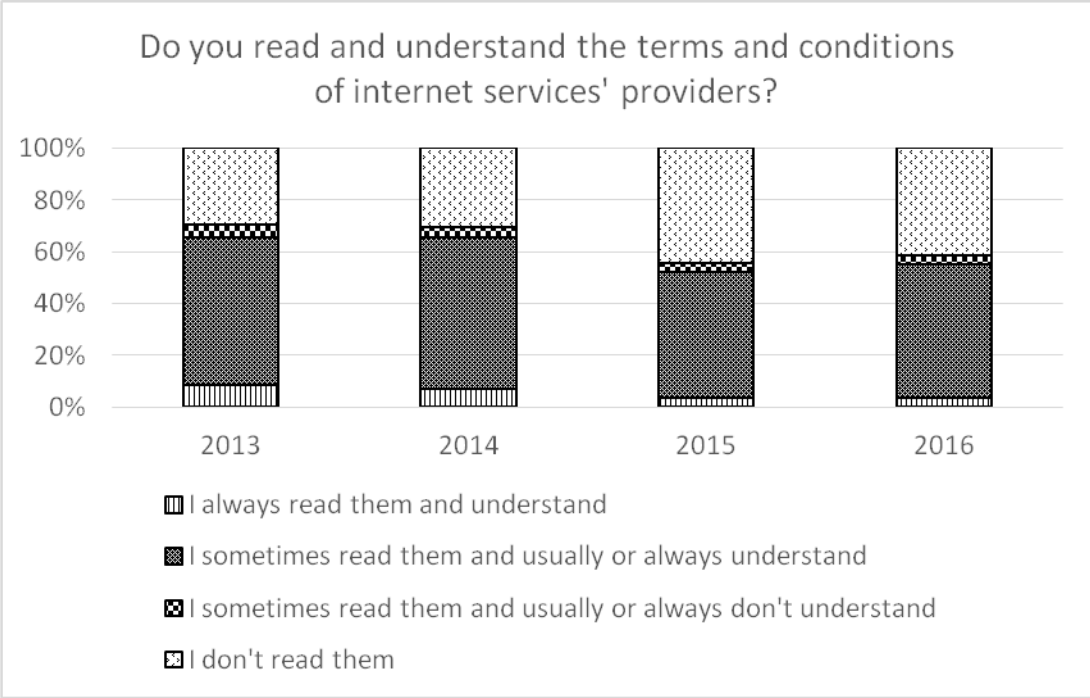

Figure 1: Terms and Conditions of online Services; Source: author

The problem is related to the complex, sophisticated and changeable (developing) character of modern technologies. Only experts can understand how they work. In addition to that they are designed not to disturb their users and that is why many of their processes run unnoticed. We can even say that precise norms of what information is used and how is almost impossible.

Nissenbaum points out that the relationship between websites or application providers and individuals is asymmetric. That is why she suggests substantive context specific norms that would regulate what information can be collected, who it can be shared with and under what conditions. The important parameters that determine the norms are actors (subject, sender, recipient), attributes (types of information), and transmission principles (constraints under which information flows from party to a party in a context like confidentiality, reciprocity etc.). (Nissenbaum, 2011, p. 33) E.g. in the health care patients expect that the doctors would share their private information with other involved doctors only. If the doctor sells the information, the expectation would be violated.

The right to privacy is for Nissenbaum the right to the appropriate flow of information. Contexts are structured social settings with specific activities, roles, relationships, power structures, norms and rules.

Online activities must be integrated into existing structures of social life bearing in mind that both online and offline activities have heterogeneous character. The problem is quite complicated. The online environment is not distinct but is part of the social environment we live in. Nissenbaum suggests we locate contexts, identify disruptive flows and evaluate them against general ethical principles and context specific values. It is not always a simple process, but must be done. In some case existing context specific information norms can be extended to online activities, in other cases the situation must be evaluated against more general principles and specific rules must be found, sometimes the purposes must be considered in order to find the relevant norms that should be followed.

3. Harms to privacy

Another approach mapping the harms related to privacy breaches represents D. Solove. D. J. Solove suggests in his article (2006) a taxonomy of privacy. He distinguishes four basic groups of harmful activities: 1) information collection, 2) information processing, 3) information dissemination and 4) invasion. Each of them has various subgroups.

The first group focuses on problems related to data subject. Surveillance and interrogation belong into the first group. Surveillance leads to discomfort and anxiety, it increases self-censorship and is an instrument of social control that supports the power of norms and regulations. Covert surveillance has chilling effects on man's behaviour.

"Interrogation includes various forms of pressuring of individuals to divulge information." (Solove, 2006, p. 500) Compulsion can cause offense as not answering may create the impression that the person has something to hide. Interrogated people have to consider how they will appear to others. Another problem related to interrogation consists in the fact that it may cause distortion as the interrogator can control the dissemination of obtained information.

The second group concerns data collectors, processors and holders. Into the second group belong aggregation of data, identification of individuals, insecurity, secondary use meaning use of information for a different purpose than originally stated and exclusion which consists in the fact that the person doesn't know about the data others have about him. Aggregation is dangerous because the results may reveal more dangerous facts than if they were separated. Aggregation thus causes information asymmetries. One shouldn't forget that information obtained by aggregation needn't be precise or even correct.

The third group of hams to privacy includes dissemination where processed data are transferred to others or disseminated. This group includes breach of confidentiality, disclosure (revelation of truthful information to others), exposure which is connected to someone's body privacy, increased accessibility of information on someone, blackmail, appropriation of someone's identity to help achieve aims and interests of another person and distortion which involves dissemination of false information about someone.

Disclosure puts a person into risk of harmful activities as a lot of information is available and can be misused. Consider e.g. stalking, harassment etc.

The fourth group concerns direct impingement on the individual and involves invasion into private affairs like intrusion, which is the act that disturbs the protected realm or asylum and interferes into the decision-making. Examples include spam, junk mail or telemarketing. People have to spend their time, interrupt their activities and feel under attack.

4. Communication Privacy Management

Sandra Petronio (2002) has developed communication privacy management theory describing the way people make decisions in cases of revealing and concealing private information. People establish and remove privacy boundaries with partners in communication according to the perceived benefits and costs. The boundary divides between private and public information.

Self-disclosure is a mean for developing close relationships. Revealing information to others allows sharing bad life circumstances and gives other the opportunity to help. On the other hand we have a desire for privacy and we wouldn't like other people to share information we have disclosed to them.

Everybody has some privacy boundaries distinguishing private and public information. Only the object of the private information knows the boundaries, others don't. The boundaries can be porous or quite thick which is the case with secrets. When a person discloses private information to someone he reshapes the boundaries. Petronio differentiates five core principles of the privacy management. 1) People believe they own and have a right to control their private information. 2) People control their private information through the use of personal privacy rules. 3) When others are told or given access to a person's private information, they become co-owners of that information. 4) Co-owners of private information need to negotiate mutually agreeable privacy rules about telling others. 5) When co-owners of private information don't effectively negotiate and follow mutually held privacy rules, boundary turbulence is the likely result.

Petronio speaks about rules, not laws to express there are no universal laws, but selected rules. The adoption of rules is based on five factors: culture, gender, motivation, context, and risk/benefit ratios. Disclosing information to someone makes the collective boundary out of the personal boundary. Co-owners feel some responsibility for the information, but not identical to the original owner. Sharing private information may usually create a sort of expectation and duty to help or assist. Knowing something is not innocent and people are expected to behave according to their knowledge, e.g. to offer help if the know the person is in need. For the informed people it is necessary to negotiate with the owners of information common privacy boundaries. The negotiation focuses on three aspects: boundary ownership (rights and duties co-owners of information have regarding its spreading), boundary linkage (decision about who else should know the information), and boundary permeability (how closed the boundary should be). When boundary coordination fails and the boundaries are not synchronized, the result is a turbulence. (West & Turner, 2007)

5. Theory of planned behaviour

In order to explain a behaviour we need a theory describing its course. In current literature, behavioural change theories are quite popular. They consider environmental, personal and behavioural characteristics the major determinants of behaviour, especially change of behaviour. These theories thus analyse the factors determining change of behaviour which can include threat, fear, response efficacy, self-eficacy, barriers, benefits, subjective norms, attitudes, intentions, cues to action or reactance.

The theory of planned behaviour belongs into the category of behaviour change theories and was quite successful in describing health behaviour. It is useful if social norm as a variable is involved, so it is appropriate for the description of prosocial behaviour like charity, advertising, etc. Its precursor was the theory of reasoned action that was based on the idea that actors consider the consequences of their behaviour before acting. The theory of planned behaviour was developed by Ajzen in 1985 and also emphasized the importance of intentions, but attempted to include cases

where the actor doesn't fully control the factors which affect the behaviour and its results. Therefore, the amount of control over the behaviour and actor's intention in performing it became determinants of the behaviour. In 2010 a new theory was developed by Ajzen and Fishbein called reasoned action approach. We will focus on the theory of planned behaviour according to Ajzen (1985).

The behaviour is according to this theory governed by three impulses: 1) behavioural beliefs about the consequences, which produce positive or negative attitude towards the behaviour, 2) normative beliefs about the normative expectations of others, which result in social pressure, or subjective norm and 3) control beliefs about presence of factors that may facilitate or impede the behaviour, which implies the formation of intention. The theory thinks once the intention to perform an action is developed, the behaviour will be carried out.

6. Model of Online Privacy

We should supplement the three beliefs with the theories of privacy we have described above. Nissenbaum is looking for norms for every context and that is why she supplements the normative beliefs. Petronio's rule based management also considers some boundary norms and could also specify the normative beliefs. Control beliefs deal with persuasion that the person controls the results of the behaviour and that is why they could be specified by Petronio's privacy management which considers the treating of the private information of co-owners and by Solove who gives us hints as to what type of harms could appear which provides us with a starting point in investigating the probability of the harms. Privacy management could provide us with some guidelines regarding the attitude towards the results of the behaviour as we strive for something when we disclose private information to somebody. However, in many cases disclosing private information is not the aim of the behaviour, but the condition of some behaviour or its results only. We should also analyse the relationship between intention and behaviour and the reasons obstructing the translation of intention into real activity.

The model could be broadened to include more areas of information ethics, like the Mason's four features of information ethics: privacy, accuracy, property and accessibility. In this case the three theories should be adapted, too. We would have to find respective harms for all four categories, model of four features' management and specify the context-sensitive norms.

Every of the three types of beliefs is also influences by other factors. We should concentrate on the personal characteristics of the people, like education, position in the hierarchy, age, gender etc. The strength of these factors should be calculated, regression coefficients, path coefficients and correlation coefficients should be stated. The fit indices of the model should be calculated as well, specifically discrepancy functions like RMS, RMSEA and CFI.

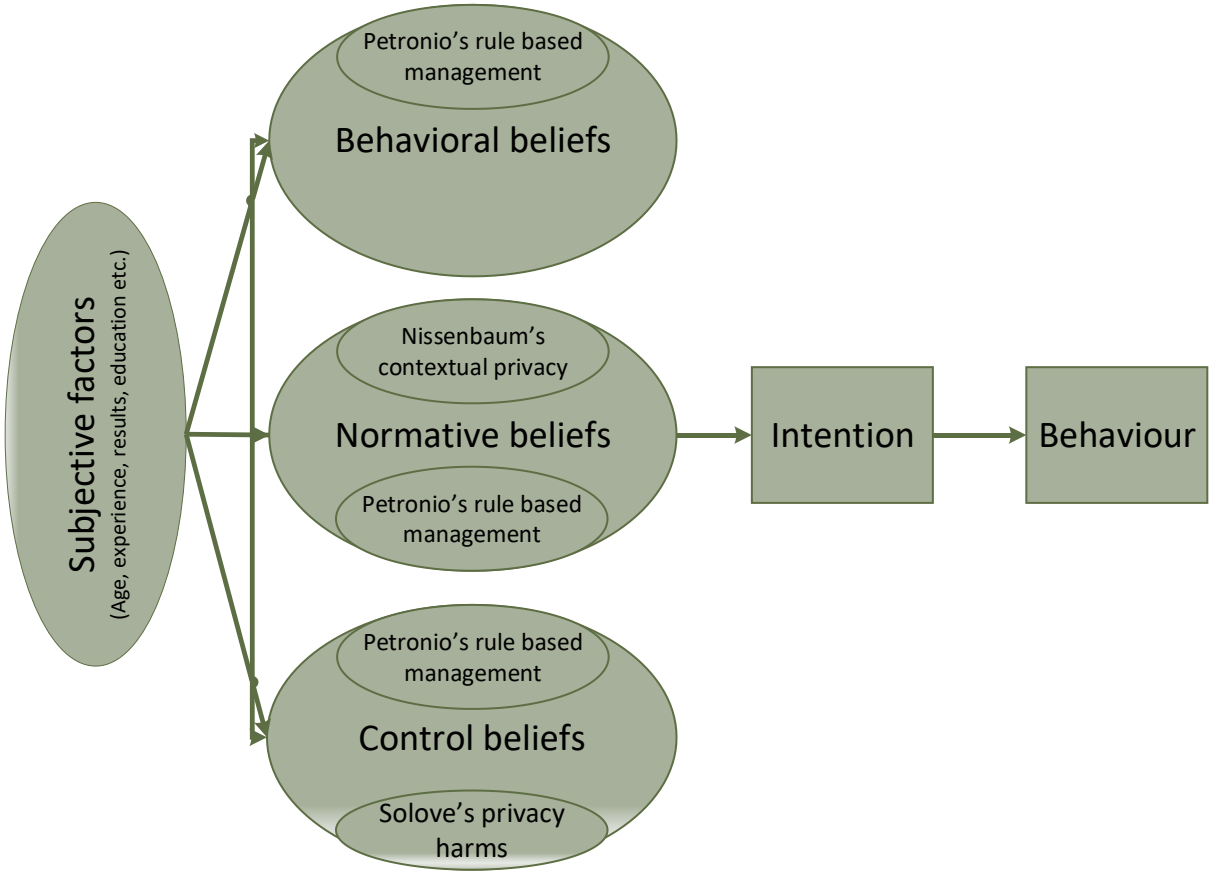

Figure 2: Model of Online Privacy; source: author

However, the model is not ideal. It assumes the opportunities and resources have been acquired, it doesn't consider other factors that influence intention and motivation (fear, threat, experience), leaves out environmental or economic factors, presupposes a linear decision making process (no change in time is admitted). (Boston University School of Public Health, 2017)

There are also other theories of the behaviour. Many of them were developed for the medical purposes – to help in the promotion of desirable positive behaviour improving the health of population. They could be generalized and adapted to privacy or information ethics. We can name just a few of those theories. In the 50s the health belief model was developed. The model consists of perceived susceptibility (vulnerability to harms if the behaviour is not adopted), severity (seriousness of the risks), benefits, barriers (obstacles), cue to action (stimulus needed to trigger the behaviour), self-efficacy (confidence in the ability to perform the behaviour). The social cognitive theory developed in 60s and improved in the 80s puts focuses on the social aspect of learning. Its behavioural models are reciprocal determinism, behavioural capability, observational learning, reinforcement, expectations (anticipated consequences) and self-efficacy. In the 70s Prochaska and DiClemente proposed the transtheoretical model which describes the six stages of the process of behavioural change: precontemplation, contemplation, preparation, action, maintenance, and termination. (Boston University School of Public Health, 2017). Our persuasion is that for our purposes the proposed model represents the best solution.

The model has a relevance for the business sphere as it identifies determinants of privacy respecting behaviour which are relevant for all human beings including managers. An interesting question would be what factors specific for managers are determinants of ethical behavior. We can think of organizational culture supporting or not supporting ethical approach, success or failure of previous ethical projects, level of experience with ethical issues, position in the organizational hierarchy,

education of the manager, his age, type of project, personal characteristics etc. These factors should be classified according to the three types of beliefs (behavioral, normative, control).

If we identify and statistically confirm factors affecting ethical behaviour, we can use them to increase their ethical behaviour in privacy matters and further we can search for factors affecting those characteristics that do not support ethical behaviour.

7. Acknowledgement

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SALES PROMOTION AND USING SOCIAL MEDIA IN THE SLOVAK INTERNET BOOK MARKET

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Customer satisfaction, Digital environment, Sales promotion, Social media, Digital bookstore

Abstract

Current trends in marketing communication are offering more and more options and opportunities to manage customer relationships so that individual campaigns and other methods of marketing communication will become most effective and acceptable for customers. The paper is mainly focused on monitoring the possibility of customer relationship management in the digital environment, together with the possibilities of sales promotion via social media. Digital technologies and digital marketing bring a combination of more benefits and factors that together can present information about the product, brand or service more effectively and comprehensively. The paper refers to the growing profitability of social media (focusing on Facebook) in sales promotion in the Slovak internet book market.

1. Introduction

One of the most significant changes in human interaction in recent years is the booming of social media and social networks. The rapid growth of web platforms greatly affects social behavior. Real social relationships are transferred to the virtual - digital environment, which leads to the creation of online communities that connect people from all over the world. This move to the digital environment enables individuals to share knowledge, build contacts and promote dialogue between different cultures. (Tiago & Veríssimo, 2014). The question is no longer whether people are joining and signing up. The real question remains where people join (login) or why they visit certain websites or use certain applications.

Digital marketing (or online marketing, internet marketing, or web marketing) means "a set of marketing activities in the Internet (online)" (BESTPRACTICE, 2017). In a simple way, it could be say that digital marketing represents marketing activities realized through internet and mobile communications, i.e., on the internet, through social networks, email, apps, platforms, and more (Kannan & Li, 2017). Over the last 10 years, this marketing sector has seen a huge boom, underlying the rapid expansion of the internet, mobile phones and social networks (Madzík, Piteková, & Daňková, 2015).

Digital marketing is currently covering a professional term that describes the entire process of using digital technologies to acquire customers and build customer preferences, brand support, customer retention, and sales growth (Smutný, Rezníček, & Pavlíček, 2013). However, digital marketing goes beyond internet marketing and also includes channels that do not require internet usage (mobile phones - SMS and MMS, display advertising, social media marketing, search engine marketing,...).

The current environment is characterized by a large number of internet messages transmitted through social media. Social media has become a major factor in influencing various aspects of consumer behavior, including gaining information, opinions, attitudes, awareness, buying behavior, communication, and post-purchase ratings. However, many managers can not fully appreciate the role of social media in the promotional effort of their organization. Although the social media multiplied consumer-to-consumer conversations, methods to form these interviews have not yet been formulated (Mangold & Faulds, 2009). Due to high up-to-date nature, social media are still a subject of interest. Impact survey and reach of this phenomenon on human behavior (not only for marketing use), is still ongoing.

The power of social networking is such that, the number of worldwide users is expected to reach some 2.95 billion by 2020, around a third of Earth's entire population. An estimated 650 million of these users are expected to be from China alone and approximately a third of a million from India. The region with the highest penetration rate of social networks is North America, where around 60 percent of the population has at least one social account. As of 2016, 78 percent of the United States population had a social networking profile (STATISTA, The Statistics Portal, Statistics and facts about social media usage, 2017). Leading social networks usually boast a high number of user accounts or strong user engagement metrics. For example, Facebook is the only social network having surpassed the 1 billion monthly active user mark and has, as of 2016, more than 1.7 billion MAU (monthly active users) worldwide.

Despite the ubiquity of social networks, market potential is still increasing, as not only user figures but also user engagement continues to grow. As of the 4th quarter of 2015, the average daily time spent on social networks by users in Brazil and Philippines was more than 3 hours, while those in the United States only clocked in at almost 1.7 hours per day. On average, global internet users spend some 109 minutes per day surfing social networks (STATISTA, The Statistics Portal, Statistics and facts about social media usage, 2017). This prompts worldwide brands and their marketers to use that time and screen space to promote various products and services via social media marketing or social advertising.

Based on statistic that provides information on the most popular networks worldwide as of April 2017, ranked by number of active accounts, market leader Facebook was the first social network to surpass 1 billion registered accounts and currently sits at 1.97 billion monthly active users (STATISTA, The Statistics Portal, Global social networks ranked by number of users 2017, 2017). Due to a constant presence in the lives of their users, social networks have a decidedly strong social impact. The blurring between offline and virtual life as well as the concept of digital identity and online social interactions are some of the aspects that have emerged in current discussions.

If marketers want their marketing strategies to be as effective as possible, they must endeavor to meet customer requirements (Madzík, 2016) and meet the needs of all types and generations of current and potential customers. It should be remembered that each type of personality and generation has positive qualities (Copuš, 2014). Good communication with different generations is crucial for effective management (Altimier, 2004). That is why we present some unique aspects of typical age generations currently suitable for marketing use.

In the world, the designated generations of the population (taken from the US environment) are divided into 5 basic groups in relation to information and communication technologies (Table 1).

The size of the individual segments is shown for Slovakia where the research was carried out but proportional are consistent with global research.

Table 1: Segmentation of the digital market for marketing activities

Serial number	Generation	The period of birth of the population	Segment size in Slovakia	Characteristics of activities on the internet
1.	**„Baby Boomers“**	1945 - 1965	1.8 million	78% news portals, email, internet banking 1.8% social networks, desktop, notebook, smartphone
2.	**„X“**	1966 - 1979	1.2 million	83% internet banking, news portals, email 2.8% social networks, smartphone, notebook, desktop
3.	**„Y“**	1980 – 1994	1.2 million	82% internet banking, social networks, email less 4.1% social networks, smartphone
4.	**„Z“**	1995 – 2012	1 million	82% social networks, listening to music, YouTube online games, FB messenger 5.2% social networks, tablets, smartphone
5.	**„Alfa“**	2013 -	?	Their characteristics are not yet known - the subject is in current research and studies

Source: own processing

And why is it important to know and talk about current generations? The main reason is that they are or will be the main purchasing power and the most economically active generation for a few years. Different generations of customers have different experience that affect their values, preferences, and buying behaviors (Parment, 2013). Generations of current and potential customers are also the future of organizations that are planning to stay on the market for a minimum of 30-40 years.

Based on the knowledge of the specifics and characteristics of individual generations of customers, the authors have decided to focus on Generation Y, i.e. of young people aged 20-25, because this generation is currently an extremely attractive market segment.

In response to the above, the authors of the contribution decided to conduct a survey aimed at identifying and evaluating the forms of support for the sale of selected internet bookstores in Slovakia, which are interesting and useing by the current young generation (Generation Y).

The aim of the contribution is to bring the perception of "Y" generation about quality of promotion and communication of Slovak internet bookstores in Facebook and refer about the growing profitability of social media (focusing on Facebook) in sales promotion in the Slovak internet book market.

2. Methodology

The topic of this paper was focused on selected online bookstores in Slovakia. The obtained data has several resources needed for an empirical assessment of the topic.

The first source of information is the statistical data obtained on the size and structure of the production of Slovak books based on statistical surveys conducted by the Ministry of Culture of the Slovak Republic. In spite of the penetration of modern information technologies, reading is the basic strategy of acquiring knowledge, expertise, dissemination and deepening of the human knowledge base. It is for this reason important to encourage the young generation to read books. Improving reading literacy is now highly desirable. The Ministry of Education, Science, Research and Sports of the Slovak Republic has published National Strategy for Level Upgrading and Continuous Development of Reading Literacy, which formulates a strategic goal - to improve the level of reading literacy in PISA 2018 testing above the OECD average. For this reason, the Minister of Education announced the school year 2016/2017 for the Year of Reading Literacy (Ministry of Education, Science, Research and Sport of the SR, 2016).

According to the data available from the Slovak Book Market Report for the year 2015, bookstore networks and bookshops are still the main channel of books sales in the Slovak Republic. Internet bookstores are the second most popular sales channel in Slovakia with an annual turnover of almost 18 million € (Association of Publishers and Bookstores of Slovakia, 2016). The document includes, for example, the number of periodical and non-periodical publications by thematic groups, the forms and issues of the publication, the number of tradition stores and internet bookshops and so one. From these data, a list of selected internet bookshops was created (subject of the survey).

Based on the list of bookshops where visited in the next step of the survey their official websites (second source of information) The third source of information with which authors contributed were the official profiles of selected internet bookstores on the Facebook social network. From the data obtained, it was possible to examine and evaluate the realized marketing activities and forms of sales promotion on the selected social network.

The growing popularity of internet shopping is evidenced by the growing number of online stores in Slovakia. Price Comparison Portal on the Internet Heureka.sk confirmed that there are approximately 8,250 online stores in Slovakia. It incorporates the landscape among e-commerce superpowers similar to Czech Republic, where there are even more than 37,000 online stores. This number of e-shops is comparable to Great Britain. For example, in the neighboring Poland, there are about ten thousand internet shops (Eshops Association, 2014).

The following figure describes the process of the survey.

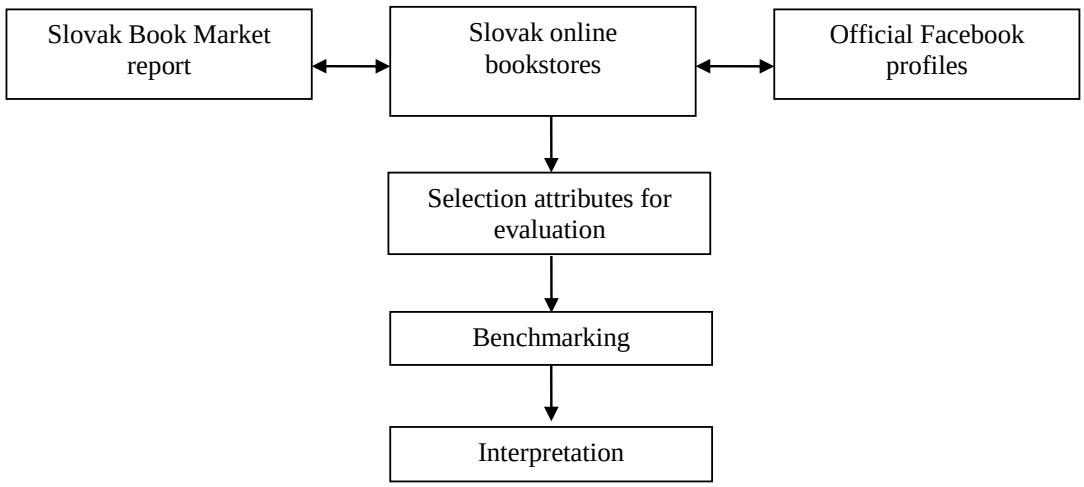

Figure 1: Progress of the survey; Source: own processing

By processing of data set consisting from the four internet bookshops and eight variables (parameters), it was possible to examine the interrelationships and order of importance between the acquired variables. Sales promotion as part of the marketing communication mix is important in every organization today. This fact also applies for marketing activities in the social networking environment in the internet bookstore sector. Realisation of sales promotion in selected bookshops on the Facebook social network is primarily builts for attract of new customers, rewarding and increasing of purchases of existing customers. The result of these activities is building loyalty and maintaining of relationships with them.

3. Results and discusion

By processing of results, the authors assumed that all of these online marketing parameters are equally important for realisation of sales support. The results shown in Table 2 were obtained by conducting a survey among students (daily form students) of the 1st year of Master's study at the Management Department of Educational Faculty (Catholic University in Ružomberok) in Poprad. The students were acquainted with the evaluation criteria, which they subsequently evaluated at selected online bookstores in the February 2017. Information was obtained from 45 students (respondents) during the course of marketing communication. Each of the criteria could be rated on a scale of 0-5, where 0 was the worst rating, on the other hand the 5 best rating for that criterion.

Subjective view of the individual attributes students assessed after visiting the official web profiles of selected internet bookstores on the Facebook social network. At the same time, however, they also expressed their opinion of own experience. By evaluating profiles in terms of users, respondents rated available information as the number of "likes" and the number of people who talked about it. Subsequently, they presented a subjective view of selected attributes such as profile appearance, way of communication with customers, the number and content of videos, content for customers, product and services, additional services and customer information.

The obtained variables were analyzed. The table shows the results of the analysis of selected internet bookshops together with the rating (overall average) of monitored criteria.

Table 2: Analysis of Facebook profiles of selected online bookshops

Online bookstores	Atributes (Facebook)									
	Number of "likes"	**Talking about**	**Communication with customers**	**Photos and videos**	**Content**	**Offer (products and services)**	**Additional services**	**Information**	**Total Score**	**Rank**
Panta Rhei.sk	4,8	1,8	4,9	4,9	4,8	4,9	4,7	4,8	35,6	3.
Martinus.sk	5	5	4,9	4,9	4,9	4,9	4,7	4,8	39,1	1.
Gorila.sk	4,1	1,2	4,8	4,7	4,7	4,6	4,6	4,7	33,4	4.
Bux.sk	4,9	4,4	4,8	4,8	4,6	4,7	4,9	4,8	37,9	2.

Source: own processing

The quantification of these views enabled the conclusion of this contribution to summarize some contextual implications extending the possibilities of scientific and practical discussion. In order to better interpret the obtained results, they were processed into graphical form (Figure 2).

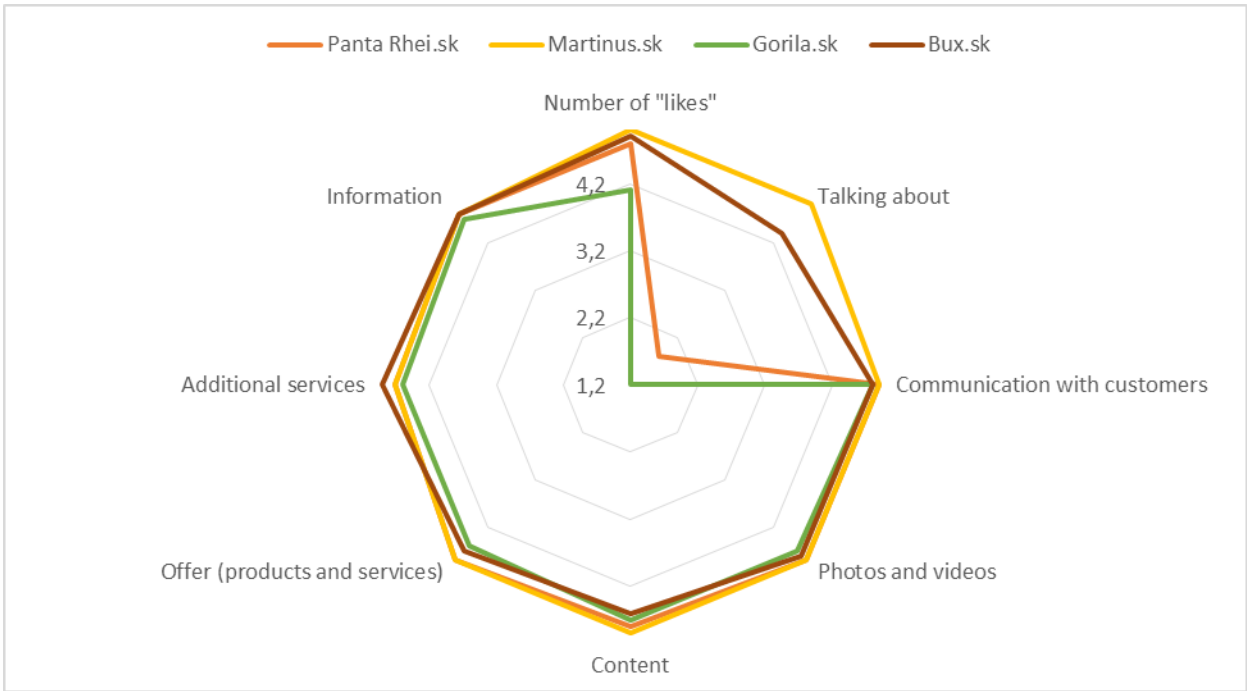

Figure 2: Analysis of FB profiles of selected internet bookstores; Source: own processing

The obtained results show that the differences in the marketing activities of selected internet bookstores on Facebook are minimal. They only differ in the number of fans who have labeled answer "Talking about". The low figures in the assessment of this attribute point to the low knowledge for respondents of online bookstores named Panta Rhei and Gorilla.

From the above, we can say that being in regular contact with customers is a basic attribute of any success. Regular contact is important. In the context of the knowledge of the basic characteristics of individual generations of customers are the results of the survey the high value. Since the most

striking variations were noted in assessing the "Talking about" attribute in two online bookstores, it is possible to evaluate the realized marketing activities of Pante Rhei and Gorilla online bookshops in this area as insufficient in the sense of a balanced marketing mix in the digital environment. The results of the survey, which was attended by young people aged 20-25 (Generation Y), clearly highlight for a needing to address of tighter and more active "Talking about" attribute, as it is very attractive for young people today. In the other evaluated attributes, each online bookstore has relatively high scores with minimal differences, which suggests that individual bookstores carry relatively balanced marketing campaigns on the Internet and are able to communicate effectively with current customers.

4. Conclusion

Coca-Cola Marketing Manager Sergio Zyman has said in time that marketing, as we know him in the knowledge economy, ends and is taking place the new era of creative, courageous and effective marketing. In practice, this means that vendors will not offer their products to unknown potential customers, but will focus on existing customers and new values.

The challenge for marketing professionals is also the study of preferences and the purchasing behavior of new generations of customers. Currently the dominant generations "Y" and "Z" will replace the Alpha generation. This forces us to change the current communication strategies of the media, advertising and PR agencies, as well as brands or shops. The future of communication and information sharing will have to be targeted to the virtual world. Similarly, speech and marketing tools will have to be tailored to the demands of the dominant generations of customers, of which is the Generation 2020 coming up. This trend is confirmed by the results of the survey, which clearly show that Y generation is a very attractive market segment. It is therefore reasonable to say that social media represent a revolutionary new trend that should be of interest to companies operating in online space or any space.

The results presented in this paper are partial and the research will be expanded by analysis of Facebook profiles with some "soft" metrics, such as textual analysis of comments and posts, as well as frequency of posts.

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DO GENDER AND PERSONALITY TRAITS INFLUENCE VISITS OF AND PURCHASES AT DEAL SITES?

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Keywords

Adoption, deal sites, personality traits, empirical research

Abstract

As deal sites became widespread, there are multiple international and local players in the Czech market. The research presented in the paper investigates if gender and personality traits influence frequency of visits of deal sites and the number of coupon purchases. Big Five Inventory-10 is used to measure personality traits. None of the factors influenced frequency of visits of deal sites. Only openness to experience seems to positively influence the number of coupon purchases, though the its significance is borderline.

1. Introduction

Deal sites are sites which offer a certain product for a discounted price for a limited period of time. Deal sites, such as Groupon and LivingSocial (acquired by Groupon in October 2016) were launched about a decade ago. These days, probably most people think of Groupon when talking about deal sites, Possible reasons are summarized in (Sudzina, 2016b).

Within the business model framework compiled by Taran et al. (2016), Groupon can be classified as affinity club (Johnson, 2010), round-up buyers (like Linder and Cantrell's (2000) buying club), and trade show (like Timmers' (1998) third-party marketplace).

Deal sites gained general popularity in the Czech Republic in 2010 with the advent of the company Slevomat.cz, the leader of the Czech market, whose name became synonym with group shopping in the Czech Republic. In the last two years, the Czech market has achieved its growth limits, overall sales have stabilized, and there has been dramatic reduction of the number of firms.

According to Grosová (2002), the price is often, esp. when it comes to customer goods, considered the main determinant of the purchase decision. According Delina (2014), transparency of prices and demands plays a significant role in achieving fair market prices. Deal sites use transparency for accumulating marginal acceptable demand which provide possibility to offer bargain price. Smutný (2015) presents importance and the use of online marketplaces (e.g. AppStore, Groupon) for marketing activities by Czech companies doing business over the Internet. Ministr and Ráček (2011) describe how sentiment evaluation in unstructured Czech text could be conducted but such analysis is outside of the scope of this paper.

The aim of the presented research is to establish whether gender or personality traits can be linked to frequency of visits of deal sites and to the number of coupon purchases. The rest of the paper is organized in the following way: In the next section, there is a description what data were collected and how, and how they were analyzed. In the following section, results of the analysis are presented. The last section offers conclusions.

2. Data and methodology

Data were collected between December 2016 and January 2017 using an on-line questionnaire. Respondents were 264 university students from the Czech Republic, of which 140 respondents indicated that they use deal sites, and 124 do not. (The analysis of use versus non-use of deal sites from this data set was published in (Sudzina & Pavlíček, 2017).)

SurveyXact was used for the questionnaire. Unlike Qualtrics, it does not allow to show/hide questions based on previous answers on the same page. Therefore, the questionnaire was split into two pages and questions for deal sites users appeared on the second page. Seven respondents stopped after the first page. So, the effective sample size is 133 (43 men, 90 women; on average 20 years old).

On the second page of the on-line questionnaire, there was a question "How often do you visit deal sites?" Possible answers were taken from (Sudzina, 2016a)

- Once a year
- Every 6 months
- Every 3 months
- Once a month
- 2-4 times a month
- Many times per week

The distribution of the values is provided in Table 1.

Table 1 Distribution of frequency of visits of deal sites

Frequency	Count	Percentage
Once a year	24	18.0%
Every 6 months	25	18.8%
Every 3 months	32	24.1%
Once a month	26	19.5%
2-4 times a month	21	15.8%
Many times per week	5	3.8%

The following question was "How many times did you shop on deal sites within the last 6 months?" One respondent wrote 142520; this number was treated as missing. So, the effective sample size for this analysis is 132.

Personality traits were measured using the Big Five Inventory-10, i.e. a 10-item version of the questionnaire for the Big Five Inventory, developed by Rammstedt and John (2007) and translated to Czech by Hřebíčková et al. (2016). The instruction was to rate "How well do the following statements describe your personality" with statements "I see myself as someone who..."

- ... is reserved,
- ... is generally trusting,
- ... tends to be lazy,
- ... is relaxed, handles stress well,
- ... has few artistic interests,
- ... is outgoing, sociable,
- ... tends to find fault with others,
- ... does a thorough job,
- ... gets nervous easily,
- ... has an active imagination

on a 1-5 Likert scale where 1 meant strongly disagrees and 5 stood for strongly agree. *Extraversion* was calculated as an average of the 1st (reversed-scored) and the 6th answer, *agreeableness* as an average of the 2nd and the 7th (reversed-scored) answer, *conscientiousness* as an average of the 3rd (reversed-scored) and the 8th answer, *neuroticism* as an average of the 4th (reversed-scored) and the 9th answer, and *openness to experience* as an average of the 5th (reversed-scored) and the 10th answer. The questionnaire contained additional questions which were not used in the analysis presented in this paper.

Ordinal logisitic regression was used to analyze impact of gender and five personality traits (extraversion, agreeableness, conscientiousness, neuroticism, openness to experience) on frequency of visits of deal sites (a higher number means a higher frequency of visits). Accompanying Cox&Snell pseudo-R^2, Nagelkerke pseudo-R^2, and McFadden pseudo-R^2 (i.e. all pseudo-R^2s typically calculated for this kind of model) will be provided in order to describe explanatory power of ordinal logisitic regression models.

General linear model was used to analyze impact of the same independent variables on how many times did a respondent shop on deal sites within the last 6 months. Parameter estimates are provided in tables in order to communicate the direction of relationships. The method is equivalent with linear regression. R^2 and R^2_{adj} will be provided in order to describe explanatory power of linear regression models.

A multivariate approach was used in both cases. SPSS software was used for the analysis. With regards to abbreviations used in Tables 2-5, B stands for unstandardized coefficient, S.E. stands for standard error, t stands for t-statistics, Wald stands for Wald-statistics, df stands for the number of degrees of freedom, and sig. stands for significance, i.e. p-value.

3. Results

The first model analyzes impact of gender and five personality traits on frequency of visits of deal sites. Parameter estimates for the ordinal logistic regression model are provided in Table 2. Cox&Snell pseudo-R^2 is .018, Nagelkerke pseudo-R^2 is .018, McFadden pseudo-R^2 is .005, and p-value is .884.

Table 2 Ordinal logistic regression for the full model 1

Variable	B	S.E.	Wald	df	Sig.
Frequency = 1	-.705	1.584	.198	1	.657
Frequency = 2	.266	1.582	.028	1	.866
Frequency = 3	1.260	1.585	.631	1	.427
Frequency = 4	2.256	1.594	2.004	1	.157
Frequency = 5	4.101	1.646	6.208	1	.013
Extraversion	.045	.183	.062	1	.804
Agreeableness	-.134	.214	.396	1	.529
Conscientiousness	.109	.196	.312	1	.577
Neuroticism	.084	.160	.274	1	.601
Openness to experience	.138	.181	.579	1	.447
Gender = male	-.153	.370	.170	1	.680

In order to make sure it is not the highest frequency (many times per week) with the smallest count (5) that cause all results to insignificant, the two highest frequencies were merged and the ordinal logistic regression model was tested again. Parameter estimates are provided in Table 3. Cox&Snell pseudo-R^2 is .018, Nagelkerke pseudo-R^2 is .019, McFadden pseudo-R^2 is .006, and p-value is .881.

Table 3 Ordinal logistic regression for the full model 1 with two merged values

Variable	B	S.E.	Wald	df	Sig.
Frequency = 1	-.741	1.588	.218	1	.641
Frequency = 2	.230	1.585	.021	1	.885
Frequency = 3	1.224	1.588	.594	1	.441
Frequency = 4	2.221	1.596	1.935	1	.164
Extraversion	.047	.183	.066	1	.797
Agreeableness	-.141	.214	.436	1	.509
Conscientiousness	.109	.196	.307	1	.580
Neuroticism	.093	.161	.333	1	.564
Openness to experience	.125	.182	.475	1	.491
Gender = male	-.157	.371	.179	1	.672

To sum up, merging the two highest frequencies had only a marginal effect on the model.

Next, impact of gender and five personality traits on how many times did a respondent shop on deal sites within the last 6 months was analyzed. Parameter estimates for the general linear model are provided in Table 4. With regards to the explanatory power of the model, R^2 is .030, R^2_{adj} is -.017, and p-value is .696.

Table 4 Linear regression for the full model 2

Variable	B	S.E.	t	Sig.
Intercept	-1.461	3.094	-.472	.638
Extraversion	.144	.358	.403	.687
Agreeableness	.231	.419	.552	.582
Conscientiousness	.089	.384	.231	.818
Neuroticism	-.020	.314	-.064	.949
Openness to experience	.588	.355	1.657	.100
Gender = male	.414	.725	.570	.569

Openness to experience is significant at the .1 level. Carlson and Wu (2012) suggest to exclude independent variables that are not significant. Parameter estimates for the reduced model are provided in Table 5. With regards to the explanatory power of the model, R^2 is .023, R^2_{adj} is .015, and p-value is .085.

Table 5 Linear regression for the reduced model 2

Variable	B	S.E.	t	Sig.
Intercept	.263	1.243	.212	.833
Openness to experience	.577	.333	1.734	.085

Although the significance of openness to experience is not below 0.05, it should not be dismissed. Baroudi and Orlikowski (1989) estimated that information systems researchers typically have a 40% chance of not detecting the phenomenon under study, even though it, in fact, may exist.

4. Conclusions

Although deal sites exist over a decade now, they are used only by approximately by half of the surveyed respondents. The aim of the paper was to investigate the influence of gender and Big Five Inventory personality traits on frequency of visits of deal sites and on the number of coupon purchases.

With regards to the results, none of the considered independent variables impacts frequency of visits of deal sites. In previous research (Sudzina, 2016a) conducted in Denmark, the wording was more loose, and the question was about use, not visits, and there were the same possible answers. Impact of openness to experience was negative and significant at the .05 level, and impact of extraversion was positive and significant at the .1 level.In the current research, only openness to experience influences the number of coupon purchases, and even this personality trait is significant only at the .1 level. The impact of openness to experience is positive, i.e. the more open is a person, the more coupons the person buys.

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IMPACT OF GENDER AND PERSONALITY TRAITS (BFI-10) ON TECH SAVVINESS

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Tech savviness, personality traits, gender, empirical research, quantitative methods

Abstract

Nowadays, it is necessary to use technology in various everyday activities. A certain level of what used to be called high-tech savviness is needed to access almost all modern services. The aim of this paper is to analyze if gender and personality traits (Big Five Inventory-10) influence self-perceived tech savviness. A not so surprising finding is that gender influences self-perceived tech savviness, i.e. men consider themselves more tech savvy. Moreover, neuroticism has a negative and openness to experience has a positive impact on self-perceived tech savviness.

1. Introduction

As Witt, Massman and Jackson (2011) put it, "[t]he benefits of being technologically fluent are obvious, but the liabilities of not being "tech savvy" may be more substantial (e.g., increased isolation from world, local, interpersonal, and personally meaningful events)".

Among others, tech-savviness can be used, to measure self-identity, as it was done e.g. in (Gimpel, Sudzina and Petrovčiková, 2014; 2016).

The aim of this research is to investigate the impact of gender and personality traits according to the Big Five Inventory on tech savviness. This paper is a partial replication of (Sudzina, 2015a). Sudzina (2015a) considered tech savviness in the eyes of others and tech savviness in one's own opinion, this research focuses only on the latter - tech savviness in one's own opinion - as the former was also self-reported.

Probably with the exception of adoption of deal sites (Sudzina, 2015b) where women were found about twice as likely to use them compared to men, virtually all other studies report either higher technology adoption in men or that there are no statistical differences found between genders. It is also possible that men and women use technology for different things. To sum up, it is possible to hypothesize a higher self-perceived tech savviness in men.

Big Five Inventory became a de facto standard for investigating personality traits in information systems literature. For example in Computers in Human Behavior there are more than 160 articles using the framework.

So far, there was only a limited amount of research targeting the impact of gender and of personality traits according to the Big Five Inventory on tech savviness. A search for

"tech savvy" OR "tech savviness" "big five" OR "big 5"

as a topic within Web of Science (the first disjunction in one field and the second disjunction in the another field, the two fields connected with AND) did not yield any results. The same query in Google Scholar (full-text search) resulted in about 275 hits but majority of the papers were false positives. The most relevant was (Witt, Massman and Jackson, 2011); they investigated the impact of Big Five personality traits (and self-esteem, gender, income, and race) on tech savviness, well, on frequency of use of:

- videogames (e.g. play video games on a computer, and play video games on a console);
- general computer use (e.g. create documents for school, save images/graphics);
- communication (e.g. talk on a cell phone, and instant message with friends).

There are negative aspects of technology use, such as too much time devoted to social media (Pavlíček, 2013) or to mobile phone-related activities (Chiu, 2014). Tech savviness may lead to shadow IT (Silic and Back, 2014), i.e. creating or using IT in an organization without an explicit approval from the top management or the relevant superior. These issues are not considered in this paper.

The rest of the paper is organized as follows: The next section describes the questionnaire and the analysis, the following section contains results, and the final section summarizes the findings.

2. Data and methodology

Research was focused on university students from the Czech Republic (264 respondents: 117 male and 147 female). Data were collected by an on-line questionnaire SurveyXact in between December 2016 and January 2017.

The questionnaire was split into two pages and it contained also questions which are not covered in this paper. Independent variables were on the first page, and the dependent variable was on the second page. Seven respondents stopped after the first page and one respondent provided random high numbers as answers for multiple open-ended questions - these answers were excluded from the analysis. So, the effective sample size was 256.

The dependent variable was measured using the instruction "Please indicate to what degree you agree with the following statement: I consider myself tech savvy" on a 1-5 Likert scale where 1 meant strongly disagrees and 5 stood for strongly agree.

Personality traits were identified by Rammstedt & John's (2007) Big Five Inventory-10, i.e. a 10-item version of the Big Five Inventory questionnaire developed by John & Srivastava (1999), and translated to Czech by Hřebíčková et al. (2016). The instruction for the respondent was as follows: "How well do the following statements describe your personality" with statements "I see myself as someone who..."

1. ... is reserved,
2. ... is generally trusting,
3. ... tends to be lazy,
4. ... is relaxed, handles stress well,
5. ... has few artistic interests,
6. ... is outgoing, sociable,
7. ... tends to find fault with others,
8. ... does a thorough job,
9. ... gets nervous easily,
10. ... has an active imagination

on a 1-5 Likert scale where 1 meant strongly disagrees and 5 stood for strongly agree. Extraversion was calculated as an average of the 1st (reversed-scored) and the 6th answer, agreeableness as an average of the 2nd and the 7th (reversed-scored) answer, conscientiousness as an average of the 3rd (reversed-scored) and the 8th answer, neuroticism as an average of the 4th (reversed-scored) and the 9th answer, and openness to experience as an average of the 5th (reversed-scored) and the 10th answer. Cronbach alphas for personality traits will not be reported since the Big Five Inventory-10 (Rammstedt and John, 2007) was not constructed with this statistics in mind.

A generalized linear model (GLM) was used to analyze impact of gender and of five personality traits (extraversion, agreeableness, conscientiousness, neuroticism, openness to experience) on tech savviness. A multivariate approach to testing was used. Parameter estimates tables will be provided (instead of ANOVA-style tables) in order to be able to see signs of parameter estimates (not only p-values). The results should be equivalent to a multiple linear regression model estimates in case the dummy variable is set to 1 for male and to 0 for female. R^2 and R^2_{adj} are provided in order to be transparent about how much a model explains though it may be significant. SPSS software was used for all the tests.

3. Results

Parameter estimates for the generalized linear model analyzing impact of gender and of personality traits on self-perceived tech savviness are provided in Table 1.

Table 1: Parameter estimates for the full model

Parameter	B	Std. Error	t	Sig.	Partial Eta Squared
Intercept	2.636	.552	4.774	.000	.084
Extraversion	.058	.064	.918	.359	.003
Agreeableness	-.034	.073	-.464	.643	.001
Conscientiousness	-.016	.071	-.228	.820	.000
Neuroticism	-.122	.058	-2.084	.038	.017
Openness to experience	.237	.066	3.611	.000	.050
Gender = male	.370	.128	2.878	.004	.032
Gender = female	0[a]	.	.	.	.

a. This parameter is set to zero because it is redundant.

The model per se is significant (p-value < .001), R^2 = .117, R^2_{adj} = .096 and neuroticism and openness to experience appear to be significant in this model. In (Sudzina, 2015a), the model per se was not significant (p-value = .277), R^2 = .044, R^2_{adj} = .009; p-values of all independent variables were above .1.

Carlson and Wu (2012) suggest to exclude independent variables that are not significant. Parameter estimates for the streamlined submodel are provided in Table 2.

Table 2: Parameter estimates for the streamlined model

Parameter	B	Std. Error	t	Sig.	Partial Eta Squared
Intercept	2.657	.338	7.862	.000	.197
Neuroticism	-.122	.058	-2.107	.036	.017
Openness to experience	.242	.065	3.715	.000	.052
Gender = male	.375	.125	2.988	.003	.034
Gender = female	0[a]	.	.	.	.

a. This parameter is set to zero because it is redundant.

The model per se is significant (p-value < .001), R^2 = .113, R^2_{adj} = .103 and neuroticism and openness to experience appear to be significant in this model. In (Sudzina, 2015a), the streamlined model consisting only of gender (which had the lowest p-value in the full model) was not significant (p-value = .065), R^2 = .020, R^2_{adj} = .014.

4. Conclusions

The aim of the paper was to analyze the impact of gender and of personality traits on self-perceived tech savviness.

Men believed to be more tech savvy than women. Neuroticism had a negative and openness to experience had a positive impact on self-perceived tech savviness. The result is not surprising – the gender aspect of perceived tech savviness was expected, clearly, men think of themselves as more technologically advanced. The explanation of the negative impact of neuroticism is a bit problematic, authors do not dare to come with some clarification on this matter, especially since it was the weakest one. Openness to experience, on the other hand, is quite easy to reason – since tech savviness requires work with new technologies and exploring new technological devices and trends, it is quite understandable, that this would be positively connected with this personality trait.

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ONLINE PLATFORMS - METHOD OF PROMOTING AN IT COMPANY THROUGH SOCIAL MEDIA

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Keywords

Social media, online platform, marketing strategy

Abstract

As in traditional marketing, also in the online one, once there is a well built and realistic profile of customers, marketing activities can be better targeted and have a more powerful effect. IT companies will reach that by designing a message that resonates with customer needs, leading to a lower cost of acquisition through online channels and to increased revenue.

As a result of this research, it is proposed a platform that can be used by IT companies with the aim to maintain a strong relationship with existing and potential customers. This platform will ensure their safety and availability by maintaining a focus on costumer's satisfaction. The IT companies will gain their customer's loyalty and an excellent recommendation on the future.

IT companies have usually their focus on developing products and software and often they pass over the marketing strategies suitable for promoting their work. Considering the technical profile and interests often found among IT people, more and more IT companies require leaders to build social strategies of business. The ideal employee today should be able to cope with fast changes and meet the challenges required by the company's clients. Therefore, they should have a perspective on people beyond the business objectives of communication, marketing and accountability.

For implementing an online marketing strategy it is important to invest heavily in the validation of product market. Most developers of IT products and services are tempted to substitute their own experience and needs with the end customer's. Thus, the emphasis will be on quality, relevance, and design of the posts, the added value they bring to the work and company's productivity. The structure and content of the social platform will account for performance management, as it can help to streamline processes and procedures within the company. It can also improve customer service and the products according to their requirements, even if there will be changes along the way.

1. Introduction

Creating plans and strategies for marketing today is the most challenging process of management. There is an increasing choice of interactive devices, platforms and channels that potential customers use, from smart phones and tablets to social networks and web search tools. The growth of using

the online environment by the users has declined their interest from traditional channels such as TV, print and radio, which lead to the idea of creating the platform described in this paper.

The proposed online platform will give to the employees of the IT companies that will implement it an up to date status of the customer's reviews regarding the products and services with the purpose of improving them.

Along with technological evolution, at the present moment, there is a growing number of IT companies all over the world. They are focusing on developing products and software giving the fact that the Internet is used by more and more people of all ages. That is because through online environment and the Internet, people are able to access all kind of data within seconds, breaking the boundaries between space and time. Relying their activity mostly on the online environment, people that work in this field and develop products for IT, are familiar with social media, websites and most of the online channels. This is the reason why the best promoting strategy for IT companies should be considered the online advertising.

This platform was designed to improve the company's presence in the online environment and maintain a strong relation with its clients, having access to all their opinions and preferences about products and services in real time through social networks. The platform will use modern marketing strategies to focus on the differences of product or services a company is going to offer, features and benefits. Thus, it will be established the right price of sales to maximize profits and also build strong relationships with customers.

The target of this paper is to establish the proper marketing strategy of the online marketing platform by stating delivery of products or services in ways that will satisfy the customers and gain their loyalty.

2. State of the art

Social networks are used more and more to promote business in the online environment for all type of companies and products, regardless their dimension or field. Beside the purpose of this paper, there is a considerable number of researchers which focused their attention on modern marketing strategies in order to come up with better solutions that could be used for improving the online presence of a company and increase its profitability.

The scientific literature states that social network presence of enterprises has become an important marketing tool of a company and a new challenge for companies to attract customers. Thus, to develop an online marketing platform which aims to promote IT companies and their products or services there should be taken into account its social network presence.

A proposed model by some authors is based on data collected from analyzed questionnaires, using structural equation modeling. Their results reveal that customer engagement has a direct and positive influence on customer loyalty as well as an indirect influence through customer value creation. [Zang, 2017]

Aiming to develop an online marketing platform to promote IT companies, in this paper the statistics are also given by customers but instead of using questionnaires, it is used their online behavior and comments.

Another concept related to the target of this paper consists in including the presence of entertainment. It is apparently the strongest prognosticator of response towards online media. [Wiese, 2016]

Through the internal part of the proposed platform for IT companies, the users are able to communicate with each other using chats and leaving comments. This availability can be entertaining and also delightful.

In the small and medium-sized enterprises (SMEs) the social networks usage are not a suitable choice because they do not have a responsive market orientation. However, social network usage is not directly related to SME gains; yet, it interferes in the relationship between entrepreneurial orientation and SME growth. Impressively, large companies have obtained opposite effects regarding performance-related consequences of social network usage. [Eggers, 2017]

That is why the model of the marketing platform is intended for a corporate environment.

According to other researchers, the communication through messaging between consumers is an important aspect and therefore it was implemented an application for the Secure Opportunistic Schemes (SOS) middleware permitting routing structures to be easily implemented when relieving the burden of security and connection. [Baker, 2017]

The platform described in the present research is focused on enabling the communication between all the people that have an account to access it, offering a good contribution to organizational communication efficiency.

3. Departments in an IT company

The IT field is expanding every day, together with the number of companies that are dealing with IT products and services. Their target is to find quality oriented solutions to consumers most specific IT needs and provide for other companies solutions to leave their mark in the digital space and to make sure it lasts, respecting consumer's demands. The IT companies are organized into small, medium size, national and multinational ones.

In smaller companies, there are not predefined departments for the IT activity. An IT company with a medium size or a multinational one is divided into multiple functional structures; the commercial part (sales, marketing and public relations departments), the financial structures (financial-accounting and human resources departments), logistics and the legal services, besides the software department development organized in practice according to the technical field approached.

The marketing department is the one in charge of promoting the company and its products. The experts in this field should make a market research and establish a strategy to reach the targeted customers by giving an appealing and a practical aspect to the specific of its products or services. According to its profile, an IT company will focus its attention on assembling, web programming, mobile programming, desktop programming, hardware on certain devices etc., building a marketing strategy to underline its competitive advantages. Beside the experts in marketing, there are other employees that have the responsibility to develop and maintain a web platform with the aim of attracting customers and give the company brand awareness.

Given the accelerated growth of Internet users, the Internet has become a worldwide source of information for millions of people at work, at home or at school. Changing forever the way businesses of all sizes are managed and being in a continuous process of change and innovation, the Internet has two components that have expanded recently, the mobile technology and the social web. This paper states the importance of adapting a more effective online platform to business objectives of marketing for better go with its mission, designing frameworks and solutions that will help the management team to monitor the processes and manage the information and figures quicker as everything can be mechanized and additionally accessible.

4. Social media - a decisive factor for promoting a business online

Always at hand via tablets, laptops, smartphones and other modern devices, social networks can be accessed anywhere and anytime, requiring only a network connection to the Internet and an account on the favorite social networks. Considering the time that users spend navigating on social networks, the online presence for any company, regardless of its size or field of activity on social networks has become a necessity. On the other hand, the use of promotional tools like Facebook, Twitter, Google+, Instagram, Pinterest, etc., becomes a very economical way of promoting social media, as the customers are targeted more quickly and easily.

More and more consumers use social media to find out about the experiences of other users, to learn more information about brands, products and services and find the best deals. Thus, it becomes important for companies to monitor what is said about them and their products or services on the Internet. Modern consumers expect businesses to be highly recognizable and easy to be found in the virtual environment, using social media to find out about the experiences of other users. Thus, a presence in social media allows companies to obtain more information about the advantages/disadvantages of their products and the improvements they can make. Moreover, by creating forums they allow entry into dialogue with their customers. This will give them the opportunity to solve problems that they have with services and products, earning customers loyalty and a good recommendation from them.

Most of the search engines (Google or Bing, for example) consider a company's social media presence as a key factor that will help in placing its website in the top searches. For this, the company needs a strong anchor for its posts: video, infographic, or articles with titles as descriptive as catchy. The old websites which look like a booklet get increasingly more small utility for both Internet users and for network visibility. Giving the fact that the Internet expansion has forever changed the way business is managed nowadays, all managers should consider in building company's strategy the traffic evolution forecasted by Cisco as adapted in Fig. 1 and Fig. 2. (http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/complete-white-paper-c11-481360.html)

Analyzing the social media platforms, used for connecting people and stories, it is important the understanding of the reasons why people are connecting on a specific platform. This is the point where Business to Business (B2B) it differs from Business to Consumer (B2C) marketing, building specific tactics to engage targeted people or companies starting with the platform they are using. The research elaborated for this paper revealed that, comparing the social media platforms currently used by the marketers, B2B marketers are more focused on Facebook, while for B2B marketers, Linkedin platform is apparently more advantageous. (Fig. 3 – data adapted from: http://socialmediatec.com/2017/01/14/the-true-impact-of-social-media-marketing-for-business/)

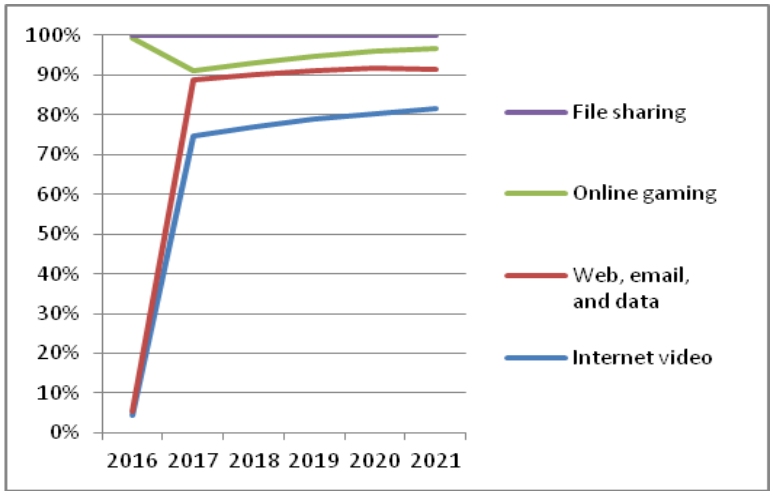

Figure 1. Global consumer internet traffic by sub segment, 2016–2021

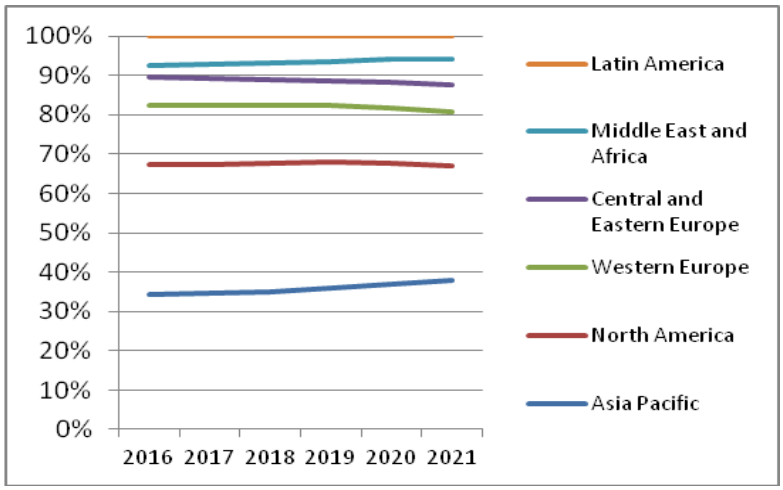

Figure 2. Global consumer internet traffic by geography, 2016–2021

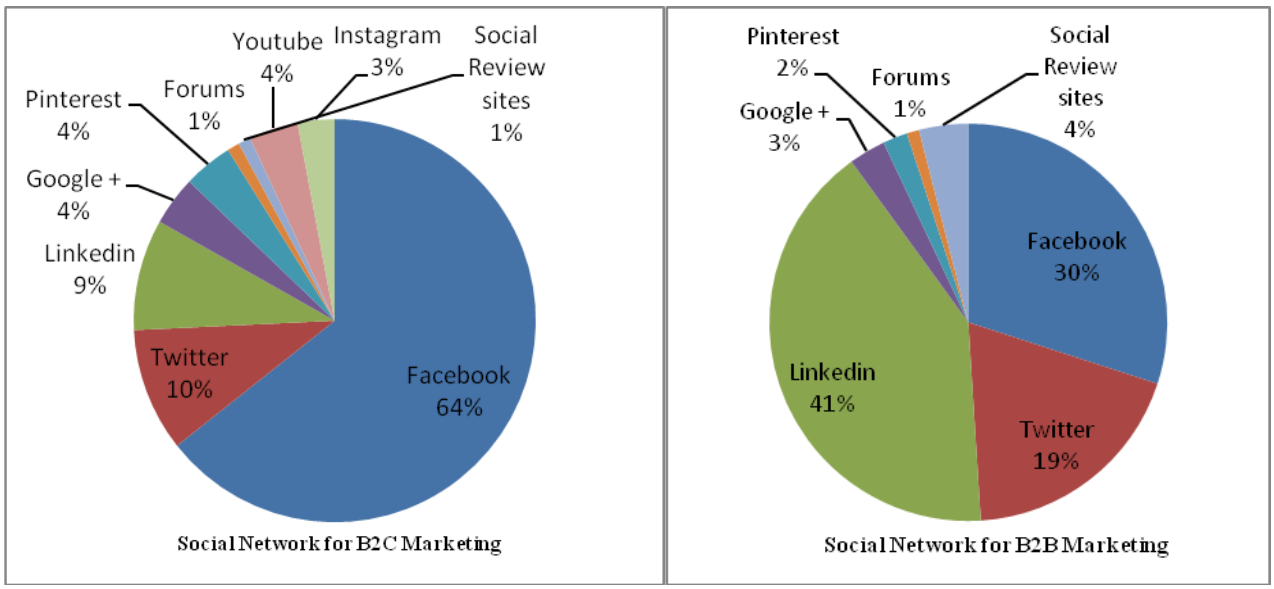

Figure 3. The usage of social networks by marketers, Business to Business (B2B) VS Business to Consumer (B2C)

5. Online platform

The aim of the platform described by this paper is to gather information provided by consumers about products or services offered by the company on all social networks in which these are promoted. Also, it is intended for the regular customers as a tool to outline the products and services of the IT companies and their characteristics and the opinion of others regarding them.

The platform will also be available within the marketing department witch needs access to customer's opinion, sharing the conclusions in meetings inside the organization. The purpose of the platform is to be accessed by users which have an account created and use it to procure products and services. The platform proposed in this paper offers transparency, a concept valued at the present moment and information about the products in a very accurate manner.

The platform proposed has the following features and screens:

1. The platform has a main page from where the user can display the information individually, depending on his choice regarding the social network, by pressing buttons such as "Facebook", "Twitter", etc. or it can be selected the option "All social networks", where is gather all data. There is a short description of the IT company and from the navigation bar it can be customized the user's profile and see the messages.

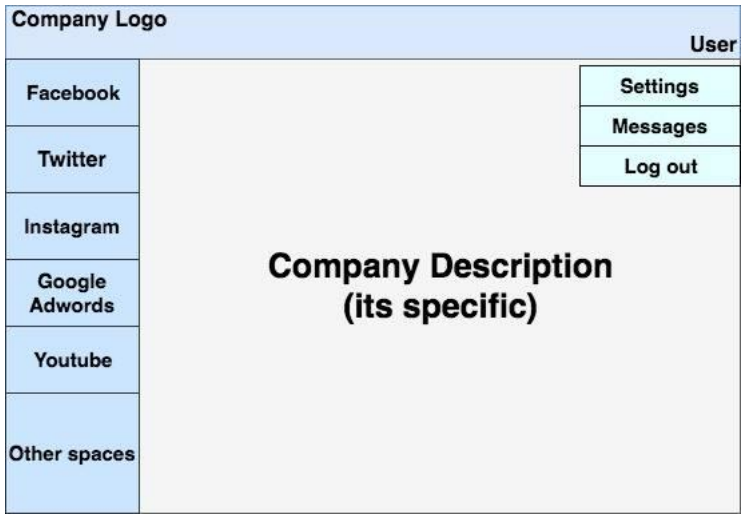

Figure 4. Main Screen of the platform

2. Each option like Facebook, Twitter redirects the user to another screen. The new one contains customer's review, likes, information about different products and services offered by the IT company. All this data is received in real time, so that customers receive quick responses to their questions or queries, but also because the marketing department can forward the conclusions made after analyzing this information in order to improve the offered products or services and the selling process of the company.

This availability and customer-company relationship is very important in the customer's point of view, who wishes to be taken into consideration and to the companies who aim to evolve and satisfy their customers.

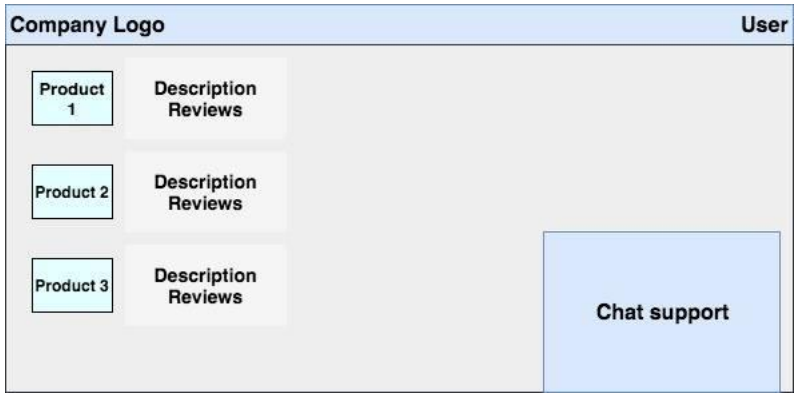

Figure 5. Descriptions Products Screen

3. Another feature of the platform consists in displaying reports and charts which reflect customer's satisfaction related to the entire company, as well as a product or service individually and it indicates the percentage of sales which is an essential market measure.

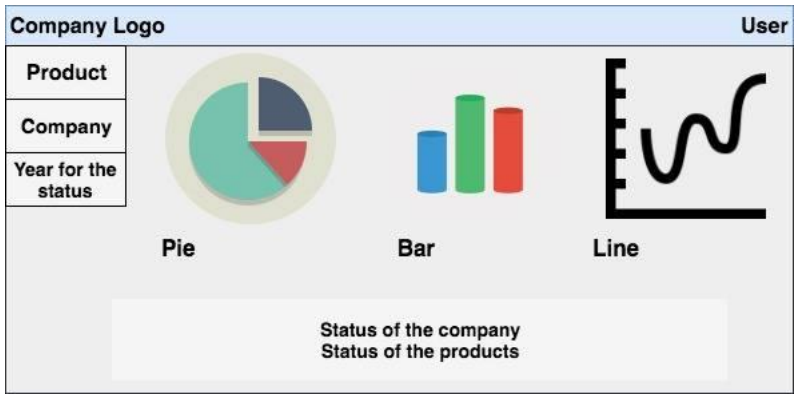

Fig. 6. Product and Company Status

There are several types of charts from which the user of the marketing department can choose, depending on the one that looks friendly in his or her opinion and by setting a certain period or year for which the statistics or reviews will be shown. Once new data is posted on one of the platforms, the content is instantly updated in the platform of the employee.

Every customer who will create an account in order to visualize or purchase products or services, will benefit of this platform, with restricted rights in comparison to an employee and also can see other people's opinions, share the personal ones and compare it with other similar products from other companies just by entering product codes from the manufacturer. Thus, the platform will outline the differences and similarities from a specialist's point of view, helping the client to make the right choice. This option does not promote other companies or products and services, but it shows to the potential clients their suitable choice. The client can easily see the advantages and disadvantages of the products from as many companies as he wishes, only by having an Internet connection and an account to the company which has this online platform implemented.

The proposed online platform was therefore designed to give to IT company new features by giving the employees of the companies and their customers, up to date reviews of the products and services, specialized support and an overview of the business's status.

6. Conclusions

As said above, Social Networks have an enormous impact in order to develop an IT business and to raise its profits. Social media generates massive information that concerns the opinion of customers in real time.

There are consistently over 500 million Tweets, 4.5 billion likes on Facebook and furthermore 95 million photographs and videos uploaded on Instagram. Behind these amazing numbers it is a considerable amount of information regarding the customers of each company - their description, their tastes, and more important, their opinion about the company's brands. Through everyday dynamic engagement and also following the Social Networks, marketers can gather information through the platform proposed about and from the clients and use it for smarter business choices.

The online platform proposed enables the company that has implemented it to accumulate the relevant amount of data from all Social Networks where the business is promoted in real time, with the aim of improving its products or services, the company's relation with its clients and building brand awareness on the market.

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SESSION E: E-HEALTH

CONQUERING FRAILTY WITH A MULTI-PERSPECTIVE APPROACH

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Keywords

Frailty prevention, system integration, social frailty, mixed methods

Abstract

My-AHA Project as an example for integrated platforms, symbiosis of interventions and individualization of support for patients.

My-AHA proposes a holistic view of age-related frailty, comprising frailty across interrelated domains of: cognition, physical function, mood, social isolation and sleep. Age-related frailty represents a major burden to older adults and social and health care systems. Early detection and intervention are crucial in sustaining active and healthy ageing (AHA) and slowing or reversing further decline. The main aim of My-AHA is to reduce frailty risk in older adults at risk of becoming frail by improving physical activity and cognitive function, psychological state, social resources, nutrition, sleep and overall well-being. It will empower older citizens to better manage their own health, resulting in healthcare cost savings. My-AHA will use state-of-the-art analytical concepts to provide new ways of health monitoring and disease prevention through individualized profiling and personalized recommendations, feedback and support.

An ICT-based platform will detect defined risks in the frailty domains early and accurately via non-stigmatising embedded sensors and data readily available in the daily living environment of older adults. When risk is detected, My-AHA will provide individually tailored ICT-based interventions with a scientific evidence base of efficacy, including vetted interventions from established providers of medical and AHA support. These interventions will be deployed in a manner designed to motivate users to participate in exercise, cognitively stimulating games and social networking to achieve long-term behavioural change, sustained by continued end user engagement with My-AHA. By this, different platforms (Smart Companion, iStoppFalls, etc.) will be connected by the My-AHA Middleware and combine information and data from different sources with a decision support system for choosing the personal interventions. The My-AHA platform will be tested in a multi-centre randomized controlled trial involving centres across Europe, Japan, South Korea and Australia.

The project is currently in Alpha phase testing. Following alpha wave testing, the RCT will commence including feasibility and manageability testing of the pre-post design. During the first project year, interventions were defined and analysed for their proven effectiveness and their chance for combination. Selection of the platforms has been completed with middleware development approaching completion. The prototype setup has been deployed with the first participants in the Alpha Wave. During this time, experience on the new data protection regulation for EU countries was gained as well as for business opportunities for the developed interventions

and results of the trial. This paper provides a short overview of the projects approach and current status.

1. Introduction

1.1. The Project

My-AHA is a project funded under Horizon 2020 and commenced in Jan. 2016. With a holistic approach of the understanding of frailty by comprising a combination of physical, cognitive, psychological and social domains, a multidisciplinary team consisting of medical, psychological, physiological and social scientists across Europe, in Japan, Korea and Australia is developing and testing this innovative platform.

1.2. Aim

The main aim of My-AHA is to reduce frailty risk by improving physical activity and cognitive function, psychological state, social resources, nutrition, sleep and overall well-being. It will empower older citizens to better manage their own health, resulting in healthcare cost savings. My-AHA will use state-of-the-art analytical concepts to provide new ways of health monitoring and disease prevention through individualized profiling and personalized recommendations, feedback and support.

1.3. Approach

An ICT-based platform will detect defined risks in the frailty domains early and accurately via non-stigmatising embedded sensors and data readily available in the daily living environment of older adults. When risk is detected, My-AHA will provide individually-tailored ICT-based interventions with a scientific evidence base of efficacy, including vetted offerings from established providers of medical and AHA support. These interventions will follow an integrated approach to motivate users to participate in exercise, cognitively stimulating games and social networking to achieve long-term behavioral change, sustained by continued end user engagement with My-AHA.

2. Methodology

In a mixed consortium of technicians, social scientists, physiologists, medical doctors, psychologists and many more, it is natural to have a mixed method approach. Each discipline is contributing to the evaluation and all are following the same aim: proof of effect by intervention. The interventions are a set of multi-discipline approaches to fight frailty and to reduce the risk factors from different areas of frailty. In My-AHA it was decided on to follow the design of a multicentre randomized controlled trial (RCT) (Chalmers et al., 1981; Schulz et al., 2010) for the interventions to proof the increased effect interventions. The multicentre randomized controlled trial (RCT) will be carried out in different European and non-European countries with a total number of 600 participants: 300 control participants and 300 participants in the intervention group. The multicentre RCT will involve international centres from Austria, Germany, Spain, Italy, UK, Belgium, Sweden, Japan, South Korea and Australia. In addition, the RCT will work with parallel-groups at the local level, indicating that the RCT is also clustered and is pragmatic(Zwarenstein et al., 2008).

An Alpha-Wave (pilot testing) phase is being conducted in Italy, Spain, Germany and Austria to test the system set up, the general usability and user experience as well as the handling of

assessment tools as well as the intervention acceptance and manageability of several test batteries at one shot. After the Alpha-Wave delivers results to developers and test sites, the assessment instruments and intervention structures will be modified if required prior to be finalised for implementation in the RCT.

2.1. Clustering of Interventions

My-AHA will deploy interventions targeting different frailty domains. Each domain has specific requirements that have to be taken into account. To the best of our knowledge, cross-domain interaction effects have not previously been examined, however some of the interventions selected contain elements suggestive of multiple-domain targets.

An evidence-based process was used to select interventions to be deployed in the my-AHA trial. Each intervention has evidence to support efficacy for participants. Physical interventions include FAME training (Skelton et al., 2005) as well as endurance and strength training (Buchner et al., 1997). Social interventions are taken from multiple approaches for conquering risk factors for social isolation and loneliness (Dickens et al., 2011; Hawthorne, 2006; Masi et al., 2011). Next to inevitable risk factors in the social domain like the loss of loved people, addiction related aspects like smoking and alcohol abuse or health problems (urinary incontinence (Mv et al., 2003), colorectal cancer (Cornwell and Waite, 2009) and functional disabilities(Glass et al., 2006)) factors like education and early retirement are providing a bigger picture to design interventions. As interventions chosen, senior cafés and self-help groups are established at each trial site together with different additional activities like cooking classes or inter-domain interventions (card playing groups, hiking groups etc.). For cognitive interventions two methods have been selected for My-AHA: working memory training(Buschkuehl et al., 2008) and cognitive bias modification therapy(Hallion and Ruscio, 2011).

2.2. System Architecture Overview

A combination of existing software packages: iStoppFalls for exergames, SmartCompanion System,VitalinQ, Meidsana's Vitadoc, JINS MEME eyeglasses will be utilised. Additional data collection (blood pressure, blood sugar, activities, heartrate) will be incorporated into the system. System architecture will incorporate risk models from domain experts as analog versions, system security, network security, application security, cryptography.

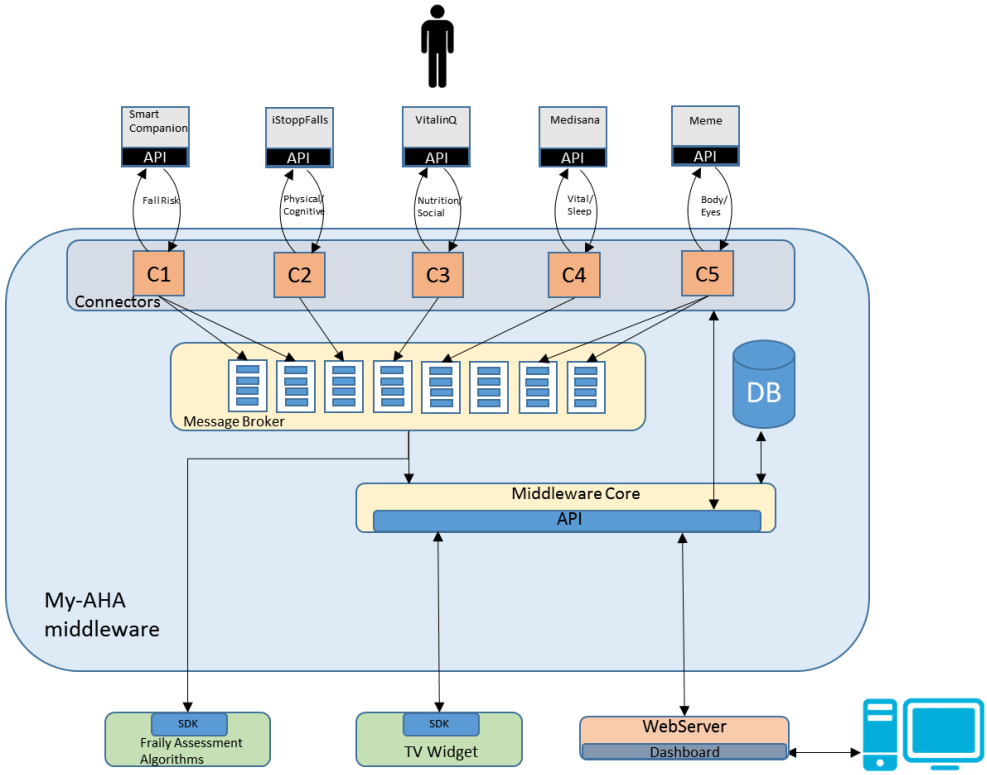
Middleware using JSON will be developed for storing measurements and integrating the various software platforms in use.

When designing the architecture for the My-AHA solution, the choice of technologies is subject to strict criteria in order to minimize the risks. Factors like stability, maturity, scalability, interoperability, licensing, etc., were properly considered when selecting the tools.

The proposed architecture for My-AHA is a message-driven architecture. A message broker, which is the core, provides several message topics, each one associated with a parameter considered for frailty assessment that can be extracted from one of the existing solutions. The broker works in a publish/subscribe model and each topic should allow an unlimited number of subscribers who wish to receive the data for any specific purpose. This requires a layer of security in order to prevent unauthorized users to access sensitive information. To ease the interaction with the message broker, an SDK is provided in order to avoid for third-parties to deal with technical specificities.

On top of the message broker, several modules ("connectors") are responsible to communicate with the existing solutions, using their API and dealing with the respective authentication/authorization mechanisms. The connectors will check periodically the users registered in My-AHA platform who have valid accounts for each solution and fetch the data from them. The data from each solution is

decomposed into the supported parameters and sent to the proper topic in a pre-defined format, so that it becomes platform-agnostic. These connectors will run as a multi-threaded independent process in the My-AHA server, which will run periodically, more specifically on a daily basis.



No component will interact directly with the middleware core, only through a RESTful API that will be responsible for fetching the wanted data from the database, which stores all the user profiles, data retrieved from original solutions, knowledge and recommendations generated by the decision support system and complementary algorithms for frailty assessment. As the original solutions' data and respective structure is very different from each other and will not be modified, it is required a database with flexible models to put them all together, hence the use of NoSQL in this system.

The RESTful API has a security layer in order to restrict the access to those who are not authorized or do not have access to perform some actions and will provide the needed methods for the dashboard in order to manage and visualize the user's information and data in a more user-friendly way.

3. Statusreport

My-AHA started in January 2016 and will last until December 2019. At the time of writing the paper the first year has passed and was mainly devoted to developing of interfaces and defining of risk models. The next part of the project is about testing the platform and interventions and prepare the randomized controlled trial for the third and fourth year.

3.1. Challenges

For the preparation of the Alpha Wave, we experienced challenges arising from changes to data protection law from the new European data protection regulation as well as by ethical requirements for the recruitment and inclusion/exclusion criteria. Cross-disciplinary factors have the potential for

generating conflicts in understanding due to differences in priorities and ethical requirements. Ethics are of greater concern to care providers and medical/social scientists than for software developers. Data protection is perceived from different perspectives; from software engineering to structural setups of databases. In the process of selecting interventions, marked differences emerged in the evaluation of psychological interventions compared to the evaluation of social interventions as result of the application of different models (e.g., for psychological interventions clear experimental approaches were found whereas in the social interventions mostly project reports about lessons learned could be found). In the psychological domain, most of the interventions are developed in a top-down manner by scientists and therapists for patients. In the social domain, a bottom-up approach is prevalent, with primary and secondary users developing interventions from a practical direction.

A challenge in the Alpha-wave was to identify assessment tools validated across multiple languages. As each questionnaire has to be provided in a validated version in English, German, Italian, Spanish, Dutch, French and Swedish for the European Partners, as well as Japanese and Korean versions. To find or to translate questionnaires and evaluation tools is a significant problem in multi-centred trials across countries.

3.2. Problems solved

The development process was marked by bridging of different sorts. Once the interfaces between different software systems through the middleware had to be solved. Each application had to be translated as well in the trial languages. For the Alpha Wave translations for Italian, Spanish and German were available. in advance of the RCT commencing the majority of language versions for the European trials are tested. The assessment instruments being tested in the Alpha Wave vary across test sites so as to fully assess multiple assessment forms. A challenge for this Alpha Wave phase is the coordination of which tests are being examined in which Alpha Wave site to ensure that all measures being considered for the RCT are fully evaluated. Nevertheless a setup for the alpha wave has been agreed on and will commence as soon as the final system tests passed the quality check.

For the translation of questionnaires that are not available in all languages, the system of reverse-translation is used to ensure at least a common basic level of quality assurance. Reverse translation is a method where a translated text is independently translated back to the original language and compared with the original. This allows some sort of accuracy check. It is not a substitute for a complete validation process but at least something that can be done during a project time to have a useful tool if no validated translation is available.

International recruitment seemed to be one of the main problems that could occur. It proved most valuable to use a large network of Johanniter as an international active care organization to get in contact with trial sites across Europe. The topic of frailty prevention hit the right spot in most of the wanted testing areas and was well accepted. A problem that showed up was the motivation to keep people involved as the development had some delays and the people could not start what they intended to do right away. To make volunteering participants understand the problems of delays of an international project is troublesome. But a process-oriented project management would take to many downtimes in the project runtime and unnecessarily prolong actions. By this, it is a problem still to be solved and permanently to be watched to keep the gaps between expected interventions and developments as tight as possible.

Information about the project can be found at www.activeageing.unito.it and at https://www.facebook.com/myactiveageing/ .

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UTILIZATION OF ICT IN HOSPITAL HUMAN RESOURCES MANAGEMENT

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ICT, health care, human resources management, employee satisfaction

Abstract

The Faculty of Health Studies cooperates on a long-term basis with 5 hospitals in the Pardubice region, which are joined into one joint-stock company. One of the topics of the mutual projects is evaluation of employee satisfaction. Hospital is required to evaluate employee satisfaction as one of the quality management standards in the legislation. The aim of the project was to find a system for employee satisfaction assessment including an effective ICT setting. This article introduces how this system can be set up.

1. Introduction

ICT forms an information spine of a successful medical care, belongs among standard means assisting in life-saving actions, primarily thanks to their versatile utilisation, provides continuous access to important information and improving efficiency of single medical and administrative processes. Health monitoring and IS/ICT facilities surveyed by European Union show that there is a certain potential for improvement in the Czech Republic (Potančok et all., 2015). However, in the Czech hospitals there are certain barriers to successful ICT development predominantly related to financial and human recourses (Antlová, 2013). The collaboration with the faculty can overcome these barriers.

One of the standards increasing the quality in the inpatient ward care is the standard evaluating the employee satisfaction. This standard is based on the legislative setting of the quality of care assessment. The quality assessment and safety in healthcare in the Czech Republic is legislatively enshrined by the Ministry of Health of the Czech Republic (MZČR) in Act no. 372/2011Sb, On Health Services and Conditions of their Provision (Act on Health Services). Within this act the provider is obliged to assure quality and safety of healthcare according to article 47 paragraph 3 letter b) by means of introducing internal system of quality assessment and assessment of healthcare safety (Act no. 372/2011 Sb. MZČR, 2011). The conditions for employee satisfaction monitoring are determined only in general terms and these standards are also implemented by the Joint Accreditation Board (Joint Accreditation Board, 2013).

On the other hand the interest in the issues of the job satisfaction of the medical staff is increasing recently. And it is mainly because of the persisting lack of doctors and nurses. In particular, nursing shortage is a worldwide phenomenon and it is expected to increase (Van Eyck, 2003 in Hasselhorn et al., 2005). The growing demand for nurses is the result of economic expansion, population growth, ageing population, technological advances, and higher patient expectations (Simoens, 2005). The data from Eurostat show a decreasing average number of nurses per 100 000 inhabitants in European countries (including the Czech Republic) from 2012 to 2014 (Eurostat, 2016). According to the data of the Czech Nurses Association (CAS), 5 000 nurses and paramedical assistants were missing in the Czech health care system in 2008 (Bezděková, 2008). CAS described the underfinancing of the health care with the impact on the inadequate financial remuneration, especially of nurses, as the main cause of this situation. Information of the Institute of Health Information and Statistics of the Czech Republic (www.uzis.cz) demonstrates a long-term decrease of nurses. The shortage of nurses is considered to be a society-wide problem, but there has not been realized a research yet that would bring a complete overview of the factors affecting the shortage of nurses. Medical facilities are recently facing the problem how to gain and keep qualified and motivated staff. Bártová (2006) mentions that employee satisfaction influences functioning of medical organizations as well as their results. Satisfied employees lead to satisfied patients who are the main target of medical facilities. Monitoring the employee satisfaction is the crucial supposition for successful of human resources management, it is an important source of information and it provides the management the efficient feedback.

Job satisfaction is related to many aspects of the performed job. It is a positive emotional state resulting from job evaluation or work experience (Locke, 1976 in Arnold et al., 2007). Employee satisfaction is reflected in their own engagement. The engagement is, therefore, the resulting effect of employee satisfaction for the employer, as a satisfied employee may not have the incentive to give the best performance for the organization (Gallup, 2008). According to Armstrong (2007) engagement appears when people are devoted to their job and are interested in what they do. Engaged behaviour manifests itself in the form of a trust in the organization, spreading its good name, showing the interest in one's own work, an effort to work in the way to improve things, cooperating closely with colleagues to improve job performance, etc. (Gallup, 2008).

As Holá (2011) mentions, engagement is based on a good quality management and effective internal communication, which creates a social climate for a job performance. Based on Škrla, Škrlová (2003), the satisfaction and the engagement of employees in health care influence the quality of results of their performance, decrease the probability of errors and influence the attitude towards the medical profession. Denison (1990) presents that dissatisfied and disengaged employees may show higher level of absence, lower productivity, bad morale, higher fluctuation, etc. These may result in worse results of the whole medical organization.

Providing health care and improving its quality is influenced by a specific social climate of the work place characterized by relationships between employees and the organization and among the

employees themselves. Relationships at the workplace are based on the values and standards shared by the members of the organization which influence upon their behaviour (Arnold et al., 2007). The healthy social climate is according to Cejthamer and Dědina (2010) characterized by good interpersonal relationships, mutual trust and open discussion, appropriate management behaviour and appropriate control style, opportunities for personal and career promotion, identification with the organization and employee loyalty, etc. An important role in the creation of the social climate as a positive stimulant is played by the management communication and creation of desirable communication environment (D´Aprix, 2006). The role of the management is to constantly cultivate and protect the social climate so as not to endanger the quality of the provided health care. According to Bedrnová (2013) unfavourable social climate can aggravate the fulfilment of the organization targets, lead to low engagement of the staff, influence negatively the relationships at the workplace and lead to conflicts. It can also intensify job dissatisfaction and subsequently increase employee fluctuation.

The above mentioned shows that healthy social climate and organization culture are important factors for development and prospects of medical facilities. It is also important to accept the job satisfaction as one of the assumptions creating positive attitude towards work and providing good quality of health care. The issue of quality management in modern medical facilities is becoming a theme of scientific researches. It is happening due to the fact that quality management forms a part of coordinated processes of health care and its aim is to minimize risks of adverse events and to determine good practice. Quality of care, especially the care provided by doctors and also paramedical staff is a topical subject. As stated by Škrla and Škrlová (2003), the quality of modern healthcare also represents the satisfaction of requirements that the patient decides. However, as De Pelsmaker (2003) states, the client is also an employee creating an internal organization with which it is important to build a good relationship. So in order to maintain the quality assurance in medical facilities, the employee satisfaction needs to be monitored, assessed, and increased.

2. Setting up the basic system for monitoring employee satisfaction evaluation

The goal of the project was to set the system for employee satisfaction monitoring in a way which can be feasible in acute care hospitals in each professional groups of employees. The selected setting must provide a wide feedback for improvement of HRM for benchmarking of individual hospitals. Considering the fact that all the involved hospitals currently belong to one organisation and all hospitals are currently accredited by the Joint Accreditation Board, it was necessary to create a consistent tool for data collection, analysis and interpretation.

Each of the hospitals used their own system of employee satisfaction evaluation. None of the 5 hospitals realised a blanket survey. Each year the hospitals focused on a specific topic for a specific group of employees, or held a survey of employee satisfaction with hospital catering. Since 2015 all the 5 acute care hospitals have belonged to one joint-stock company whose management seeks maximum efficiency across the company. It means the implementation of many changes in short time. The management encourages open communication and implementation of changes. Through a unified satisfaction survey they try to detect factors influencing satisfaction, respectively employee engagement. The aim of the survey was to check whether the employees perceived the creation of one company as advantageous, whether they accepted the common targets and the changes.

An important criterion for the creation of the evaluation system was the implementation of benchmarking to seek the best practices in the individual hospitals, respectively professions. Within the framework of all the requirements, a project was developed for the employee satisfaction assessment system. The framework of the project aimed at finding a suitable methodology for assessment of employee satisfaction as follows: to create a questionnaire, to create the methodology

for data collection, data processing, data analysis and data interpretation. The whole project relied on the IT/IS facilities of the hospitals and the university. The hospitals were allocated certain capacity on the university server and LimeSurvey system was made available for the data collection. The questionnaire validation and data validation were checked through a pilot study in the hospitals via tablets connected on-line. The pilot survey was run to prove the validity and the reliability of the questionnaire for employees. Data were evaluated using statistics in every single hospital and they were further analysed in comparison with individual hospitals using contingence tables.

Within the system, the emphasis was put on the fact that the basic tool for data collection – questionnaire, was to fulfil the elementary criteria of the indicators according to Gladkij (2003), which provide sufficient validity, practicality, sensitivity, and specificity.

The questionnaire was created on the basis of the standardised questionnaires Gallup Employee Engagement (Gallup Consulting; 2008) considering the specific requirements of the top management and it was approved by the quality team. The questionnaire contained individual domains of satisfaction evaluation, and each of them was represented by several questions. The respondents expressed the level of their agreement with the satisfaction on the Likert scale from 1 to 5 and the range from 1 to 2 was considered as a positive evaluation. The individual domains were focused on the basic factors influencing the employee satisfaction:

1. Level of formal setting of the work performance.
2. Education, professional and career growth.
3. Level of management control.
4. Level of engagement and potential for innovation and cooperation.
5. Level of self-realization, satisfaction with personal and professional development.
6. Level of belonging to the organization.

The meaning of the domains was checked in the last part of the questionnaire (D7). The purpose of this part was to prove that the chosen domains of evaluation were really important for employees. Respondents' classification criteria were chosen with the reference to the required benchmarking results: the affiliation of the respondent to the hospital, the professional group (doctors, paramedical staff, others) and the type of workplace (internal, surgical, complementary, ARO, ambulance, non-medical departments). The length of the employment and job classification (manager, employee) were also chosen.

3. The first survey of employee satisfaction and the chosen results

The survey was realized in December 2015 and January 2016 in all 5 hospitals of Hospitals of the Pardubice region. The whole population of the hospitals were questioned. The data were collected through anonymous online questionnaires; each of the addressed respondents received a generated unique password and they all could fill in the questionnaire just once. The total number of employees in the individual hospitals based on the professional groups was 4595 to the date 31 December, 2015; 2100 of them participated in the survey, but the number of finished and valid questionnaires included into the evaluation was 1564, it means 34 %.

The representation of the individual professional groups roughly corresponds with the proportional representation of the employees. The biggest part is made by the paramedical staff, then it is the other employees and the smallest part is made by the doctors. The division of the sample of the employees in the professional groups and in the individual hospitals is shown in Table 1.

Table 2 shows the total evaluation of individual domains in the hospitals. Based on the average values, it can be presumed that the most positive evaluation in all the hospitals is shown in the domain D1 Level of formal setting of the work performance. All the other domains reach the average evaluation higher than 2.¨

Table 1 Contingency table: number of employees in professional groups in the individual hospitals – sample

Hospital	Position (Paramedical staff)	Position (Doctor)	Position (Non-medical)	**TOTAL**
Hospital A	165	13	27	**205**
	80,49%	6,34%	13,17%	
Hospital B	186	24	42	**252**
	73,81%	9,52%	16,67%	
Hospital C	418	79	81	**578**
	72,32%	13,67%	14,01%	
Hospital D	215	32	35	**282**
	76,24%	11,35%	12,41%	
Hospital E	194	26	27	**247**
	78,54%	10,53%	10,93%	
TOTAL	**1178**	**174**	**212**	**1564**

The worst evaluation is in the domain D6 Level of belonging to the organization. The evaluation of the respondents from the hospital A is the worst in all the domains among all the respondents (i.e. they are satisfied the least). Table 3 shows the evaluation of the individual domains in the professional groups. Doctors were the most critical, especially in the domain D6 Level of belonging to the organization, where the assessment reached nearly the value 3, i.e. negative evaluation. The doctors expressed criticism in the questions of trust in the top management (only 14 % in the positive zone). On the other hand, the doctors gave the best assessment in the domain D1 Level of formal setting of the work performance and in D2 Education, professional and career growth. Among the paramedical staff the positive evaluation appeared only in the domain D1, too. The other employees gave the lowest assessment in the domain D4 Level of engagement and potential for innovation and cooperation.

Table 2 Average value of the individual assessed domains in the hospitals

HOSPITAL	D1	D2	D3	D4	D5	D6	**weighted mean**
Hospital A	1,861	2,459	2,639	2,510	2,369	2,711	**2,407**
Hospital B	1,748	2,051	2,276	2,484	2,083	2,575	**2,223**
Hospital C	1,765	2,209	2,476	2,455	2,205	2,541	**2,262**
Hospital D	1,806	2,246	2,277	2,494	2,245	2,694	**2,298**
Hospital E	1,689	2,146	2,439	2,466	2,185	2,778	**2,299**
weighted mean	**1,776**	**2,218**	**2,385**	**2,484**	**2,218**	**2,668**	**2,295**

Within the data evaluation, almost 260 contingency tables were processed. The contingency tables contain various combinations of frequencies of answers to each question in groups of employees according to the chosen criteria.

Table 3 Average value of the individual assessed domains in the professional groups

PROFESSION	D1	D2	D3	D4	D5	D6	**weighted mean**
DOCTOR	1,953	2,000	2,393	2,517	2,292	2,819	**2,349**
PARAMEDICAL STAFF	1,745	2,210	2,380	2,472	2,219	2,683	**2,291**
OTHER	1,805	2,442	2,402	2,519	2,150	2,465	**2,272**
weighted mean	**1,776**	**2,218**	**2,385**	**2,484**	**2,218**	**2,668**	**2,295**

These results lead to other conclusions. For instance, which professional groups are given the best level of job performance and in which hospitals, which professional groups are most and least satisfied with the support of their education, professional and career growth, with the level of the top management control, with the level of engagement and the state of potential for innovations, which hospitals and which professional groups feel the highest belonging to the organization. It is also very interesting to compare the assessment of the top managers and the other employees. The managers are more satisfied in all the assessed domains. The other important result is the monitoring of the satisfaction in the groups based on the length of the employment. The most satisfied group are employees who work in the organization more than 10 years. All the data analysis were processed in STATISTICA© thanks to the online connection between the hospital and the university, thanks to migration of data between the collecting survey system and the statistical software, and the university cloud storage allowed the respondents as well as the top management to work with the data nonstop with the sufficient user's comfort.

4. Discussion

The data in the survey provide the management a lot of inspiring conclusions. These results show not only how employees are satisfied with the given area but also how important the area is for them. These results can also contribute to the choice of important factors which might attract the attention in the future. The questionnaire provided an option of open questions at the end that allowed further comments and suggestions. This option was used by 405 employees, which made 25.9 % of all the answers. All the groups reached an agreement that the evaluation of the importance of the assessed domains was highly important. More detailed analysis then shows that the most important aspects influencing personal satisfaction are for all the groups the same and they are good cooperation at workplace (85 % of the respondents regard it as highly important) and friendly interpersonal relations (80 % of the respondents regard it as highly important). The financial evaluation as an important aspect appears at the 7th place the highest. The employees rather prefer correct relations with the superiors, observing the ethical standards, sufficient number of staff and adequately equipped workplace.

The majority of Czech hospitals prepare their own ad hoc evaluation of employee satisfaction in order to fulfil the accreditation standards. Some hospitals use the service of HCI Health Care Institute (2015), which offers evaluation of employee satisfaction as a commercial service. This evaluation, however, does not provide a validation of the data collection methodology nor the questionnaire. The authors believe that even the system for evaluation of satisfaction should follow the requirements for the result validation. The system must be sensitive enough, which means it

must be able to detect changes, must be practical in the user's comfort of data collection and evaluation and specific in order to focus on specific and current pro

blems. In agreement with Von Eiff (2015) they can also confirm that it is necessary to take the current situations in the organizations into consideration and to keep the set system for the benchmarking and evaluation in timelines. The absence of the system makes the relevant evaluation impossible and it also makes the credibility of the results impossible.

Setting the system also includes the evaluation of the feedback and realization of the recommendations for improvement. If these phases are omitted, the number of respondents will decrease in the future, as well as the credibility of the whole measuring, as evidenced by Amstrong (2008) and Holá and Pikhart (2014), who consider evaluation of satisfaction to be a part of building the open communication. It is an essential condition of the effective internal communication, just like effective usage of ICT in an organization. Setting these two quantities clearly contributes to increasing the engagement of the employees and the prosperity of the organization, as evidenced by Yates (2006) and Holá and Čapek (2014). Setting the system is another important activity showing the cooperation between the Hospitals of the Pardubice region and the Faculty of Health Studies, University of Pardubice, that also participated in setting the system for evaluation of patient satisfaction (Holá, Čapek, Pavlová, 2016).

5. Conclusion

The Hospitals of Pardubice region, a joint-stock company, is an organization that was founded on 31st December, 2014 integrating five acute care hospitals in the Pardubice region. Currently the hospitals have used a unified tool and methodology for the assessment of patient satisfaction with hospital care since 2015 and a unified tool and methodology for the assessment of employee satisfaction. Both the systems are based on the efficient utilisation of ICT and they were created within the cooperation with the Faculty of Health Studies, University of Pardubice. ICT definitely contributes to fulfilment of all the criteria. It would be impossible to ensure the validity of data collection (online, anonymity, unique password, pilot survey via tablets) without using the ICT. Technologies definitely bolstered the functionality and availability for all those who were involved. There is no doubt that thanks to technologies the system has been validated and made more efficient.

The system set for monitoring and evaluating the employee satisfaction definitely contributed not only to streamlining of HRM but also to building good relations between the management and employees. The first surveys realized within the set system showed that there were many impulses for improvement. This system, however, brings also possibilities for benchmarking, and finding and sharing best practices in all five hospitals. That makes the system a strong tool for the top management and for monitoring the current satisfaction and engagement of employees as well as possible increase. The system also enables data collection and keeping the data for further research. The authors of the article are planning more extensive exploratory analyses in the future, the results of which would extend the know-how in HRM in the health care.

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METHODOLOGY OF E-HEALTH IMPLEMENTATION TO HEALTHCARE FACILITIES

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Keywords

eHealth, health, health information systems, health information technology, telemedicine

Abstract

Currently, eHealth can contribute to improvements in the quality of patient care, the elimination of risks, work efficiency, financial savings and assisted living. Wider implementation of eHealth has not yet been successful in many healthcare facilities. The aim of this paper is, therefore, to design a methodology of eHealth implementation. Qualitative research, namely a case study, has been used to define prerequisites to the methodology. The study design and methodology are based on the MBI (Management of Business Informatics) model. The final structure of the methodology covers factors, scenarios and tasks of implementing eHealth solutions.

1. Introduction

Aging population (United Nations, 2015) and a growing number of patients with chronical diseases (World Health Organization, 2005) require healthcare facilities to implement new healthcare concepts using information systems / information and communication technologies (IS/ICT). Currently, one of the most trending concepts is assisted living supported by eHealth (Stephanie et al., 2011).

According to the Czech Statistical Office, 88% Czech-based physicians use the Internet in their offices, 56% have high-speed Internet, 29% have their own websites, and only 10% provide online ordering and consultation (ČSÚ, 2014). Unfortunately, many physicians, healthcare professionals and patients share negative attitudes to and prejudices against the use of new technologies (IS/ICT) in healthcare. Further expansion of eHealth is also impeded by the shortcomings in the definition of national strategies, the failures of big projects in the past, the lack of enthusiasm of medical staff and patients, and by too many organizations influencing the eHealth sector.

The main aim of this paper is to design a methodology for implementing eHealth or existing elements of eHealth to outpatient healthcare facilities (primary care, i.e., independent physicians' offices).

There are 24,542 outpatient healthcare facilities in the Czech Republic, including both state and private facilities, with the total of 55,379 employees (UZIS, 2012) providing care to patients from all over the Czech Republic. The following research methods have been used: first, eHealth implementation barriers and challenges were analyzed using existing literature; second,

a methodology of eHealth implementation was created based on a pilot case study and the MBI (Management of Business Informatics) model (MBI, 2015b). An outpatient healthcare facility (Feige et al., 2013) was selected for the case study. It is a typical Czech outpatient facility, which provides general medical services. As part of the case study, interviews with stakeholders (patients, managers and staff) were conducted. The average length of an interview was 40 minutes. The beginning of each interview was unstructured to get as much information and opinions about eHealth as possible, followed by a semi-structured part with questions about the implementation of eHealth. Other sources of information included national eHealth strategies (MZ ČR, 2016), internal notes, meeting minutes, annual reports and organization structure. The research is fully consistent with the definition of a case study as a qualitative research method within the exploratory and theory-building phase presented by (Myers, 2013) and (Yin, 2009).

2. eHealth and assisted living

eHealth entails the implementation of information systems and information and communication technologies (IS/ICT), processes and services to all levels of patient care. G. Eysenbach defines eHealth as *"an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterizes not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve healthcare locally, regionally, and worldwide by using information and communication technology." (Eysenbach, 2001)*

Assisted living aiming *"to extend the time which elderly people can live independently in their preferred environment using ICT technologies for personal healthcare" (Memon et al., 2014)* is closely connected to eHealth. Assisted living offers many possibilities for the application of eHealth (Hanke et al., 2011), using its tools, standards, network protocols, and middleware technologies (Memon et al., 2014). The growing trend of personal monitoring and assisted living (Kumari et al., 2017), (Milenković et al., 2006) stimulates eHealth implementation into healthcare facilities and their processes.

3. Current situation of eHealth implementation

The benefits of eHealth have been studied and proven by several studies (Ilminen, 2003) and (Kunstová et al., 2013). Unfortunately, the implementation of eHealth and its elements has not yet been successful in many countries of the European Union (EU) (e.g., the Czech Republic, Slovakia and Poland). (Potančok, 2015a) Figure 1 shows the eHealth implementation rate of the EU 27+3 (n=1753), the Czech Republic (n=20) and Sweden (n=26). The Czech Republic is where the case study has been carried out; Sweden has been selected as the leading country in eHealth implementation to demonstrate the difference in the rate of eHealth implementation within the EU.

The findings of the case study confirm which psychological aspects and barriers related to eHealth implementation (Potančok, 2015a) should be considered when planning eHealth projects. In the interviews carried out as part of the case study, doctors often mentioned problems with previous projects and concerns about negative impacts on their core processes. The following psychological aspects and barriers have been confirmed as the most important: fear and concern, distrust, motivation, expectations, core work vs new work, misunderstanding. As such, they need to be taken into consideration when creating a methodology for eHealth implementation and are the reason a methodology for eHealth implementation to healthcare facilities is needed.

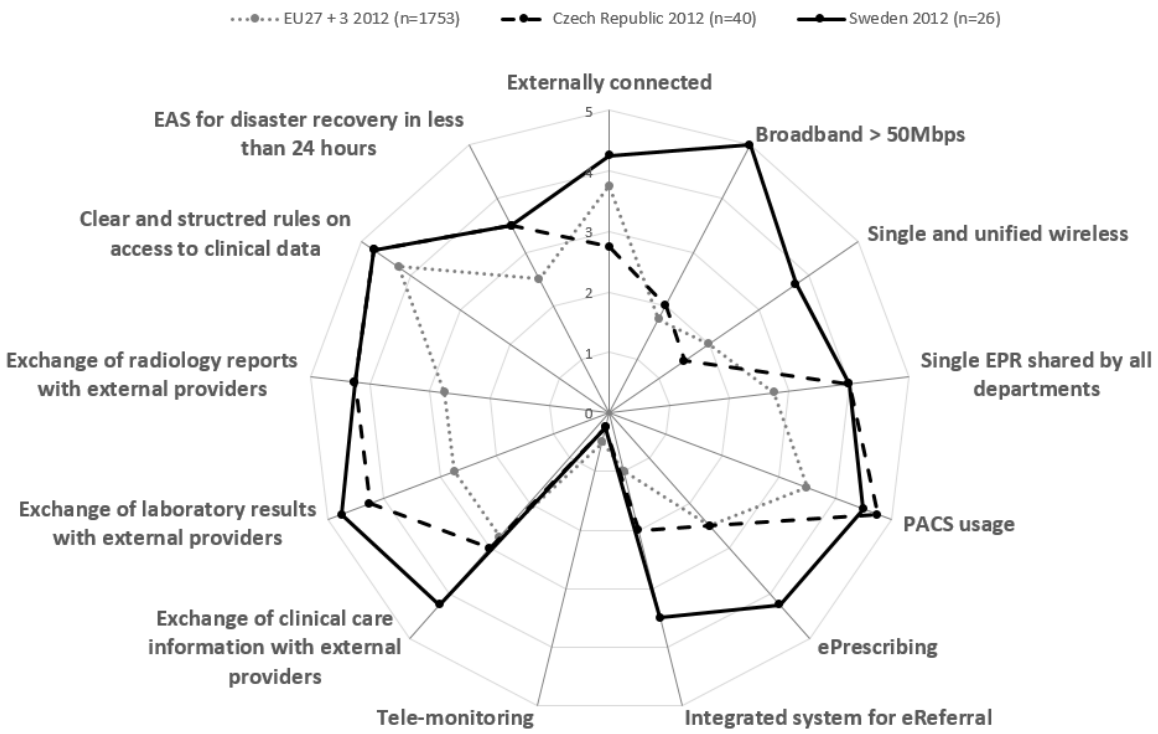

Figure 1: eHealth profiles, data source (Sabes-Figuera, 2013)

4. Methodology of eHealth implementation

eHealth requires a precise and comprehensive methodology of implementation to healthcare facilities. The right methodology of eHealth implementation can tackle psychological aspects and barriers related to eHealth implementation (e.g., fear and concern, misunderstanding, etc.). Although, many methodologies for the implementation of IS/ICT are used in the commercial (manufacturing) sector (Voříšek et al., 2008), (MBI, 2015b), there is no comprehensive methodology for the healthcare sector.

It is necessary to design a suitable methodology which will take into account the specifics of the healthcare environment. (Potančok, 2015b) Some of the existing general methodologies can be used and extended to healthcare. The MBI (Management of Business Informatics) model (MBI, 2015b) has been chosen for the initial implementation of eHealth elements to outpatient healthcare facilities. The MBI model is a flexible business informatics management methodology, which includes best practice guidelines for specific industries; healthcare can be one of them considering the characteristics of the model. The MBI model consists of the following components (Voříšek et al., 2015):

- Factors

Factors have a significant impact on the way a particular task is performed. The most important factors include: organization size, industry sector (where the organization operates) and organization type (i.e., a private company or a public institution). Consider, for example, how the following task, the preparation of a tender for the supply of IT services, would be carried out by different organization types: in the case of a public institution it would be completely different than in the case of a private company, because public institutions need to comply with specific legislation.

- Scenarios

Scenarios are typical issues that need to be addressed by an organization. For example, if an organization wants to reduce its IT costs, the MBI model identifies relevant tasks, documents and metrics and gives recommendations to achieve the desired cost reduction.

- Tasks

Tasks are key MBI components, basic business informatics management units. A task describes how to proceed in solving a management problem.

Based on the MBI model, its structure, and the above described situation in eHealth, the following methodology structure has been designed:

- Factors – F015/Healthcare; F901XHE/The national plan for eHealth; F902XHE/Outpatient healthcare facilities
- Scenario – S901XHE/An outpatient healthcare facility needs to implement eHealth
- Tasks – U551A/eHealth implementation feasibility study; U552A/eHealth implementation analysis and design; U553A/eHealth implementation; U554A/eHealth implementation into operation & migration

In accordance with the aim of the paper, the conducted research focused specifically on scenarios and tasks. The factors of healthcare, eHealth and healthcare facilities are integral to the environment and as such have already been described in detail in (Milosevic et al., 2016), (MBI, 2015a) and (Potančok, 2015b).

4.1. Scenario – S901XHE/An outpatient healthcare facility needs to implement eHealth

The scenario consists of the following phases: familiarization, readiness, planning and implementation, and deriving the benefits. Figure 2 shows topics and questions for each of the phases as well as the relationship between time and the level of change.

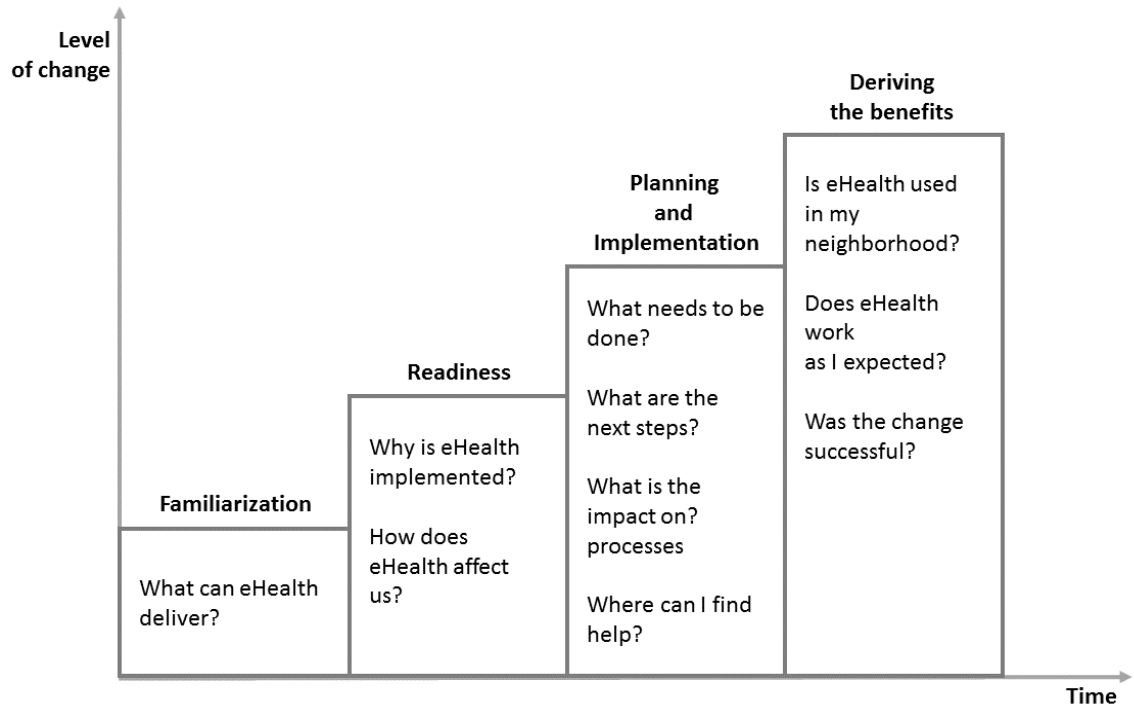

Figure 2: Topics and questions during eHealth implementation

4.2. Task collection – TG550XHE/eHealth implementation project

The collection of eHealth implementation project tasks includes application and implementation tasks reflecting the specifics of the healthcare (healthcare facilities) environment. This task collection directly expands on the project management task collection (TG401/Project management) and is indirectly influenced by the portfolio management task collection (TG103/Portfolio management). The tasks of eHealth implementation project draw on the common solution project tasks (TG410/Solution project).

eHealth projects are managed by project managers (R103/Project manager) together with CIO (R101/CIO), portfolio managers (R111/Portfolio manager), and IS/ICT development managers (R104/IS/ICT development manager).

The project team (according to the project specifications) consists of business and training services professionals (RG200/Business and training services professionals), analysts and system analysts (RG300/Analysts and system analysts), developers (RG400/Developers), database designers and administrators (RG500/Database designers and administrators), and system administrators (RG600/ System administrators). The project team needs to cooperate with users, which include methodists, key users (RQ032/Methodist, key user), business process owners (RQ033/Business process owners), and business requirements owners (RQ034/Business requirements owner).

4.2.1. Task – U551A/eHealth implementation feasibility study

The aim of this task is to develop an overall concept of the implementation of eHealth to an outpatient healthcare facility. The initial task is to clearly describe the final product. It is necessary to define the vision and scope of and approach to the eHealth project. The critical success factors of the task include:

- *Support from the healthcare facility management/owners* – Implementation of eHealth or its elements must comply with the visions and goals of the facility. The ability to accept changes is also important.
- *Complete and explicit definition of the scope and subject of the feasibility study* – The healthcare facility needs to know/define the functionality and cost of the expected eHealth solution.
- *Active participation of business process owners* – eHealth implementation is likely to affect or change a considerable portion of internal processes. It is, therefore, necessary for the team to work together with the healthcare professionals that know the processes and activities. Ideally, individual process owners / employees who can influence and change processes should also be the key users in each area.
- *Active participation of key users* – The users of the future applications need to be involved in the development as key users (healthcare professionals, staff of healthcare facilities, patients). They must be technically proficient, have thorough knowledge of the processes and be able to redefine and re-configure them. Their participation in the project, expertise and utilization is one of the key factors determining successful implementation.
- *Presenting the changes to users/patients/society* – In healthcare we often see resistance to change within organizations and from the general public. As a result, it is necessary to explain planned changes clearly and well in advance and provide reasons why eHealth should be implemented.
- *Restrained planning* – Cost and schedule planning is often underestimated. It is also necessary to include reserves. Estimations should be done by a specialist, preferably based

on data from previous projects. The return of investment in eHealth projects has not yet been determined. eHealth projects are also associated with high initial expenses.

- *Supplier and product selection* – It is necessary to choose a product which meets the needs of the healthcare facility (see the above-mentioned critical success factors) and a reliable supplier that has enough experience with similar healthcare facilities. In the Czech Republic, the ehealth.vse.cz portal (eHealth, 2017) can be used in this phase, as it lists both healthcare facilities and organizations dealing with eHealth.
- *Legislation* – The current legal framework is fragmented, lacks clarity and does not support eHealth applications, especially mobile applications collecting health data.

4.2.2. Task – U552A/eHealth implementation analysis and design

The aim of this task is to define the desired eHealth functionality and the level of customization according to the needs of the healthcare facility (see task U551A/eHealth implementation feasibility study above). The tasks' critical success factors are:

- Greater interoperability of eHealth services
    - Introduction (inclusion) of standards and certification
    - Changes to organizational structure
    - Resolving legal issues
- Support for research, development, innovation and competitiveness in eHealth
- Adoption and promotion of wider adoption of eHealth
    - Skills and digital literacy in the health sector
    - Measuring added value

4.2.3. Task – U553A/eHealth implementation

The aim of the task is to take concrete steps to ensure eHealth operation, i.e., software installation and process changes. Prior to the actual implementation it is necessary to carry out an initial study confirming the benefits of the project and approving its implementation, as well as to carry out an analysis of the system itself and design it. The task's critical success factors are:

- A strategic and clearly defined process of implementation and leadership
- Determination of critical factors such as laws and regulations, and funding
- An analysis of stakeholders
- Having all key activities planned prior to the actual implementation
- User system training

4.2.4. Task – U554A/eHealth implementation into operation & migration

The aim of the task is to fully prepare the eHealth solution and its elements for everyday operation. Based on the project specifications and documentation of migration, handover procedures are carried out and the required functionality and operational characteristics of applications (such as response time, reliability, etc.) are confirmed. An acceptance protocol formally concludes the project and since then its further development and adjustments comes under change management. The task's critical success factors are:

- Migration strategy – It is necessary to determine the basic migration concept (immediate transition to the new application, or parallel operation of the old and new applications) by assessing the requirements and costs of the alternatives against their potential risks.
- Specification of the extent of participation and co-operation of the external supplier, especially regarding data migration
- Original system data documentation for data migration
- Change management

The proposed methodology includes IS/ICT organizations operating in the eHealth environment, elements of eHealth, activities carried out before and during implementation, changes in internal regulations (including IS/ICT strategies and sourcing strategies) and IS/ICT installation processes, training, user involvement, etc. The subject of the methodology is the implementation of existing elements of eHealth; this methodology is not intended to help create new elements or eHealth national concepts.

5. Conclusion

The aim of this paper has been to design a methodology of the implementation of eHealth or eHealth elements to outpatient healthcare facilities, where it can enable and support assisted living services.

A structure of the eHealth implementation methodology has been designed. The methodology is specific to the healthcare environment and the scenario when an outpatient healthcare facility needs to implement eHealth; it includes tasks describing how to proceed in eHealth implementation.

The applicability of the results is twofold. First, project designers and promoters can use the methodology when preparing new projects; the results can also be used by IS/ICT professionals when designing new eHealth elements. Second, the results can be used in further research. It is necessary to expand the case study by seeking more detailed opinions of patients and citizens.

6. Acknowledgements

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SESSION F: DIGITAL SINGLE MARKET INNOVATION

DIGITAL SINGLE MARKET INNOVATION

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Keywords

Digital market, transparency, interoperability, companies,DSM

Abstract

Based on the strategy for the Digital Single Market (DSM) adopted by the European Commission, having in mind also the European Parliament and the Council directive (EU) Regulation No. 910/2014 from 23 July 2014 regarding electronic identification and trust services for electronic transactions in the internal market, the European Commission emphasizes the need for development and understanding the digital single market's impact on the economy, market environment and society as a whole. The paper tries to examine how the development of standardization, interoperability, digital and data economy will affect changes in the level of market transparency, reduction the asymmetry of information, competition, pricing and benefits of products and services, the level of trust and entrepreneurship values in the digital market on performance characteristics of the market environment. The research will be based on data from the real environment.

1. Introduction

The Europe 2020 Strategy represent the plan of EU to face the major challenges of the society. The EU has identified five key areas in which it wants to meet its targets by the end of this decade. These areas are employment, education, research and innovation, social inclusion, poverty reduction and climate / energy. Creation of the digital single market in EU, was set as the first pillar of the EU strategy and it was also recognized as the one of the top priorities of the Presidency of the SR. The development factors of digital single market in EU are intertwined with a number of flagship initiatives (Digital Agenda, Innovation Union, Integrated Industrial Policy and the Agenda for new skills). Specifics of the digital market should, according to the EC, contribute to the development of innovation, economic and inclusive growth and the general growth of trust in the economic environment and its bodies. Based on the Digital single market (DSM) strategy and the

European Parliament and the Council directive (EU) No. 910 / 2014 from July 23rd 2014 on electronic identification and trusted services for electronic transactions in the internal market, European Commission stresses the needs of achievement and development of the following areas:

- Trust - Building trust is according to the EC a key to economic and social development and aims to strengthen the trust by achieving greater transparency in the online environment but also acknowledges the need of understanding the role of trust in e-environment and its impact on the economic environment and market stability.
- Development of digital services and the digital economy with long-term growth potential - ensured by the development of interoperability and standards for e-business and business systems.
- Developing and understanding of online platforms - creating new forms of market and bringing new multidisciplinary problems and challenges for economic and technical sciences.
- The development of "data economy" that is based on the development of data infrastructure of digital data (open data, big data, etc.) with an estimate of their share in 2020 to be up to 40% of all data. Their use could bring huge billion savings as well as it is estimated that relevant data analysis could strengthen the GDP growth of EU countries by up to 1.9%!
- Development of new skills in the context of the development of innovative environment of the digital market, linked with the growth of data and new knowledge generated in the "data economy" environment (see Doucek et. al, 2014).

In order to make these recommendations of the European Commission applicable in an effective and sustainable manner it is necessary to understand the practical difficulties and opportunities for developing DSM. They includes research areas such as: impact of these priorities on transparency, changes in market structures, attitudes and perceptions of DSM elements by market participants, changes in inter-organizational activities, trust and market stability, the asymmetry of information, prices and benefits. (Delina, 2012).

2. Literature review regarding pillars of DSM

Network activities on the electronic market relate to interoperability, standardization and transparency. In this area, some scientific studies have examined the network effects and diffusion theory of innovation and impact on the group of market participants and their innovation absorption capacity. Weitzel (Weitzel et al, 2003) emphasizes that understanding the networking environment is highly important because without proper understanding of what happens, promoting networking can sometimes be dangerous. Modelling of network effects on products was already dealt by Schoder (1995), stressing that it is the diffuse (network) phenomenon that is critical for understanding the operation of socio-economic environment (Schoder 1995). The scientific literature in the field of network effects is based on neoclassical assumptions, where agents operating in an environment know the entire realistic model and the characteristics of other agents as well as their utility functions, which may lead to a unique and Pareto optimal Equilibrium, but only if the absence of network externalities and unsolvability. Market transparency also plays an important role in this model (Weitzel et al, 2003). Weitzel therefore proposed an interdisciplinary network theory also acceptable by economists and social scientists with acceptance of bounded rationality, incomplete information and social cohesion. Some specifics in this area are now starting to appear in world studies. E.g. Turnes, P. B. and Ernst, R. (2014) claim in their article that in the near future there will be a huge increase in standardized business processes that will be determined

by the need for an enormous increase of interoperability between systems and reviewing of impact on the environment. Delina (2015) indicated the need to review the impact of these specifics on actual deployment, acceptance and changing of environmental parameters such as stability, transparency and monopolization. Regarding the impact of transparency, Henze, Schuett and Sluijs (2015) argue based on experimental research that transparency is an effective tool for the growth of well-being and consumer surplus. Under imperfect information producers keep prices above their marginal costs, and this allows them to "get rich" at the expense of buyers. Thanks to transparency the competition between retailers is better because they see the price and quality of competing products. Veldkamp (2006) argues that transparency is one of the most important factors for maintaining market stability. Reducing information asymmetries allows companies to reallocate resources more effectively in the case of an internal or external shock. Willmott (2003) considers transparency an important factor in building confidence. On the other hand, according to Kitchin (2003), confidence among consumers and companies is not influenced only by transparency but also by consumer expectations of how the company will manage activities that can't be made more transparent. Kang, K. and Hustvedt, G. (2013) confirmed that transparency is a strong factor that has a positive impact on confidence. According to other authors and studies (OECD 2012, Soh et al 2006; Zhu 2004 Ozcelik and Ozdemir, 2011; Gu and Hehenkamp, 2010 Delina 2012), increasing transparency may also have negative impacts, eg. unwillingness of certain companies to engage in a transparent process, problems of requiring anonymity / trade secrets, damage of market competition, the possibility of anti-competitive activities, reducing innovation capabilities, development of monopolization and others. Mares and Harstad (2003) in their work pointed out the different effect of public and private information being made available at the auctions, causing more than just asymmetry of information. Various works in the field of game theory and experimental economics point to the fact that increasing the level of transparency can have a negative impact on the efficiency of the auction process. Among others, Gothelf (2010) came to the conclusion that disclosure of the auction participant may lead to reduced revenues from auctions for the auctioneer, and Feinberg and Tennenholtz (2005) have shown in their research that anonymity of auction participants may lead to higher expected returns. The opposite conclusion has been reached by Mikoucheva and Sonin (2004), Anufriev et al. (2011) or Gershkov (2009) as an example, demonstrating the positive impact of transparency and accessibility of information on the effectiveness of auctions, although in some cases only under specific circumstances. This diversity of views, along with works suggestive of a wide range of other variables affecting the level of trust and efficiency of auction systems (for example Milgrom et al. 1982, Lorentziadis 2015, Dass et al., 2014, Milgrom and Weber 1982, Gróf et al., 2012 and Gazda et al., 2012) leads us to conclude that a detailed examination of the specifics offered by the DSM, and estimation of changes in the behaviour of market participants as well as indicators of stability / growth of the market and identifying strategies for deploying components of the DSM is necessary to ensure the effective transition of the market environment to a new form of productivity, fairness and credibility based market. Understanding the impact of IT and technological solutions on various changes in the transparency of processes, services and data in the digital society and understanding of the impact of these changes on the stability and evolution of the market as a whole (for example see Fischer et al., 2013) is one of the most sensitive and most critical factors of development of the digital society.

3. Methodology and description of the sample

The research in this paper is based on 2367 procurement offers, conducted within the years 2005-2016 and listed in the PROEBIZ platform. The initial sample was larger, but we filter out all cases, which does not have defined estimated price or wining price. The size of saving (S) per particular offer were is determined by formula:

$$S = \frac{EP - WP}{EP} * 100$$

Where, EP is estimated price, which is price of the offer estimated by procurer and WP is the price of the winning bid. The preliminary analysis of the bid shows some discrepancies regarding the correctness of stated prices mostly for offers with more than one items. It happens quite often, in practice that estimated price is defined per item but winning price is defined for all items altogether and vice versa. It is hard to identify such discrepancies within the database and savings calculated based on these differently calculated prices are abnormal high or low. This is the reason why we decided to filter out all offers which has savings higher than 50% and lower than -100%. (Saving higher than 50% means that the wining price is more than two times lower than estimated price. Saving lower than -100% mean that wining price is more than two times higher than estimated price.) The offers filtered by these rules represent less than 4,4 % of sample.

4. The research

The focus of our study is to analyse various transparency orientated settings, which can procurers choose for their procurement actions. As was mentioned above, we used five variables to define 16 different transparency profiles in order to determine which settings or combination of settings are mostly used in real environment. The research is divided into two parts. First part analyses how often are particular settings used by procurers. The second part investigates the distribution of the savings based on chosen transparency profile. In effort to determine which transparency-orientated settings are favoured by procurers and which are not, we basically compare occurrence of predefined profiles of 2367 offers. The detailed description of profiles together with the frequencies of their occurrence within the sample are presented in Table 1.

As can be seen from Table 1, the transparency-orientated settings were used in more than a half of analysed offers. In majority of cases (43.3%), procurers use settings corresponding to profile A. This profile represent the auction setting in which bidders are allowed to see the lowest price and the rank of their bid. For more than 5% of offers, procurers used settings corresponding with profile B. The settings of profile B allow bidders to see the lowest price and the ranking of their bid for particular item. The settings corresponding with profile D, were used in 70 offers. The settings in this profile enable user to see the lowest bid in auctions with multi-criterial selection process as well as it enable bidder to see the ranking of parameters of their bid in this type of auction. Although 70 cases are relatively small number, the settings within profile D can be used only in auctions, which have multi-criterial selection process. The studied sample includes only 169 auctions like these. The settings corresponding to profile D were used in 41% of all multi-criterial auction presented in the sample. The Table 1 also showed, that transparency orientated setting, which provide information regarding bidder's advancement or non-advancement to next round (profile C), is not commonly used by procurers. However, such setting procurers sometime used in combination with settings presented in profile A. This combination is known as profile AC and occurs only in 9 cases. Interestingly the procurers do not often use combinations of different transparency orientated settings in their auctions. The combination of settings that were used mostly correspond to profile AB. This combination of setting occur only in 2,6% of cases. On the other hand, combination of settings corresponding to profiles CD, ABC, ACD, BCD were not presented in the analysed offers. The results of the analyses also showed that in more than one third of analysed offers (33,2%) no transparency orientated settings were used. In these auctions, the procurers allowed bidders to see only the price of lowest bid.

Table 1: Characterization of transparency profiles and presentation of their frequencies within the sample; source: Author

Label	Transparent lowest bid	Transparent ranking of user	Transparent ranking of item	Information regarding user advancement/ non-advancement to next round	Transparent ranking of parameters in multi-criterial selection	Frequency	Percentage of sample
A	X	X				1024	43,3%
B	X		X			127	5,4%
C	X			X		0	0,0%
D	X				X	70	3,0%
AB	X	X	X			61	2,6%
AC	X	X		X		9	0,4%
AD	X	X			X	12	0,5%
BC	X		X	X		1	0,0%
BD	X		X		X	3	0,1%
CD	X			X	X	0	0,0%
ABC	X	X	X	X		0	0,0%
ABD	X	X	X		X	2	0,1%
ACD	X	X		X	X	0	0,0%
BCD	X		X	X	X	0	0,0%
Only price	X					787	33,2%
One-bid offer						271	11,4%

In the next section, we analyse whether, the type or frequencies of transparency-orientated settings differentiate based on type of procurement. Aim of this task is to find out whether private procurers prefer different transparency settings than public ones. The figure 1 showed Pareto analysis graphs describing which transparency orientated settings, (described as profiles), are often used by public and private procurers. As can be seen from Figure 1 majority of private procurement offers are auctions without any transparency oriented settings, more than a third of private procurement offers (32,3 %) used setting corresponding to transparency profile A. The occurrence of other profiles in the sample of private offers is less than 10% (e.g. Profile B: 7,1%). Interestingly, the results showed, that, the private procurers does not seem to favour use one bid mechanisms for their offers. Less than 0,5% of offers made by private procurers were one-bid offers. The situation is different when we analyze public procurement offers. Although majority of offers represent the auctions with settings corresponding to profile A, it should be also mentioned than more than third of public procurement offers use non transparent method of procurement- one bid offer. Other transparency-oriented settings are use very rarely in public procurement.

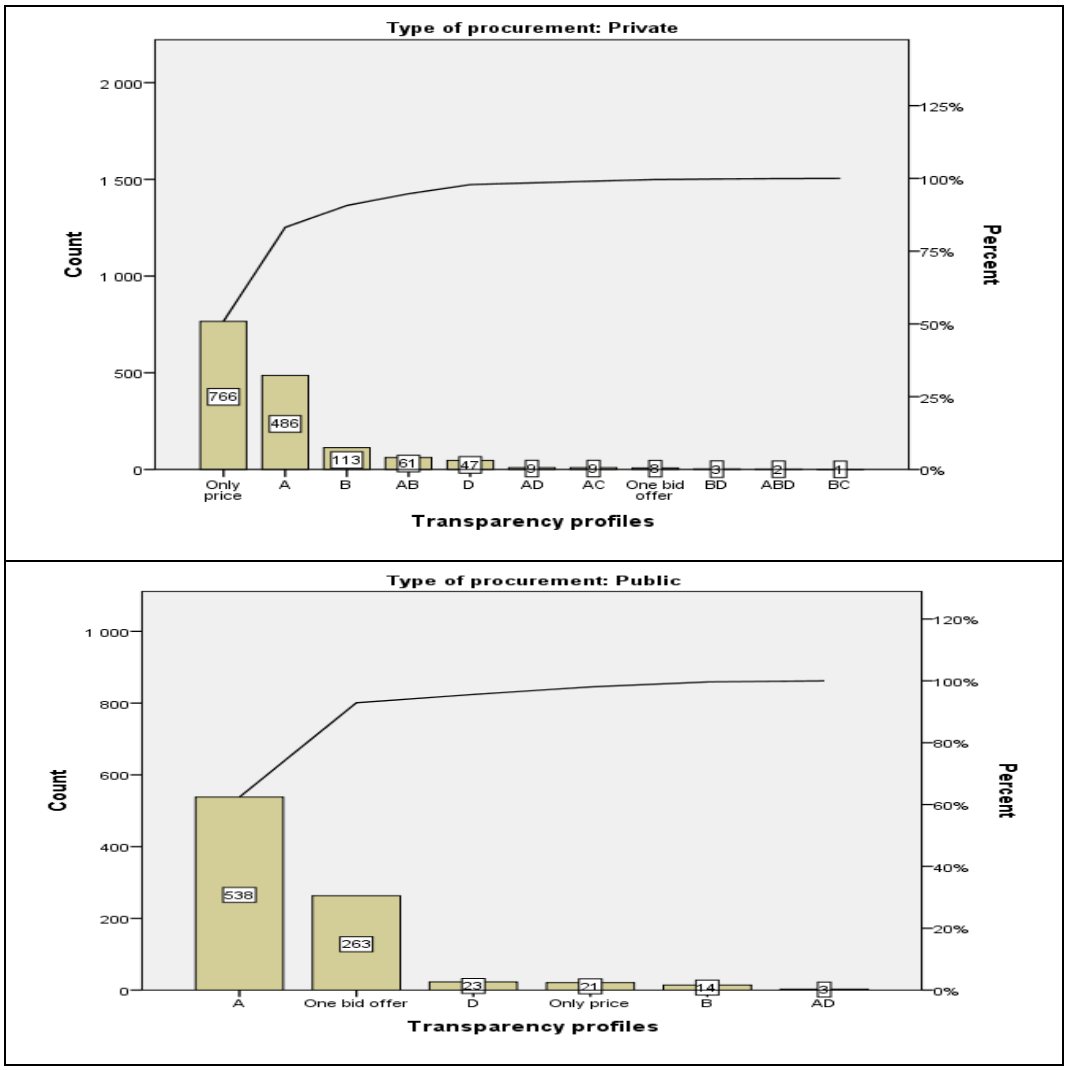
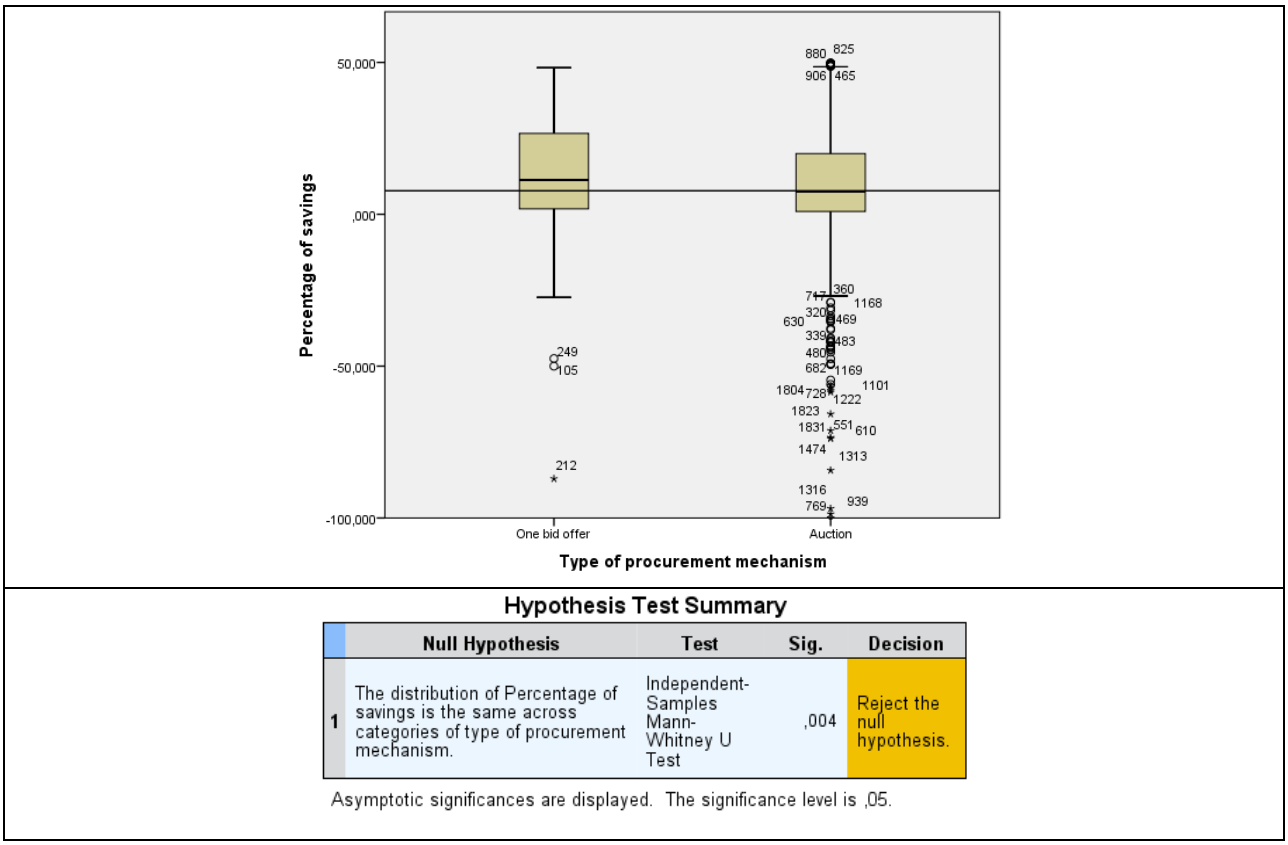


Figure 1: Pareto analysis of transparency profiles based on type of procurement;Source: Author

The second part of research investigates whether the transparency-orientated settings influence the distribution of savings from procurement actions. In other words, we try to determine, how the median and variability of offers' savings differ based on implemented transparency profiles. First we analyse how are savings distributed in one bid offers and auction offers. The aim of this analysis is to provide comparison between procurement mechanisms with no transparency (one-bid offers) and procurement mechanism where procurer can choose various transparency orientated settings. The result of this comparison in form of Box-plot analysis and Mann Whitney U test is provided in Figure 2.

The Figure 2 showed that there is difference between distribution of savings from one-bid offers and from auctions. These differences were also confirmed by Mann Whitney U test. The results of this test are presented in lower part of Figure 2. Because the the p-value (Sig. 0,004) of the test is lower than 0,05, we can rejected the null hypothesis stating that distribution of savings are the same across different type procurement mechanisms. Moreover, the box-plot analysis presented in Figure 2 showed that one-bid offers tends to provide higher saving than auctions. The median as well as interquartile range of savings is bigger for one bid offers than it is for auction.



Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Percentage of savings is the same across categories of type of procurement mechanism.	Independent-Samples Mann-Whitney U Test	,004	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is ,05.

Figure 2: Box-plot analysis of savings based on used procurement mechanism; Source: Author

Last part of the research analyses distributions of the savings based on transparency-orientated settings used by procurers. As in the previous analyses, also here, is every combination of transparency-orientated settings assigned to particular profile. The box-plot analysis describing the median and variability of savings for every profile is described in Figure 3.

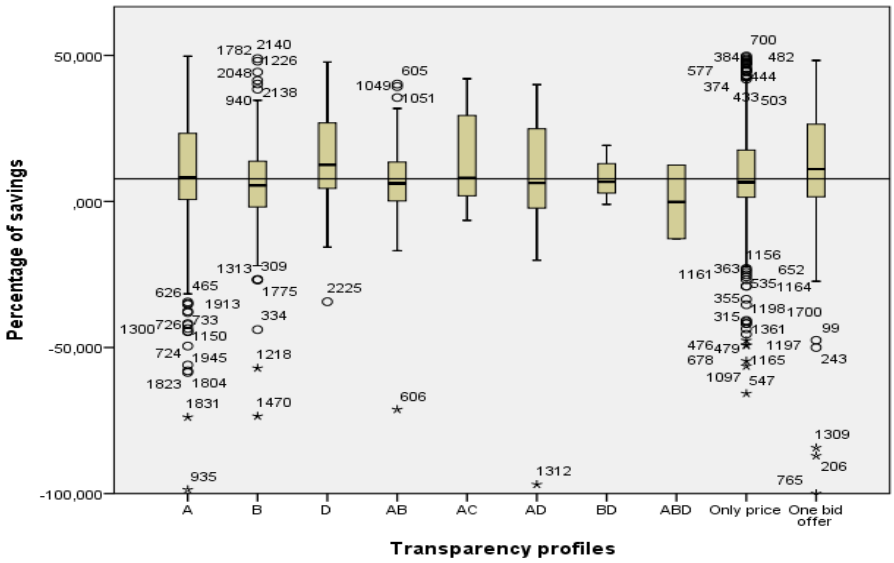


Figure 3: The Box-plot analysis of savings' distributions based on used profiles; Source: Author

As can be seen from Figure 3 the majority of transparency-orientated settings doesn't provide as good results, in term of median and interquartile range of percentage of savings, as one bid offers do. On the other hand, one bid offers and transparency-orientated settings corresponding to profile D have quite similar distribution of savings. Nonetheless profile D is very specific profile because it

can be used only for multicriterial auctions. From results presented in Figure 3, it does not seem that increased transparency lead to better savings from procurement actions. Moreover, box-plots showed that auctions with some transparency-orientated settings have lesser savings than all other type of auctions. For example every profile that includes setting: Transparent ranking of item, (letter "B" is in the name of the profile), has median of savings lower than the median of the whole sample. The box-plots also showed that auctions, which have none of transparency orientated settings (profile named "Only price") seems to have worst results in term of savings than auctions, which allow bidders see their ranking (profile A).

5. Conclusion

Implementation of Digital single market strategy brings radical changes to key areas of business environment. Proper investigation of these changes and their impact is essential step in order to ensure fulfilment of this strategy and its sustainable growth. Research in this paper is focused on transparency as one of the aspects that employment of digital single market strategy should improve. Concretely, we decided to focus on transparency between bidders in procurement action and analyze its impact on procurement savings. The purpose of the transparency, in general, is to reduce informational asymmetry in business relationships. The results of the research does not provide much evidence to the claim that increased transparency and better informed bidders lead to less procurement costs and higher savings from procurement actions. Moreover, results showed that one bid offers, which are characterized by no transparency, generates higher savings than auctions, where the transparency can be adjusted. Further analysis of the auctions showed, that in majority of cases, procurers used transparent ranking of the user as one and only transparency orientated setting or they use no transparency orientated setting at all. In the first case bidder, see lowest bid and their rank. In the second case, bidders have only information about the lowest bid. When comparing these two auction settings, it seems that information about ranking (better transparency) generates higher saving than setting which allow user to see only the lowest bid. On the other hand, the analysis also showed that auctions, which allow bidder to see ranking of item, tend to have on average lower savings that other auction. Situation is different for multi-criterial auctions. The mutli-crititerial auctions, which allow bidders to see ranking of parameters in multi-criterial selection process, have highest saving from all the auctions in the sample. Moreover, distribution of savings from these auctions was similar to distribution of savings generated from one bid auctions.

6. Acknowledgment

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PROCURING COMMODITIES THROUGH E-AUCTIONS: RESULTS AND SPECIFICS

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Keywords

Purchasing strategy, purchasing commodities, Kruskal-Wallis ANOVA, savings from e-auctions.

Abstract

E-auctions are commonly used to purchase large variety of items, including commodities. Most of current e-auction literature presumes e-auction should perform better than diversified products, usually based on their easier specification (e.g. Kaufmann & Carter, 2004) or vast supplier base (e.g. Parente et al, 2010) . We empirically test this assumption using large dataset of real e-auction cases and two methods of calculating e-auction results, concluding that there is no statistically significant difference for savings based on estimated price, while savings based on initial price are actually lower for commodities. We provide discussion on this fact, using the agrument of Beall et al (2003), who state that commodities tend to have lower margins.

1. Introduction

Reverse electronic auctions (e-auctions) can be defined as "an online, real-time auction between a buying organization and two or more invited suppliers, where suppliers can submit multiple bids during the time period of the auction, and where some degree of visibility exists among suppliers regarding the actions of their competitors" (Carter et al, 2004). They have become ubiquitous part of the purchasing strategy in many organizations in the past decade, allowing their users to reach significant financial savings on the costs of the procured items (Beall et al, 2003). Despite the obvious advantage of cost savings, e-auctions are also the source of some controversies. Some scholars claim they can seriously damage supplier-buyer relationships (Tassabehji et al, 2006), or the savings are hard to verify and sustain (Emiliani & Stec, 2005). In practice, e-auctions can lead to some contradictory results. The results are influenced by many conflicting factors, which are according to Mithas and Jones (2007) the main barrier of the spread of this procurement method.

We could see purchasing commodities through e-auctions as one of those controversies. Most authors conceptually claim that when the item of e-auction is a commodity, it should lead to better results (higher savings) and are therefore suitable method for their procurement. However, we find that e-auction for commodities form only a small part of all e-auctions. The vast majority of e-auctions is held to procure other (diversified) items, including wide variety of items such as

construction contracts, IT services, cars, transportation, groceries and many other goods and services. The goal of this contribution is therefore to examine the performance of e-auctions based on the type of procured item (commodities and diversified products). We use both commonly used methods measuring the results: savings based on the estimated and initial prices (see chapter 2.2.).

The contribution is organized as follows: first, we summarize current knowledge on commodities in e-auctions and operationalize the measurement of e-auction performance. Then, we present the research methodology, dataset and hypotheses. The analytical part comprises of statistical tests to test the hypotheses. Then, we provide conclusion, interpret the results and set up agenda for further research.

2. Theoretical background

Commodities can have various definitions. They are, however, usually seen as homogenous, non-differentiated goods traded on commodity exchanges under some sort of reference price or index (Rauch, 1999). Besides "traditional" commodities, such as coal, oil or electricity, we can see some other goods and services that can be seen as commodities: for example cell phone tariff with certain parameters (data limit etc., Enke et al, 2014). Organizations procuring large lots of those communities usually have direct or semi-direct (through broker) access to respective exchange. There are, however, some institutional barriers (minimal amount purchased, entry fee, company location etc.) that effectively disallow smaller institutions from entering the exchanges. Those commodities could use e-auctions to purchase commodities from other suppliers.

2.1. Commodities in e-auctions

Most of contemporary e-auction literature (e.g. Jap, 2002; Parente et al, 2010; Kaufmann & Carter, 2004; Mabert & Skeels, 2002; Wagner & Schwab, 2004) presume that commodities are ideal e-auction item. Parente et al (2010) and Teich et al (2006) claim that their homogeneity should secure the participation of many suppliers in the e-auction, which should then improve its results (fact confirmed by many authors, e.g. Mithas & Jones, 2007).

Kaufmann & Carter (2004) and Mabert & Skeels (2002) postulate that commodities are easy to specify, which should again lead to better results. Hawkins et al (2010) examine this assumption empirically, confirming that ease of specification (specifiability) leads to higher competition in the e-auction, increasing the probability of positive result (savings). Wagner and Schwab (2004) claim that e-auctions should be used only if the demand can be properly specified, for example by CAD designs or industry standards. Commodities don't have those issues and are specified by default.

Elmaghraby (2005) states that commodities don't necessary reach higher savings in e-auctions, but their use does not damage the supplier-buyer relationship due to their transactional nature. Huang et al (2008) similarly claim that more traditional forms of negotiations should be used for more complex items, as the use of e-auctions can be seen as untrustworthy amongst the suppliers.

Jap (2002) evaluates commoditized products as suitable for e-auctions, mentioning that their value is usually well known and can be used to estimate the price. Lösch & Lambert (2007) show that more complex products reach worse results in e-auctions and recommend to stick with the simpler, commoditized products.

There are nevertheless some authors taking perhaps more sceptical attitude towards commodity performance in e-auctions. Beall et al (2003) point out that most commoditized products tend to have lower margin levels, as the prices are set by commodity exchanges and markets. E-auctions on commodities therefore won't lead to high savings, as the suppliers won't lower the price below the

threshold of current market price. Furthermore, the authors presume the positive effect of e-auctions on prices is untenable to a certain point, as the suppliers simply can't lower the prices forever and must sometimes even increase their bids in a repeated purchase, should the market situation change. If all suppliers respect the changes of the market price, the purchaser then finds that the savings are negative. Furthermore, Schoenherr & Mabert (2008) empirically assess the suitability of commodities, finding no statistically significant difference.

2.2. Measuring the results of e-auction

Researchers usually understand the result of an e-auction as the direct financial savings reached on certain case. Although it is known that e-auction can bring the company many other benefits than just direct financial savings, these other benefits are very hard to measure and compare across companies (Parente et al, 2004), and would require additional, qualitative studies (Millet et al, 2004). Mithas & Jones (2007) examine this phenomenon and find that purchasing managers themselves prefer this perhaps simplified approach.

We can distinguish two methods of calculating the financial savings in an e-auction – savings based on estimated price and savings based on initial price (Delina, 2014). The estimated price is specified by the buyer and serves as a benchmark of what the price would be if e-auction was not used for the procurement case. According to Janke & Kubačka (2013), it could be determined by one of following three ways or their combination:

- by analysis of the current market situation, where the buyer via telephone, e-mail or internet finds current catalogue price (Delina, 2014);
- based on last e-auction of the procured item in the case of repeated purchase;
- based on subjective expectations, where the buyer sets the price using their own experience. This approach is perhaps the least precise, but quite often used in practice as it is the least time consuming method.

Klézl (2017) shows that this combining of approaches and methods when setting the estimated price can be problematic. First, researchers do not know which of the methods was used to determine the estimated price for certain purchasing case, as those data are very sensitive. Secondly, it is not known whether buyers within one company are consistent in their methods, or use different method for each case, based for example on the value of the lot.

The initial price is then based on the first bids of suppliers, who are invited to participate in the e-auction (Delina, 2014). They are requested to send their starting prices, and lowest of those starting prices is the initial price. The initial price is then automatically stored by the e-auction system, which leads to more cases for analysis, as the estimated price is recorded voluntarily by the bidder. Janke and Kubačka (2013) claim that the savings based on initial price better reflect the situation on the market. It is, however, not ideal method either – the first bids might be a subject of strategy utilized by the suppliers, influencing the information value of the initial price (Delina, 2014).

3. Research methodology

In this chapter, we establish the research methodology used in this contribution. We describe the data used in the research, set up research hypotheses, and describe statistical methods used to evaluate the hypotheses.

3.1. Research goals and hypotheses

Using chapter 2.1 of this contribution as a reference, we can see that current knowledge on the performance of commodities in e-auctions is ambivalent at least and lacks empirical evidence. The goal of our research is therefore to test whether the results of e-auctions on commodities vary from results of e-auctions on diversified products, and, should we find some significant differences, to examine those.

We can therefore set up two main hypotheses (presented as null hypotheses):

- H_{a0}: Savings based on *estimated* price are not statistically different for commodities and diversified products;
- H_{b0}: Savings based on *initial* price are not statistically different for commodities and diversified products.

3.2. Data set

The data used for this contribution could be considered secondary. It is data from real e-auction cases conducted in the e-auction software Proe.biz in years 2011-2014. The data set required quite extensive editing, because it contained many errors in data integrity, completeness, validity and consistency (Müller & Freytag, 2003).

Table 1: Sample sizes for each category and data set

Subject	Estimated price	Initial price
Commodity	613	870
Diversified product	10 909	12 957
Total N	**11 522**	**13 827**

After the editing, we had two datasets (one for each results calculation method), allowing us to manually categorized the e-auctions by their subject. As Table 1 shows, we have found very low amount of e-auctions on commodities in the file. The method we use for analysis (Kruskal-Wallis ANOVA test, see chapter 3.4) however can be used for different sample sizes.

3.3. Computing the e-auction results

As specified before, we compute two savings variables. Savings based on estimated price is computed as follows:

$$S_{EP} = (1 - FP/EP)*100 \qquad (1)$$

where EP is the estimated price and FP is the final price (Delina, 2014). Savings based on initial price is then given as:

$$S_{IP} = (1 - FP/IP)*100 \qquad (2)$$

where IP is the initial price and FP is again the final price (Delina, 2014).

Finally, it is worth to note that the savings based on estimated price can be negative, as the final price can be higher than the estimations. On the other hand, savings based on the initial price cannot be lower than zero (if there are none price changes in the e-auction).

3.4. Methods of analysis

Due to the limited scope of this contribution, we deploy somewhat simpler statistical method of Kruskal-Wallis ANOVA. According to Hendl (2015), this test can serve as non-parametric method of standard Analysis of Variance, when its assumptions are not met. Hendl (2015) also argues it is better to use Kruskal-Wallis ANOVA with unequal sample sizes, which is our case, as established in chapter 3.2. In this case, we found that our data are not of normal distribution, tested by Shapiro-Wilk test. We present only the results of the tests in Appendix 1, due to the limited scope of this contribution.

According to Hendl (2015) Kruskal-Wallis test is based on the H values computed as:

$$H = (N-1)\frac{\sum_{i=1}^{g} n_i(\overline{r_i}.-\bar{r})^2}{\sum_{i=1}^{g}\sum_{j=1}^{n_i}(\overline{r_{ij}}-\bar{r})^2} \qquad (3)$$

where n_i is the number of observations in the group *i*, r_{ij} is the rank of *j* observation in group *i* amongst all the observations, *N* is the number of all observations, $\overline{r_i}.$ is the average rank of an observation within the *i* group and $\bar{r}$ je is the mean of all r_{ij}. P-value of the Kruskal-Wallis ANOVA test can be approximated by chi-square distribution with *k – 1* degrees of freedom, where *k* is the number of groups, according to Hendl (2015). Degrees of freedom can be defined as number of parameters of the system that may vary independently (Hendl, 2015).

For all the statistical calculations, we use IBM SPSS 22 software.

4. Analysis of e-auction item and the results

In this chapter, we analyse the medians of savings for both methods of calculation and examine the hypotheses set in chapter 3.1, based on the actual p-values of Kruskal-Wallis tests.

4.1. Savings based on estimated price

We conclude that the variables complies with all assumptions of the Kruskal-Wallis ANOVA test and we can therefore use it to compare the medians of savings based on estimated price when grouped by e-auction item.

Table 2: Median of savings based on estimated price by e-auction item

E-auction item	Diversified product	Commodity	Population
Median for Savings based on estimated price	7,7747	7,7778	7,7762

In Table 2, you can see the medians itself, followed by Table 3 with the results of the Kruskal-Wallis test.

Table 3: Kruskal-Wallis test results for savings based on estimated price grouped by e-auction item

Statistic	Total N	Test Statistic	Degrees of Freedom	P-value
Value	11 522	3,275	1	0,070

We can observe the values for medians are very similar, as confirmed by the values of Kruskal-Wallis test, which shows no statistically significant difference with $\chi 2$ (1) = 3,275, p = 0,070. We therefore *fail to reject* H_{a0}. We discuss this finding in chapter 5.

4.2. Savings based on initial price

We have found no violation of the Kruskal-Wallis test assumptions either for the savings based on initial price. Thus, we present the median values in Table 4 and values of the Kruskal-Wallis test in Table 5.

Table 4: Median of savings based on initial price by e-auction item

E-auction item	**Diversified product**	**Commodity**	**Population**
Median for Savings based on initial price	3,2432	2,3298	3,1792

Median values of savings based on initial price are actually *lower* for commodities. This is in direct contradiction with most of the current literature. We discuss this fact further in Chapter 5.

Table 5 Kruskal-Wallis test results for savings based on initial price grouped by e-auction item

Statistic	**Total N**	**Test Statistic**	**Degrees of Freedom**	**P-value**
Value	13 827	21,044	1	0,000

Kruskall-Wallis test confirms the difference of the means for two groups are statistically significantly different, with $\chi 2$ (1) = 21,044, p < 0,000. We therefore *reject* H_{b0}, concluding that the median values are statistically significantly different for the two groups.

5. Interpretation and conclusion

We come with two main contributions in this paper: first, the influence of the type of procured item (commodity or diversified product) is significant only when examining the result as a saving on initial price. The second contribution lies in the fact that those savings are actually *lower* for commodities, disrupting current e-auction literature.

The first finding, showing the medians for savings based on estimated price are not statistically significantly different (in fact, the medians are practically the same), while savings based on initial price are different. This could perhaps shed a new light on the way the savings are determined: it seems that buyers are not aware of existing price-setting mechanisms when estimating a price in the e-auction. Or, if they are aware, do not incorporate those information into their price estimate. Suppliers, on the other hand, see the difference between commodities and diversified products when setting the first prices. This lead us to think that there is certain information asymmetry amongst suppliers and buyers in their knowledge of current market situation for the appropriate item, which benefits the suppliers in the e-auction process, allowing them to set more favourable strategies.

Our second finding – lower median values for commodities, when using savings based on initial price as a method of calculating the result – empirically proves wrong most of the current e-auction literature, as seen conceptually in Elmaghraby (2005), Mabert & Skeels (2004) or Kaufmann & Carter (2004), and empirically in Hawkins et al (2010), Jap (2002) or Lösch and Lambert (2007). This could be again the case of the information asymmetry described in previous paragraph. Furthermore, most of the empirical proofs of higher savings for commodities rely on less

convincing data sets usually acquired experimentally or by simulation. For example, Lösch and Lambert rely solely on questioning suppliers instead of acquiring the e-auction data, which could seriously distort the results.

Alternatively, Beall et al (2003) and Wagner & Schwab (2004) convincingly claim that due to standardization, commodities ten to have lower margin levels. E-auctions generally serve only as a method to reduce the margin of a supplier, therefore making it harder to reduce the price when margins are already depleted. Furthermore, Beall et al (2004) fittingly show that savings in an e-auction are very often unsustainable, as the price cannot drop below the level of market prices. Therefore, the relative level of savings based on initial price should be lower than savings for diversified products.

6. Acknowledgement

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8. Appendix 1 – tests of normality

Table 6: Normality test for Savings based on Estimated price grouped by e-auction item

Tests of Normality

E-auction Item		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Savings based on estimated price	Diversified product	,123	10909	0,000			
	Commodity	,106	613	,000	,939	613	,000

a. Lilliefors Significance Correction

Table 7: Normality test for Savings based on Initial price grouped by e-auction item

Tests of Normality

E-auction Item		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Savings based on initial price	Diversified product	,205	12957	0,000			
	Commodity	,223	870	,000	,775	870	,000

a. Lilliefors Significance Correction

CONCEPTUAL FRAMEWORK FOR EVALUATING THE EFFICIENCY OF PUBLIC ADMINISTRATION

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Keywords

Public administration, trust, efficiency, two-step DEA

Abstract

Public administration is often criticized by the public. Building trust in this sector is therefore a critical factor in the satisfaction of public administration clients. In many cases, confidence in public administration is a major factor in the success of individual governments. Assessing the efficiency of processes in the public service sector is therefore an essential part of building trust. In this work, we have proposed conceptual framework for evaluating the efficiency in processes of public administration. Methodology of the concept is made using the two-step DEA approach. First, individual efficiencies need to be computed. In step two, impact of explanatory variables proposed in conceptual framework is to be determined. This will be done using the truncated regression model. The most crucial thing is selection of the variables, since there is lack of research studies in this field. These variables should be carefully tested in future case studies. The result of this study is the general proposal of conceptual framework for evaluating the efficiency of public administration bodies.

1. Introduction

Public administration has its irreplaceable place in almost every country in the world. Public administration is a set of activities that are carried out by public authorities, self-governments and public institutions. Public administration has been built on a tight hierarchy and authority theory for

a long time. In a first step, citizens elect their representatives to the government. Subsequently these representatives create policy and delegate other activities to unelected administrators (Kettle, 2015). Regarding unelected administrators, for example elections in Slovakia are often associated with massive change of representatives at the labour offices, regional offices, municipal authorities, and district office. In such way elected representatives maintain hierarchical control over implementation of their policies.

Simplified, public administration can be characterized as managing public affairs or implementing public policies (Shafritz et al. 2015). On the other hand, these authors claim that we cannot be satisfied only with one simple definition and they suggest another 18 definitions in four categories: political, legal, managerial and occupational.

The aim of this article is to design a conceptual model to assess the efficiency of public administrations subjects. The role of this assessment is to highlight various shortcomings in order to improve processes in public administration. In this way, it will be possible to contribute to increasing of public trust in digital services of public administration.

One way to increase trust in public administration, is improvement of quality of e-government actions. Gracia – Arinob (2014) have found that perceived e-service quality has a strong and positive effect on trust in public administration. They also suggest high government investments in quality to improve trust. Tolbert and Mossberger (2006) found out comparable results. Based on research, they have proven statistically significant relationship between e-government use and trust in government. Belanche et al. (2014) also proved that trust in the public e-service has influence on trust in the public administration. There also exists vice versa relationship. Fakhoury – Aubert (2015) claim that active citizenship and trust in use of e-government services may improve public administration.

On the other hand, e-service quality cannot be obtained immediately. First, it is necessary to build infrastructure between public administration subjects. Based on recommendations of Matei – Băieşiu (2014), there should be built information network between subjects at national and local level with creation of database which would include information from all subjects. It can be very helpful – if there are clear competencies set (with available and correct information), it could increase trust in public administration due to its flexibility, speed or reliability. We can describe this on example of conceptual model of the Italian System for Public Connectivity – citizen ask for a document from public administration subject and there can occur two possibilities: this subject provide document (if it is in its responsibility) or send a request to another public administration subject (Nicola et al. 2014). This means that citizen does not have to visit several public administration subjects. Document is delivering to him by the interconnection between subjects.

Vigoda – Yuval (2003) dealt with relationship between performance and trust. Based on their results they conclude that administrative performance may affect trust in governance. The question is what level of performance can create trust.

Efficiency means achieving the maximum outputs at level of resources that are used during the activity. Evaluating the efficiency means measuring the relationship between the results and inputs at the beginning. We can say organization or subject is efficient when produces maximum outputs at minimum level of available inputs. The efficiency of public service creation and delivery is very difficult to measure for many reasons. This measurement is more difficult in the public sector in comparison with the private sector, because public services are often provided to clients free of charge. In many cases, public services are at a subsidized price. From this reason, their valuation cannot be used market prices.

Consequently, evaluation of efficiency of the public sector has a historical tendency to base on results more than on resources. Historical approach also focused on higher expenditure to public

services considered appropriate to the same increase of outputs. This concept has already been overcome. Nowadays, current concept is based on meaningful estimate of outputs of public sector. Afonso et al. (2005) point out that the best economic performance report countries with small public sector while countries with large public sector show more equal income. Also, Mintzberg (1993) points in his publication that bigger subjects are more efficient that small ones, because administrative size increases with the growth organizational size.

Measuring public administration subjects has long been considered as a necessary source of improving the efficiency of the public sector. Undoubtedly, we can consider public administration as an important factor in the economy and society, too. Additionally, public administration is responsible for support of economic growth, social development, providing public goods and service, furthermore for regulating the business activities. We consider evaluating the efficiency of public administration subjects and division necessary to increase and improve their activities and outputs based not only on feedback from public opinions, but other economic indicators.

2. Methodology and methods

There are many public administration subjects on the different level, so we need find the way how to compare them. One way how to evaluate public administration subjects is evaluation based on their efficiency. On this purpose, we can use the Data Envelopment Analysis method as suggest Buleca and Mura (2014). There are also other methods, such as Stochastic frontier analysis, benchmarking, etc. Liu et al. (2013) proposed a literature review which has shown that DEA is used across many fields of research.

The evaluation of impact of the environmental variables on the efficiency of evaluated subject could be done in two steps. First, we need to compute individual efficiencies and then, in second step, using selected variables, we should determine impact of variables proposed in conceptual framework we will propose. This can be done using two-step Data Envelopment analysis with truncated regression models. This method is easier to use than other methods (e.g. SFA). One of disadvantages of DEA is its deterministic character. SFA is stochastic method. This disadvantage could be removed by using few proposed algorithms mentioned below. Other disadvantage is that DEA cannot count with negative numbers, so the selection of variables must consider this fact.

In the first step of two-step DEA, we should compute the efficiency scores using CCR output oriented DEA model according to following Cooper´s et al. (2007) input oriented model (1) as a reciprocal value 1/Θ. We need n optimizations to find the solution. In each optimization, we use the notation DMU_o, o =1, 2, ..., n, to denote DMU_j. Then the optimal solution of the problem of obtaining weights for all inputs and outputs is received by the partial modelling using the following expression where u and v are variables:

$$\begin{aligned}
&\max_{u,v} \theta = \frac{u_1 y_{10} + u_2 y_{20} + \ldots\ldots\ldots + u_s y_{so}}{v_1 x_{10} + v_2 x_{20} + \ldots\ldots\ldots\ldots + v_m x_{m0}} \\
&where \frac{u_1 y_{1j} + u_2 y_{2j} + \ldots\ldots\ldots + u_s y_{sj}}{v_1 x_{1j} + v_2 x_{2j} + \ldots\ldots\ldots\ldots + v_m x_{mj}} \leq 1;\ j = 1,2,\ldots,n. \\
&v_1, v_2, \ldots, v_m \geq 0 \\
&u_1, u_2, \ldots, u_s \geq 0
\end{aligned} \tag{1}$$

Then the model of linear-programming has the following form:

$$\begin{aligned}
&\max_{u,v} \theta = \mu_1 y_{10} + ... + \mu_s y_{1s} \\
&where \upsilon_1 x_{10} + ... + \upsilon_m x_{m0} = 1 \\
&\mu_1 y_{1j} + ... + \mu_s y_{sj} \le \upsilon_1 x_{1j} + ... + \upsilon_m x_{mj}, j = 1,2,...,n. \\
&\upsilon_1, \upsilon_2, ..., \upsilon_m \ge 0 \\
&\mu_1, \mu_2, ..., \mu_s \ge 0
\end{aligned} \qquad (2)$$

„Let $v = \upsilon = \upsilon^*$, $u = \mu = \mu^*$ a $\theta = \theta^*$ is the optimal solution, then DMU$_j$ is CCR effective if optimal $\theta^* = 1$ and there exists at least one optimal (u^*, v^*) satisfying the condition $u^*, v^* > 0$. Else DMU$_j$ is CCR non-effective "(Cooper et al. 2007).

In second step, we need to use regression to check the impact of selected explanatory variables on computed efficiency. For this purpose, truncated regression is often used in DEA models. To get consistent estimates of regression model we need to use algorithm proposed by Simar and Wilson (2007), which using the double bootstrap mechanism, provides the true bias corrected DEA efficiencies. Simar a Wilson (2007) suggested to solve problems with deterministic nature of computed efficiencies two algorithms. The first algorithm does not consider the distortion of data, because of that we will use second algorithm, which is used more often than the first.

$$\delta_i = z_i \beta + \varepsilon_i, i = 1, ..., n. \qquad (3)$$

where δ_i is DEA efficiency score of selected DMU, z_i is set of explanatory variables, β are regression coefficients and ε_i is standard error. If we use algorithm proposed by Simar a Wilson (2007) truncated regression model will have following form:

$$\begin{aligned}
&\widehat{\delta}_i^{BC} \approx z_i \beta + \varepsilon_i \quad \text{i} = 1,2,....., \text{n}, \\
&\text{where } \varepsilon_\text{i} \ge 1 - z_i \beta \text{ and } \varepsilon_\text{i} \in \text{N}\left(0, \sigma_s^{\,2}\right)
\end{aligned} \qquad (4)$$

where $\widehat{\delta}_i^{BC}$ is bias corrected efficiency using the second algorithm proposed by Simar and Wilson (2007).

Data will be truncated left to point 1, because output efficiencies are in interval 1 to infinity. The main point of this regression is that explanatory and dependent variables under this boundary are completely latent.

The subject of research will be then individual subjects of public administration, which belongs under governmental administration and have to serve to citizens such as labour offices, town offices, higher territorial units, social insurance offices, and many others. The focus could be as well as on the efficiency of processes of implementing the e-services in public administration subject.

3. Results

According to our research, there is lack of concepts of evaluating the public administration subjects using mathematical methods. If we want to build up trust in public sector services, first, we need to improve the accessibility of information to the citizens. Building trust in the public sector is challenging. If we want to measure and evaluate efficiency in the public sector, we need to identify the key value drivers, i.e. the variables of our concept. In the first step of the two-step DEA, we

need to specify DEA input and output variables. These variables must be based on the nature of processes in the public sector, but must also be quantifiable and measurable. The issue of selection of the variables is more difficult, because so far there has been a very small number of studies that would examine the suitability of the use of individual indicators in the practical field. But this fact opens the wide area of possible research. In the figure 1 we propose theoretical framework for the variables, which could be used in the DEA two-step models. In the first step, we need to define inputs and outputs of CCR and BCC models DEA. We divided the input variables into three main groups:

- Financial indicators – they deal with financial and monetary value drivers,
- Staff Indicators – these indicators deal with number and structure of staff key indicators,
- Capacity indicators – they show, how is the capacity of individual subjects utilized.

We have included to capacity indicators Number of kiosks – information facilities and Number of desks serviced, which can be the average rate of desks occupancy during the selected period. To staff indicators we have included Number of staff – absolute value, qualification of employees, certificates and degrees, which can be rated by verified schemes of personnel qualification levels, and in case of grant schemes application we selected variable Number of staff in project team. As financial indicators, we selected Costs or Expenditures – from financial statements (mostly for lower level of public administration), Personnel costs, Project management costs (personnel and other costs) and Annual salary bonuses as a proxy for measuring the adequacy of personnel performance valuation. Output variables has been divided to three groups:

- Administration indicators – which deal with the satisfaction of clients and performance of individual subjects in fulfilling request of clients,
- Grant scheme indicators – these indicators deal with success of individual projects,
- Financial indicators – which shows the financial effect of administration processes in selected – mostly in lower level of public administration.

Administration indicators are mainly Number of clients, Number of satisfied or dissatisfied and number of tasks fulfilled – average yearly percentage based on monthly data. Grant schemes success indicators are amount of grant received – in monetary expressions, Number of projects submitted, Number of people employed within the project and Number of successfully granted projects. To financial indicators, mainly suitable for lower level of public administration subjects we have incorporated Tax revenues and Mandatory fees, which can be significant income especially for smaller municipalities.

The special groups of variables are explanatory variables. These variables can explain, which effects have statistically significant impact on efficiency measured in the first step. These variables are predominantly of a general nature and point to a certain common characteristic of a particular region. The variables, we have selected are mentioned in the fig. 1.

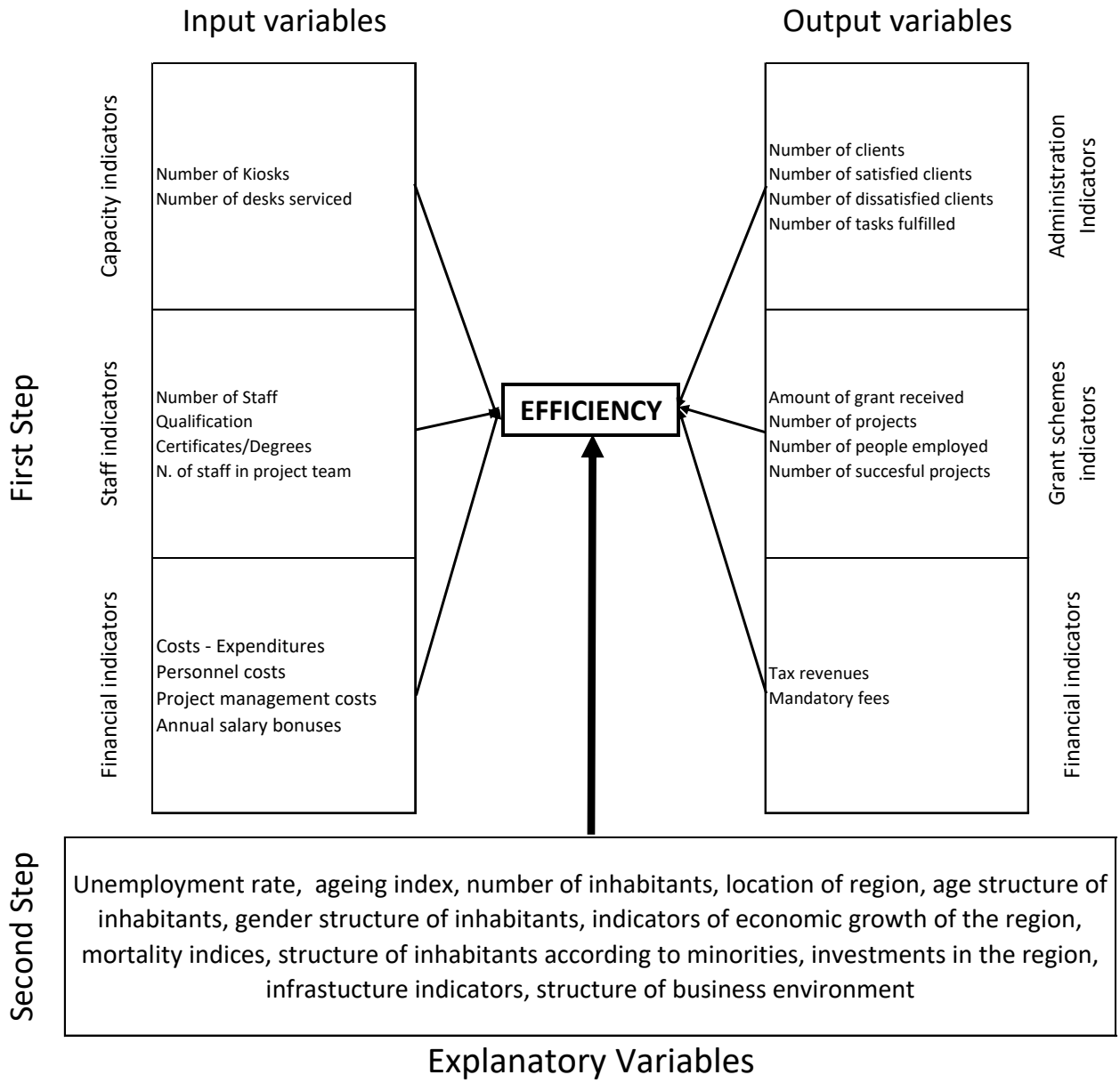

Figure 1 Conceptual framework of evaluating the efficiency of public administration

4. Discussion and conclusion

Concept, we have proposed could be used on most of the levels of public administration. It could be easily modified and used to measuring the efficiency of e-services in public administration and improve the truest in such digital services. The most important thing is, that the concept has to be supported by the government and individual public administration subjects. If so, then we can build and improve the trust in government and in public administration. Citizens could then observe how efficiently organized government processes are, how effectively public resources are used, and how effective staff officers are. The most important question is the selection of variables of this concept, the choice of variables must be individual for each type of public body. It is necessary to thoroughly review the processes and thus identify the key drivers of the values and performance of the given types of public administration bodies. We have to note, the conceptual framework we have proposed is not the final solution. It is just framework, the algorithm how to measure and

evaluate the efficiencies. This framework needs serious discussion in the field of research. According to our research there is gap in this field of research, so there is space for researchers to prove or refute this concept of evaluation. Based on this, individual variables have not been tested yet by any author. Many case studies could be done. If government is likely to discuss and implement this concept, it would be useful, because the government and public administrations subjects have access to individual indicator´s values. In the case of Slovak republic, some of the variables is hard to obtain. There is chance to build automatized algorithm of evaluating the efficiency in public administration, which will provide results for decision makers. All we need is cooperation with higher levels of public administration bodies. Explanatory (environmental) variables are also very important, because they can explain how individual factors of particular region, could influence the efficiency of public administration subject. These variables are easier to get, than the variables needed in first step of analysis. The main source of data could be in case of CEE countries EUROSTAT, but also national agencies for statistical data. There are differences of inhabitant's structure, for example in regions with unemployment rate, there will be more clients, who are searching for the job and thus more work for labour offices.

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ONLINE REPUTATION OF SELECTED CAR BRANDS

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Keywords

Reputation, On-line reputation, Reputation determinant, Reputator, Internet, TOR, Automotive

Abstract

The paper discusses the issue of reputation, more specifically the ways and methods of its measurements in selected entities operating in the automotive sector. A thorough multifactor analysis of reputation in the virtual world of the Internet was conducted on a specific sample of entities/ subjects – Top 10 car brands by market share on Slovak market. Using a careful statistical testing relationships between factors were examined in order to identify and describe facts affecting online reputation of those entities in the hyper competitive market environment of the Internet. The findings identified by the analysis of online environment were compared to traditional success indicators as market share. The results of analysis thus providing a comprehensive view on the issue of the online reputation in the widest possible range of perspectives.

1. Introduction

Reputation is an extremely important factor for gaining and strengthening consumer trust and confidence in the virtual as well as real world (Helm et al, 2011; Gottschalk, 2011; Maryška, Doucek, Novotný, 2012; Maryška, Doucek, Kunstova, 2012; Pollák, et al, 2016; Dorčák, Markovič, Pollák, 2017). Trust building is a long and arduous process and includes feelings, impressions and experiences of people who came into contact with the given company / business entity. The Internet has changed the way we perceive reputation (Stec et al., 2014). In the past reputation of a company or individual was the result of hard work and also well-guarded. At present, all it takes to destroy good reputation is just a few mouse clicks. There are many people who are trying to destroy someone's reputation deliberately, like envious competitors, unsuccessful job applicants or dissatisfied clients. The Internet gives them the opportunity to constantly interfere with online reputation of a company using Google or entire site which are flooded with false or modified information. If a company is thoroughly prepared, it can defend itself from such attacks on their reputation. The Internet is hard to ignore, it is not a trend that would disappear, but rather its strength is growing. Even though some companies do not care about their reputation, everyone else is watching it - employees, potential customers, competitors (Soviar, 2011). Available information thus change everyone else's view of the company (Fertik, Thomson, 2010). Online reputation management is the process of ensuring that the right information appears when people searches for it in browsers such as Yahoo!, Bing, Google or social networks Facebook, Twitter, Linked In and the like. The idea behind online reputation management is to minimize the negative content and promote flattering content. To achieve this goal, it is necessary to monitor the search engines and social networks and do what we can to minimize the amount of negative comments (Stradtman, 2012). Negative content can be pushed back by creating enough positive content so it would appear that negative content just vanished. Also, it is sometimes possible to get a competent administrator access and remove such a content. While access to the actual analysis, let's look in more detail at the basic characteristics of research problems. The following instructions should be followed as closely as possible.

1.1. Reputation in the online environment, online reputation management

Many Slovak and foreign authors (Kanika, 2016; Sasko, 2014; Pollák, Belovodská, 2015; Delina, 2014; Delina, Dráb, 2009; Delina, Tkáč, 2010) argue that the concept of online reputation may cover many aspects ranging from organic presence in the search results, through traditional channels of marketing communication to its presence in its own virtual channels via social media. Reputation is thus the result of the activities carried out by a business entity on the Internet. Reputation also includes interaction with customers and their reactions (Fill, 2009). Today, there is no need to question why the online reputation is important, but rather how to analyze the current state of online reputation and how to get started with its active management (Marsden, 2013). In the following three points, we will point out a few facts that are crucial for active online branding:

- the number of potential online customers is increasing,
- availability of information on the Internet,
- need to keep the brand under control.

It is an objective fact that the number of potential online customers is increasing. More and more companies are becoming aware of the fact that online presence is a necessity. Consumers enjoy fast access to and favorable prices of services and goods on the Internet. It is likely that people soon will buy online goods and services mainly because of their convenience and not only for favorable prices. Therefore, online presence and reputation are crucial for attracting new customers. Online

references and reviews have a similar effect as recommendations from customers. Overlooking online reputation may mean the difference between success and failure or bankruptcy (Leboff, 2011). Another very important factor speaking in favor of online presence is the ever-increasing availability of information. Nowadays many people are familiar with social networks which also feature online reviews. It is quite possible that a lot of things we do offline will become online matters. Therefore, it is important to remember that online and offline world are closely linked and our business activities in the offline world will be eventually reflected in our online reputation. Online reputation management is one of the best possible ways to find out the current status of business entity's corporate brand. It is more than possible that our customers will at some point of time leave a review on the Internet. In addition to web platforms and websites it is necessary to control all the "other" media associated with our brand like interaction with customers, fans or even competitors (Pollák, 2015; Dorčák, Štrach, Pollák, 2015; Soviar, Vodák, 2012). The article provides an insight into the active reputation management in the online environment using a thorough analysis of one of the available methodologies. Moreover, the article also evaluates data, identifies common background and provides recommendations regarding the subject matter, namely top-selling brand of cars operating on the Slovak market.

2. Aims and methods

The main objective of the paper is to present chosen option for measuring online reputation of selected entities operating in the automotive sector with an aim to increase their competitiveness through a better understanding of the basic determinants of effective management of online reputation. Based on the current state of the issue theoretical knowledge and bases were accumulated, that provide knowledge base for the subsequent empirical research. A thorough multifactor analysis of reputation in the virtual world of the Internet was conducted on a specific sample of entities – Top 10 Slovak bestselling car brands of year 2016 by tier market share (in table indicate in % as "MCS", or MCS score). For the purpose of this research we used modified multi-factor sentiment analysis on which we would like to demonstrate model option for measuring total online reputation (TOR) of selected entities.

Methodology of the modified multi-factor analysis (Pollák et al, 2016) of the total online reputation TOR (Pollák, 2015), brings more variability in its application on a broader spectrum of subjects than standard multi-factor analysis introduced by Sasko (2014). Moreover, it also brings a comprehensive look at the reputation of the given entity relative to the total possible reputation expressed as a percentage. Methodology used in the TOR index uses n-factors.

The first step analyses the sentiment of the first 10 results on Google. As for the number of groups, the standard is at least three groups: 1st group: name of the entity, 2nd group: name of the entity + the first most important keyword from the field the entity operates in, in our case it was „Slovensko" (taking into account the language competencies of the customers of the selected market). The number of groups is not particularly limited. Quantification is then ensured by unifying the scores into the percentage form. This is based on the assumption that within a single group the entity may receive a maximum score of 155 points – the ratio 1 point = 0.645%. For purpose of our analysis with 2 groups, the entity may receive a maximum score of 310 points – the ratio 1 point = 0.32%.

Second step identifies the determinants of online reputation, the reputators. Reputator can be any determinant that can objectively affect the perceived online reputation of the entity, while its value can be quantified as a percentage (Pollák, 2015). Normally these are important web pages, catalogs or social networks that can significantly affect the reputation of the entity. Given the various business fields entities operate in, reputation determinants cannot be clearly defined in advance. In

terms of advantage quantification, it is possible to approach individual reputation determinants by calculation of reputators' competitive score - the amount of users (fans / customers / followers) the particular entity has relative to the sum of all tested subjects. The result serves as a basis for calculating the percentage of the reputators' competitive score (CS) of the particular entity. In other words, reputator competitive strength of the particular subject can be calculated as the size ratio of its own tribe indicated as the total number of subject followers/ fans/ subscribers/ to the total amount of tribes of all tested subjects.

In the third step we can calculate the total advantage of the entity's online reputation with regard to its pre-defined competitors, as follows: Standard equation (Pollák, 2015) features specific determinants of online reputation and their weight. The basic reputation determinant is the ASA percentage score. The equation allows us to take into account any number of other reputation determinants. For the calculation itself it is necessary to determine the weights of individual reputation determinants which are normally determined depending on the subject and target market. If the weight of individual reputation determinants is not known in advance, the simplified formula for calculating the overall online reputation is as follows:

$$TOR = \frac{R_{ASA} + \sum_{i=1}^{n} R_i}{n+1}$$

Where:

TOR- Total online reputation in %

R_i - Reputator (% score based on a given i-th determinant of online reputation

R_{ASA} - Reputator ASA (% score based on the advanced sentiment analysis)

n - Number of indicators

In this case, the value of the overall online reputation of an entity is the arithmetic mean of individual indicators (partial scores of individual reputators). Relations among factors (online reputation score based on the advanced sentiment analysis compared to the indices of reputation offered by the main Internet players, such as Facebook and YouTube provide as a part of their ratings) were then examined in thorough statistical testing using non-parametrical methods, such as Kendall rank coefficient, in order to identify and describe basic facts affecting online reputation of selected entities in the hypercompetitive market environment of the Internet.

3. Results and discussion

Each of the set of selected entities, in this case top 10 Slovak bestselling car brands of year 2016, try to shape their reputation both within real and virtual world through their management. For the purposes of our research, we focused on the virtual world of the Internet.

3.1. Overview table of partial score

Using the advanced sentiment analysis (ASA), we calculated partial score presenting the power of online reputation of entities based on the nature of the first 10 Google search results (personalization of results was removed by utilization of online proxy anonymizer). Google and its search results are, however, only one of many ways in which potential customers can access relevant information.

Considering the previous research in the field of automotive industry, we identified the following other determinants of online reputation (reputators) of automotive entities, in particular:

- Facebook (total number of fans of the official global profile),
- YouTube (total number of subscribers of the official global profile).

Each of these reputators has its own system which determines the overall score. But basically all of them operate with a certain tribe of the customers (followers, fans, subscribers). For the purposes of further analysis scores of partial reputators were unified to the parameter which we named competitive strength, hereafter referred to as CS and converted into a percentage. Before we analyze the results by statistical testing, it is necessary to expound the specific values and partial score for the analyzed subjects through the overview table.

The following table presents partial results - measured values of individual determinants / score of partial reputators of online reputation/ as well as score of total (overall) online reputation:

Table 1: Overall (Total) online reputation; Source: own processing

Rank	Car brand/ Result sentiment	ASA score (%)	FCS score (%)	YCS score (%)	Number of pages indexed by Google	MCS score (%)	TOR Score in %
1.	Volkswagen	33.92	29.69	17.99	573 000 000	29.57	27.20
2.	Hyundai	22.72	19.76	7.97	560 000 000	19.64	16.82
3.	KIA	31.04	15.12	12.95	526 000 000	15.19	19.70
4.	Škoda	23.36	11.75	25.42	62 400 000	11.84	20.18
5.	Peugeot	21.76	10.56	16.56	473 000 000	10.60	16.32
6.	Dacia	17.28	4.32	2.55	106 000 000	4.30	8.05
7.	Opel	31.68	3.98	2.39	361 000 000	3.97	12.69
8.	Mazda	12.16	2.77	7.21	464 000 000	2.80	7.38
9.	Suzuki	23.04	1.10	2.26	630 000 000	1.10	8.80
10.	Mitsubishi	41.28	0.96	4.59	553 000 000	0.99	15.61

Firstly, we focused on analyzing the reputation of the selected business entities using broad sentiment analysis. For each analyzed subject we took into account the first ten results after typing in the selected keywords – name of the brand - in the search engine Google. The first results featured, as expected, brands' own websites followed by websites with predominantly neutral character. A link to the online encyclopedia Wikipedia and links to profiles on virtual social networks were marked as having a positive sentiment. Interestingly only two brands showed negative results in the search engine. Then, we added to the name of the brand another key word - "Slovakia". This keyword significantly increased the incidence of positive sentiments (as well as negative in selected cases) in the search results. Except for the brand Škoda, all subjects showed at least one positive sentiment.

In the second step, we analyzed the dominant determinants of reputation focusing on profiles on the most popular virtual social networks / media. We found that each of the analyzed business entities actively uses localized channels on YouTube. Each of the analyzed entities uses the social network Facebook to implement their marketing activities (although this medium is in terms of e-marketing considered a necessity). Although the language and content localization are sufficient, the efforts are insufficient given the trend.

In the third step of our analysis we calculated the overall reputation. The clear winner is Volkswagen, Škoda and KIA, which showed the best results among all the studied subjects. The following figures will show some interesting facts resulting from the analysis.

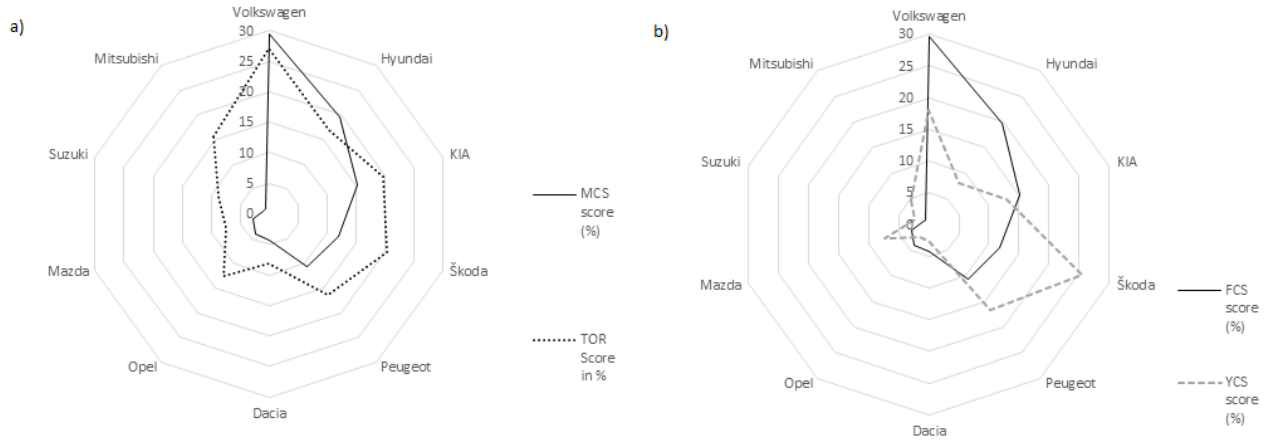

Figure 1: (a) Market share vs. Overall On-line Reputation; (b) Activity on VSN; Source: own processing

Figure a) compares the market share of brands from the point of view of the strength of their total virtual reputation. Figure b) shows the power each brand has on the social network Facebook and YouTube in terms of fans / followers. With regard to the overall reputation and the total market share of the brand, figure a) clearly shows that the Volkswagen Group duo does the best work among all the studied brands. Based on the analysis' results we began with statistical testing of the selected context. Regarding the correlation between the market share and the level of the overall virtual reputation, the p-value is more than 0.05 (the significance level of 5 %). Thus, we can reject the existence of a statistically significant connection between the variables. With regard to the correlation between the scores given by the sentiment analysis and the total number of Google index pages regarding the business entity, we can conclude that the p-value is less than 0.05 (the significance level of 5 %). Thus, we were able to confirm a statistically significant correlation between variables.

4. Conclusions

From the point of view of analyzed subjects, brands in the leading positions have a distinctive advantage in terms of their online reputation among Internet users. In case the user seeking information about a particular subject does not encounter positive reputation indicators, this can ultimately affect his/ her overall perception of the entity. Brands should attempt to curb negative publicity, and vice versa, to enhance and work on the positive publicity. This can be achieved particularly through the active online communication policy like dissemination of positive information through renowned major online newspapers or social networks. The best way to remove negative or neutral publicity in the first ten search results is a literal displacement of negative publicity by a thoughtful marketing communication policy conducted in the online environment. In general, it would seem that the most effective model of the comprehensive online reputational management is to focus on dominant reputation determinants. Active instruments of the online reputational management can greatly facilitate active communication with public, help in acquiring and evaluating feedback or speed up implementation of measures related to a crisis marketing communication. Without a strong base of users none of this is possible, not with a significant result. What can we state at the end? The comprehensive analysis provided comprehensive results. Despite the limitations (local market conditions) we would like to state that

the resulting comparisons and formulated interpretations provide a realistic and comprehensive view of the market of automotive sector focusing on the Top 10 local car brands. The offline world represented by traditional players as newspapers or magazines largely affects the reputation of selected entities, especially among professionals. Given the specificities of the time (and the number of other research and analyses) we would like to state that the general public, generations X and Y, is affected by those traditional players in terms of reputation shaping to a limited extent. The center of their information world is the Internet. Another trend of the times, the move away from mainstream information sources to alternative media and community portals makes it harder to control one's reputation. Search results on Google in the form of links to fan pages, community forums, catalog portals or local media can reveal even smallest imperfections in marketing communication. In combination with Facebook and Google ratings in the form of stars a single person can destroy reputation of a company. The strength of that person's "marketing" message is enforced through authenticity that this message carries and making it look legit. Our research synthesizes all mentioned viewpoints and offers a clear comparison of reputations of analyzed subjects across both worlds (online and offline). The results (processed graphically) bring interesting findings worthy of greater consideration.

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SESSION G: CYBER SECURITY

PRIVACY AND SECURITY - FRIENDS OR ENEMIES?

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Cyber security, privacy, interdependence, IoT

Abstract

Privacy and security seem to be natural enemies: an attacker cannot be identified if he is anonymous, and if we want to remain incognito, man-in-the-middle attacks become possible. But this is not always the case, as privacy and security might need each other. For instance, anonymous remailers do not work without encryption, and police investigations often require anonymity. But while privacy obviously needs security, the other connection is not so obvious. This article discusses such interdependencies. Specific topics include storing IP addresses in webserver logs (legality is based on whether technical needs exist outweighing privacy risks) and whistleblowing platforms (strong security needed to absolutely guarantee anonymity, including how to obtain trust in a platform which the actual users will never recommend to remain anonymous).

1. Introduction

Privacy and Security are often seen as antagonists: only criminals want privacy as everyone else has nothing to hide, and if privacy is granted, security deteriorates and terrorists rejoice. However, this need not be the case. Consider the following examples: if a security problem/incident can be disclosed anonymously, an employee is much more likely to publish it, as she need not fear repercussions from her employer. And publishing a vulnerability a company knows that it exists, but does not acknowledge or patch, can be a significant permanent increase of security – after a short time of decrease. Or imagine disclosing that all customer login passwords (clear text or weakly hashed) had been stolen: users can then take countermeasures (changing password) or precautions (paying attention for signs of identity theft). Companies like to keep such incidents secret, even if they occurred on a massive scale, which was made evident last year e.g. by Yahoo, when it admitted having lost 500 million user accounts in 2014 and 1 billion in 2013 (Goel/Perlroth 2016). But privacy can directly improve security too: encrypting communication (using HTTPS instead of HTTP) protects against eavesdropping and content manipulations, but is also useful to verify the identity of the webserver, i.e. to ensure you are really contacting your bank and not a phishing website. And note that while your bank has every right to identify you before granting access to your account, everyone else should not even know which bank you are contacting (desirable for phishing to show you an exact replica of *your* bank, and not just *some* bank) and for what (could influence your creditworthiness). Strong anonymity, e.g. surfing the web via the Tor anonymization network, improves user's security (or safety) significantly – in some countries this might actually save your life.

This paper is therefore concerned with the interdependence of features: explicit functional ones (what privacy implications security features have and vice versa), but also indirect ones (like how to acquire trust into anonymous servers in the so-called darknet). Another issue is feature interaction in the security domain. Two features might be perfectly secure and fine, but their combination is perhaps not. Consider the following scenario: your flat is equipped with one of the new loudspeaker-assistants (Amazon Echo, Google Home etc; they require a specific word to activate as a "security" feature) as well as a door intercom (securing physical access). What if someone rings at your door, you answer it (thereby activating the loudspeaker of the intercom), and the "attacker" than quickly plays a high-volume command, which is immediately executed by the system before the owner can react? This could be a command to open the door, download some malware, or access pornography. Or consider a fridge with an audio interface (for telling you the current content/weather/…) or a smart mirror (reading to you the news or your new E-Mails). If these devices get hacked, a similar indirect attack becomes possible. Increased privacy, like physical interaction before performing commands or training to specific voices (but note that recording a voice and cutting it to achieve the desired command text may be easy!) could reduce this security issue. That such IoT devices can often be hacked easily is shown by the Mirai botnet (Krebs 2016), which consisted at one time of approx. 3 million devices. Apart from being used in attacks on third parties, for instance hacked cameras are a privacy problem too.

What this paper leaves open is finding the exact balance between security and privacy – which is less a technical discussion and more an aspect of society and to be framed in laws by politics.

2. Interdependence of privacy and security

Privacy needs security. If data is not encrypted and secured against modification, privacy does not really exist. Because if data remains unencrypted, everyone with access to it will be able to see the content/any metadata (documents stored somewhere) or know who is the sender/recipient (communication). Additionally, a lack of security allows impersonation, thereby obtaining more personal data from the other party. This is not a law of nature. If for instance in the offline world the source has been completely anonymized (cutting letters from newspapers, gluing them on an empty sheet with gloves etc), it can be stored or sent anonymously. This is possible, but impractical. Unfortunately, with IT systems this is impossible, as communication needs source information for replies (technical, not in the sense of a message), and stored data is always associated with metadata by various entities like the operating system, a webserver, anti-virus logs (so in the analogy no gloves exists). Also, practically all activities on a computer leave traces – these can only be prevented by security measures.

A big disadvantage of IT security measures improving privacy is that they mostly depend on third parties. To identify the other partner (whether we can trust him/her) we need a certification authority or lots of other persons (web of trust). If we want to communicate anonymously, we need trustworthy Tor node operators or anonymous remailers. If we buy digital goods online with Bitcoins, we have to hope that the operators do not store our IP or E-Mail address or need mixing services (which we have to trust to not suddenly disappear with the entrusted money) etc. So most systems contain some sort of "chaining"; they perform anonymity measures several times after each other identically and ensure that any single trustworthy entity suffices. In this way, the lack of trust into an individual is replaced by a trust, that at least one of a group will be trustworthy.

Security needs privacy. As seen recently, security researchers (Krebs's website under the Mirai botnet attack) or security measures (regular DDoS attacks of increasing bandwidth against providers) can come under attack easily. The reason is, that everyone knows who and where they are. Attacking someone anonymous (see the similarly named collective) is much more difficult,

enhancing their security. And while security by obscurity is no solution, it often renders attacks more difficult - so use it, but do not rely on it. Another example is Google. Many persons depend on its search engine, especially that they are directed towards valid information (not fake news) and no websites containing malware. But attackers urgently desire to be included at the top of result lists. So they present different content on their websites to Googlebot than to other (human) visitors. If everyone is perfectly identified by the webserver, countermeasures against this would be extremely difficult, as the owners could easily differentiate whether to include malware in their response or not. Because of this, Google visits webpages anonymously too: they impersonate a "normal" visitor with a normal browser and compare the results. This includes not only faking the browser header but also using varying IP addresses that are not directly associated with Google. In this way they are using privacy features to verify web pages for search results, enhancing end-user security. Consider also Uber (Isaac 2017), who showed false information to persons suspected as government officials to avoid being detected operating illegally. Here privacy would have been helpful to obtain evidence.

But most of the time, security can work without privacy, and sometimes this might even cause problems. See e.g. mail server lists against spam (open relays, weak anti-spam policies…): mail servers should not remain anonymous; otherwise this countermeasure will not work anymore. Because of this danger many exit nodes in the Tor network prohibit port 25 – the SMTP protocol – which is used for sending E-Mails.

2.1. Storing IP addresses in webserver logs?

Whether storing (dynamic) IP addresses of visitors in the logfile of a website is legal or not was at the centre of a recent court proceeding in Germany (BGH 16.5.2017, VI ZR 135/13 – full decision not yet published, but remanded to lower court for more investigation into actual needs for storing IP addresses), which also involved the ECJ (6.12.2016, C-582/14). The question was, whether these IP addresses are personal data or not. If yes, then they may not be stored and logs may only be kept without this information (or individual consent by each user is necessary – including for the first request, which is technically challenging). This is obviously a privacy issue, but could also involve security implications. The ECJ decided that IP addresses are personal data, as long as the person storing them has the legal possibility of obtaining the identity of the person behind the IP address. This is possible for instance in case of cyberattacks, when the web server operator can ask (through a court) the internet service provider owning this IP address to provide the identity of their customer it was assigned to at that point in time. As IP addresses are now definitively personal data, storing them is generally prohibited. In Germany this was even more strict, as no usage at all, except for providing the service and charging the user, was allowed by law. Therefore, theoretically no web server is allowed to store any IP address in Germany anymore (but see below). This is not limited to webservers (only these proceedings are), but applies e.g. to firewalls or other security devices too.

While this is advantageous for privacy, it could result in a security issue. However, the ECJ simultaneously decided that the absolute prohibition of storing such data in German law contradicts EU law. The option of the person storing personal data to explain that because of overriding interests such storage and use is legal (as laid down in Art 7 lit f of the EU privacy directive 95/46) must remain possible. Then the provider must argue why storing IP addresses is necessary, and for how long this reasoning applies, to allow the current practice to continue. This is however seen as problematic, as an expertise in this proceeding (Köpsell 2011) explained that for security reasons it is never necessary to store IP addresses, at least in direct (=unencrypted or unhashed) form. However, this expertise is in my opinion at least partially flawed or misleading. Consider e.g. the following case: an attacker tries to hack a webserver and fails initially, but the next attack succeeds. The only trace to this attacker might be his IP address from the first attempt. And while it is correct

that proxies or Tor anonymization servers can be used to hide the IP address of the real attacker, not every attacker will be using these, sometimes forget about using them, or mess up in a different way. Moreover, it is well established that encryption is very useful to improve privacy, but does not in any way remove the legal classification of data as "personal" as long as the key is not under control of a different person without a disclosure obligation. The same probably applies to hashing in case of IPv4: there are only 4 billion IP addresses, so hashing them all for a comparison is trivial. Because of this, encryption (or hashing) does not change anything legally, and from the security point of view is only helpful in the event of an attacker obtaining access to the log files, but not the decryption key (so asymmetric cryptography is needed or the symmetric key would presumably be obtained at the same time as the logs). Legally it is difficult to argue that a measure that would at least in some cases help identifying an attacker is more harmful than briefly (a common duration seems to be 7 days) storing an IP address, which in itself (and note: even for almost all attackers!) cannot legally, and almost always practically too, be associated with a computer - which is moreover one further step removed from a person.

Additionally, it should not be forgotten that storing IP addresses also works the other way around, e.g. for companies storing the IP addresses of their employees when accessing their own webserver or (e.g. on a web proxy) external servers. In this case there is no question that these are personal data, but additionally there can be no doubt that this storage is useful to pinpoint e.g. data extrusion (by the employee or because that computer is infected by malware) or illicit behaviour.

In my opinion, the storage of IP addresses is a good example that privacy and security can coexist friendly. If this data is stored, there is little danger for the person involved: unless an attack occurs, there is little incentive for the company to attribute this IP address to an individual. Simultaneously, it would be very hard (and often illegal) for it as well. Any attacker would have the same problem as the company, so unless reidentification is possible, e.g. based on other information available to the attacker or inherently from the logged data, this is neither a very lucrative target nor a danger. The main driver behind this peaceful coexistence is the separation of the identifier (IP address) and the identifying information (who this IP address belongs to). Therefore any "integration", e.g. by secret services etc, is much more problematic. So this assessment only applies if the IP addresses are stored (securely!) and are used only for investigations because of actual attacks. This principle is endorsed in the new privacy regulation and called "pseudonymity". However, the regulation does not require different data owners or the existence of legal restrictions; only keeping it separate and technical and organisational measures to prevent combining the pieces are needed. This applies to the company-internal example above too, as typically the IP assignment is separated from the log files and must be kept in this way. It should be noted that additional security precautions are advisable to ensure that this separation remains in place unless there is a legitimate reason for identifying someone – and to prevent both parts stolen simultaneously, or combined without any traces like logfiles or instruction from supervisors.

2.2. Whistle-blowing systems

Whistle-blowing is becoming a commonplace occurrence in some areas, e.g. regarding secret services or some national public administrations. Even if such disclosures are not necessarily seen as positive by all involved parties, much smaller occurrences are important as well. E.g. in many companies such a system is helpful to discover internal fraud, bribery, or simply wasting resources. While in this context the need for privacy is obvious, exceptional circumstances apply. For instance, often a channel for bidirectional communication is desirable, to e.g. allow questions (details, clarifications…), preventing many common forms of anonymous communication. In addition, security gets important in both directions: preventing an anonymous report with an attachment (e.g. ostensibly a document or financial data) from infecting company computers used

for investigating the report, but also similar attachments of a question to the whistle-blowers from disclosing their identity.

A new functionality hitherto not implemented by whistleblowing systems could be a secure confirmation of sending a report. The idea is, that you send a report about some shady dealings within your company, and if the problem is not addresses but becomes only much later, you can show the confirmation and explain, that you did report it and nothing more could have been expected from you. If the management did not act on his information, at least the whistle-blower will not go to jail. Here both security and privacy must be closely intertwined and work together to guarantee anonymity for the whistle-blowers, but allow them – and only them! – to reveal their identity and prove, that a specific report was submitted at a specific point in time.

To implement such functionality, first the confirmation would have to include the specific content of the report. Otherwise a useless triviality is reported and the confirmation employed as exculpation in a much more serious case. This content need not necessarily be the full report, but could e.g. be its hash value only. However, as this is to be used potentially "against" the company, the whistle-blower would have to be able to recreate the exact report or the hash would be useless as the company could provide subtly different files as the "officially reported" ones – or none at all ("No report was received."). It is therefore recommended to simply include the whole message with all attachments. Only then a verification is possible and the report itself can be evaluated whether it did contain "enough" information for legal privilege. Simultaneously it must be ensured that the report has really been sent (and received), moreover at a specific point in time, as mere production and local storage of a report cannot be enough. This can be ensured with a signature received when submitting a report. Again, it must be ensured that the company cannot later somehow invalidate this signature, e.g. by deleting a key or certificate. Because of this, the whole signature chain needs to be stored (see also "certificate transparency"). As the evidence might have to remain valid for a long time, a very secure signature is recommended; respectively the whistle-blower must obtain confirmation timestamps/updated signatures over time to retain evidentiary value.

It is necessary to consider that in this approach the company officially "signs" a document they do not yet know the specific content of. From the security point of view, it is therefore important to use separate keys/certificates from other functionality and ensure that it is impossible to obtain an arbitrary signature. The system should therefore not sign the report as it is, but rather a "confirmation document" containing a hash of the report, together with a timestamp and some random (=unpredictable) data. The whistle-blower can then obtain a signed timestamp from a third party for this document to prove that the confirmation was received before a certain point in time.

A remaining problem is that the whistle-blower must store not only the confirmation but also the report. This is evidence against him or her - if found in his/her possession. Secure storage is therefore important to protect privacy; e.g. by storing it in an encrypted container or as a (re-digitizable) printout in a physically secure location. If in doubt that the company would decline issuing a confirmation, a third party could be involved (which could be e.g. an independent operator of the whistle-blowing platform, or be implemented using blind signatures or fair exchange protocols with some other TTP). In this way, simultaneous disclosure (report and confirmation) becomes possible.

Another potential issue is a fraudulent confirmation, e.g. after the content of the report is discovered and published, a top manager creates a report he claims to have submitted a year before, but which had been ignored, as an excuse for himself. As he might obtain access to the technical infrastructure (including keys etc) of the company, the only solution to this attack is an external timestamp. To prevent such attacks, the timestamp above for a successfully handed-in report, while optional for an honest whistle-blower, must be mandatory so nobody can create a report after the fact.

This example clearly shows the interdependency of security and privacy, where security is needed to guarantee privacy, while privacy is needed to obtain information improving inter alia security.

2.3. Trust in darknet servers

Servers in the darknet remain anonymous in the sense, that their physical location (and typically also their operator) are hidden. While this is not a problem for e.g. accessing Facebook via the Tor network (typically to avoid censorship), other services like whistle-blowing platforms find this problematic. How does someone know he really is at the platform to disclose information to *the* New-York Times and not just *someone/-thing* called "New York Times"? And where is this server physically (e.g. regarding fears of government interference)? He can only compare the onion URL (nytimes2tsqtnxek.onion) to a known value (of a hopefully trustworthy source), and potentially (if present) check a certificate (in this case issued only to "The New York Times Company" – which could be correct or not). While it would be very hard to modify the directory of hidden services, adding a new hidden service is trivial to do; then you only need to convince the victim to connect to your site instead of the real one.

There is a second level of trust involved, too: can we trust the real New York Times? This institution might be well known, but they are subject to USA law. And for shops offering illegal goods typically no one is known as the operator (respectively only as a pseudonym). To reduce this problem third parties holding the payment until confirmation of receipt are sometimes used. But whether these can be trusted is similarly problematic, as every now and then one of these escrow sites folds and the operator runs away with the currently entrusted bitcoins. This closely resembles e.g. e-Bay: can you trust the seller to send the actual product (and not a stone inside a package), or the buyer to not claim having not received the product at all (or an empty package)? And while official postal confirmation is easy for legal sales, sending e.g. drugs through mail with registered sender and recipient could be problematic regarding privacy (the recipient must always be known or no product can be sent; false identities or stolen accounts for mail drop systems are needed for anonymity).

So how is trust possible when the other side is technically anonymous – everyone can claim to be someone else easily? Here security comes in, similar to the web of trust. If many other persons trust a website/shop/whistle-blowing platform, then I can trust them too. Unfortunately, lots of positive reviews are easily written by a single person. Security should ensure that these persons are real and different (but potentially unknown) persons. Electronic signatures do not help there, as a key is as easily generated as registering a free E-Mail address is. So only if this anonymous identity is tied to multiple and extensive other elements (old blog posts, known from other sites etc) believability exists. But confirmation by other persons is only useful, if a chain to non-anonymous and trusted persons can be built, i.e. if the persons are not fully anonymous, but merely for you (=pseudonymous). While such an approach could be gamed too, it requires a lot more effort and especially time to prepare. So logically "long existence" is often equated with "trust". This therefore only works against short-term ("immediate" or often-repeated, typically of low value) fraud, but not one prepared for a long time in advance (once/rarely, involving high stakes); and identities providing confirmation for one fraud can be reused for the next one. Note that such trust is very difficult to bootstrap, as no previous record exists. The first user must blindly trust the service, and only later users might determine – based on his reports – that this is a/the real website.

Because of this, whistle-blowing platforms are especially vulnerable, as the actual users never want any traceability to their real identity. Confirmation can therefore only stem from non-users, i.e. the operators of the platform. As these are probably unknown as persons to potential whistle-blowers, another confirmation is necessary. Mere mention of the Onion-URL on an associated "normal" website is only useful, if the integrity and identity of this website is assured. E.g. if this website is

not accessed via HTTPS, any system on the transmission path could easily change the Onion-URL or any other information. Another possibility would be a signed statement including the Onion-URL on the submission or the public website. Then trust in this statement's signers is necessary. But many persons can sign it so the probability of a trust path is much higher. Also, these need not be limited to the organization operating the whistle-blowing website, but can be any third person.

3. Feature interaction in the security/privacy domain

Feature interaction (see e.g. Nhblasti/Laney/Nuseibeh, 2008) is concerned with two (or more features), which are perfectly fine if considered solitary, but may lead to undesirable behaviour if combined in a specific way. This may be seen as emergent behaviour or an aspect of holism too: combining elements can amount to more than the mere "addition" of these elements. This is not directly applicable to security, as is is not a functional feature which is "added" to a product. Still, security consists of very specific individual functions, like methods of user identification (password, fingerprints, facial recognition etc), storing data (various methods of encrypting data and organizational measure for storing the keys) or ensuring anonymity (like partitioning data – pseudonymization – or anonymization). Unfortunately, these elements might still be somewhat distributed (e.g. permission checks), so some standard approaches to prevent undesirable feature interaction, like architectural decomposition or serialisation of activities, are not applicable.

In the context of privacy, feature interaction is a ubiquitous problem, but typically seen under the name of "reidentification". Assuming we store various information about a person in file A, then this might be perfectly anonymous (or at least pseudonymous, according to the new data protection regulation; Example: student number + birth date). Simultaneously other information about the same person is stored at B (student number and home address), which is again anonymous or pseudonymous. But if both files are combined, the identity of the person can be identified, as birth date + home address are very likely unique, while either of this information alone is not. Any other data in these files is then attributable to these newly identified persons.

What could be done to prevent, or at least simplify detection of, unwanted interactions of security or privacy features between themselves or with other elements? Examples are:

- Clear separation of security functionality: If security is intermingled with other functions, changing and updating it becomes difficult. Moreover, the uncertainty of distinguishing undesirable interactions from normal ones increases, as it can be difficult to localize a problem, especially if it can stem from a security denial or a functional problem, but occurs at the same location. In the context of a web application for example a definition of access permission to pages should be centralized, like a configuration file, while manually checking permissions in the code should be avoided (easy to forget, varying error messages etc).
- Unified and centralized storage definition: Like security, logging and data storage should be centralized. This means that the configuration of which elements to log/store and where should be stored logically in a single central configuration, while the physical location of the elements can be distributed widely and in whatever manner is useful (and which might depend e.g. on privacy considerations too). This also allows determining from a sample of the stored data whether their combination is problematic for privacy or not.
- User input must be treated cautiously: Every user input may be a security issue, as it might stem from a malicious user. In web applications this is obvious, as a website is typically accessible from the entire world. But this applies to all sensor input: it might have been hacked or its input (or output) modified, which could lead to undesirable behaviour in

further processing. Any user input also has an originator, whose privacy might be important to protect – or not. Because of this, all input needs considerations whether it is attributed to a single person (can this be removed, should it be stored etc.), or whether – together with other data – it might allow identification.

- Improve authentication: See e.g. the audio examples from the introduction. While it is nice not to have to train the audio recognition, an unknown voice should be limited to "harmless" commands (which in itself can be difficult to decide upon). Speaking the name of the recognized person in the answer could be used as a simple feedback. This feature would simultaneously prevent loops between devices like the whistle-blowing example above: do not sign (or repeat) anything provided as a report (voice input), but create a new output merely based on the input received. While announcing the name seems to be contrary to privacy, it allows filtering on other devices and provides feedback to the user.
- Interaction between security and privacy: Smart homes typically have the problem that either no internal permissions exist (anybody can issue any command; security problem), or authentication is necessary for each sensitive command (cumbersome, potentially problematic for devices lacking a user interface; privacy issues). If the identity is verified only once and then the user tracked across the home, no separate identification is necessary. This could be implemented in a way that any individual device only receives the information that the person issuing a command is authorized, but not who this person is, or only a pseudonymous token. This approach becomes especially important if these devices are not merely local elements, like a TV (age restrictions for watching), but networked and information is exported to external providers (like networked thermostats).

While it seems obvious, a significant improvement for feature interaction in the security as well as privacy domain would be testing in actual environments by simulated attackers. The focus here lies on "actual environments" – as an individual element they may be perfectly safe, but in a *typical* (hopefully) and (ideally) *any possible* environment other elements could be important. As an example see the Mirai botnet mentioned above: alone e.g. a camera may be reasonably secure and not pose a danger. But when considering that it is connected to the Internet and is both reachable by anyone and can connect everywhere, together they create a huge danger.

Centralisation seems a good approach to solve feature interaction (see e.g. the case for a single central smart home system in the cloud, monitoring and controlling everything), but this is in my opinion doubtful regarding feature interaction. A central instance may have the possibility to check all interactions, but is this going to happen? And how? The more elements are combined (and a single central instance would by definition have to encompass everything), the more interactions may and will occur, with a theoretically (in practice not everything will/is able to interact with every other device) exponential increase. And would it be in the interest of this institution? Imagine that several devices together might disclose the identity of visitors in the home (e.g. doorbell/presence sensors + personal calendars of the persons living there) – for advertisers or social networks this would be very valuable and useful information and not an instance of unwanted, but rather desirable feature interaction. The visitors might assess this differently. Similarly, criminals might see security problems as an advantage, but also would intelligence agencies or the police. Feature interaction, especially in security and privacy, must therefore also be appraised from the point of view of various stakeholders. Some might see this interaction as positive, others as negative.

Full separation of all devices is a fool proof solution to feature interaction, but simultaneously ends all interaction and is therefore no practical and desirable situation. A middle ground is therefore necessary. How could this be found? Criteria for deciding on the degree of centralisation could be:

- Compartmentalization: Centralisation, but only for limited and small areas. E.g. centralisation for heating in a single household, but not block-/citywide. The scope of potentially unwanted interaction is limited in this way, and easier to test too (see above). At the same time passing out personal information is limited too.
- Hierarchy: Less interaction, and on a more general level the larger the scope is. E.g. regarding the heating example, a shared "average outside temperature estimation" could be city-wide communicated to all devices. This also means disclosing only that information (outside temperature), which is really needed at higher levels. In this way privacy (e.g. inside temperature and its adjustment) is protected best.
- Independence: Systems should contain all the capabilities they need and not depend on other systems as far as possible. Speech recognition for instance could take place locally instead of at a single provider, while e.g. the weather forecast will remain centralized. This might not be as efficient, but it automatically creates redundancy. This will hinder some business models and increase prices (more computing power needed locally), but retain at least some functionality in case the central system fails, communication is not possible, updates are no longer available, the central API changes etc.

As an example for (lack of) independence a recent investigation (Lauinger et al 2017) of the security of JavaScript libraries can serve, i.e. whether a website uses an outdated and known to be vulnerable version of a library: when a library is directly included in a website, then it is less likely to be outdated than when it is included indirectly from an intermediate script or within a frame. The inclusion of a script by ad, widget, or tracker code is in some areas almost double as likely to be outdated than direct inclusions. This could e.g. be reduced by directly including all elements into the own website (=local copy on webserver), which would also solve or at least reduce the problem of double inclusion, perhaps even in different versions, of the same library (also investigated in that paper). When not including scripts from external websites, these external parties also loose the possibility of tracking users, e.g. through cookies, thereby improving privacy. As a bonus, legal certainty increases as well, as linking to foreign data is now becoming increasingly dangerous (legally and within the EU). A local copy poses much less difficulties in assessing its legality.

4. Conclusions

Privacy is subordinate to security in ICT: security can exist without privacy, but not vice versa. But in some cases security does need privacy or in many cases is improved through it. This interdependence was explored through a few examples specifically and a discussion of feature interaction more generally. It was also identified that more attention is needed for the stakeholders: who is privacy and security intended for? In many cases these might be intended for "externals" only, but not between the end-user and a service provider (especially privacy). Security might also aim at merely fulfilling legal obligations and securing one party – whether the other party is adequately covered is less an issue. For future development, the following aspects seem paramount:

- Independence: The more elements from other providers are included for creating the results, the more fragile the entire system becomes, the more avenues for attacks exist, and the more persons can identify and track the user.
- Include embedding in a system: Similar to ordinary products, software must consider not only whether security and privacy are guaranteed in itself, but also for both normal use as well as foreseeable misuse. In the area of product security law this is already the basic standard for physical products. Software should adhere to the same standard.

- Interdependence in design: When implementing security measures, investigate the privacy implications and vice versa. Depending on the circumstances, one aspect might be more important than the other, several options might exist, or small additions can improve the other element.

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EARLY TRAFFIC WARNING USING SMS

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Keywords

Traffic, Radio-HELP, eCall, early warning, SMS

Abstract

The main objective of telematics applications is to provide the right information to the driver at the right time. Telematics systems include a variety of projects. These projects range from the mandatory implementation of eCall through a test run of various projects for early warning to the concepts including artificial intelligence. The future will show the potential of the use of these systems, but their benefits are undeniable, as shown by past experience. The aim of this work is to improve road safety in the form of prevention. This paper proposes a solution based on SMS. The solution offers advantages like simple implementation, low costs and easy handling of the message by a potential end user. There are some disadvantages as well. It is not possible to exclude unnecessary receivers in the specific area. The paper discusses the method and introduces possible solutions.

1. Introduction

Despite the fact that the automotive industry reached manufacturing safer and more efficient vehicles in recent years, traffic accidents are responsible for thousands of lives each year in Europe (European Commission, 2017). Technological progress contributes to solving these problems. This applies to communication systems and promotion of intelligent transport systems in order to improve road safety. It is expected that communication between vehicles will be able to provide drivers with more information about their surroundings, allowing them to make better decisions, which in turn will lead to increased safety. Some cars are already equipped with radars, cameras and similar devices.

2. Telematics applications

Telematics applications for traffic have been evolved for a long time. Applications range from simple variable traffic boards and RDS-TMC to eCall system. There are more complicated telematics systems where individual cars can communicate with each other as well.

One method of preventing accidents is to use various sensors in the vehicle. This issue is described in many specialised articles. Its principle consists of engagement position sensors, geographic coordinates, radar, laser, accelerometer, gyroscope and cameras (Maurer, 2012). Various combinations of sensors were tested (He, 2013). They can be used in sensors placed within the vehicle or mobile equipment sensors (Fernardes et al., 2015).

Another option on how to prevent accidents is a congestion prediction based on telematics data. With this issue deals e.g. Abadi (2015), where, with the aid of a limited amount of traffic data it is possible to obtain reliable forecasts for tens of minutes ahead. Further work (LV et al., 2015) describes a learning algorithm that uses so-called Big data.

Cooperative systems were developed to transfer information among different components of the traffic. For dissemination of information three basic types of wireless communication are used – DSRC, cellular network and satellite communication. (Pípa, 2015).

3. Warning SMS

One way of improving current traffic information dissemination process is to use existing and proven technologies and to bring improvement in the form of combination with proper using of other data channels. Digital radio can carry encoded information. A combination with non-addressed SMS messages bearing the position code is also possible. In principle, this method is similar to Radio-Help method (Skrbek, 2012), where instead of sending an SMS radio broadcasting would be received. This SMS principle would work in all types od communication standards – GSM, UMTS or LTE.

In cases where the vehicle is far from the accident site, it is time to use standard methods of warnings (Fig. 1 - "long distance"). Conversely, if the vehicle is very close to the accident it may communicate directly with the vehicle located in the critical area (C2C Communications - Fig. 1 - "short distance"). And in a situation where the vehicle is in the middle distance where none of the listed methods can be used then SMS method would be available. (Fig. 1 - "middle distance"). In the event that the vehicle is near a short distance, the warning would have no impact, as the driver would have visual contact with the point of the traffic problem.

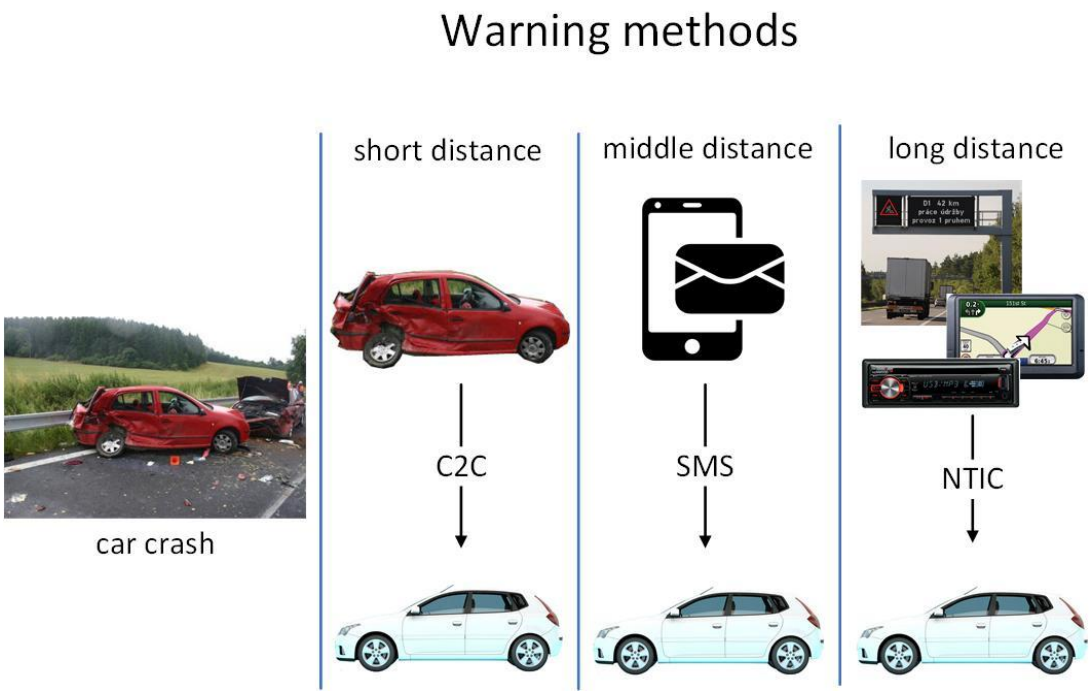

Figure 1: Comparing of used and proposed methods

An SMS message in the appropriate format would launch the desired action - warning - in the case of concordance position in the report and the vehicle position. The warning would be launched without any intervention from the driver. The driver would receive a warning only when the car is

in the endangered area. This solution would be relatively inexpensive and would involve modifying software and using mobile devices as warning units. The vehicle position would be determined by the mobile network operator. An accuracy depends on the density BTS transmitters, ranging from units of kilometres to tens of meters.

This concept requires a mobile device able to launch a predefined action on the basis of a specific group of characters contained in the SMS message. Future work will focus on the form of message. Advantages are simple solution and penetration of vehicles active SIM cards. Possible pitfalls may lie in the network overload when sending SMS messages to all of these devices with an active SIM card in a given area (Fig. 2).

Figure 2: Warning areas

NTIC (National Traffic Information Centre) would have defined a receiving area of unaddressed messages so all the drivers in the area can be informed. It is not an area of the traffic problem (mostly a traffic accident) but the area in which vehicles aiming to the problem area are located. However, in practice, targeting of non-targeted SMS messages can not be so precise so the messages would be sent to the whole region, ie. including the site of the accident. After receiving an SMS message a mobile device (typically a mobile phone) will automatically activate a warning. Activation of the warning will be initiated by a specific set of characters contained in the report. The warning should be both acoustic and visual.

Before using the concept of warning SMS messages existing solutions were modelled using UML (Unified Modeling Language). UML diagram (Fig. 3) shows the use cases and actors involved in the process of warning. Actors are eCall unit or witness of an accident. Furthermore, the National Traffic Information Center, under which fall actors: RDS-TMC, WEB and Information boards. There could be more actors but for simplification of the diagram only these three are used. The last actor is the driver receiving a warning.

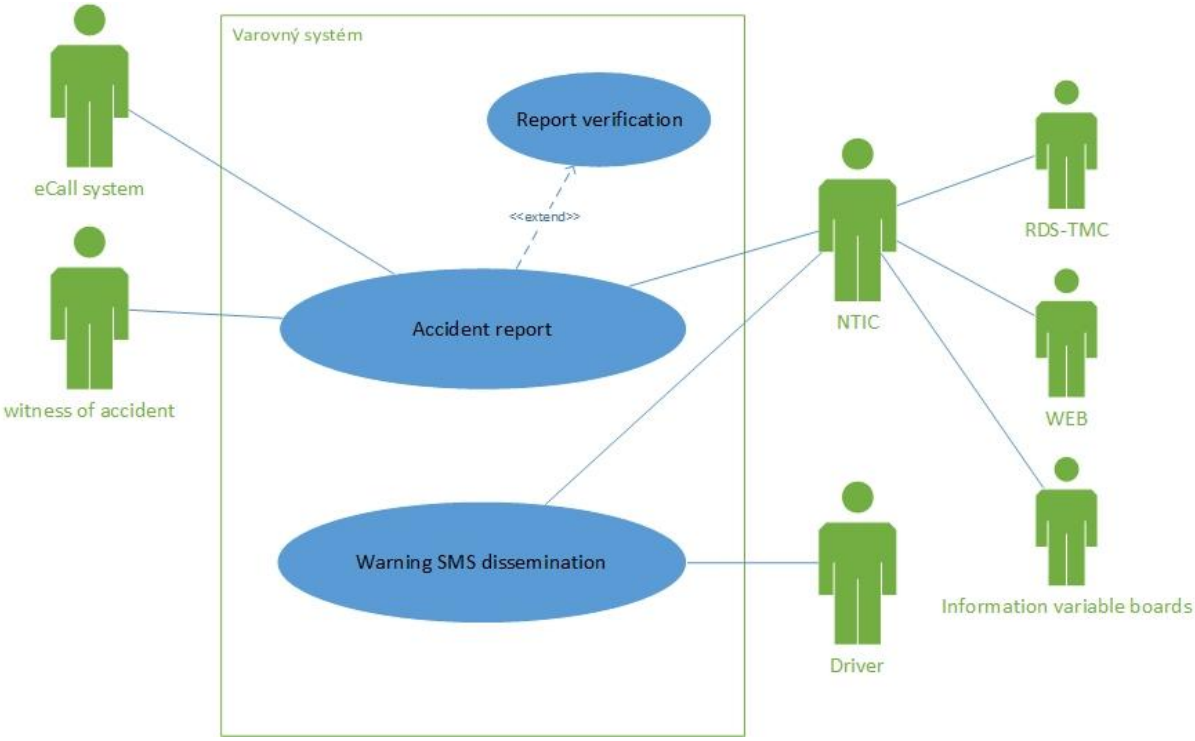

Figure 3: UML diagram of the current warning process

Main success scenario:

1. eCall opens a communication channel with the emergency number.
2. Emergency line records and process a notice of an accident and passes it to NTIC.
3. National Traffic Information Center defines the area for the warning.
4. National Traffic Information Center sends out a warning through the available channels.
5. The driver receives a warning.

Extension:

- 1.a: Report of an accident is made by a witness to an accident.
- 3.a: National Traffic Information Center verifies accident.
- 3.b: National Traffic Information Center defines the area for the warning.

Delay occurs between sending warning from NTIC and receiving via communication channels by the driver. The needed information is not available in time and the following proposal could resolve the issue.

Notifications via SMS has the advantage of already implemented the technology for their receiving (mobile phones). However, it is necessary to develop the way the warnings will be received and displayed. The function of the system can be divided into several segments. These are the definition of the critical area, message format, message sending, receiving and processing reports and activation of warning.

A new actor is added into previously described UML model. The actor is GSM operator (Fig. 4). He is associated with application use case „report the accident“ and the „dissemination of warning SMS message“. The operator receives a report about the area with an emergency situation and sends unaddressed warning SMS message to all active SIM cards in the area. The standard warning channels remain active.

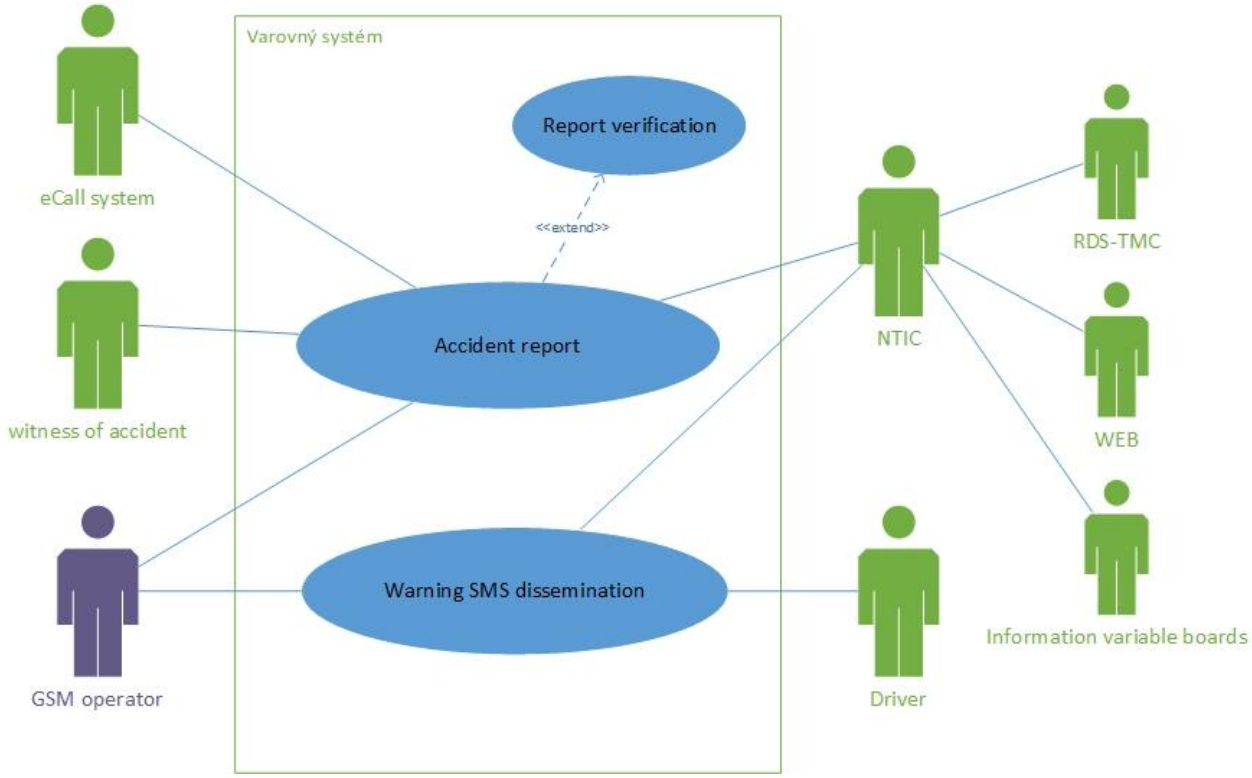

Figure 4: UML diagram of the proposed warning process

There are several types of messages received by mobile phones. A list of the most frequently used messages follows. Needs of the proposed system are best met with unaddressed SMS messages.

Silent SMS

Silent SMS or "stealth SMS" and "stealth ping" are used to locate people. This type of message appears on the screen or can activate a message alert. Their main purpose is to provide special services of any network mobile operator. This type of messages is independent on the communication standards. For the purpose of warning it could be used to identify the location of the recipient without interruption, but in terms of user adoption this is not a suitable way and probably would not be accepted positively. However, this type of reporting could contribute to solving the unwanted reception of warning messages.

Non-addressed SMS messages

This type of messaging allows sending an SMS message to any device with an active SIM card within reach. Since the device is actively logging on to the network operator, given BTS (Base Transceiver Station) keeps track of the currently logged-active SIM cards. Thus, it is technologically possible to send unaddressed SMS messages to those devices.

3.1. SMS format and processing

For practical using, there has to be a predefined standard for the warning SMS format. The standard allows automated processing without driver intervention. The first set of characters would be used to identify the message as a warning message. Following characters would identify geographical coordinates of the accident. Optionally there could be several characters for defining a warning type (traffic accident, traffic accident chain, difficult transport conditions etc.). This additional information is not necessary, but given the possible length of an SMS would be appropriate to use it.

SMS message in the appropriate format (containing a specific set of characters) would initiate the required action – warning – only if a geographical position from SMS is in concordance with the vehicle position. This solution would be relatively inexpensive and would involve editing mobile phones' software and the use of mobile devices as warning units. Vehicle position would be determined via a mobile network. Accuracy would be dependent on BTS units density - from kilometres to tens of meters.

Regarding the above-mentioned software modification, two cases may occur depending on the type of mobile phone. In case it is a mobile phone without an operating system, it would be necessary to modify its firmware, which would require cooperation with the manufacturers or services. However, the most mobile phones sold worldwide are equipped with the operating system (Android, iOS, Windows and Blackberry) and only 0.2% of the equipment is without an operating system (Gartner, 2016). These phones are sufficient to launch the functionality of installed applications, which can process incoming SMS. This application would obviously have to go through the approval process to get on the list of applications that can be installed, but yet it is much simpler process than changing the firmware. In the Czech Republic, the number of smartphones is lower, but it is rising steadily.

The disadvantage of this solution is an impossibility to exclude non-participating people from receiving a warning message - both passengers and permanent residents of the area. There is a real possibility, that not only the driver receives the warning message, but passengers as well. This could be avoided by setting the processing app active or not (driver/passenger). However, the likelihood that people will always do this operation is very low.

The problem could also occur in a situation where permanent residents of the area have no processing application. Those people would receive warning messages directly via SMS. If these people were not drivers in a different time they would not need to be worried. They could only be distracted. But if those people were also drivers, applications could move into warning mode only after pairing with a tag in the vehicle, using Bluetooth or NFC. This issue will be the subject of further research.

For completeness, it is necessary to mention the possibility of adding a comparator for the geographic position. It would allow determining whether the vehicle is moving toward or away from the accident. This solution would require turning on the unit determining the position and thus would cause a delay. But if the legislation changed and for example GPS unit of a system eCall would have examined the position permanently, it would be appropriate to use this solution and do not show such warning drivers that are not heading to the critical area. Or it might not be a change in legislation, but the activity of the user who will use for example a camera to record the GPS or another device capable of sharing its location with the mobile device. If there were known routes, a vehicle (and therefore the driver) could be informed more precisely. The situation on the roads, which will not pass, would have been ignored.

3.2. Activation and displaying of the warning

Possibilities for displaying information in the vehicle are currently at a high level. In addition to traditional methods such as info panel on the centre console or dashboard, Head-Up Display is increasingly common (Prasanth, 2016). The most widely used method would be to display a message or start some action on a mobile phone after receiving warning SMS. The sound notification could be adapted to the noise level in the vehicle. An example solution may be the solution for the company Škoda Auto, Inc. It allows easy connection between mobile phone and vehicle's infotainment. The infotainment panel replaces mobile devices screen and handles calls, maps, reports and so on. It is easier and safer (Škoda Auto, 2017). The communication channel could be used to display a warning.

From a security perspective, it would theoretically be possible to send a false message to a certain area or, knowing the specific phone number, directly to the vehicle. In the worst case scenario, this message would cause the driver to be noticed or the vehicle decelerate subsequently. This risk is permissible. If some manufacturers link the communication and control parts of the vehicle, they must also secure these parts accordingly.

4. Conclusions

Using SMS for improving traffic warning is a new approach and therefore it has to be more explored. There are some aspects that have to be discussed, like bothering other passengers in the car in the endangered area while sending warning SMS. But in principle, this solution could be functional and not difficult to implement. People are familiar with SMS messages and this fact could be very helpful for the implementation. The solution should not be expensive so the only problem would be to solve unwanted sending to uninvolved people. The aspect of distraction of the driver was also taken onto account. There is also a field of self-driving vehicles. However, the penetration of vehicles equipped with these technologies is currently minimal and the solutions outlined in this article are more feasible in the current state of technology. In principle, it would be possible to initiate, for example, a deceleration or braking. But most automakers, due to safety, separate the vehicle's communication and control units.

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DATA PROTECTION AS A PART OF CYBER SECURITY

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Keywords

Cybersecurity, Data protection, Blockchain technology, Hash function

Abstract

Introduction of computers in all spheres of life substantially changed the ways of how people communicate and exchange information. It is creating a virtually paperless work environment.

Keyless Signatures Infrastructures are an alternative solution to traditional PKI signatures. Storing and safely sending a large amount of information is a problem on one side, on the other hand increasing communication between things (for example smart cars, consumer houses etc.) requires a secure exchange of information where the blockchanging method is promising.

1. Introduction and related works

One of the definitions of the cybersecurity says that "Cyber Security is a branch of computer technology known as information security as applied to computers and networks. The objective of computer security includes protection of information and property from theft, corruption, or natural disaster, while allowing the information and property to remain accessible and productive to its intended users. The term: "computer system security" means the collective processes and mechanisms when sensitive and valuable information and services are protect from publication, tampering or collapse by unauthorized activities or untrustworthy individuals and unplanned events respectively. The strategies and methodologies of computer security often differ from most other computer technologies because of its somewhat exclusive objective of preventing unwanted computer behaviour instead of enabling wanted computer behaviour" Cybersecurity (2010-2017). The others expressions for example the Merriam Webster dictionary (2017) defines it as "measures taken to protect a computer or computer system (as on the Internet) against unauthorized access or attack". The International Telecommunications Union (ITU 2008) defines cyber security as follows: "Cyber security is the collection of tools, policies, security concepts, security safeguards, guidelines, risk management approaches, actions, training, best practices, assurance and technologies that can be used to protect the cyber environment and organization and user's assets. Organization and user's assets include connected computing devices, personnel, infrastructure, applications, services, telecommunications systems, and the totality of transmitted and/or stored information in the cyber environment. Cyber security strives to ensure the attainment maintenance of the security properties of the organization and user's assets against relevant security risks in the cyber environment." For example, Sonntag (2016) did the introduction into cyber security problems. Capek Hola (2016) roughly did the approach to cyber security in the Czech Republic.

The paper is organized as follows: on the background of the impact of cybersecurity on the nowadays society is focused to information overload from a security perspective. Next part is dedicated to keyless signature infrastructure as an alternative solution to traditional PKI signature, where the blockchanging method is promising-

2. Information overload

The current phenomenon of "information overload" or "information explosion", thus too rapidly growing volume of information available online, including increasing online publishing specialized materials, and thus increase the number of specialized databases and records to be kept in them, is one of the primary obstacles when searching, finding and evaluating information. (Sklenák V. at al 2001) This deepens existing barriers in the continued effort to provide users with the most effective (best ideal) search results arising from the relationship between the coefficients of the inverse accuracy and completeness search and leads to information chaos. Beasley et al. (2011) who state that the information chaos significantly contributes to bad decisions, not just physicians, support these conclusions. Information chaos these authors mean information overload, lack thereof, fragmented sources of information, information conflicts, incorrect information and combining said (Capek.2013).The assumptions of the information explosion could be characterized by three main factors Souček (2013):

Exponential growth of documents and information in electronic form (digitization - creation of electronic documents directly in the PC or scanning of material documents).

Availability of this information and documents through improved network connectivity (expanding, linking and accessing web space).

The validity of Moor's law on the exponential growth of computer computing power (the law characterizes the technical and economic development, which is the main cause and prerequisite for the information explosion in the long-term context)

One of our old “habits” is sending information (documents) across the organization as a way of arranging the information logistics in administrative/business processes, such as decision-making, insurance claim processing, reclamation processing, selling, purchasing, hiring and firing people, etc. The only difference is that nowadays, we do it electronically, not in the paper form. The modern technology gives us a possibility to prepare and send documents quicker than before, which in its turn results in us sending more documents to more people. The productivity of the logistics itself grows, while the productivity and quality of the administrative processes may remain the same or even decrease according (Bider, 2008).

Document transfer and storage

When the inventors of the Internet implemented their ideas for communication, they were not thinking about security. Indeed, at that time, there was little justification for thinking about security, no one could ever have predicted the profound impact, and trillion dollar industries that have been built based on their invention. The reality is that there has been little fundamental cryptographic innovation in security over the last 40 years. Public Key Infrastructure (PKI) remains the only tool in the cryptographic tool-shed for authenticating data, but the model is based on centralized trust authorities, which are in direct opposition to distributed open systems such as the Internet.

PKI is the designation of an entire cryptographic system based on asymmetric cryptography. This is a set of hardware, software, security policies, procedures, and users that create, store, distribute, use, and revoke digital certificates. The complexity and structure of the PKI may vary significantly depending on the size of the organization / firm and its security policy. For each secure document

delivery, we need a private and public key, that is, we cannot send a document without a third party (certification authority). The alternative solution to traditional PKI signatures is for example Keyless Signature Infrastructure.

3. Keyless Signature Infrastructure

Keyless Signature Infrastructure (KSI) is an example of a blockchain technology optimized for the Industrial Internet–trusted parties are eliminated for verifying the integrity and provenance of both infrastructure components and data generated from that infrastructure. If we think of the Industrial Internet as a giant logistics platform for data, then we can think of a transaction as a transport or processing of data. Data is generated from sensors (network), processed (compute) and kept for reuse later (storage).

The main differences between PKI and KSI digital signature technologies from the implementation point of view are the following table 1:

Table 1 The main difference between PKI and KSI according (KSI (2010)

	PKI	KSI
Signature creation	Off-line	Server-assisted
Consequence of key abuse	The number of forgeries is unlimited	Limited
Revocation check	During signature verification	During signature creation
Revocation solution	Complex	Simple
Evidence integrity	Relies on TTP confirmations	Mathematically provable
Quantum threat	Insecure	Quantum immune

Sharma (2016) argue that KSI is a Hash-tree based industrial scale Blockchain technology that is part of data security. This technology provides real-time massive scale data integrity validation, time stamping and signature signer identification services. It provides proof of time and integrity of electronic data as well as attribution of origin. KSI uses formal mathematical methods to authenticate independently any type of electronic data without threats, in real time, without the need of trusted keys, cryptographic secrets, or credentials.

Privacy is assured. With KSI, digital assets acquire immutable properties with forensic proof for provenance, security and integrity. The signed data is preserved in KSI Blockchain, which later can be verified to know signing time, signing entity and most importantly data integrity. The reality is that for the Industrial Internet System Integrity is much more important than confidentiality. Let us consider some examples.

Table 2 Comparison of the System Integrity and Confidentiality (according Gualt 2014)

	Integrity Breach	Confidentiality Breach
Your Car	Your braking system stops working.	Your braking patterns are exposed.
Your Flight	Your plane's instruments report that you are 1,000 feet lower than you actually are	Your flight plan is posted on the Internet. (note: it already is)
Your Power Station	Critical systems compromised leading to shutdown or catastrophic failure	Your electricity bill is published.
Your Pacemaker	Shutdown and death	Your heartbeat becomes public knowledge.
Your Home	Your security system is remotely disabled	The contents of your fridge are "leaked". You drink how much beer?

One of the most significant trends over the last few years, by has been the move away from centralized trust authorities to decentralized "consensus" trust models where assertions about what is and what is not true can be verified independently using a public ledger built using consensus based decision making. The closest real-life analogy we can think is "a tamper-evident seal on a software package": if you open the box (change the file, document), it is detected. Hashes, compile a stream of data (files, documents) into a small digest and it is strictly a one-way operation. All hashes of the same type - this example shows the "SHA-256" variety - have the same size no matter how big is original text. A cryptographic hash (also called a "digest") is a kind of "signature" for a stream of data that represents the contents. A Hash function takes arbitrary-sized data as an input and generates a unique fixed-size bit sequence as output. See Fig. 1.

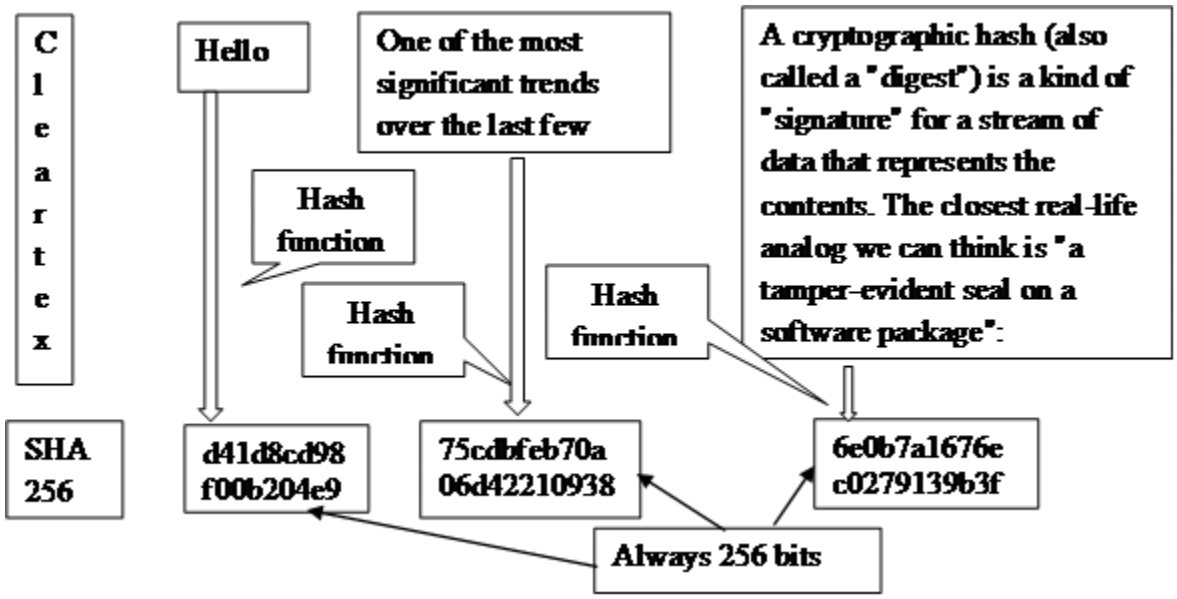

Figure 1 Hashing – One-way operation (Source author)

KSI Service Infrastructure is compound from following parts:

- Core Cluster - a component responsible for managing the KSI blockchain.
- Aggregation Network - a component providing scale, redundancy and global reach for the KSI service delivery network.
- Gateway Server - a hardware or software component at the customer premises providing access to the KSI service.

- Application Integration - Guardtime (2017) provides fully featured SDK-s for C, Java and .NET to facilitate KSI service integration to customer applications.

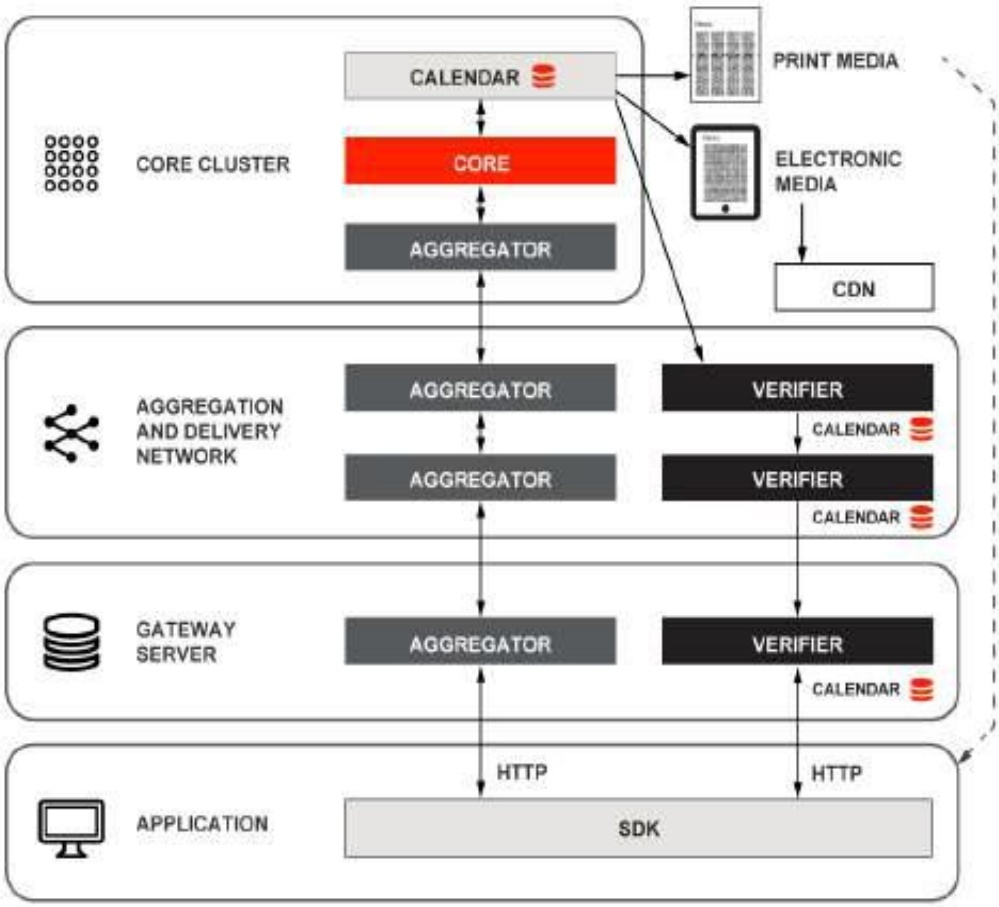

Figure2 KSI Infrastructure (according KSI 2010)

Aggregation creates a cryptographic connection between all involved requests; so create hash collision free tree. (Fig. 3) the authenticating aggregate value is use as input for the linking operation.

A Hash Tree takes hash values as inputs and, via repeated hash function application, generates a single root hash value.

On the figure:

- X_1 to X_8 are the input hash values
- h() represents hashing (hash function application)
- | represents chaining

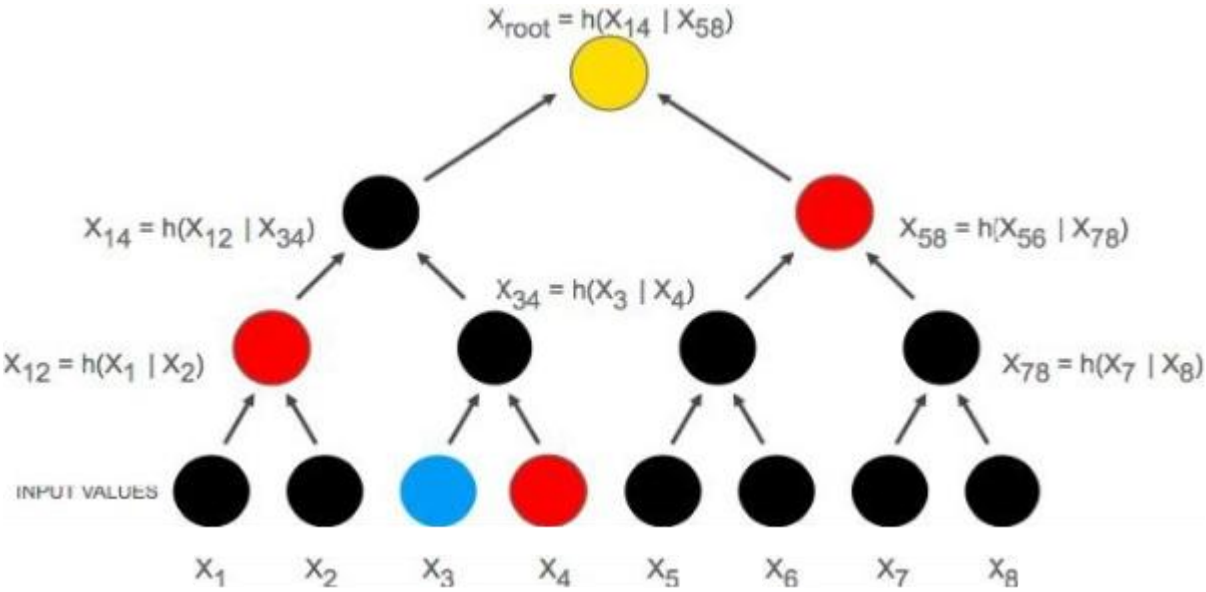

Figure 3 A hash tree with 8 leaves containing the input hash values (according Target at al 2016)

According Buldas (2016) Keyless signatures are implemented in practice as multi-signatures, i.e. many documents are signed at a time. The signing process involves the steps of:

7. Hashing: The documents to be signed are hashed and the hash values are used to represent the documents in the rest of the process.(X_1 - X_8 in figure 3)
8. Aggregation: A global temporary per-round hash tree is created to represent all documents signed during a round. The duration of rounds may vary; it is _fixed to one second in the described implementation. (for example: from X_{12} and X_{34} to X_{14}; from X_{56} and X_{78} to X_{58} and finally form X_{14} and X_{58} to X_{root} in figure 3).
9. Publication: The top hash values (X_{root} in figure 3) of the per-round aggregation trees are collected into a perpetual hash tree (so-called hash calendar) and the top hash value of that tree is published as a trust anchor.

4. Conclusion

Nowadays we are standing in front of information explosion. Exponential growth of documents and information in electronic form (digitization - creation of electronic documents directly in the PC or scanning of material documents). Storing and safely sending a large amount of information is a problem on one side, on the other hand increasing communication between things (for example smart cars, consumer houses etc.) requires a secure exchange of information where the blockchanging method is promising. Keyless Signatures Infrastructures are an alternative solution to traditional PKI signatures (Buldas at al 2016). The word keyless does not mean that no cryptographic keys are used during the signature creation. Keys are still necessary for authentication, but the signatures can be reliably verified without assuming continued secrecy of the keys. Keyless signatures are not vulnerable to key compromise and hence provide a solution to the long-term validity of digital signatures. Finally, with help Target at al (2016) one can summarized KSI benefits as follows:

- Proof
    - Proof of time and integrity of electronic data as well as attribution of origin
- Massively scalable

    - System performance is practically independent of the number of clients
- Open verification
    - One needs to trust publicly available information only
- Portable
    - Data can be verified even after that has crossed organizational boundaries
- Long term validity
    - Proof is based only on the properties of hash functions
- Supports near real-time protection
    - KSI verifications require only milliseconds which allows clients to perform continuous monitoring and tamper detection
- Offline
    - The system does not require network connectivity for verification
- Post-Quantum
    - The proof stays valid even assuming functioning quantum computers, i.e. does not rely on traditional asymmetric or elliptic curve cryptography

Future work will be oriented into communication within framework Internet of Things, to assess the possibility to exchange messages communicating parties.

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LESSONS LEARNED FROM PHISHING TEST

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Keywords

Social engineering, phishing, spear phishing, attack, e-mail

Abstract

This paper focuses on one of the forms of social engineering – phishing and spear phishing. The essence of the spear phishing is its personality. It focuses on specific individuals and e-mails are personalised, making it more credible. Within the paper, we provide the results of research, in which we tested about 10,000 users. The test has shown some interesting results; especially how more personalised phishing attack can increase the number of victims. Based on these results, in this paper we provide some recommendations for protection against this type of social engineering.

1. Introduction

Cyberspace offers new opportunities, but it is also a source of new threats for both, individuals and for organizations. Therefore, network security has become an increasingly important part of modern society. ENISA Threat Landscape 2016 (ENISA, 2017) states current threat landscape. Several forms of social engineering occur in the threat landscape. In social engineering, an attacker uses their victims to act in a particular way. Highest placed form of social engineering is phishing (6th place). The Oxford English Dictionary defines a *phishing* as „the fraudulent practice of sending emails purporting to be from reputable companies, in order to induce individuals to reveal personal information, such as passwords and credit card numbers, online" (Oxford, 2009). Phishing can be also defined as "a form of social engineering in which an attacker, also known as a phisher, attempts to fraudulently retrieve legitimate users' confidential or sensitive credentials by mimicking electronic communications from a trustworthy or public organization in an automated fashion" (Jakobsson, 2016).

Mitigation of the phishing attacks is difficult as they are aimed at exploiting people (end users of a system) (Khonji et al., 2013). For example, as evaluated in Sheng at al. (2010), people who were trained with the best performing awareness program, still failed to detect 29% of phishing attacks. On the other hand, software detection techniques are evaluated against bulk phishing attacks. Therefore, their performance against targeted forms of phishing is practically unknown. These limitations were a direct cause of security breaches in several organisations, including leading information security providers (Higgins, 2015). In the specialised cases, the phishing targets narrow spectrum of email addresses that are related to each other. In that case, we talk about

spear phishing. Caputo et al. (2014) showed "very high click rate at spear phishing e-mails' links (around 60%) which could be affected by the difficulty of detecting the spear phishing elements."

For the aforementioned reasons, we decided to run a *phishing test* within an academic organization with two categories of users (victims) – students and employees. We analysed current status of phishing and spear phishing on a sample of about 10.000 users of the organization. In this paper, we address the following three research questions within the phishing test:

- analysis of the impact of language and graphic design of the fraudulent web pages and emails to the phishing campaign,
- analysis of possibilities of implementing central security measures against phishing and
- analysis of reaction time with regard to lowering impact of the phishing campaign.

This paper is organised into five sections. Section II focuses on the review of published research related to security awareness in phishing and lessons learned from phishing test. Section III outlines the methodology in the phishing test. Section IV presents the results of phishing test and discusses the important points. The last section contains conclusions and our suggestions for the future research.

2. Related works

Research in phishing is not novel. There are several related papers that cover how susceptible individuals are to phishing attacks. Research areas of these papers focus on why people fall for phishing and what kind of people are more susceptible to it. Important paper on analysis of phishing is Dhamija et. al. (2006). Authors analyse a large set of captured phishing attacks and develop a set of hypotheses about why these strategies might work. Arachchilage et. al. (2014) claim that conceptual knowledge or procedural knowledge positively affects computer users' self-efficacy to thwart phishing threats. On the other hand, Jakobsson (2007) discusses importance of understanding psychological aspects of phishing.

A similar *phishing test* like our test has been done in Croatia. Andrić et al. (2016) focus on examining familiarity of students with threats in form of social engineering and phishing attacks. The results show that more than 59% of students were targeted by phishing attacks and students without theoretical knowledge about phishing attacks are gullible and susceptible to phishing attacks.

Papers discussing *security awareness training* are also relevant for our research. Dodge et al. (2007) states that user security education and training is one of the most important aspects of an organizations security posture. These conclusions are confirmed by Jansson et al. (2013), who show that embedded training can eliminate phishing victims - the amounts of reactions were 42.63% less in the second week after users received the embedded training. Currently, new method of security awareness training has been evolving. Arachchilage et al. (2016) reported on a design and development of a mobile game prototype as an educational tool to help computer users protect themselves against phishing attacks. Their study shows a significant improvement of participants' phishing avoidance behaviour.

3. Experimental design

The phishing test was run in 3 phases. Organization's users (victims) received a phishing email 3 times. Users´ email addresses were obtained from organization's public web pages. In each phase

"the quality" of the phishing emails was increased. Research has focused on users who just clicked on a link and entered a web page with fraudulent form (threat of malicious code download) and users who also filled in their data into a fraudulent form. Organization's users were not trained for phishing before the test started. Within the test, 10,154 emails were sent in the 1st phase, 10,119 emails were sent in the 2nd phase and 9,655 emails were sent in the 3rd phase. The main reason for the different number of emails, which were sent was the fluctuation of employees in the organisation during the phishing test.

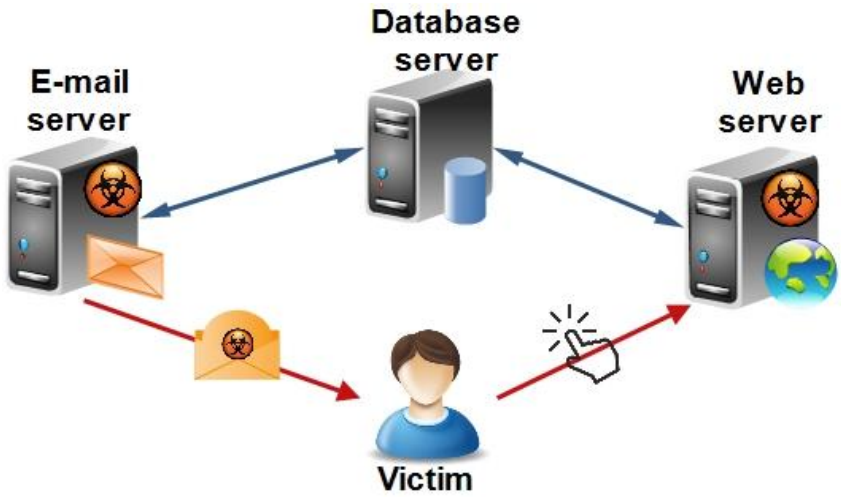

Figure 1: Scheme of the testing infrastructure

3.1. Scheme of the infrastructure

The main problem of the spear phishing test which needed to be solved before the test began was the infrastructure of the realization. The infrastructure (shown in Fig. 1) consists of:

- *email server* – sent out the phishing and spear phishing emails,
- *database of victims* – list of users within the organization which were targets for the phishing and spear phishing emails and
- *web server* – hosted all fraudulent web pages.

Web server and *database server* were placed within the organization's computer network for privacy protection reasons. For phishing web page, we used the *Let's encrypt service* (Lukovenko, 2016) to generate a certificate for the web page, so HTTPS connection is established and users are shown that phishing web page is secure. In the most web browser, the users see the green lock in address bar. An important question was the selection of a service that would send the phishing emails. Some email services have a *significantly limited number of emails sent* (50-100 per day). For running the phishing campaign this is inadequate. To implement this campaign, we were inspired by *Social Engineering Toolkit* (Pavković and Perkov, 2011), which allows anyone to send a single email or entire phishing campaigns using Google email account or private email server. The Gmail email service has official mailing quotas - about 500 per day - up to 1,000. These limitations are inadequate for the phishing campaign. In addition, to achieve higher security, we've decided to *use private Postfix email server*.

Phishing emails were sent to users in each phase of this test. In the 2nd and the 3rd phase of test, each email contained a unique link to produce more detailed statistics. At each phase, we recorded the IP address, timestamp, and, if the form was filled, login name if entered. Passwords did not need to be saved and we did not collect them for security reasons.

In addition to the above, the database contained a list of organizational users with their email addresses. This list is publicly available. According to the legal order at the time of the test, these data were published, which allowed us to use them without the consent of the users.

3.2. The phases of the phishing test

The *first phase of the phishing test* involved sending phishing emails in English language. The appearance of the phishing web page of the 1st phase of phishing test is illustrated in Fig. 2 (left). The user (victim) was requested to fill in the following information: username, server and password. Example of phishing email is: "Attention: Email user. Dear *user*! Your email account mailbox requires immediate update. (Reason: Quarterly quota maintenance). To update your email account, please CLICK HERE immediately for reactivation of your web-mail Account. Administrative System." Instead of *user* a concrete name of the user was inserted in the phishing email.

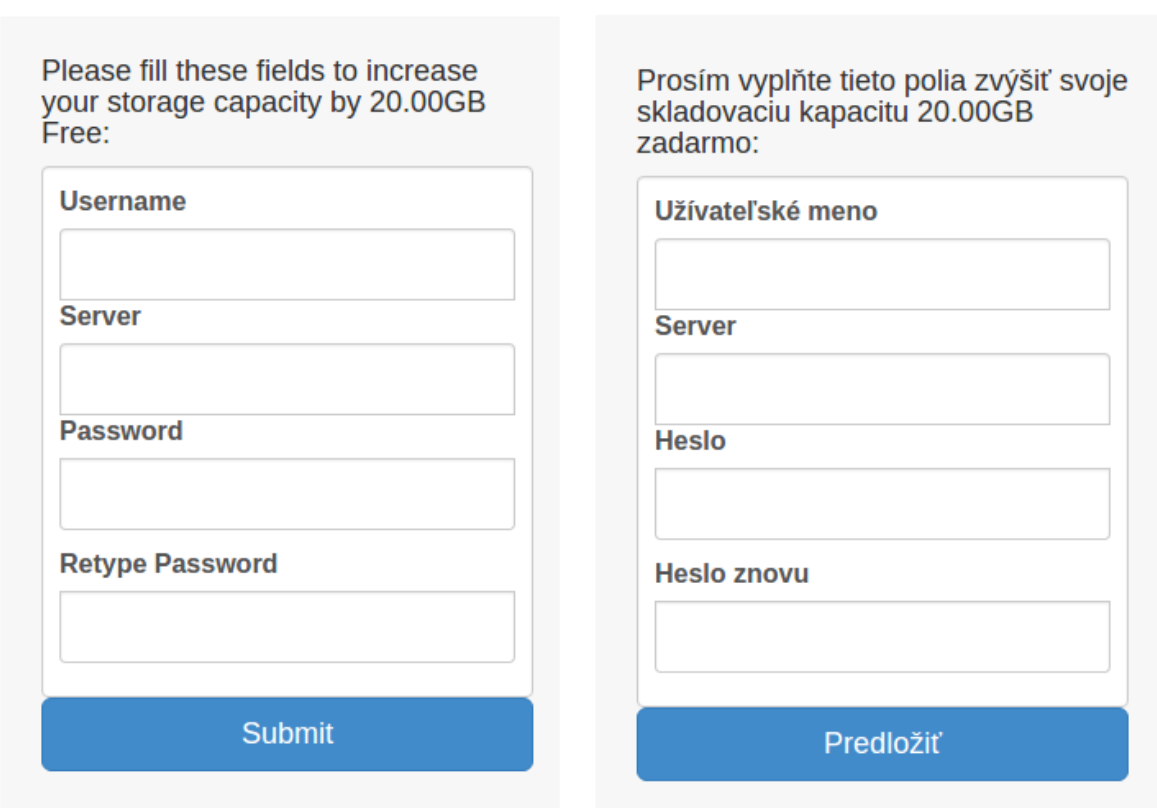

Figure 2: Phishing webpage of the first phase of test (left) and the second phase of test (right)

The *2nd phase of the phishing test* was identical to the previous phase. The only difference was phishing emails and phishing web page. Since the test organization is in the Slovak republic, we have translated the English texts from the previous phase of the text to the Slovak language using the Google translator. We did not perform any additional special adjustments. The appearance of the phishing web page from this phase is illustrated in Fig. 2 (right). This phase can be called *spear phishing*.

In the *3rd phase of the phishing test*, we have manually translated the English texts from the 1st phase of the text to the Slovak language (no automatic translate using the Google translator). The phishing email of this phase is show in Fig. 3 (left) and the phishing web page of this phase is illustrated in Fig. 3 (right). The phishing email warned of an increased phishing frequency lately, requiring the verification module to run to verify the password. The appearance of the phishing

page was the same as that of a page used by Microsoft company for their Office365 online service. After completing the email and password, the victim was redirected to the Office365 online service. As the previous phase, this phase can be called *spear phishing*.

Figure 3: Example of phishing email (left) and webpage (right) in the 3rd phase of the phishing test

4. Results and discussion

4.1. Clicking the link and filling the scam form

The first objective is to analyse users from the perspective of *reaction to the phishing campaign*. In other words, we distinguish between two categories of users, namely those who *did not respond* to the fraudulent email ("no response") and those who *responded* ("response"). Subsequently, we distinguish between users who have just clicked link ("*click only*") link and users who have filled in their information on a web page ("*click + filling*"). The results of the individual phases can be seen in Table 1.

Table 1: Users´ behaviour in a phishing campaign

	The 1st phase	The 2nd phase	The 3rd phase
no response	96,95%	94,40%	93,54%
response	3,05%	5,60%	6,46%
click only	2,82%	4,47%	2,92%
click + filling	0,23%	1,13%	3,54%

From the above results, it can be concluded that spear phishing has greater impact on users than phishing. In the 2nd and the 3rd phases, there was almost a double increase in the number of users (5.6% and 6.46% respectively) who responded to these fraudulent messages compared to the first phase (only 3.05%). Users are increasingly prone to emails in which they are addressed, which is evident in the results of the 2nd and 3rd phases. As shown in Table 1, most users completed their data in the 3rd phase of the test, although there was only a slight increase in the number of users who responded. Most users who previously clicked the link but failed to fill in their data decided to provide their data at this stage. In this case, it is possible to talk about increasing the credibility of such a phishing campaign. In our opinion, the reason for the change of the user's decision is the possibility to see the text of a fraudulent email and a scam page in their native language. At the same time, graphic design of fraudulent email and fraudulent page is a copy of their legitimate sources.

Another aspect this paper focuses on is the question of the type of user. As the test was conducted within the academic organisation, we distinguish two categories of users - *students* and *employees*. As mentioned above, since the 1st phase of the test was phishing, at this stage, the person who clicked the link in the fraudulent email was not tested. From the 2nd phase, a unique identifier was sent to the user, allowing to detect between employees and students. The results of the 2nd and the 3rd phase of phishing test from students and employees can be seen in Table 2.

Table 2: Users´ behaviour in a phishing campaign

	The 2nd phase (student)	The 2nd phase (employees)	The 3rd phase (student)	The 3rd phase (employees)
no response	94,74%	92,13%	93,99%	90,52%
response	5,26%	7,87%	6,01%	9,48%
only click	4,17%	6,31%	2,44%	6,15%
click + filling	1,09%	1,56%	3,57%	3,33%

From the above results, it can be concluded that the security awareness of the students is higher than that of the employees. Based on the category of users who responded to the phishing campaign ("click + filling" type), the numbers are comparable. The difference can only be seen in the category of users who just clicked the link. In our opinion, this may be because they are not aware of the dangers that such fraudulent sites bring with them.

4.2. Access to scam forms

One of the aims of our research was to monitor if *phishing control within a computer network* (e.g. firewall or proxy service) *can be implemented* within an academic organisation. For this purpose, we investigated from where the users who clicked the link accessed. The results of the test can be seen in Table 3. It is evident from the results of the table that deploying such a solution would be ineffective. Most users (at least 72.1% in the 2nd phase of the phishing test) access from the IP addresses that are outside of the organization and therefore out of control of the security mechanisms of the academic organisation. For this reason, it is better to focus on solution, which can only be used within the organization´s computer network. For example, user education. Another example could be a service which is able to respond to the user if the email they forwarded to this service is a phishing email or not.

Table 3: Access to scam forms in a phishing campaign

	The 1st phase	The 2nd phase	The 3rd phase
Access from the IP address of organisation	17,74%	27,90%	24,49%
Access from the IP address outside of organisation	82,26%	72,10%	75,51%

4.3. Reaction time of users

The last objective is to analyse the *users' reaction time*. The results of this indicator are shown in Fig. 4. As with distinguishing the user type, only the results of the 2nd and the 3rd phase are considered in this indicator. In the 1st phase, the user did not receive a specific timestamped

link. Therefore, we cannot accurately determine their reaction time. When analysing this aspect, we distinguish between 4 categories of reaction time, within 24 hours, 24 hours - 3 days, 3 days - 7 days and 7 days and more. Within the table, you can see undetermined values that indicate that the user has modified their link and their response time cannot be assigned to individuals and therefore user types. Most users respond within 24 hours of receiving fraudulent emails (72.13% in the 2nd phase and 61.38% in the 3rd phase). Interestingly, after this time there is a significant number of users who respond to fraudulent emails (18.34% in the 2nd phase and 37.98% in the 3rd phase). Based on this, it can be assumed that within the framework of the computer network security, it is worth considering the introduction of an information system for users to reporting phishing campaigns.

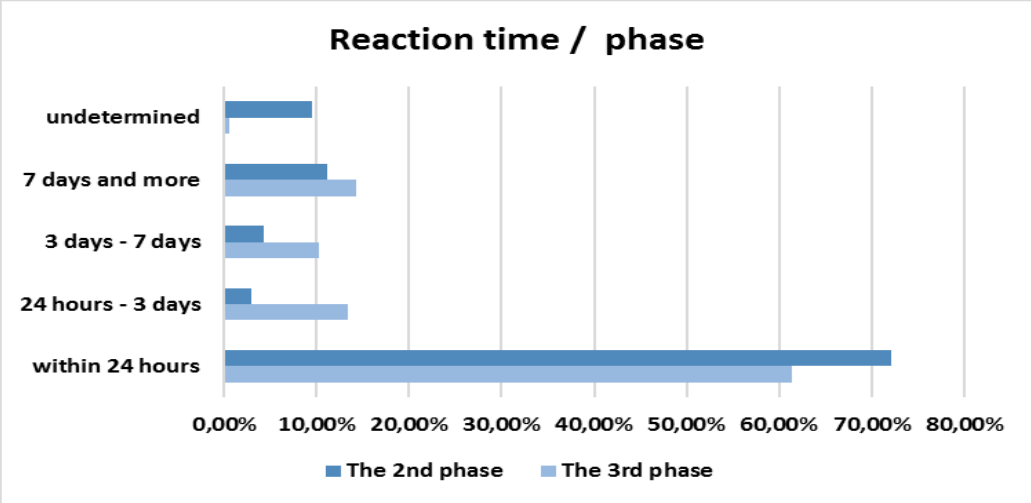

Figure 4: Reaction time of users in a phishing campaign

5. Conclusions and future works

We analysed the impact of two forms of social engineering - phishing and spear phishing. In this paper, we have shown how a phishing test can be done within the organization. Although the test was conducted within an academic organisation, the procedures in this paper can be applied to any organisation. The paper has several conclusions and recommendations that can be broken down into two categories, namely technical conclusions and recommendations and conclusions and recommendations for user safety awareness.

From our results, it is evident that users still fill in their data after 24 hours and therefore it makes sense to address measures against phishing after this period. Creating a system within the organization to inform users of such campaign is an effective measure. Central anti-phishing solution is ineffective. This is due to our next finding – *collective user awareness*. Users inform each other with other communication means and ask questions about emails they have received. It is not necessary to train all users; training part of them is sufficient, because the knowledge spreads among untrained users, too. An interesting research problem is how to identify users who are well educated – how many should be selected so the risk of social engineering threat is reduced. Prerequisite for collective user awareness is the situation where the users know each other and can pass on information. This prerequisite should be taken into account for identifying of selected users.

Using the Let's encrypt service for provisioning of server certificates shows that HTTPS as a reference for a safe web page is overcome. We recommend a phishing test as a relatively inexpensive and good way to increase users' awareness of organization's information security.

Future research can be conducted on other aspects of social engineering. We would like to focus on tests like this one to increase security awareness of organizational users. Also, the ethical and legal aspects are very interesting. For this reason, we will focus on them in the future research.

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ANALYSIS OF BARRIERS TO PUBLISHING AND RE-USE OF OPEN GOVERNMENT DATA

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Keywords

Barriers, Challenges, Data publishing, Data re-use, Open Data, Open Government

Abstract

Governments and public organizations hold significant amount of data that, if published under conditions permitting its re-use and in open and machine-readable formats, could be a source of various benefits to individuals, organization, states and wider society. Open Government Data is becoming a widely accepted practice in sharing government data for re-use and in many countries an Open Data initiative has already been launched. Despite this fact, the number of truly open datasets still remains low. Stakeholders in the Open Data ecosystem face various barriers when publishing or re-using Open Government Data. The goal of this paper is to analyze what barriers these stakeholders are facing and how the view of the perceived barriers has changed over time. Results of an analysis of several studies and papers dealing with such barriers are presented in this paper and based on these results future research topics are proposed.

1. Introduction

Open Government Data (OGD) is becoming a widely accepted practice in sharing government data for re-use. According to the World Wide Web Foundation (2015) 55% out of 92 countries studied in the third edition of the Open Data Barometer Global Report now have an Open Data initiative in place. Open Data is data "*that can be freely used, re-used and redistributed by anyone – subject only, at most, to the requirement to attribute and sharealike*" (Open Knowledge International, n.d. b). In order to ensure re-usability, Open Data needs to be open both technically and legally. I.e. Open Data needs to be released under an open license permitting its re-use and redistribution and it should be available in an open and machine-readable format, as a complete dataset and preferably for a free download (Open Knowledge International, n.d. a).

Re-use of Open Data could result in various benefits to individuals, organization, states and wider society. According to the World Wide Web Foundation (2015) these benefits include political impacts such as increased transparency and accountability or improved efficiency and effectiveness in the public sector, social impacts such as positive environmental impacts or contribution to the social inclusion, or economic impacts such as contribution to the national economy or support to businesses and start-ups. Carrara, Chan, Fischer and van Steenbergen (2015a) distinguished between direct and indirect benefits of OGD. Direct benefits represent monetized benefits such as revenues, Gross Value Added, cost savings or number of jobs created. Carrara et al. (2015a) further divided the indirect benefits into economic benefits (e.g. new job potential, knowledge economy growth or increased public service efficiency), political benefits (e.g. increased public transparency

and accountability, civic participation, political awareness or access to information) and social benefits (e.g. social inclusion and empowerment or support to decision-making). Open Data could lower barriers hindering access to information and therefore it is seen as one of the enablers of the Open Government movement (Bauer & Kaltenböck, 2012).

Despite the number of Open Data initiatives, global availability of government data that fully meets the Open Data definition remains low (World Wide Web Foundation, 2015). An assessment of the Open Data maturity in Europe 2016 revealed that only 52% of the studied countries provided more than 90% of the published datasets in machine-readable formats (Carrara, Nieuwenhuis, & Vollers, 2016). However publishing and re-use of OGD is not just a technical issue and both providers and consumers of OGD still face variety of other barriers as well (Berends, Carrara, & Vollers, 2017).

The goal of this paper is to analyze what barriers to publishing and re-use of Open Government Data the stakeholders in the Open Data ecosystem are facing and how the view of the perceived barriers has changed over time. In order to meet this goal several papers and studies aimed at identification of these barriers published between 2011 and 2017 were analyzed. Results and discussion thereof are presented in this paper. Contribution of this paper therefore lies not in the identification of new barriers to the OGD publishing or re-use but rather in the discussion resulting in the recommendations for future research.

The remainder of this paper is structured as follows. In the following section our research approach is explained. Results of the analysis are presented in the next section which is followed with a discussion of the results. Conclusions are summarized at the end of the paper.

2. Research approach

The idea of sharing data held by public organizations for re-use is not entirely related to the OGD initiatives. For example in Europe the Directive 2003/98/EC on the re-use of public sector information (PSI Directive) was adopted in 2003 (European Commission, 2003). OGD started to gain momentum at the end of the first decade of the new millennium with the start of the Open Government movement (Bauer & Kaltenböck, 2012). President Obama's Administration issued the Memorandum on Transparency and Open Government in January 2009 (Administration of Barack H. Obama, 2009). In the United Kingdom the national data portal data.gov.uk was launched in January 2010 (National Audit Office, 2012).

As the first step of our research relevant papers and studies were collected. Because the OGD initiatives started to be implemented between the years 2009 and 2010, the search for the relevant papers and studies was narrowed down to works published after 2010. The search was focused on works discussing barriers to publishing or re-reuse of Open Data / Open Government Data. The aim of our research was to study the breadth of the perceived barriers rather that to provide their detailed discussion. Therefore only papers or studies discussing multiple barriers were selected. In total, eleven papers and studies published between the years 2011 and 2017 were selected.

As the next step a list of barriers discussed in the analyzed studies was developed. Same or similar barriers discussed in multiple analyzed works were identified and labeled with a normalized terms. Normalized list of the barriers was compiled by combining barriers labeled with the normalized terms and barriers mentioned only once. Because most of the barriers on the normalized list were too fine-grained, closely related barriers were aggregated into generalized barriers. Then, specific barriers discussed in the analyzed works were mapped to these generalized barriers. Finally, related generalized barriers were grouped into categories.

3. Barriers to the publishing and re-use of Open Government Data

As a result of the analysis 50 generalized barriers to the publishing and re-use of OGD were identified that were classified into 10 categories. In total 319 occurrences of the generalized barriers were found in the analyzed papers and studies. Table 1 shows distribution of the occurrences of the generalized barriers across the defined categories of the generalized barriers.

Issues related to the data and metadata availability, accessibility and quality were the most frequently discussed barriers to the publishing and re-use of OGD. This category was followed by the barriers related to legislation, licensing, data protection and privacy. In the analyzed works there was a relatively low number of technology barriers and barriers related to availability of the suitable tools. However, a different approach to the technology barriers was taken compared to the analyzed works. In some of these works data quality issues or issues related to the data portals were classified as the technical barriers, whereas in our research issues related to data portals were considered as the data accessibility barriers. Data and metadata quality issues were treated as a separate generalized barrier.

Breakdown of the generalized barriers to the publishing and re-use of OGD per category and their occurrences between the years 2011 and 2017 based on the years of publication of the respective works is presented in table 2. Description of the barriers is provided in the following subsections.

Table 1: Occurrences of the generalized barriers per category

Category of the generalized barriers	Occurrences of the generalized barriers
Data and metadata availability, accessibility and quality	89
Legislation, licensing, data and privacy protection	61
Negative and unwanted impacts	27
Open Data stakeholder attitudes and interactions	25
Coordination, organization, processes and management	24
Benefits and positive impacts	24
Resources, costs and financing	22
Leadership, policy and strategy	21
Knowledge, skills and capabilities	17
Technology and tools	9
Total	**319**

3.1. Data and metadata availability, accessibility and quality

According to Carrara et al. (2016, p. 56) "*there is not much Open Data available yet and availability can vary considerably from one data domain to another*". World Wide Web Foundation (2015) pointed out that governments are publishing at least some data online, but only a fraction of this data conforms to the definition of Open Data. This finding is in line with the findings of the recent assessment of the Open Data maturity in Europe which showed that only some countries publish majority of its data in machine-readable formats (Carrara et al., 2016).

Even if data is published, users have difficulties in finding the datasets they need (Janssen, Charalabidis, & Zuiderwijk, 2012; Berends, Carrara, & Vollers, 2017). In some cases data are being sold or fees are being collected for access to data which acts as a barrier to the re-use of data (Janssen et al., 2012; Martin, Foulonneau, Turki, & Ihadjadene, 2013; Ubaldi, 2013). According to Berends et al. (2017) geospatial data is a domain in which data is often charged for as it is a significant source of income of national and regional governments.

Table 2: Generalized barriers to the publishing and re-use of Open Government Data

Generalized barriers	2011	2012	2013	2014	2015	2016	2017
Data and metadata availability, accessibility and quality							
Data and metadata quality issues	X[a]	X[b]	X[c,d]	X[e]	X[g,h,i]	X[j]	X[k]
Data availability issues		X[b]	X[c]		X[g,h]	X[j]	X[k]
Data accessibility issues		X[b]	X[c,d]				X[k]
Data is not always available for free		X[b]	X[c,d]				X[k]
Data portal API and harvesting issues			X[c]		X[h]		
Complexity of datasets or data formats	X[a]	X[b]					X[k]
No central data portal		X[b]	X[d]				
Legislation, licensing, data and privacy protection							
Data protection, privacy or security constraints and data anonymization issues	X[a]	X[b]	X[c,d]	X[e]	X[g,h]	X[j]	X[k]
Data licensing issues and terms of use restricting re-use		X[b]	X[c,d]	X[e]	X[h,i]	X[j]	X[k]
Issues related to legislation and legal framework			X[c,d]	X[e]	X[h]	X[j]	X[k]
Concerns about possible legal disputes and liability		X[b]		X[e]			
Unclear ownership of data			X[d]	X[f]			
Existing contracts or already engaged rights hindering publishing or re-use		X[b]	X[c]				
Compliance issues other than data or privacy protection			X[d]				
Negative and unwanted impacts							
Abuse, misuse or misinterpretation of data		X[b]	X[c]	X[e,f]			
Open Data could contribute to the digital divide	X[a]	X[b]	X[c,d]	X[e]			
Unwanted consequences and other negative impacts of Open Data		X[b]	X[c]	X[e]			
Concerns about public scrutiny and negative impacts if improper or low quality data is published		X[b]	X[c]	X[e]			
Transparency might sometimes undermine trust rather than help to build it		X[b]		X[e]			
Information overload	X[a]	X[b]					
Open Data might negatively impact markets			X[c]				
Open Data stakeholder attitudes and interactions							
Lack of willingness to share data and a need to change the cultural mindset	X[a]	X[b]	X[c]	X[e]	X[g,h]		
Low interest of users		X[b]			X[h]		
User input and feedback issues		X[b]					X[k]
Low attention is paid to the demand and user needs		X[b]	X[d]				
Lack of dialogue between Open Data stakeholders			X[c,d]				
Difficulties in building the Open Data ecosystem			X[d]				X[k]
Coordination, organization, processes and management							
Challenges arising from the coordination and collaboration among public organizations or departments			X[c,d]		X[g,h]	X[j]	X[k]

Generalized barriers	2011	2012	2013	2014	2015	2016	2017
Data governance and management issues			X[d]		X[i]		X[k]
Lack of appropriate organizational structures, roles and responsibilities			X[d]		X[i]		X[k]
Lack of appropriate processes		X[b]	X[d]				X[k]
Too many Open Data initiatives		X[b]					
Benefits and positive impacts							
Low stakeholders' awareness of the Open Data availability, benefits and value		X[b]	X[c,d]	X[e]	X[h,i]	X[j]	X[k]
Unclear benefits of Open Data and difficulties related to its measurement	X[a]	X[b]	X[c,d]	X[e]			X[k]
Effectiveness or impact of Open Data initiatives is not measured					X[h]		
Low public sector's awareness of the benefits of crowd sourcing			X[d]				
Resources, costs and financing							
Loss of revenue when providing data for free resulting in a need to change the funding model	X[a]	X[b]	X[c,d]	X[e,f]	X[h]	X[j]	X[k]
Costs of Open Data initiatives		X[b]	X[c,d]	X[e]	X[h]		
Lacking or not sustainable funding		X[b]	X[c]				X[k]
Lack of non-financial resources				X[e]	X[h]		
Leadership, policy and strategy							
Open Data policy issues	X[a]	X[b]	X[c,d]	X[e]	X[h]	X[j]	X[k]
Publishing Open Data is not a priority				X[f]	X[h]	X[j]	X[k]
Lack of Open Data strategy			X[d]	X[e]			
Lack of leadership				X[e]			
Knowledge, skills and capabilities							
Lack of knowledge, skills or capabilities to use data		X[b]	X[c,d]		X[h,i]		X[k]
Lack of knowledge, skills or capabilities to publish data			X[d]	X[e]		X[j]	X[k]
Technology and tools							
Technology issues	X[a]	X[b]	X[d]				
Users lack appropriate tools		X[b]					
Support for data publishers might not be always available		X[b]					
Support for users might not be always available		X[b]					

[a](Huijboom & Van den Broek, 2011). [b](Janssen et al., 2012). [c](Martin et al., 2013). [d](Ubaldi, 2013). [e](Barry & Bannister, 2014). [f](Conradie & Choenni, 2014). [g](Carrara et al., 2015b). [h](Carrara et al., 2015c). [i](Carrara et al., 2015d). [j](Carrara et al., 2016). [k](Berends et al., 2017).

Quality of the published data as well as its accompanying metadata is perceived to be low by data users (Berends et al., 2017). Range of the data and metadata quality issues is diverse including absence, incompleteness or inaccuracy of data or metadata to name some examples. Lack of machine-readable formats mentioned above was also classified as one of the data quality issues in our research. One of the frequently cited barrier is also heterogeneity of datasets and lack of standardization of data (Janssen et al., 2012; Martin et al., 2013; Ubaldi, 2013; Barry & Bannister, 2014; Carrara, Fischer, & van Steenbergen, 2015c; Carrara et al., 2016; Berends et al., 2017) and metadata (Janssen et al., 2012; Martin et al., 2013; Berends et al., 2017).

Janssen et al. (2012) identified a missing central data portal as one of the barriers to the publishing and re-use of OGD. Ubaldi (2013) discussed establishment of a central data portal as a way to integrate activities of multiple public organizations publishing OGD. In 2015 87% of the European

Union member states together with the European Free Trade Association countries reported to have a national Open Data portal (Carrara et al., 2015c). Even though more than two thirds of these portals provide a machine-readable Application Programming Interface (API), the type of the API is not always clear (Carrara et al., 2015c).

3.2. Legislation, licensing, data and privacy protection

Not every dataset held by public organizations could be made available as an open dataset. Some legislative regimes could prevent certain data from being published such as the privacy protection legislation or national security legislation (Ubaldi, 2013). Anonymization of large datasets is still a challenge (Carrara, Fischer and van Steenbergen, 2015b). Some also express concerns than anonymized data could be deanonymized under certain circumstances (Barry & Bannister, 2014).

Licensing is also a frequently cited legal barrier to the publishing and re-use of OGD. Open licenses ensuring rights to re-use the data are sometimes missing (see for example Janssen et al., 2012; Carrara, Fischer, Oudkerk, van Steenbergen, & Tinholt, 2015d; or Berends et al., 2017). The terms of use might be restrictive (Janssen et al., 2012; Martin et al., 2013; Ubaldi, 2013) or incompatible (Martin et al., 2013). Not every country has a national regulation related to licensing and in some countries national licenses are not always used (Berends et al., 2017).

Some countries also face issues related to the legal framework for publishing OGD. Such a framework may not be developed or, if it exists, it may not be clear or specific enough (Berends et al., 2017). According to Carrara et al. (2015c) countries with higher OGD maturity should verify that legislation related to OGD is implemented properly. Ambitious OGD legislation might also take more time to implement because it could face more resistance (Carrara et al., 2016).

3.3. Negative and unwanted impacts

Concerns about negative or unwanted impacts of OGD might also represent a barrier. According to Martin et al. (2013) civil servants were concerned about possible misinterpretation of the published data or about interpretation of data putting public actions under more challenge from the public. Barry and Bannister (2014) reported that some civil servants were concerned about negative stories based on the published data and also about publishing data containing errors which, if discovered, could bring negative attention to the organization that published the data. Huijboom and Van den Broek (2011) and Janssen et al. (2012) pointed out that increased data availability could contribute to the information overload. Concerns were also expressed that Open Data could contribute to the digital divide because not everybody is able use the available data (Huijboom & Van den Broek, 2011; Janssen et al., 2012; Martin et al., 2013; Barry & Bannister, 2014).

3.4. Open Data stakeholder attitudes and interactions

Not every public organization is willing to share its data (Carrara et al. 2015c). Publishing OGD often requires a change to the civil servants' mindset or a change to the organizational culture of public organizations which was reported to be closed, defensive or risk-averse (Huijboom & Van den Broek, 2011; Janssen et al., 2012; Martin et al., 2013; Barry & Bannister, 2014; Carrara et al., 2015b). However, it is not only the lack willingness to share data that might act as a barrier to the OGD re-use. Janssen at al. (2012) pointed out that incentives for users might be missing or that users may have no time to use data. Carrara et al. (2015c) argued that prioritization of datasets for publishing could benefit from more intense involvement of the demand side. Ubaldi (2013) argued that reaping the potential benefits of OGD requires an ecosystem of key actors. However providers of OGD, users, and policy makers might not know each other (Berends et al., 2017).

3.5. Coordination, organization, processes and management

Publishing and re-use of OGD also brings organizational and managerial issues. Coordination between public sector organizations or departments is needed to support the OGD publishing, but sometimes there is a perceived lack of culture that would be open towards sharing and collaboration between departments (Carrara et al., 2015c). Cooperation is also needed between national and regional public organizations (Carrara et al., 2016). Publishing and re-use of OGD also requires appropriate processes, organizational structures and data governance practices that are not always in place (Ubaldi 2013; Carrara et al., 2015d; Berends et al., 2017). Janssen et al. (2012) also pointed out that some users were frustrated at existence of too many OGD initiatives.

3.6. Benefits and positive impacts

Potential users are not always aware of the available datasets or of the potential benefits of OGD (Janssen et al., 2012; Ubaldi, 2013). However, there are only few awareness raising activities (Carrara et al., 2015c, Carrara et al., 2016; Berends et al., 2017). Awareness of politicians and public sector representatives of the OGD benefits is also low or lacking (Barry & Bannister, 2014; Berends et al., 2017). The economic benefits of OGD were also seen as uncertain (Huijboom & Van den Broek, 2011) or unclear in general which was reported to complicate development of a business case for OGD (Janssen et al., 2012; Ubaldi, 2013; Barry & Bannister, 2014; Berends et al., 2017). One of the findings of the assessment of the Open Data maturity in Europe 2015 was that "*long running Open Data initiatives check neither effectiveness nor impact*" (Carrara et al., 2015c).

3.7. Resources, costs and financing

Selling data or collection of fees represent a barrier to the re-use of government data (see the section 3.1). However for some public organization switching to providing data free of charge would result in a loss of revenue (Janssen et al., 2012; Ubaldi, 2013; Conradie & Choenni, 2014; Barry & Bannister, 2014; Carrara et al., 2015c; Carrara et al., 2016; Berends et al., 2017). Therefore new funding models might be needed in order to allow publishing government data for free.

Publishing of OGD requires resources and funding, however this funding might be sometimes lacking (Janssen et al., 2012; Berends et al., 2017). Berends et al. (2017) also argued that sustainable funding of the OGD initiatives need to be ensured. Otherwise the OGD portals might be threatened with a lack of funding to maintain their operation.

3.8. Leadership, policy and strategy

According to Ubaldi (2013) few countries had a long-term OGD policy or strategy. Other authors reported that the barrier does not lie in the complete lack of some OGD policy but rather in inconsistencies between multiple existing policies (Huijboom & Van den Broek, 2011; Janssen et al., 2012; Martin et al., 2013; Barry & Bannister, 2014; Berends et al., 2017). Unclear responsibilities for the OGD policy (Martin et al., 2013) or varying interests of those involved in its development (Berends et al., 2017) might contribute to this barrier. In public sector OGD publishing requires political support, but in some countries OGD is not a political priority (Conradie & Choenni, 2014; Carrara et al., 2015c; Carrara et al., 2016; Berends et al., 2017).

3.9. Knowledge, skills and capabilities

Lack of knowledge, skills and capabilities could be a barrier to the OGD publishing and re-use (Janssen et al., 2012; Martin et al., 2013; Ubaldi, 2013; Barry & Bannister, 2014; Carrara et al., 2015c; Carrara et al., 2015d; Carrara et al., 2016; Berends et al., 2017). According to Carrara et al.

(2015b) use of OGD requires variety of skills such as technical, statistical, analytical and communication skills as well as business insight and domain knowledge. On the OGD publisher side the lack of technical skills was also mentioned (e.g. Barry & Bannister, 2014, or Carrara et al., 2016). Ubaldi (2013) specifically mentioned the lack of skills for working with Linked Data.

3.10. Technology and tools

According to Huijboom and Van den Broek (2011) limited network capacity was perceived as a barrier to the OGD publishing and re-use. Janssen et al. (2012) discussed the perceived lack of tools and support and they pointed out that the OGD publishing might be complicated by legacy or fragmented applications. According to Ubaldi (2013) the OGD publishing requires improvements to the technology infrastructure and integration of OGD tools and applications.

4. Discussion

OGD initiatives has been established in many countries worldwide (World Wide Web Foundation, 2015). Despite the efforts many barriers to the publishing and re-use of OGD still prevail. Our research shows that the range of the barriers is diverse and that the barriers are faced by both publishers and consumers of OGD. However these barriers are not only diverse but, as Janssen et al. (2012) pointed out, they are often interrelated. For example low quality of metadata hinders discoverability of data (Berends et al., 2017). Perceived lack of clarity of the benefits of OGD could impair willingness to share and re-use data. Overcoming the barriers therefore needs both in-depth study of the individual barriers in order to find solutions that would fit to the problems in particular and a holistic approach that would cover diversity of the barriers and relationships between them in order to be able to provide comprehensive recommendations to the stakeholders.

A set of Best practices for Sharing Public Sector Information (Share-PSI 2.0, 2016a) was developed in order to help organizations and individuals with this task. This set of best practices is accompanied with the Data on the Web Best Practices that was adopted as a W3C Recommendation in January 2017 (Lóscio, Burle, & Calegari, 2017). National and local governments as well as international organizations and institutions are developing their own guidelines for publishing and re-use of PSI and OGD (Share-PSI 2.0, 2016b). Future research should study how these best practices and guidelines are being implemented and how they contribute to overcoming the barriers to the publishing and re-use of OGD.

Some of the generalized barriers analyzed in our research have been present for the whole or most of the studied period. Future research focusing on these barriers still seems to be relevant. Therefore domains of the future research should include: quality of OGD including the quality of the related metadata; availability of OGD; data protection, privacy or security constraints and data anonymization in relationship to OGD; OGD licensing, legislation and legal frameworks for OGD; awareness of the stakeholders in the OGD ecosystem; OGD benefits and its measurement; funding models enabling sustainable OGD provision and the OGD policies and strategies.

Concerns about the possible negative or unwanted impacts of OGD were discussed in several works published up to 2014. In the works published later these concerns were not explicitly mentioned. Therefore future research should study whether these issues are still perceived as barriers to the OGD publishing and re-use. The same applies to the barriers related to technology and tools.

On the other hand, low political priority of the OGD initiatives was reported for four consequent years starting from the year 2014. Future research should therefore study whether OGD initiatives will face lacking or diminishing political priority in the near future.

5. Conclusions

Re-use of data held by governments and public organizations could result in political, social and economic benefits. In order to make government data re-usable, many governments across the globe has launched their OGD initiatives (World Wide Web Foundation, 2015). Even though these initiatives have been gaining momentum for the last couple of years, stakeholders in the OGD ecosystem still face various barriers when publishing and re-using OGD.

In this paper results of an analysis of eleven papers and studies published between the years 2011 and 2017 that dealt with barriers to the publishing and re-use of OGD were presented. In total 50 generalized barriers classified in 10 categories were derived from the barriers discussed in the analyzed works.

Stakeholders in the OGD ecosystem face diverse range of barriers. These barriers are often interrelated which makes publishing and re-use of OGD a complex problem (Janssen et al., 2012). Our research shows that some of the barriers such as the barriers related to low or insufficient availability, accessibility and quality of data and metadata or the barriers related to licensing and legislation, as well as many others, were discussed by multiple authors throughout the whole studied period. This indicates that despite the efforts to support the OGD initiatives there are still many prevailing challenges in the domain of the OGD publishing and re-use.

Discussion of the results of our research indicated several topics for future research. These topics include studying how the best practices and guidelines for OGD publishing and re-use are being implemented and how they contribute to overcoming the barriers. Future research seems to be necessary in domains where the barriers have been prevailing for many years such as the quality and availability of OGD; data protection, privacy and security; OGD licensing, legislation and legal frameworks; awareness of the OGD stakeholders; OGD benefits and its measurement; funding models of the OGD provision or the OGD policies and strategies. Future research should also study whether all of the barriers are still relevant. Attention should also be paid to the perceived low political support to OGD that has been mentioned in some of the recent works.

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SESSION H: CORPORATE AND ICT PERFORMANCE MANAGEMENT

DOES BUSINESS INTELLIGENCE SUPPORT CORPORATE STRATEGY IMPLEMENTATION?

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Keywords

Strategy, Business Intelligence, Strategy Implementation, Contingency Factors, Management Control System.

Abstract

The paper reacts to the gaps encountered in recent review of research on Business Intelligence (BI) impacts. The objective of the paper is to confirm the positive impact of BI systems on strategy implementation processes in companies domiciled in the Czech Republic and to test selected contextual factors influencing such relation, such as size, sector or character of output markets. The fulfilment of the objectives is searched by means of factor analysis, regression and correlation analyses. These analyses reveal moderate positive association between the level of BI systems and support of strategy. As far as the contextual factors are concerned, only differentiation between industrial and non-industrial sectors was found statistically significant.

1. Introduction

Recent review of Business Intelligence (BI) systems concludes "BI Impacts have been a main focus of BI studies for the last 15 years…. However, the BI literature has been silent on how these BI Impacts complement other internal and external factors to create business value." (Trieu, 2017, p. 116). The review covered 106 articles published in leading journal in the field of information systems including MIS Quarterly (MISQ) and Decision Support Systems (DSS), that is why it might serve as a good estimate of the current state of the art in the field of BI systems and their consequences.

This paper aims at the in the review identified gap in knowledge about external factors influencing the BI impacts. Specifically, *the objective of the paper* is to confirm the positive impact of BI systems on strategy implementation processes in companies domiciled in the Czech Republic and to test selected contextual factors influencing such relation.

The paper is organized as follows. The next part briefly summarizes current knowledge about BI system and derives hypotheses. Then information on sample and methods is introduced and followed by results. The final part concludes findings.

2. Impacts of BI systems

Business intelligence (BI) systems help managers to interpret data captured by the ERP systems of their companies and thus support planning and control, decision making, and - as a final consequence - achieving higher performance compared to competitors. The cited review (Trieu,

2017) lists number of studies documenting the BI impacts such as transforming business processes or enriching organizational intelligence (Elbashir, Collier, & Davern, 2008; Lau, Liao, Wong, & Chiu, 2012; Zorrilla & García-Saiz, 2013). In addition to sources covered by Trieu (2017), some light was shed on the capability of BI systems to support advanced management accounting and control systems (MCS) (Elbashir, Collier, & Sutton, 2011), to enhance performance measurement capabilities (Peters, Wieder, Sutton, & Wakefield, 2016) or to improve performance (Lee & Widener, 2016). These are the reason why it is possible to assume the following hypothesis:

(H1) *The higher the level of BI systems used by a company is, the more significantly all strategic systems contribute to its strategy implementation*.

To fill the gaps identified by Trieu (2017), which concern a lack of studies on the role of complementarity between BI impacts and external factors, the rich stream of articles about contingency theory from MCS literature served as an inspiration (Bedford, Malmi, & Sandelin, 2016; Bisbe & Malagueño, 2012; Chenhall, 2006; Otley, 2016; Widener, 2007). From these contingency studies, the four potentially influential external factors were derived and the following hypothesis formulated:

(H2) *The support of strategy implementation depends not only on BI systems but also on external factors, namely on (i) size of a company, (ii) its sector, (iii) B2B or B2C character of the output markets, and (iv) membership in a group of companies.*

3. Methods

Logic of the research presented in this paper is outlined in Figure 1. The first hypothesis (H1) concentrates on the focal relation between BI systems and strategy support. The second hypotheses (H2) adds the selected contextual variables (i) to (iv) next to the focal relation.

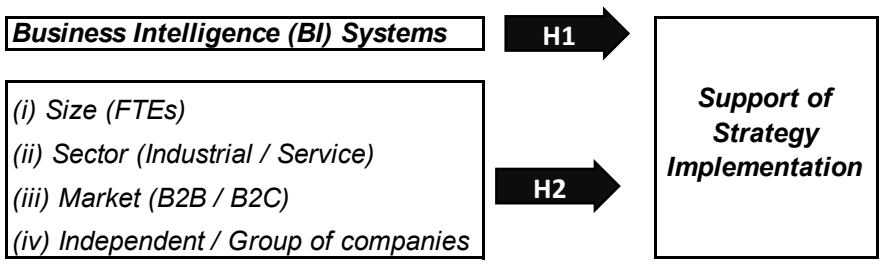

Figure 1: Model of the research; Source: Author.

To fulfil the objective of the paper, a survey among 156 companies domiciled in the Czech Republic was done. The following subsections give detailed information about the questions used, sample characteristics and, eventually, statistical methods applied on gathered data.

3.1. Questionnaire

To prevent - or at least minimize - potential problems with validity, the batteries of questions were used, which has been already established in the previous studies published in the most cited journal.

To measure the first focal concept of *BI Systems*, the questions used by Peters et al. (2016) were applied. The respondents from the companies were asked to evaluate the following statements on the scale "-3 = not true at all about the reporting IS in the Company" ... "0 = half true" ... "+3 = totally true about the reporting IS in the Company". The common wording of the whole battery was "The Company's information system for reporting and long-term performance analysis..." and the tested statements:

- (qBI_Visualization) "…contains sophisticated functions to visualize data and their time series."
- (qBI_SelfReporting) "…allows interactive reporting (e.g. ad-hoc definitions of user queries)."
- (qBI_DrillDown) "…immediately offers the user detailed information at request (drill-down)."
- (qBI_QuickResp) "…needs short time for response."
- (qBI_Integrated) "…is a fully integrated solution (normally rounded up with a Business Intelligence application)."

The measurement of the second focal concept of *Strategy Support* stemmed from (Speckbacher, Bischof, & Pfeiffer, 2003). On the scale ranging from "-3 = minimal contribution for the area in question" to "3 = maximal contribution for the area in question", the respondents were asked to evaluate "How does the top management assess the contribution of the use of management control systems in the following areas":

- (qStratSupport_Link) "Linking the strategy with the Company's everyday operation."
- (qStratSupport_Spread) "Clarifying and communicating of the Company's strategy."
- (qStratSupport_Perf) "Improving the long-term performance of the Company."
- (qStratSupport_NonFin) "Significant consideration for non-financial aspects of performance."
- (qStratSupport_Focus) "Concentration of the Company's sources on its strategy."

The variable (i) *Size of a company* was calculated as a natural logarithm of FTEs. The reason for using just one measure log(FTEs) was derived from (Fiala & Hedija, 2015), who obtained comparable results for separately tested size values: FTEs, revenue and assets on data sample of thousands..

Categorical variable (ii) *Sector* was drawn from BizNode database. To form sufficiently large groups of responding companies, just two categories (Industrial / Service) were coded. The first category of industrial companies included CZ-NACE sections raging from "B - mining and quarrying" through manufacturing, utilities up to "F - Construction" and was assigned code "1". The second category of service and trade comprised "G - wholesale and retail trade" and all service sectors and was coded as "0".

The variable (iii) *Market* regarding B2B or B2C character of the output markets and variable (iv) *Membership in a group of companies* were reported by respondents in separate identification questions. Both variables were dichotomous and coded with "1" if a responded chose "B2C" and "Independent", respectively.

3.2. Data collection and respondent characteristics

Data collection was done through a web-based questionnaire consisting of 15 connected webpages with progress indicator programmed in Limesurvey version 2.58. The survey was cross-sectional covering all profit seeking 1-digit NACE sectors except A-Agriculture. The companies were drawn from the database BizNode Albertina. Based on this source and verified with data published by Czech Statistical Office, 8,687 companies with more than 50 FTEs operate in the Czech Republic. The questionnaire was distributed to the stratified sample of 2,076 companies drawn randomly by IBM SPSS (ver. 23) procedure Complex sample using criteria sector and district proportion same as in the frame. The survey was carried out in November with two follow-ups (the 2nd postal) in December 2016. The targeted respondents were ideally members of top management.

A total of 156 useable answers was gathered, which corresponds to the response rate of approximately 7 percent. The low response rate obtained from the survey raises the potential for non-response bias. Often non-responders are different in crucial aspects to responders (De Vaus, 2002). Therefore, to test for a non-response bias a comparison of the means of all variables measured on Likert scales was undertaken for quarters of early and late respondents. Mann-Whitney U tests did not signal significant differences between early and late respondent groups.

Among respondents, the count of top managers or owners amounted to 77, middle managers to 33, lower managers to 16 and 26 respondents were without managerial rank. Subsequent Kruskal-Wallis test did not identify statistically significant differences among answers of top, middle, lower and non-managers.

As far as the functional structure is concerned, the sample of respondents consisted of 42 people from finance departments, 38 general managers (CEOs) or owners, 21 from marketing and selling departments, 18 from technical or operations departments, 8 from procurement and 29 from other departments of responding companies.

From the sectoral point of view, industrial production was the main activity for 83 responding companies and 73 were involved in trade and services.

Viewed from the perspective of the official EU size categories as defined in the EU recommendation 2003/361/EC, there were 80 medium-sized entities (50–249 FTEs) and 76 large entities (more than 250 FTEs). It was 1 and 4 percent, respectively, out of the entire population of the companies domiciled in the Czech Republic.

3.3. Data processing

IBM SPSS v. 23 was used for statistical processing of the obtained data. Despite the ordinal nature of the questions included into focal concepts, these were treated as metric data due to relatively long scales which were almost fully used by respondents.

Firstly, the descriptive statistics were calculated. For each question from focal concepts, these are presented in Table I. The statistics of kurtosis and skewness did not deviate from the interval [-1, 1] too much, which is a sign of approximate fulfilment of normal distribution (Mareš, Rabušic, & Soukup, 2015) assumed in regression analysis.

Secondly, the factor analysis was applied to reduce the original set of questions into just one factor per each focal concept. The principal component analysis (PCA) was the method applied for extraction. The Kaiser-Meyer-Olkin Measure reported .879 in case of *BI Systems* concept and .845 in case of *Strategy Support* concept, both meaning that sample was adequate or meritorious according to (Hutcheson & Sofroniou, 1999). The explained total variance in underlying questions amounted to 73.5 % for the concept *BI Systems* and 58.0 % for the concept *Strategy Support.* The final scores for both focal concepts were derived through regression method. Factor loadings

ranging from 0.70 to 0.79 for the *BI Systems* and from 0,81 to 0,90 for the *Strategy Support* concepts signal quit similar importance of each question in the final concept construction.

Thirdly, ordinary least square linear regression was applied. At first, the hypothesis (H1) was verified when *Strategy Support* was regressed on *BI Systems*. In the next step, the hypothesis (H2) was tested through inclusion of the contextual variables (i) to (iv) into the model as additional predictors. Both models were found to be statistically significant based on total F-test. After that, parameters of each model were tested whether they are significantly different from zero and thus influence significantly *Strategy Support.*

4. Results

Descriptive statistics of questions aiming at both focal concepts are presented in tab. I. The underlying question are sorted by descending means. Thus, table I. reveals that the most important feature of the *BI Systems* was the ability to formulate own queries followed by visualization and drill-down. On the contrary, the level of BI integration was not perceived so important by respondents. As far as the *Strategy support* is concerned, the most expected contribution of MCS use was the improvement of long-term performance.

Table 1: Descriptive statistics

Question	Mean	Minimum	Maximum	Std. Deviation	Kurtosis	Skewness
qBI_SelfReporting	0.76	-3.00	3.00	1.71	-0.72	-0.35
qBI_Visualization	0.62	-3.00	3.00	1.83	-0.93	-0.34
qBI_DrillDown	0.62	-3.00	3.00	1.79	-0.88	-0.30
qBI_QuickResponse	0.58	-3.00	3.00	1.65	-0.84	-0.26
qBI_IntegratedBI	0.34	-3.00	3.00	1.93	-1.03	-0.30
qStratSupport_Perf	1.18	-2.00	3.00	1.23	0.10	-0.80
qStratSupport_Spread	0.83	-2.00	3.00	1.28	-0.37	-0.45
qStratSupport_Focus	0.70	-2.00	3.00	1.35	-0.61	-0.22
qStratSupport_Link	0.62	-3.00	3.00	1.27	-0.06	-0.18
qStratSupport_NonFin	0.34	-3.00	3.00	1.21	0.33	-0.59

Source: Author in SPSS.

The factor analyses using PCA resulted into the concepts of *BI Systems* and *Strategy Support*. The consequent OLS regression model proved *BI Systems* to be statistically significant (p= 0.000018) predictor of *Strategy Support.* In other words, the hypothesis (H1) was verified. The standardized regression coefficient (in model with just one predictor equals to correlation coefficient) achieved the amount of .354, thus *BI Systems* explained 12.5 % ($R^{2)}$ of the total variance in the target concept of *Strategy Support*.

Findings similar to the regression analysis with aggregated concepts are obvious from the more detailed analysis of correlations between each pair of the questions underlying the concepts of *BI Systems* and *Strategy Support.* Results of such bivariate correlation analysis are depicted in table II. The correlation coefficients are slightly lower than in the previous regression model

because there is no adjustment through distillation of the variance into the shared first principal component. On the other hand, table II paints more detailed view of associations between the underlying traits of the focal concepts of *BI Systems* and *Strategy Support*.

Table 2: Bivariate Person's correlations of the underlying questions of both focal concepts

	qStratSupport_Link	qStratSupport_Spread	qStratSupport_Perf	qStratSupport_NonFin	qStratSupport_Focus
qBI_Visualization	.242**	.278**	.281**	.200*	.181*
qBI_SelfReporting	.159	.300**	.256**	.211*	.196*
qBI_DrillDown	.218**	.290**	.303**	.141	.284**
qBI_QuickResponse	.158	.308**	.235**	.072	.195*
qBI_IntegratedBI	.185*	.346**	.284**	.169*	.251**

Note: ** Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed); Source: Author in SPSS.

The second OLS regression model added contextual variables (i) to (iv). The estimated parameters for such model are summarized in table III. The model explained 18.2 % of the total variance in target *Strategy Support* concept and 15.1 % after adjustment for model complexity (R^2 adjusted). Despite being statistically significant as a whole, most parameters were not significantly different from zero. Just variable (ii) *Sector* turned to be statistically significant and thus only partly verifying the hypothesis (H2) about the contextual factors complementing BI. In this context, according to the findings in table III, the respondents from industrial companies reported BI Systems to be less used to support strategy implementation than trade and service companies did.

Table 3: Model predicting Strategy Support after inclusion of contextual variables as predictors

Parameter	B	Std. Error	Beta	T	Sig.
(Constant)	.677	.419		1.617	.108
BI Systems	.324	.079	.323	4.082	.000
(i) Size of a company	-.049	.062	-.069	-.790	.431
(ii) Sector industrial	-.380	.165	-.188	-2.305	.023
(iii) Market (B2C)	-.327	.183	-.144	-1.790	.076
(iv) Member (Independent)	-.252	.173	-.125	-1.456	.148

Source: Author in SPSS.

5. Conclusions

In accordance with the objective of the paper, the presented analysis confirmed moderate positive association (Pearson's correlation = .354) between the level of BI systems and the support of strategy implementation in 156 companies domiciled in the Czech Republic. The more detailed analysis of bivariate correlations between the traits of BI systems and the ways of supporting strategy implementation revealed that BI systems support especially clarifying and communicating

strategy and improvement of the long-term performance. In that context, a fully integrated solution rounded up with some specialized BI application and enabling the drill-down function are especially important.

The second subobjective was to address the controversy of studying impact of BI Systems without studying the context of their application. That is why the second regression model included contingency factors of (i) size of a company, (ii) its sector, (iii) B2B or B2C character of the output markets, and (iv) membership in a group of companies. Only differentiation between industrial and non-industrial sectors was found statistically significant. Respondents from industrial companies reported BI Systems to be less used to support strategy implementation. This finding partly contradicts the finding that non-service industries show stronger relationships between BI impacts and organizational performance (Elbashir et al., 2008) although the mentioned discrepancy may be explained by not taking the relation strategy-performance into account.

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BUSINESS PROCESS MODELING METHOD FOR ARCHIMATE

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Keywords

Business process, business function, process abstraction level

Abstract

In this paper we have looked at use of hierarchical abstraction in ArchiMate's business layer and discussed importance of correct and consistent use of hierarchical abstraction at this top level of ArchiMate/ TOGAF architecture. As their specifications do not provide their users with a method which would guide one through business layer modeling, so that at the end one has models which elements are consistent in their levels of abstractions, we propose a method based on recent extension of MMABP methodology. This method is illustrated with real world example and its benefits discussed.

1. Introduction

As complexity of ICT system is rising every day and speed of introduction of new changes, which business and ICT have to absorb, is increasing, there is necessary to have reliable governance over the current business and ICT status quo (Aleatrati Khosroshahi, Beese, Mattes, & Winter, 2016). One of tools that help to keep this motion under control is the enterprise architecture (Simon, Fischbach, & Schoder, 2014). Taking into account systems thinking, it should ideally provide us with complete view on how the business system and other relevant systems like ICT system actually look like, what impact introduced changes have on them and how does the current architecture of the systems fit to the enterprise strategy. There has been developed a variety of enterprise architecture methodologies (Rouhani, Mahrin, Nikpay, & Nikfard, 2013), out of which one of the most popular and accepted methodology (The Open Group, 2015) is TOGAF and its extension ArchiMate.

TOGAF and so the ArchiMate are built on several interconnected architectures (layers), where on top is business architecture. This layer gives the layers beneath reason to exist. It contains description what the behavior and its intentions should be like according to enterprise strategy - in other words: business process models with definitions of enterprise goals and business processes which lead to fulfillment of these goals. Clarity and unambiguity of this layer have to be under high supervision as any error would spread into the architectures in the lower layers. Correct and unambiguous business processes enable not only reliable process management and corporate performance management, but also form reliable basis for ICT architecture and governance.

Business process model as any model is based on abstraction and the proper usage of hierarchical abstraction determines usability and consistency of such model. Hierarchical abstraction in business

process model allows infinite number of process abstraction levels. This possibility of limitless hierarchical abstraction is a strong feature but also very dangerous if used unwisely and its wrong application may eventually make the whole business process model either too complex and detailed or too abstract. In both cases the resulting model is hard to use if not unusable at all. It is the role of methods and methodologies to provide a solution for analysts so that they are able to deliver business process model which is consistent in its abstractions, always with fitting level of process abstraction to model's purpose.

Our hypothesis is that neither TOGAF nor its complement ArchiMate specify method which would provide analysts with guidance in dealing with process abstraction levels, what we see as crucial as described above. If it is so, we will suggest such method for ArchiMate on basis of current research.

2. ArchiMate and TOGAF frameworks

The ArchiMate framework (The Open Group, 2016) is product of the Open Group and it works as an extension of the TOGAF framework (The Open Group, 2011). TOGAF provides the basic metamodel whereas the ArchiMate provides analysts with modeling notation and elaboration of basic concepts of TOGAF into particular well defined terms which then as a whole form relatively consistent modeling language. Clear example of this is for instance term "business process", which is in TOGAF specification present only in general form of a "process", but particular definition what a business, application or technology process is, one has to search in the ArchiMate specification. This case is valid for most of the TOGAF/ArchiMate elements.

The ArchiMate Core Framework consists of three basic layers which are based on the three TOGAF architectures (business, application and technology) and for each layer there are defined appropriate set of concepts with their mutual relations. In addition, TOGAF provides users with the Architecture Development Method (ADM), which guides users in steps how the complete architecture should be created, what are necessary inputs, recommended models and required outputs. Specific method how to model the individual layers using the defined concepts is not present in TOGAF or in the ArchiMate specification. It is up to the users to use the ArchiMate's concepts in a model of their choice the way they need.

This gives the ArchiMate large flexibility, but there are reasons why this flexibility should be limited as noted in the introduction. The clearest example is the business layer with concepts of business process and business function. In order to stay at conceptual level it is necessary to manage their abstraction levels otherwise an analyst cannot find the moment where one is still at conceptual level and when one is in too much detail modeling already particular activities instead of processes. In order to be able to avoid this, we propose the following method for business process modeling in the ArchiMate.

3. Business Process Modeling Method

We base the proposed method on recent extension of the Methodology for Modeling and Analysis of Business Processes (MMABP) introduced in Svatoš and Řepa (2016). The reasons that led us to this decision are that the ArchiMate is very close in its principles to MMABP and the concept of process abstraction levels with focus on key processes introduced in Svatoš and Řepa (2016) brings additional benefits when compared with other methods.

First in this section we show that MMABP is in its principles compatible with TOGAF and the ArchiMate and therefore the advances in MMABP can be applied to ArchiMate. After that we

describe the MMABP's concept of process abstraction levels and formulate the business process modeling method for the ArchiMate.

3.1. MMABP and its Principles

The Methodology for Modeling and Analysis of Business Processes (MMABP) is a methodology based on three basic principles (Řepa 2007, 2008) described in Figure 1.

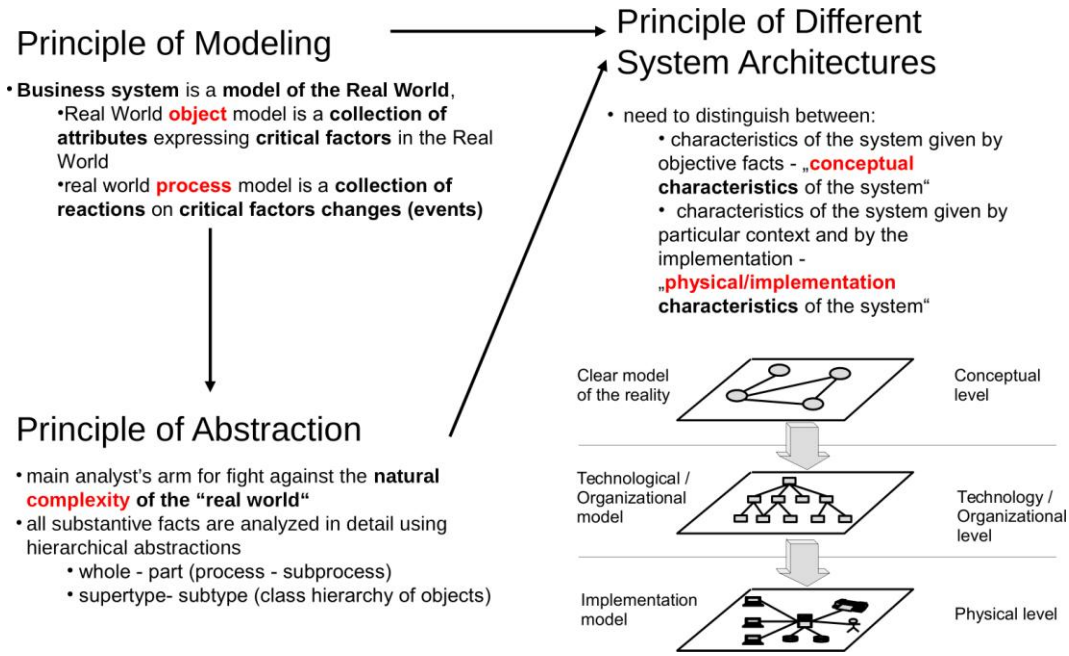

Figure 1: Basic MMABP principles (Svatoš & Řepa, 2016)

Principle of modeling is constituted in MMABP's business system model by two basic viewpoints (Figure 2), where one focuses on real world intentional behavior (processes) and the other on real world structure (objects). The same principle we can find in ArchiMate (The Open Group, 2016, p. 12) where there are distinguished behavior elements and structure elements. Principle of abstraction is in MMABP embodied in differentiation of two basic types of model: global (substance) view on a system as a whole and detailed (temporal) view on just one element of the system (Figure 2). We can find identical approach in the ArchiMate's business layer. What the global view is in MMABP, the business layer is in the ArchiMate as the architecture should map the substance of the modeled system. The detailed diagrams are not subject to the ArchiMate business layer, but it names the BPMN (Object Management Group, 2013) as a tool for modeling of detailed business process flows (The Open Group, 2016, p. 61). So does the MMABP in detailed (temporal) process view (Figure 2). The principle of (three) different architectures is again shared principle as the ArchiMate builds on it too (The Open Group, 2016, p. 9). As all three basic principles of MMABP are in common with the ArchiMate, we are convinced that the MMABP process level hierarchy can be adapted to the ArchiMate without requiring any redesign.

MMABP works with four levels of process abstraction. There are first two global levels (enterprise functionalities and business processes) which fit ArchiMate's conceptual approach and there are two detailed ones (process steps and activities) which are out of scope of this paper as the ArchiMate leaves this detail to BPMN models.

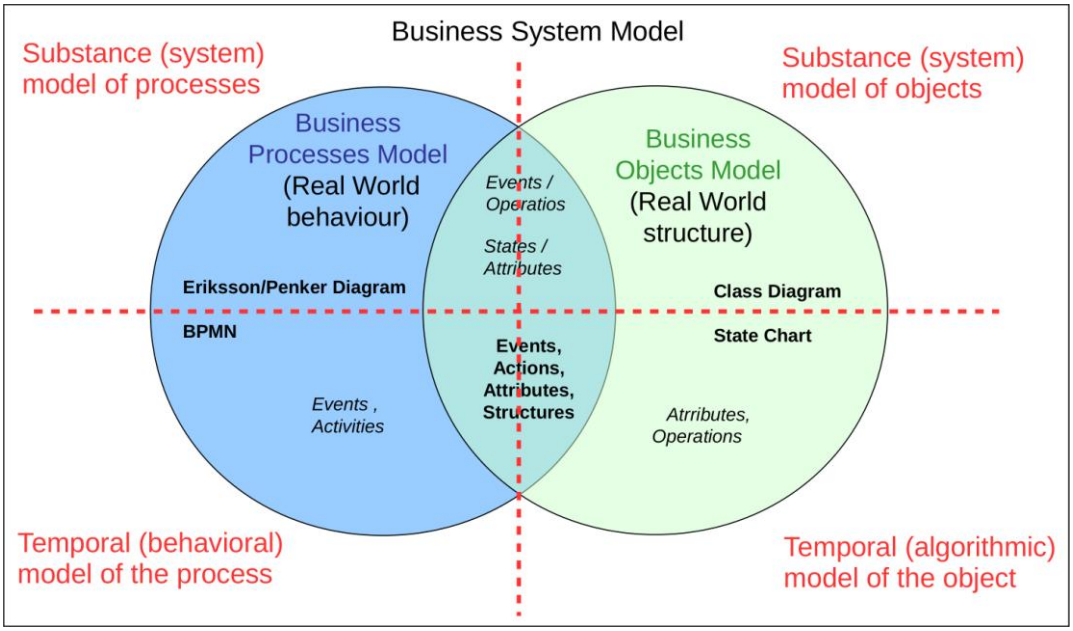

Figure 2: Two times two dimensions of the Real World (Business System) Model (Svatoš & Řepa, 2016)

The top level of process abstraction is captured in enterprise functionality map, which captures enterprise functionalities, external actors and information flows among them to which the functionalities have to react (events). As the enterprise functionalities are defined as "high level aggregation of activities of the business" (Svatoš & Řepa, 2016) and therefore consisting of different business processes, setting of the appropriate level of abstraction of the enterprise functionality is strongly dependent on the setting of business process abstraction level. This is the point where we have to start with the description of the process abstraction levels.

MMABP perceives a business process as "series of steps designed to produce such output (a product or a service) which is essential for satisfaction of specific customer's need" and there are distinguished (Svatoš & Řepa, 2016):

- Key processes, i.e. those processes in the organization which are linked directly to a customer, covering whole business cycle from expression of the customer's need to its satisfaction with the product / service.
- Supporting processes, which are linked to the customer indirectly - by means of key processes which they are supporting with particular products / services.

As the enterprise functionalities are aggregation of relevant business processes, this differentiation is applicable also in their case. We can distinguish between key enterprise functionalities, the ones which are linked directly to customers of the business, and support enterprise functionalities which support the key ones with particular products or services.

The presented business process differentiation has implications that can be elaborated further into two different classifications.

Taking into account that a business process does or does not have a support process(es) MMABP works with two types of a business process:

- Orchestration business process - a business process which has subordinate business processes and its main purpose is orchestration of the subordinate business processes.

- Elementary business process - a process which has no subordinate business processes and its main purpose is the actual performance of the value adding activities that lead to satisfaction of customer's need.

And taking into account that a customer of a business process can be not only external but also internal, MMABP generally recognizes two roles of a business process:

- End-to-End (E2E) business process - a business process which is linked directly to a customer of *enterprise functionality*, covering the whole business cycle from expression of a customer's need to its satisfaction with the product or service. Some of E2E business processes are also the *key processes* (the ones linked to external customers).
- Support business process - business process which supports E2E business process(es) with particular product or service

The types and roles of a business process always exist in combination and one has to bear in mind that the roles are assigned always relatively according to the business process which perspective we are looking from. Orchestration business process is usually in role of E2E business process, but, with the exception of the key processes, it can be also in role of a support process for another E2E business process. Elementary business process is usually a support process, but there is not excluded option that it may be in E2E business process role.

Looking at the definitions above, one can see that it is the MMABP's specific principle of E2E business process what sets the abstraction level of enterprise functionalities. There always has to exist a business process which covers the whole business cycle from expression of a customer's need to its satisfaction and this process has to be completely part of one enterprise functionality only (principle of abstraction). It may be supported by business processes from different enterprise functionalities, but the orchestrating E2E business process itself has to be part of just one enterprise functionality. With business processes it is not as much straightforward. Problem is that no matter how good the definition of a business process is, the decision, where process abstraction leaves the business process level and enters the process step level, is still in many cases up to the intuition of the analyst. Methodologically we can narrow the space where the intuition is necessary (and we do in this paper), but there will probably always remain some fuzzy space for the intuition. Abstraction level of a business process in role of E2E business process is quite clear as it is defined by the whole business cycle which it has to cover. The trouble comes with the support business processes. Support business processes are not always visible at first sight and there is not always one unambiguous way how to identify all support business processes and have them consistent at the same level of abstraction at the same time. What methodologically helps us is the nature of business processes since they represent behavior driven by an intention i.e. goal. The goal of the identified E2E business process can be usually split into sub-goals (if it is orchestrating business process by its nature), at which we can look as milestones and which must be achieved in order to be able to get to fulfillment of the goal of the E2E business process. This approach goes back to the business process definition and it is the emphasis on the essentiality of the output which draws the line between process steps and business processes and what keeps the abstraction level consistent. Each identified milestone of E2E orchestrating business process represents result of one support business process. Milestones of E2E business processes are then what sets the level of abstraction of support processes and what should help to keep the abstraction level of support business processes consistent.

3.2. Application to the ArchiMate

The discussed principles of MMABP's approach to process abstraction can be easily transferred into the ArchiMate. The ArchiMate's business function defined as "collection of business behavior

based on a chosen set of criteria; typically required business resources and/or competences" (The Open Group, 2016, p. 61) generally fits the definition of MMABP's enterprise functionality "high level aggregation of activities of the business; general capability of the enterprise which enables pursuit of enterprise goals" and the ArchiMate's business process definition "a business process represents a sequence of business behaviors that achieves a specific outcome such as a defined set of products or business services" (The Open Group, 2016, p. 60) generally fits the MMABP's "series of steps designed to produce such output (a product or a service) which is essential for satisfaction of specific customer's need". The relation of business function to business process is according to the metamodel hierarchical abstraction (The Open Group, 2011, p. 342).

As MMABP and the ArchiMate share the basic principles and work with the same process abstraction concepts in the business layer, nothing should stand in the way to apply the MMABP's business process types and roles to the ArchiMate. The procedure how to set up the first two levels of process abstraction in the ArchiMate would be the following:

1. Identify key business functions i.e. those business functions which are linked directly to customers of the business, covering the whole business cycle from expression of a customer's need to its satisfaction with product or service.
2. Identify the support business functions i.e. those business functions which support the key ones with particular products or services.
3. Identify all external entities the business communicates with and specify the exchanged information among business functions and external actors, to which the business functions have to react.
4. Select information (events) which start E2E business processes i.e. those business processes which are linked directly to customers of business functions, covering the whole business cycle from expression of a customer's need to its satisfaction with product or service. Take the time events also into consideration.
5. Identify the E2E business processes and specify their outputs and goals. Keep in mind that one business function may contain multiple E2E business processes.
6. Specify which E2E business processes are the key processes i.e. the ones which are linked directly to customers of the business, covering the whole business cycle from expression of a customer's need to its satisfaction with product or service.
7. If an identified E2E business process spans over two or more business functions, review them – one business process can orchestrate business processes from different business functions, but the orchestrating process itself has to be part of only one business function.
8. Identify support business processes for each E2E business process. Identify also the support processes hidden in the identified E2E business processes.
    a. In each identified E2E business process look for milestones which are *essential* for delivery of service or product to the customer (if there are any)
    b. Decide which milestones are result of a hidden support process
    c. Identify the support business processes and define for each triggering event and output

We illustrate results of the proposed method on real world example of an online bookshop (Figure 3). We work only with a fraction of the model but rich enough for demonstration of the discussed concepts and rules.

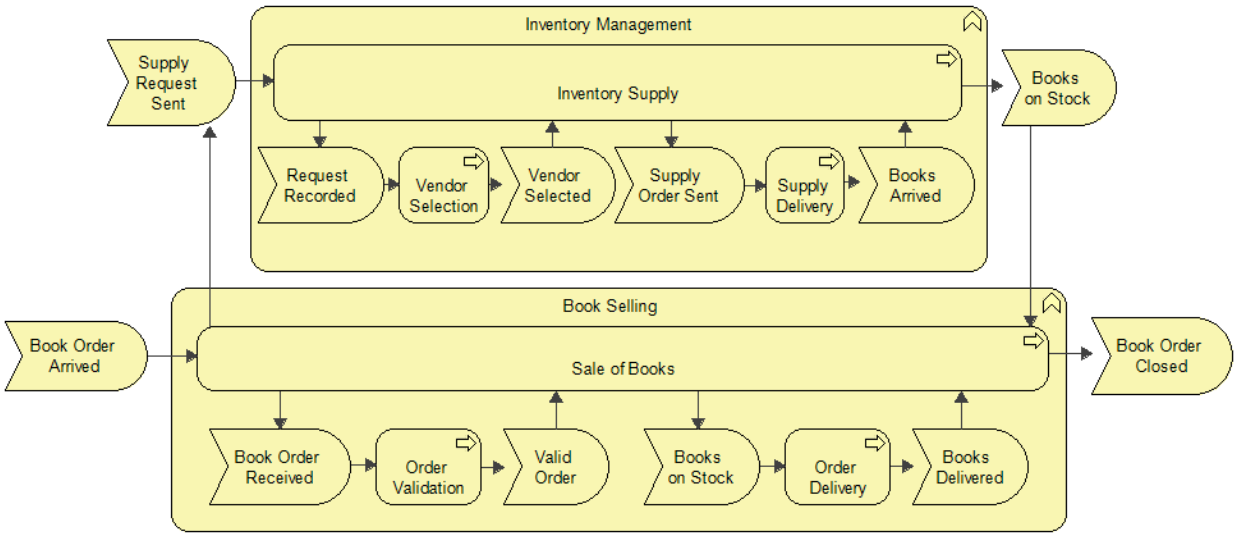

Figure 3: Example for ArchiMate combining business functions and processes

First we start with business functions. There is one key business function (the Book Selling function) which covers the whole business cycle from expression of a customer's need (book order) to its satisfaction with the product (delivered books) and there is one support business function (Inventory Management) which supports the key one by supplying the books the customer ordered. E2E business process in the key business function is the Sale of Books. As it is directly bound to customers of the business it is also in role of a key process. The book selling company in this case has only one type of business and therefore there is only one key E2E business process. This business process is an orchestrating business process and there are milestones which define the three support business processes. First milestone is a valid order. Customer may send order which contains wrong data or goods which is irretrievable. Without valid order the Sale of Book process cannot proceed any further towards its goal fulfillment. It is the goal of the support Order Validation business process to check the order and clarify the problems with the customer, if necessary, so that the book order is valid and complete. The same essentiality bear the other two milestones: having ordered books on stock and having the books delivered to customer. It is the goal of support processes Inventory Supply and Order Delivery to make this happen. The example also illustrates that the support processes do not have to be from the same business function as the E2E business process, they are supporting, is. The Inventory Supply business process is from Inventory Management business function and from its perspective it is an E2E orchestration business process accessible to internal customers. The model also shows the relativity of process roles as the Inventory Supply business process is from one perspective in role of support business process and from another in role of E2E business process. Events in the model represent synchronization moments between the cooperating business processes or an initial impulse from the customer of the business in form of the new book order.

Order the suggested method brings is visible at first sight. The main benefit is that the model stays focused on the whole business cycle of satisfaction of specific customer's need and everything is subordinated to this principle. Next benefit is that the abstraction level of business functions and processes is not driven by fuzzy intuition anymore, but by the defined rules and by the order of their application specified in the method. Extent of each business function is defined by the E2E orchestrating business processes, which through their goals define the milestones which lead us to the support processes. These are again specified at consistent level, distinguishing the orchestration and elementary process types. Events clearly define the moments when the business processes synchronize.

4. Conclusions

In this paper we have looked at use of hierarchical abstraction in the ArchiMate's business layer and discussed importance of correct and consistent use of hierarchical abstraction at this top level layer of ArchiMate/ TOGAF architecture. Our main concern was consistency of process abstraction levels represented in the ArchiMate by two business concepts: the business process and business function. Motivation in this case is not only the value the consistency of created business process models has for the stakeholders, who use them, but also the importance of the business layer for all the ArchiMate's lower layers, which build on it. As neither ArchiMate nor TOGAF specifications provide the users with a method which would guide one through business layer modeling so that at the end one has models which elements are consistent in their levels of abstraction, we proposed a method dealing with process abstraction levels based on recent extension of the Methodology for Modeling and Analysis of Business Processes (MMABP). The introduced method is illustrated with real world example and its benefits discussed. Using this method, the process abstraction levels are not driven only by intuition anymore, but by the rules specified in the method. Such model is fully compliant with main ideas of the process management, focused on customers and with consistent abstraction levels of business processes and business functions. Further research of guidance for abstraction consistency of the ArchiMate's concepts is necessary as its specification gives vast space for flexibility but also for inconsistencies.

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THE PROVISION OF EXTERNAL AND INTERNAL INFORMATION FOR STRATEGIC MANAGEMENT

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Keywords

Strategic Management Accounting, competitor information. information providers, external and internal information

Abstract

Financial information plays a key role in strategic and operations management. Management accounting can provide this financial information: traditional management accounting provides information for tactical and operations management and strategic management accounting should provide information for strategic management. In strategic management, external information about competitors plays an important role; managers consider such information exceedingly important although the source of such information is generally not the management accounting and controlling departments but special analytical departments or external consulting firms. Managers´ intuition is also important in decision making and management control.

1. Introduction and literature review

A quality information base is highly important for decision-making and management control. Traditionally, information for tactical and operational decision-making and management control has primarily been delivered through management accounting. Information for strategic management should be delivered via strategic management accounting (SMA); this term dates from 1981, when Simmonds presented the concept of SMA based largely on Porter's framework and defined it as "the provision and analysis of management accounting data about a business and its competitors, for use in developing and monitoring business strategy" (Simmonds, 1981). Simmonds claimed that SMA would be "spreading rapidly in practice" and that "management accountants are spending a significant proportion of their time and effort in collecting and estimating cost, volume, and price data on competition and calculating the relative strategic position of a firm and its competitors as a basis for forming business strategy". This was a curious claim and although the concept of SMA was considered by other researchers such as Shank, 1989, Bromwich, 1990, Cooper, 1995, later research at the turn of the 21st century and thereafter (Guilding et al., 2000; Lord, 1994, 1996; Shank, 2007) confirmed that SMA is a rarely-used term in organisations and that appreciation of the term amongst practising accountants is somewhat limited (Guilding et al., 2000). Usage rates for most SMA techniques are relatively low, but for all SMA practises appraised the perceived merit scores are significantly greater than the usage rate scores. The explanation could be that the reported gap in Ghoshal et al (1991) and Foster et al (1994) between what is needed and what is supplied by accounting systems can be extended to strategic management accounting systems more generally.

The other crucial problem regarding SMA outcomes arises from the fact that in the literature there is no generally accepted definition of SMA. At its very simplest, SMA is about making management accounting more strategic (Roslender and Hart, 2003). Bromwich (1990) provides a definition that limits SMA to financial information, but which is focused on performance relative to competitors - the provision and analysis of financial information on the firm's product markets and competitors' costs and cost structures and the monitoring of the enterprise's strategies and those of its competitors in these markets over a number of periods. The confinement of SMA to financial information and costs may be regarded by some as limiting; many consider that non-financial information is an important component of SMA.

Dixon and Smith (1993) present four stages to their SMA process: strategic business unit identification, strategic cost analysis, strategic market analysis, and strategy evaluation.

Like many SMA commentators, Lord (1996) and Dixon and Smith (1993) see SMA as lying at the interface of management accounting and strategy / strategic management. However, some other authors see marketing as the more relevant orientation for SMA. See, for example, Foster and Gupta (1994) and Roslender (1995, 1996). Roslender and Hart (2002) argued that SMA should become "more thoroughly infused with marketing issues, theories and concepts to form a 'marriage of equal partners'". The resultant "brand management accounting" would include performance measures such as market share, market growth and brand strength, and customer profitability reports would focus on sub-brands and specific market offerings.

Some authors define SMA as a process. For example, Lord (1996) describes SMA as a six-stage process as follows: (1) collection of competitor information, (2) exploitation of cost-reduction opportunities, (3) matching of accounting emphasis with strategic position, (4) collection of competitor information, (5) exploitation of cost-reduction opportunities, (6) matching of accounting emphasis with strategic position.

However, most of these definitions remind us that the focus of SMA is on external information, generally regarding competitors. Information on competitors forms a significant part of the exclusive list of generally-accepted methods identified by Cravens and Guilding (2001). This list includes 14 SMA techniques:

- *activity based costing/management (ABC/M)* - the stčrategic focus of this technique consists in the management of the activities through which it is possible to define actions aiming at achieving a competitive advantage;
- *attribute Costing* - consider products / services as a bundle of features that differentiate the products which costs are determined, this technique can be interpreted as an externally oriented because the attributes of services are determined according to customer requirements;
- *benchmarking* - involves identifying the best practices and comparing the organization's performance to those practices with the goal of improvement; this technique underline the external strategic orientation toward competitors;
- *competitive position monitoring* - aims at gathering the information on competitors regarding sales, market share, volume and unit costs; Basing on the information provided, the company is able to assess its own position relative to main competitors and, consequently, control or formulate its strategy;
- *competitor cost assessment* - in contrast to the previous technique, competitor cost assessment concentrates uniquely on cost structures of competitors; the main criticism of this technique regards the information sources;

- *competitor performance appraisal based on public financial statements* - a relevant source of competitors‘ evaluation is constituted by public financial statements; today’s international accounting harmonization permits a simpler comparison between companies of different countries;
- *customer accounting* - this technique considers customers or group of customers as unit of accounting analysis and aims at appraising profit, sales or costs deriving from customers or customer segments;
- *integrated performance measurement* - implies a definition of an integrated performance measurement system, which contains both financial and non-financial measures (balanced scorecard);
- *life cycle costing* - aims at calculating the total cost of a product throughout its life cycle, from the design to the decline, through introduction, growth and maturity; it is a clear long term accounting perspective and market orientation;
- *quality costing* - product quality has become a precondition to its market success; this technique classifies and monitors costs as deriving from quality prevention, appraisal, internal and external failures;
- *strategic costing* - costing systems are progressively getting into the strategic management process, which means that costing systems must explicitly consider strategy and the pursuit of long - term competitive advantage;
- *strategic pricing* - focuses on the use of competitor information, like competitors‘ reactions to price changes, price elasticity, economies of scale and experience, in the pricing process;
- *target costing* – within this technique many external factors intervene;
- *value chain costing* - propose an approach to accounting that considers all the activities performed from the design to the distribution of the product; the strategic implications regard the exploiting of the economies and efficiencies deriving from the external linkages between the company and both suppliers.

At least four of them of them are directly based on external information: competitive position monitoring, competitor cost assessment, competitor performance appraisal based on public financial statements, benchmarking.

The aim of this paper is to investigate how managers consider external and internal information for decision-making and management control and who provides such information.

2. Methodology

The research is based on a literature review and the direct investigation of the present situation in the Czech Republic. A questionnaire was formulated, then sent to 100 industrial and commercial companies in the Czech Republic. Fifty-six responses are included in this research. The companies included in the research operate in various business sectors. Subsequently several senior managers (Chief Executive Officers and Chief Financial Officers) were interviewed directly.

Questions on the questionnaire referred to the following areas:

- the importance of external and internal information for formulating and developing strategy and for tactical and operational management
- who provides this information to managers.

Descriptive and statistical methods, synthesis and analysis, and generalization were also employed. They were used in the following ways:

- descriptive methods were used to define the managers' tasks for which the information is required;
- synthesis and analysis were used during questionnaire development (when considering the aims, content and structure of the questionnaire);
- generalization was used when formulating the principal project outcomes.

3. Findings

The first stage of this project investigated how external and internal financial information is useful in decision-making and management control.

External information includes information from the external business environment such as competitors, suppliers, customers, financial institutions, governments, with perhaps the most important being information on competitors:

- information about competitive position monitoring (Simmonds , 1986) such as competitors' sales, market share, volume, unit costs and sales.
- information on competitors published in financial statements (Moon and Bates, 1993)
- information on competitors' manufacturing facilities, economies of scale, governmental relationships and technology/product design (Ward, 1992) describes 'indirect sources' of competitor information such as physical observation, mutual suppliers, mutual customers, and employees (particularly competitors' ex-employees)

Internal information includes information about the interested party's own business, in terms of the topic of this paper the major focus being information on product prices, sales, costs, costs structures, margins, product profits and various activities and measures arising from this information. Internal information is covered by traditional management accounting systems.

Table 1. External and internal information for managers

Description	External information	Internal information
Strategic planning and budgeting	4.29	4.44
Tactical planning and budgeting	4.21	4.48
Operational planning and budgeting	4.04	4.44
Expectation and forecast development	4.29	4.00
Strategic pricing	4.00	4.44
Information for strategic product mix decision making	3.94	3.02
Information for operating product mix decision making	3.42	4.2
Information for motivation and remuneration of employees	3.33	3.64
Information support for acquisition of business resources and management of processes (research and development, purchasing, production, logistics, sales, etc.)	4.17	3.96
Information for development and enhancement of organizational structures including follow-up activities	2.88	3.56

Source: authors' calculations.; Notes: All items are scored on a scale whereby 1 denotes "zero use" and 7 denotes "excellent use".

The research confirmed that not only for strategic management but also for operations management, external information is highly important. External information is of very similar importance to internal information. External information is relatively more important when considering strategic tasks such as strategic planning and budgeting, strategic pricing and strategic product mix than it is for operational tasks.

The second part of the research focuses on sourcing the external information. In the questionnaire managers were asked who provided the external and internal information for decision-making and management control:

Research focuses on:

- controlling or management accounting department as a traditional provider of accounting information
- special department oriented towards strategic development or mergers and acquisitions, these departments being focused on analytical work, providing senior managers with external information including the integration of internal financial and non-financial information
- strategic management consulting firms that provide strategic & financial advisory
- managers' own resources such as personal investigation and monitoring, plus informal information from employees and external sources

- the research also considers managerial intuition as an important factor in decision-making.

Table 2. Information Providers

Description	External information	Internal information
Controlling or management accounting department	2.11	4.85
Department oriented towards strategic development or mergers and acquisitions or special analytical departments	4.21	3.02
External consulting firms	4.04	1.82
Mangers' own resources	3.42	2.15
Managers' intuition	4.2	3.8

Source: authors' calculations.; Notes: All items are scored on a scale whereby 1 denotes "not used at all" and 7 denotes "excellent use".

Controlling or management accounting departments "only" supply external consulting firms or special departments with traditional management accounting information, but they do not prepare SMA information. The reasons why management accounting departments are unable to provide this important information include, among others:

- management accounting departments have no spare capacity to cover strategic management accounting. The employees are "over-tasked" dealing with operational and tactical problems and analyses and they are not well-disposed towards the very broad themes of SMA
- traditional management accounting requires very hard, accurate work whereas SMA requires creative work and the unbundling of rigid practices: it is very difficult to manage both precision and creative work.

These conclusions are very similar to previous research. Coad (1996) argued that to undertake SMA projects, accountants needed to work smart and hard. Smart work involves choosing clever and ingenious approaches to deal with a task and then modifying the approach intelligently and resourcefully when needed. Hard work is the use of effort to complete the task. Coad (1996) argues that SMA requires a learning orientation, as this motivates both smart and hard work, whereas a performance orientation only motivates hard work which is not sufficient for good SMA. He speculated that in addition to undertaking smart work the effective strategic management accountant requires high-level communication skills and the ability to empathize with others.

However, his colleague Robin Cooper expressed doubts that this would ever occur, as accountants did not have the ability to learn "new tricks". Cooper highlighted that SMA activity was developing beyond the horizon of the accounting profession and he is quoted by Shank as saying that accountants are "intellectually and emotionally un-equipped" for the transformations (Shank, 2007). At that time, Shank still disagreed with Cooper's views.

The North American professional bodies that had been dedicated to management accounting – IMA in the USA and CIMA in Canada – faced a shrinking membership and their attempts to reposition their professional magazines as "strategic" were not successful. The topic of management accounting was dropped from the core curriculum of major US MBA schools and the large SCM-based management accounting practices of the accounting and consulting firms were dying.

4. Summary and conclusions

This paper was inspired by SMA's lack of success. Thirty years ago, SMA started with great promise and for many years there was much enthusiasm from the professional and academic accounting communities.

Now, the lack of widespread SMA adoption is evident, the main causes being the absence of a generally-accepted definition, SMA's unclear methods and techniques and the fact that, in theory, management accounting provides external information on both the competitive position and competitors yet traditional management accounting and controlling departments cannot deliver such information. Managers have to find alternative sources of this information.

On the other hand the research confirmed that not only for strategic management but also for operations management, external information is highly important. External information is of very similar importance to internal information. External information is relatively more important when considering strategic tasks such as strategic planning and budgeting, strategic pricing and strategic product mix than it is for operational tasks.

The first stage of the project has provided large experience for next stages of this project. The project continues more deeply analysis relation based also on more quantitative methods.

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ANALYSIS OF ENVIRONMENTAL REPORTING OF THE LARGEST CORPORATIONS DOMICILED IN CZECHIA

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Accountability, environment, GRI, reporting, sustainability, content analysis

Abstract

The main goal of our paper is to provide analysis of the status quo of environmental reporting in annual reports of the largest corporations domiciled in Czechia. We investigate disclosed topics as well as reporting on the adoption of internationally acclaimed standards and initiatives. Last but not least, we test the hypothesis that companies which are reporting on certification according to ISO 14001 disclose the higher quantity of environmental information than other companies and hypothesis that companies which are reporting on obtained environmental subsidies disclose the higher quantity of environmental information than other companies. We found that themes "Energy", "Biodiversity", "Emissions", "Products and services", "Other" (mentions on environmental policy, environmentally related training of employees and general proclamations) and "Effluents and waste" constitute 83.11 percent of the total environmental disclosure. The most often discussed environmentally relevant standard is ISO 14001, which is mentioned by 44.90 percent of companies in our sample. In relation to our hypotheses we can conclude that group of companies which are reporting on ISO 14001 on average disclose higher quantity of environmental information than the group not reporting on ISO 14001 and group of companies which are reporting on environmental subsidies on average disclose higher quantity of environmental information than the group not reporting on these subsidies. Nevertheless, we found statistically significant difference between groups only in case of reporting on subsidies.

1. Introduction

In our paper, we strive to provide results of an original empirical research, which was aimed at external environmental reporting practices within annual reports of the largest companies domiciled in Czechia. The main goal of the paper is threefold. First, we provide a quantitative description of the status quo of environmental reporting of the largest corporations domiciled in Czechia. Consequently, we incorporate inquiry into the question whether companies in their reports report on internationally acclaimed environmental standards and initiatives. Finally, we test two hypotheses about the relation of reporting on various factors and the quantity of disclosed environmental information. Firstly, we hypothesise that companies which report on ISO 14001 disclose the higher quantity of environmental information than companies which do not report on ISO 14001. Secondly, we hypothesise that companies which report on obtained environmental subsidies disclose the higher quantity of environmental information than companies which do not report on

environmental subsidies. These hypotheses are based on the assumption that companies which consider important to discuss ISO 14001 and companies which obtain subsidies will want to persuade stakeholders about their supreme environmental performance.

The importance of the corporate responsibility reporting (which includes environmental reporting) was increasing during last years and stabilised at a high level (KPMG, 2015, p. 30). This process is according to KPMG (2015) driven by regulation, and at present, 92 percent of world's biggest companies (G250) reports on corporate responsibility. Also among the largest national companies rate of reporting increases, nevertheless the growth is not the same across individual countries, Czechia belongs among countries with low reporting rates (KPMG, 2015, p. 30).

Although corporate responsibility reporting is still largely voluntary in Czechia, European Union exerts initiatives to regulate non-financial reporting at least at the level of large companies. Pakšiová (2016, p. 700) highlighted that EU strives to consolidate the access to the reporting of financial and non-financial information on enterprises through European Union directives, IAS/IFRS Standards and Interpretations. The research into preparedness of the largest Czech companies for this kind of reporting is therefore highly needed.

Hyršlová (2014, p. 498) noticed that corporate sustainability management is closely related to communication on corporate sustainability. While there is relatively ample conceptual research into sustainability management in Czechia, empirical research containing the detailed content analysis of environmental reporting is scarce. Academic research into environmental reporting in Czechia is represented especially by the following articles.

Kašparová and Škapa (2007) conducted a quantitative content analysis of annual reports (the year 2005) of 52 Czech and 30 Slovak companies. Measurement of quantity was realised by evaluation of disclosure on a scale from zero to two (zero meant that a given topic is not disclosed at all, one meant that a given topic is disclosed in limited amount and two meant that the topic is disclosed in detail). It is evident that on the one hand, this approach is more detailed than the simplest approach (zero for non-disclosure and 1 for disclosure in any quantity), but on the other hand, it is more subjective. The authors were searching for 15 topics from the area of corporate responsibility and included were also environmental issues (information on protection of the environment in general, strategy for protection of the environment, innovation for saving resources, ecological awards). It is possible, to sum up, that among 52 Czech companies the most disclosed topic was "information on protection of the environment in general" (disclosed by 64 percent of companies). This topic was followed by "strategy for protection of environment" (disclosed by 36 percent of companies), other topics were reported substantially less.

Hřebíček, Piliar, and Soukupová (2009) analysed voluntary reports of 39 companies from chemical industry, which were authorised to use "Responsible Care" logo and reports of another 26 organisations. The researchers evaluated the type of the report (e.g. environmental report, report on responsible care, etc.), a form of reports (standalone, part of the annual report, etc.), availability of reports, the structure of reports, comprehensibility of reports and number of disclosed indicators. From the viewpoint of our paper is relevant information that environmental indicators were disclosed more often than social and economic indicators, the average number of environmental indicators per report was 16.

Kašparová (2011) in her book focused on the analysis of 104 annual reports (the year 2006) published by companies from manufacturing and construction industries. The used method was content analysis and analysed reports were coded according to Kašparová's own coding scheme. In general, Kašparová found that companies reported on all three aspects of sustainability, i.e. economic, environmental and social, but CSR-related information are often very short. By the research of the same sample of companies Kašparová (2012) published book dedicated to the analysis of determinants of corporate responsibility reporting.

Kunz, Ferencová, Hronová, and Singer (2015) investigated reporting available through web pages of 163 selected companies. From the viewpoint of the topic of our paper, it is important that among researched topics were disclosure of EMS policy, the disclosure of certification according to ČSN EN ISO 14000, involvement in the program EKO-KOM or Green Company as well as CSR reporting. Kunz et al. (2015, p. 97) found that EMS policy was disclosed by 85 companies (i.e. 52.1 percent) and ISO 14001 certificate by 70 companies (42.9 percent). Among sustainability-related topics dominated economic ones (64.4 percent), followed by environmental ones (53.3 percent) and social ones (35 percent) (Kunz et al., 2015, p. 99).

Although there are numerous other articles on corporate responsibility reporting in Czechia, the main focus of these articles is different from the detailed content analysis of published reports. Existing articles are focused especially on forms of reporting, used media, etc. without detailed analysis of content of the report (see Dočekalová, 2012; Dvořáková, 2009; Hyršlová, 2014; Hyršlová, Tomšík, & Vnoučková, 2017; Hyršlová, Vávra, & Hájek, 2007; Jindřichovská & Purcarea, 2011; Kašparová, 2015; Krechovská & Procházková, 2014; Kunz & Hronová, 2016).

Research by non-academic entities into corporate social responsibility reporting is represented especially by KPMG. Although 100 largest companies from Czechia were systematically included into KPMG's analysis, results were usually published in aggregated form so that it is impossible to identify any specific data for Czechia as an individual country. The exception was report KPMG (2008), which provided some specific data for Czechia, but only superficial ones. More specifically, the report informed that reporting on environmental and social impacts was not requested by law in Czechia and that 67 percent of companies did not report on corporate responsibility issues at all, the majority of companies included corporate responsibility information into the annual report (KPMG, 2008, p. 73-74). Environmental reporting in Czechia was not evaluated separately from other kinds of corporate responsibility reporting by KPMG (2008) at all. Consequent reports by KPMG (2011, 2013, and 2015) did not provide specific information on reporting in Czechia at all except a total number of reporting companies, which was in Czechia 40 percent among the examined 100 largest companies in the year 2015 (KPMG, 2015, p. 33).

On the basis of this literature review, it is possible to summarise that detailed and up-to-date research on environmental reporting is missing and we believe that our paper addresses this research gap.

2. Methods of data collection and data analysis

2.1. Methodology of data collection

We used database Albertina, data for the year 2014, and applied the following procedure:

1. Select for-profit companies fulfilling the following criteria: assets > 20 million EUR and turnover > 40 million EUR and a number of employees > 250.
2. Order the selected companies according to the sales.
3. Annual reports of the 50 largest companies were analysed. In case that a company did not publish an annual report for the period ending in the calendar year 2014, we excluded the company and included another one from the ordered list.

Because one of the analysed companies was very specific from the viewpoint of environmental reporting (Lesy České republiky, s.p.), we excluded this company from our analysis for this paper. In total are in the analysis included 49 annual reports.

In accordance with the prevailing approach, we analysed only annual reports. Although analysis of all communication channels could bring more comprehensive results, the majority of researchers in the accounting field uses annual reports as the only source of data. For example, Guthrie et al. (2004) highlighted that using only annual reports is a useful proxy. Similarly, Vourvachis and Woodward (2015, p. 175) found that 76 per cent researchers used annual reports as a sampling unit.

2.2. Methodology of data analysis

As a method of data analysis, we primarily used quantitative content analysis, which can be defined as "Research technique for making replicable and valid inferences from texts (or other meaningful matter) to the context of their use." (Krippendorff, 2013, p. 24). Quantitative content analysis strives to analyse data in a reliable, objective and systematic way (Neuendorf, 2017).

In the first chapter of this paper, we described several content analyses of annual reports of Czech companies by other researchers. These analyses were characterized by measuring the quantity of disclosure using the number of disclosures without taking into account the amount of disclosure at all (i.e. binary measurement non-disclosed – disclosed) or by distinguishing only several ordinal values for measurement of the quantity of disclosed information (e.g. zero for non-disclosure, one for revealing a given topic in restricted amount and two for detailed disclosure). In our paper, we take another approach, which enables to measure the amount of disclosure more precisely. Specifically, we count the number of words related to the individual environmental topics within analysed annual reports. In the following paragraphs, our approach to coding is described in more detail.

First, we used several types of codes.

Codes, which describe the location of a given information within the annual report enabled us to determine not only the amount of information but also its location (we distinguish introduction, body, notes and non-coded parts including basic financial statements). By "introduction" we understand a text undersigned by a top manager or owner. Basic financial statements include balance sheet, profit and loss statement, cash flow statement and statement of changes in owners' equity balance. Notes to the financial statements are an obligatory part of annual reports. Not-coded parts are defined as envelope, content, report on relations between related parties, procurations, a text in the second language (in the case of bilingual reports), pages with photos without relevant content and auditor's report. The body of the annual report was defined as all content of annual report other than the introduction, basic financial statements, notes to the financial statements and non-coded parts.

Codes, which served as labels for the individual themes were furthermore divided into general disclosures and specific disclosures. It is above the scope of this paper to describe all used codes. The environmentally related codes-labels can be found in Table 2. The structure of our coding scheme was inspired by well-established reporting guidelines by Global Reporting Initiative (2013).

We also included codes for additional information (e.g. quantitative disclosure) and codes for text irrelevant from the viewpoint of corporate responsibility reporting (non-coded text).

Second, we set rules related to the coding procedure.

The primary rules were: annual report must be fully divided into parts using location codes; text of the annual report located in coded parts (i.e. introduction, body and notes) has to be coded just by one of the codes-labels or as non-coded text and may also be coded by one or more codes for additional information. The basic coding unit is one sentence, and the basic unit of measurement is one word, images are not taken into measurement at all.

The process of coding had two steps. First, the data (annual reports) were coded by two pairs of coders. Consequently, coders within each pair compared their coding, discussed differences and agreed on the final coding. In case that coders after discussion were undecided which code to use, they discussed the issue with one of the researchers. The first step included only high-level coding, i.e. division of annual report into defined parts, broad-brush coding by codes-labels (for example environmental information was coded only as "environmental" without further differentiation) and coding with additional codes. Second, one of the authors of this paper added more detailed codes for environmental disclosure and if needed corrected obvious mistakes made by coders.

We are convinced that our approach, characterised by utilisation of well established coding scheme and a relatively detailed set of rules, provided a high level of validity and reliability of coding.

3. Results

First, we computed basic characteristics of the companies in our sample, and our results can be found in Table 1.

Table 1: Statistical characteristics of corporations, 49 annual reports, year = 2014

Statistic	Assets (thousands CZK)	Employees	Turnover (thousands CZK)
Mean	43,242,539	5,828	42,432,118
Median	21,126,740	2,607	24,067,214
Std. deviation	91,918,193	7,389	51,087,551
Skewness	5.65	1.96	3.52
Kurtosis	35.58	3.34	14.39

From the Table 1, it is evident that in our sample are included very large companies, which is a consequence of our sampling decision. At the same time, there are substantial differences among the companies, which is illustrated by the high value of standard deviation.

We also analysed the structure of our sample from the viewpoint of industries (NACE, rev. 2) and we found that the majority of companies (42.87 percent) belonged to section C – manufacturing, 20.41 percent belonged to section G – wholesale and retail trade; repair of motor vehicles and motorcycles, 12.24 percent belonged to section D – electricity, gas, steam and air conditioning supply, 10.20 percent belonged to section H – transportation and storage, 6.12 percent belonged to section J – information and communication, 4.08 percent belonged to section B – mining and quarrying, 2.04 percent belonged to section F – construction, and 2.04 percent belonged to section R – arts, entertainment and recreation.

Second, we computed statistical characteristics of the quantity of environmental disclosure both for the individual topics and for the total amount of environmental disclosure. Results can be found in Table 2. We add that 48 of 49 companies disclosed at least one of the defined themes.

Table 2: Environmental disclosure, 49 annual reports, year = 2014

Theme	Number of disclosing companies	Percentage of disclosing companies	Number of disclosed words	Mean of words disclosed per report	Percentage of theme on total environmental disclosure	Skewness	Kurtosis
Materials	13	26.53	1,023	20.88	3.63	6.00	38.90
Energy	20	40.82	5,039	102.84	17.90	6.17	40.78
Water	6	12.24	557	11.37	1.98	5.89	37.11
Biodiversity	22	44.90	4,927	100.55	17.50	3.76	14.81
Emissions	16	32.65	3,893	79.45	13.83	4.50	21.25
Effluents and waste	24	48.98	3,092	63.10	10.98	5.06	28.81
Products and services	23	46.94	3,253	66.39	11.56	3.44	11.82
Compliance	20	40.82	1,331	27.16	4.73	6.06	39.50
Transport	4	8.16	300	6.12	1.07	4.99	26.03
Environmental investments	12	24.49	1,293	26.39	4.59	3.80	15.78
Suppliers	4	8.16	151	3.08	0.54	4.30	19.05
Grievance	1	2.04	99	2.02	0.35	7.00	49.00
Other	40	81.63	3,191	65.12	11.34	1.62	2.24
Total			28,149	574.47	100.00	5.48	34.07

From Table 2 it is possible to summarize that the most disclosed theme is “Energy” followed by “Biodiversity”, “Emissions”, “Products and services” (i.e. environmental impacts of company’s products), “Other” (especially mentions on environmental policy, environmentally related training of employees and general proclamations) and “Effluents and waste”. Together these themes constitute 83.11 percent of the total environmental disclosure. It is important to mention that relatively high quantity of disclosure on “Biodiversity” stems from the fact that we understood this theme very broadly and we included there for example environmentally related reserves without exact specification of their purpose.

Another important observation from Table 2 is that for all themes is the distribution of the amount of disclosure (measured in words) positively skewed, i.e. the frequent scores are clustered at the lower end, i.e. there are many companies which disclose none or only short information on a given theme.

Consequently, we were looking for disclosure of external environment-related standards and initiatives adopted by a company. Specifically, we searched for standards ISO 26000 (Corporate Social Responsibility), ISO 14001 (Environmental Management System), EMAS (Eco-

Management and Audit Scheme), ISO 50001 (Energy management), "National programme for conformity assessment of corporate responsibility management", SA 8000 (Social responsibility) and AA 1000 (Accountability).

We found that none of the companies in our sample reported on ISO 26000, SA 8000 and AA 1000. Certification according to the "National programme for conformity assessment of corporate responsibility management" was reported by one company (Vodafone Czech Republic a.s.). Numbers of companies reporting about the remaining standards are summarised in Table 3.

Table 3: Disclosed standards, 49 annual reports, year = 2014

Part of annual report	ISO 14001	%	EMAS	%	ISO 50001	%
Introduction	2	4.08	0	0.00	0	0.00
Body	20	40.82	2	4.08	3	6.12
Notes	0	0.00	0	0.00	0	0.00
Total	22	44.90	2	4.08	3	6.12

It is possible to conclude that the most often mentioned standard is ISO 14001. The other standards are mentioned within reports of few companies. Interestingly, the percentage of companies which report on ISO 14001 is nearly same as in the study Kunz, Ferencová, Hronová, and Singer (2015, p. 97), where the share of these companies was 42.9 percent.

Finally, we checked two hypotheses. First, we hypothesised that the companies which report on ISO 14001 disclose more information on the environment than companies which do not report on ISO 14001. Second, we hypothesised that the companies which report on obtained environmental subsidies disclose more information on the environment than companies which do not report on obtaining environmental subsidies. The sample was therefore for each of these independent variables split into two groups. In the case of ISO 14001 group one contained companies which report on ISO 14001 and group zero contained the rest of companies. In the case of environmental subsidies, group one contained companies which report on obtained environmental subsidies and group zero contained the rest of companies. Consequently, we compared a mean number of words of environmental disclosure (dependent variable) between groups zero and one. Because the dependent variable is not normally distributed, we performed Mann-Whitney non-parametric test to find out whether the difference between groups is statistically significant. Results are in Table 4.

Table 4: Between-group comparison, 49 annual reports, year = 2014

Independent variable	Group	Number of companies	Mean rank	Mean (words)	Sig. (Mann-Whitney)
ISO 14001	0	27	23.19	409.37	0.325
	1	22	27.23	777.09	
Subsidies	0	38	20.55	243.84	0.000
	1	11	40.36	1716.64	

From Table 4 it is evident that mean number of words of environmental disclosure by companies which report on ISO 14001 (group 1) is higher than the amount of disclosure by companies which do not report on ISO 14001 (group 0). Similarly, a mean number of words of environmental

disclosure by companies which report on obtaining environmental subsidies (group 1) is higher than the amount of disclosure by companies which do not report on obtaining environmental subsidies (group 0).

In the case of independent variable "ISO 14001", the difference of means between a group of companies which report on this standard and group, which does not mention this standard, is not statistically significant. This conclusion is in accordance with Kašparová (2012, p. 70), who summarized that her research did not prove that companies with ISO reported on environmental topics more than other companies.

In the case of independent variable "environmental subsidies", the significance equals to 0.000 (i.e. is lower than 0.05) and the difference between groups is therefore statistically significant.

4. Conclusion

In this paper are discussed results of quantitative content analysis of annual reports of 49 largest companies domiciled in Czechia. We analysed the quantity of disclosed environmental information by counting words in sentences dedicated to environmental issues. We used well-established coding scheme, which enabled us to identify not only the total amount of disclosure but also disclosed themes.

It is possible to sum up that the most disclosed theme is "Energy", followed by "Biodiversity", "Emissions", "Products and services", "Other" (mainly environmental policy, environmentally related training of employees and general proclamations) and "Effluents and waste". Together these themes constitute 83.11 percent of the total environmental disclosure. Very few companies reported on environmental responsibility of their suppliers, and we hypothesise that this may indicate unwillingness of companies to expand their environmental responsibility over and above their borders. The distribution of the amount of disclosure (measured in words) is positively skewed for all themes, which indicates that there are many companies which disclose none or only short information.

Our analysis of reporting on adopted external environment-related standards and initiatives showed that only standard ISO 14001 (Environmental Management System) is mentioned in annual reports relatively often (by 44.90 percent of companies), other environmentally relevant standards are reported by an insignificant number of companies.

Finally, we tested the hypothesis that companies which mention ISO 14001 disclose more information on the environment than companies which do not mention ISO 14001 and hypothesis that companies which mention obtained environmental subsidies disclose more information on the environment than companies which do not mention these subsidies. We found that according to Mann-Whitney test the difference between a group of companies which report on ISO 14001 and group, which does not mention this standard was not statistically significant. In the case of environmental subsidies, we found statistically significant difference between groups of companies reporting and not reporting about these subsidies. It is possible to assume that companies obtaining environmental subsidies report the higher quantity of environmental information in order to prove their environmental responsibility.

Last but not least, it is necessary to mention that our research exposes limitations in several aspects. First, analysed were reports of 49 corporations domiciled in Czechia, which is a relatively small sample. Second, analysed were reports for one year (2014), i.e. our study is a snapshot. Finally, examined were only annual reports and not other media. We propose that in the further research should be extended the sample of analysed corporations. Furthermore, longitudinal study of trends would be interesting.

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PROCESS, FUNCTION, SERVICE - WHAT IS WHAT IN IT GOVERNANCE

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Keywords

Process, function, service, information technology, IT, framework, governance

Abstract

IT management/governance seems to be an area that is getting more attractive for both enterprises and academic researchers. Several frameworks are used in IT governance, e.g. COBIT, TOGAF or ITIL. All of these frameworks use terms such as process, function or service, but their usage can be confusing in the managerial practice although the frameworks use them in the same way. These terms are not synonyms, but they are often used in the same meaning. The aim of this paper is therefore to explain how to understand these core entities of IT governance frameworks (function, process, service and other related issues) because their correct understanding is the first step towards proper implementation of IT governance frameworks.

1. Introduction

Benefits of best practice frameworks have first been verified in practice and then in theory. Nevertheless, a lot of academic papers have been published within the last ten years. IT management/governance seems to be an area that is becoming more attractive for academic researchers. We can find a lot of articles and studies which discuss implementation of information technology with respect to holistic perspective of solution (Danel and Skotnica, 2017; Powell et al., 2013; Karim, Somers and Bhattacherjee, 2007). Such a solution deals with a different areas besides IT management, e.g. process analysis, business specifics, specific features in a technology.

We discussed the approach to the integration of IT governance (ITG) frameworks based on the core entities of these frameworks in (Rozehnal and Novak, 2016). The core entities of frameworks are important for their integration. Further, an integration or at least compatibility is a way how we can achieve synergistic effects in IT management/governance.

In (Rozehnal and Novak, 2016), we also dealt with the following entities: function, process and service (see in Rozehnal and Novak, (2016) figure 2). We connected these entities without additional comments. In fact, there are many questions associated with the usage of these entities, because their understanding across organizations is often confused. In the following text, we discuss a description and purpose of several entities used in IT governance frameworks.

2. Process, function and service in IT governance/management

The main domains concerning the ITG are generated from the goals of governance and its purpose. According to Weill (2004), IT governance means: "Specifying the decision rights and accountability framework to encourage desirable behavior in the use of IT". In other words, we have to work with: (1) the value creation (respecting and perception of the stakeholders), (2) achieving strategic goals (strategic alignment), (3) risk management, (4) optimizing resources, (5) performance measurement (ITGI, 2003; ISACA, 2012). Weill (2004, p. 10) continues with IT decisions which relate to ITG:

- IT principles – the business role of IT.
- IT architecture – integration and standardization requirements.
- IT infrastructure – sharing and enabling services.
- Business application needs – what to purchase or develop.
- IT investment and prioritization – what to fund and how much.

With respect to these issues, it is possible to discuss also other IT management/governance areas. The authors considered at least two of them: Enterprise Architecture and IT Service Management. Both domains have a worldwide known frameworks (TOGAF respectively ITIL) which are the de facto global standards. Together with COBIT (ITG domain representative), we cover the main tasks mentioned above with respected frameworks used in practice. The advantages of combining ITIL and COBIT were already discussed in Mingay and Bittenger (2002) "*Enterprises that want to put their ITIL program into the context of a wider control and governance framework should use COBIT*." Since that time, both frameworks are more compatible.

It is possible to find studies focused on the theoretical foundation of frameworks by designing them as conceptual metamodels (Goeken and Alter, 2009; Neto and Neto, 2013; Pereira and Silva, 2012). TOGAF framework is described via metamodel directly in standard documentation (Open Group, 2011, Part IV). All these metamodels use entities which form the essence of the concept. The research question of the paper is: how to understand the core entities (function, process and service) and related issues.

2.1. Process

Process is defined in AXELOS (2011a) as: "*A structured set of activities designed to accomplish a specific objective. A process takes one or more defined inputs and turns them into defined outputs. It may include any of the roles, responsibilities, tools and management controls required to reliably deliver the outputs. Process may define Policies, Standards, Guidelines, Activities, and Work Instructions if they are needed.*" ISACA (2012) defines process as follows: "*Generally, a collection of practices influenced by the enterprise's policies and procedures that takes inputs from a number of sources (including other processes), manipulates the inputs and produces outputs (e.g., products, services) Scope note: Processes have clear business reasons for existing, accountable owners, clear roles and responsibilities around the execution of the process, and the means to measure performance.*" Process consists of activities and has both inputs and outputs. If we follow the standards further, process also has other typical characteristics known from Business process management (process owner, capability, policies etc.). The detail of process modeling can also differ according to the purpose of their description (depends on management/business needs). TOGAF (Open Group, 2011, Chapter 34) defines a process as follows: "*A process is a flow of interactions between functions and services and cannot be physically deployed. All processes should describe the flow of execution for a function and therefore the deployment of a process is*

through the function it supports". A process describes functionality expressed in functions or services. It is important for managing because it says "what" is realized. Processes describe in more detail their activities and they also say when, why, who etc. ISACA (2017) states "*A process by its nature is results-oriented in the way that it focuses on the final outcome while optimizing the use of resources*".

Typically, process is a sequence of activities with defined inputs and outputs. Short summary:

- "*Process cannot be physically deployed*" (Open Group, 2011) and "… *is a flow of interactions between functions and services*". A process has a nonphysical character.
- A process produces outputs. Therefore, it represents some functionality (or more).
- A process is a description of sequence, flow of activities, steps, functions, services – it optimizes the resources. And this sequence should be meaningful, logical, effective and efficient to realize a predefined objective. (Bon & Hoving, 2008).
- Processes are repeatable and amount of core (important) processes is usually small.

As we can see above, one of the most important purpose of process is to say (1) what they do, (2) typically in the form of the sequence which combines important activities (according to details level), functions or services. A process is an envelope for description of important functionality (activities and their functions can be combined according to purpose which results in the final output).

The important for understanding (using) of process model is the purpose and modeling level. According to this factor, we can describe the process in more details or with the characteristics that are important for the purpose, e.g. process analysis and process maps designing.

Moreover, we can distinguish between process type and process instance (Řepa, 2012). A process type description includes basic characteristic of process, relevant relationships and most importantly, all possible variants of activities flows. A process instance means process in a specific environment, with constrains and resources.

2.2. Function

ITIL (AXELOS, 2011b) understands the function as follows: "*A team or group of people and the tools or other resources they use to carry out one or more processes or activities*". It depends on the organization type if a function is represented by a department, team or single person. According to ITIL, the term also has following meanings: (1) the purpose of person, team, process, asset or (2) statement that something works correctly. TOGAF states in (Open Group, 2011) that "*function describes units of business capability at all levels of granularity*". COBIT framework does not define the term function directly, but it uses it in two meanings: "functioning" when something works, and the function as "an expression for the essence of purpose" in a specific area. Short summary:

- A function serves as a general bounded unit of business function (domain realized in the organization). "*Functions are units of organizations specialized to perform certain types of work and responsible for specific outcomes*". (Bon & Hoving, 2008)
- A function expresses the content when we are looking from outside without defining concrete parameters or quality. It is a label, title for a unit to express expected functionality.

The function groups internal business resources according to intended functionality. The function describes a behaviour of a part of organisation.

2.3. Service

The most general definition for the term service uses ITIL " … *means of delivering value to customers by facilitating outcomes customers want to achieve without the ownership of specific costs and risks*" (AXELOS, 2011b). TOGAF understands the service as follows "*Supports business capabilities through an explicitly defined interface" and "an element of behavior that provides specific functionality in response to requests from actors or other services*" (Open Group, 2011). Although COBIT does not define a service directly, services (primarily IT services) are natural element in the framework philosophy: (1) the services are organized by activities in processes, (2) IT services represent "*day-to-day provision to customers of IT infrastructure and applications and support for their use*." (ISACA, 2012) Short summary:

- A service should serve. A service satisfies someone's (something's) needs.
- A service has an interface that is used for communication with surrounding.
- A customer meets the service. A service is externally visible functionality (Lankhorst et al., 2009).
- A service realizes functions with specific parameters (respects resources, capability, technology etc.)

As we can see, a service serves to fulfill the specific task with defined parameters. It is a kind of agreement between the provider and client. As Řepa (2012) states "*an interface of processes is a service provided to another process*" or in another words "*A business service operates as a boundary for one or more functions*" (Open Group, 2011).

3. Definition summary and discussion

How to emphasize understanding between function, process or service? The terms are not synonyms, although they are often used in the same meanings. "*Functions are often mistaken for processes*" stated Bon and Hoving (2008) in the paper where the essence of both terms is discussed. The main reasons of confusion can be seen in (1) different managerial views on the organization, (2) purpose why the organization is analyzed and (3) the level of modeled details. In terms of possible perspectives, we can discuss two different approaches of management: functional and process one. Both approaches are valuable in practice, but they work with different entities (which create view of the organization) and tell a different story (figure 1).

The process perspective

The default entity is a process. The organization is a set of processes that are carried out. The important issue is a level of description detail. The core processes (top level) express only the main purpose of the process – they say what. If processes are modeled in more details, there are activities (or procedures, or even work instructions – again according to detail) which extend description – they say why, when, who etc. See the figure 1 in (Bon & Hoving, 2008, p. 369).

Where are functions? The relationships between process and function are an expression of purpose of activities. The process (activity) is provided for a reason, in other words, it has some functionality. The function as a noun is an expression of functionality. The process can be composed of functions, which as a specific sequence realize functionality, and also final functionality of the process – its outcome. It is possible to combine the sequence of function in each process, so the outcomes can differ (figure 2, rectangle 3). With the same logic, it is possible to use a service as a part of process.

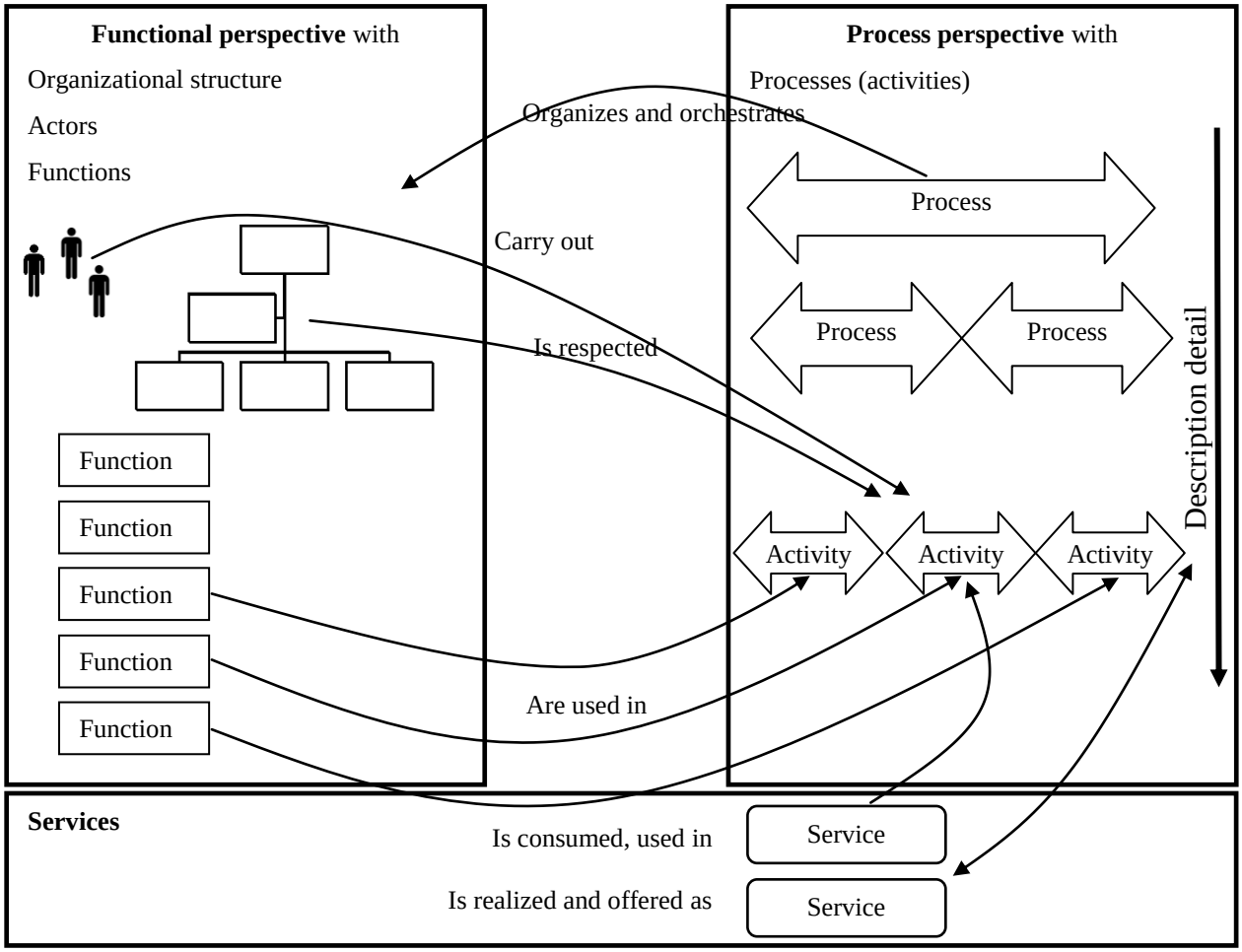

Figure 1 Managerial perspectives and entities relationships

Conversely, we can say that the function is implemented as a process. The function in more details can be also viewed as a sequence of activities – a process. Nevertheless, such approach mixes different level of detail in one model and contributes to confusion.

The functional perspective

The default entity is a function. Functions express the functionality – the ability to do something (typically in the context of organization's current situation). Functions create the structure of the organization by expressing the specialization. It is an element of uniqueness.

The specialization of resources (people, technology) in specific functionality, which they are then able to manage better than others, is a natural phenomenon in the history of mankind. It is the foundation for building an organizational structure and it relates to roles, responsibilities, resources and so on (figure 2, rectangle 4).

The relationship with processes have already been expressed. Processes coordinate the deployment of functions to ensure desired outcomes. (figure 2, rectangle 3) Functions themselves cannot ensure final goals of the organization, as they are limited and thus locked within their specialization.

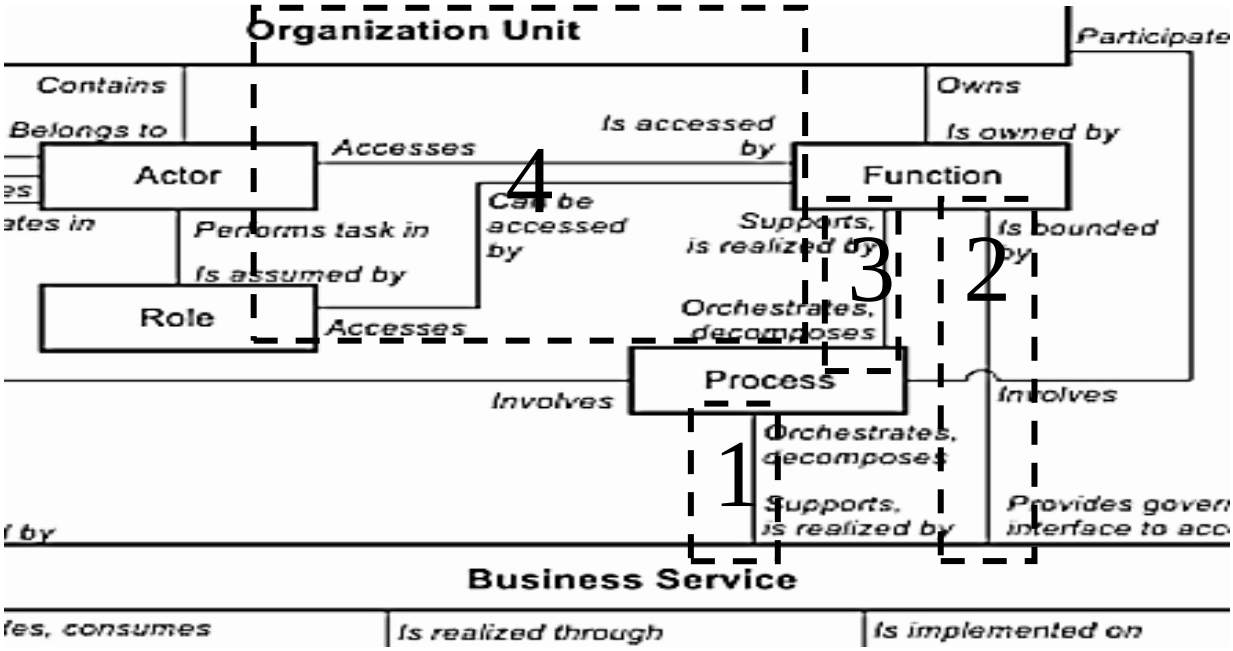

Figure 2 TOGAF metamodel (Open Group, 2011) and relationships between discussed entities (authors)

Where are services?

From the service perspective, service is an important entity. It is a way how to deliver functionality within the scope of specific parameters and defined interface (figure 2, rectangle 2). The service is a type of unit that is traded between provider and customer.

The process can be implemented by a sequence of services that follow each other and ultimately forms the outcome of the process. We can also say that the service - an inside look at service - is realized as the sequence of activities, which again represents different detail, viewpoint and purpose (figure 2, rectangle 1).

Different level of details

If a different level of detail is used, it is possible to express: (1) process as a sequence of activities, function and services, (2) function as a process - a sequence of activities, other functions and services, (3) service as a process - a sequence of activities, functions and other services. It can be a reason for different level details, but we must understand the purpose of levels (why different levels are used and what they describe) and be aware of such difference.

Process, function, service

The aim of the paper is to discuss relationships and meaning of terms such as process, function and service in terms of their compatibility in the context of efforts to integrate selected framework. Frameworks use terms in the same way. Potential problems are not within definitions in frameworks, rather in interpretation and communication between different people who are involved in their application.

TOGAF (Open Group, 2011) uses all the terms together without any problems. Why? Simply put, TOGAF strictly differentiate each term (the area of enterprise architecture must differentiate it as well). The terms are not synonyms, but they have a different meaning. If people do not differentiate it, there are confusions and misunderstandings in communication across the organization (enterprise).

Other discussed frameworks understand the terms in the same way. Although they sometimes do not work with all terms directly, (e.g. COBIT does not define service as a primary element), COBIT

as well as ITIL respect the pure meaning of the discussed terms. The difference in the use of terminology is caused by their specialization in different areas. ITIL focuses on operational level – on services. COBIT focuses on the government and works especially with processes (and service is not crucial for it).

Bon and Hoving (2008) state that it may be difficult to determine whether something is a function or a process. Frameworks (ITIL and COBIT) interpretation sometimes depends on current situation of application in a real organization. From a practical view, the process of implementation must respect a real situation. However, it does not change the fact that frameworks separate the terms. The main differences are shown briefly in table 1.

Table 1 The comparison of the main terms

	Process	Function	Service
… is the unit which describes:			
The concept	Sequence of activities	Assignment of resources	Publishing the functionality
The purpose	To know what, how we realise it	To structure organisation according to ability to perform	To know what we offer to customer
The main issues	Activities, triggers, purpose (outputs)	Skills, resources, knowledge	Service catalogue, SLA.
The approach	The process perspective, business reason	The functional perspective, operates with a specialisation	The communication with customers, publication

As Lankhorst et al. (2009) state there is many-to-many relation among processes, functions and services. There is possible to see several processes in reality that create a function, process which consists of several functions as well as a service which is realised by more processes (functions). Due to this fact it is important to distinguish among the terms. Each of them represents a different part of business.

4. Conclusion

Each of discussed terms represents a unit which describes a piece of behavior of organisation that fulfills the given purpose. The aim of this paper is 1) to show that the discussed frameworks understand all terms in the same way, 2) each term has a specific role, characteristic a unique purpose. When thinking about integration of the frameworks, the discussed terms can play two roles. First, as a core elements of the frameworks they can be common unifying elements. Second, as elements with a unique meaning they describe a behaviour in different perspective, and thus enrich the description of the whole.

Proper use of terms across frameworks is the first step in their integration in businesses, mainly in communication. It is important to ensure that frameworks are used in a compatible manner as they are compatible from their nature and all discussed frameworks understand terms in the same way. Problems may occur by combining different description detail, managerial perspective or the purpose of description. When the same approach is respected, it is possible to manage the core entities in all frameworks across the spectrum of possible perspectives – functional, process or service. Organizations need an integrated framework, but it does not exist yet (Svatá, 2016). IT managers must seek ways how to best combine existing frameworks. Such combinations suggest the involvement of professionals from different areas, but with the ability to understand the same

things in the same way. An ability to communicate and cooperate across the organization will be more and more important because it is an assumption for flexibility in adoption of technology (Pochyla, 2015) and in wider context the ability to achieve a company mission.

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SESSION I: SMART SYSTEMS EVERYWHERE – INTELLIGENCE, AUTONOMY, TECHNOLOGY AND SOCIETY

SMART SYSTEMS EVERYWHERE – HOW MUCH SMARTNESS IS TOLERABLE?

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Smart Systems, Internet of Things (IoT), Autonomous Systems, Embedded Intelligence, Cyber-physical Systems, Safety, Security, Systems-of-Systems, societal impact, liability, ethical aspects, legal aspects

Abstract

Smart Systems are today's drivers of innovation, in all industrial and social areas highly automated, intelligent systems are taking over tasks, services – and maybe one day, control of our lives. The keynote will address critical incidents in several areas – medical devices, industrial plants, autonomous vehicles, smart infrastructures, privacy, (big) data, malicious security breaches and attacks, demonstrating the limitations of too excessive use of not very trustable, uncertified systems, developed rather for functionality and neglecting too much safety, security and resilience and their interplay. The paper provides an overview on methods and standardization efforts towards achievement of trustworthy systems and systems of systems, addresses societal impacts and market disruptions respectively new market opportunities, not to forget sustainability as property. Large European projects and smaller Support Actions are introduced which proposed recommendations, roadmaps and guidance, and results, how to meet the challenges – from the technical as well the economic and societal viewpoint.

1. Introduction – Smart Systems on the Rise

Smart Anything Everywhere – that is the new hype on IoT, Internet of Things, combined with Intelligence, Autonomy and Connectivity. IoT is the infrastructure, Cyber-physical systems (CPS) are the basis of components and "Things" – may they be visible or "invisible", integrated into every day devices. The extremely high connectivity of "smart things" composed of CPS, from intelligent sensors and actuators up to more complex components and systems, leads to this world of "Internet of Things", and in the last consequence, to "Smart Anything Everywhere". Comfort, health, services of all kinds (including emergency services, rescue work and surveillance/monitoring etc.), safety, security and privacy of people depend increasingly on these. Smart Health, Smart Farming, Smart Mobility, Smart Energy, Smart Production/Manufacturing, Smart Cities/Homes/Buildings, Smart Wearables, Smart Living for Ageing Well, Smart Water Management, or Smart Critical Infrastructures in general, these are the major areas as e.g. taken up by AIOTI, the Alliance for Internet of Things Innovation. There are even developments towards unusual "smart" applications like "Smart Gastronomy", utilizing 3D printing for creating unusual forms of food, or "Smart Construction", i.e. creating buildings by smart robots and machines in very short time out of modules, which can create unusual designs not possible with standard machinery and people. The

latter was reported in a separate session and working group at the euRobotics European Robotics Forum 2017 in Edinburgh.

Highly automated or autonomous smart interacting systems are becoming the main driver for innovations and efficient services. The impact on society and economy as a whole is tremendous and will change our way of living and economy considerably - thus dependability (safety, reliability, availability, security, maintainability, but additionally resilience, robustness, sustainability, etc.) in a holistic manner becomes an important issue, despite emergent behaviors and critical interdependencies. Besides technical risks, there are considerable risks to people's privacy, independence and freedom. "Big Data" is no longer a protection making total control of a society difficult, it is now an enabler; "Big Brother" of 1984 is a weak story compared to what is or can happen today! Social media have proven, that they are not only supporting people in emergency cases, connecting people, support learning and increase knowledge, but also cause the opposite: enable new crimes, make mobbing undefeatable, distribute wide spread rumors, "fake news", undermine substantially the belief in objectivity and science, and influence even elections and referendums in a manner never foreseen before. There are studies [1], which detected, that young adults with high level of social media use feel more social isolation than those with lower social media use. The "Pisa tests" demonstrate that many abilities are lost because of the new media and new technologies, methods and tools. This has of course also happened in the past, but the influence on social behavior and the control of society was not so perfect as it will become now.

2. Internet of Things – Hype or Enabler?

Originally, communication and connectivity including always humans as one partner. With the ascent of machines talking to each other without human interaction, the age of "M2M" (Machine-to-Machine Communication) has begun, with first working groups and standards arising e.g. at ETSI, the European Telecommunications Standards Institute, one of the official ESO's (European Standardization Organisations, the others are CEN and CENELEC). With the success of the internet this led to the vision that all "Things", in all domains and applications, billions in the end, might be connected and communicating, facilitated by the extreme progress in micro- and nano-electronics and low power electronics. This vision led to the assumption that the new age of IoT (Internet bof Things) has started. Even evolving technologies and applications, which worked already quite well in a rather conventional communication environment claimed no longer to be "embedded systems" or "cyber-physical systems" but IoT (Internet of Things in general, or IIoT (Industrial Internet of things, if in the industrial domain) – this included highly automated driving, robotic applications and so forth. This is considered characteristic for a "hype" – but the development around the evolving ecosystem of IoT led the EC to support the IoT European Research Cluster IERC in the preparation of the Alliance for Internet of Things Innovation AIOTI [3]. The work started in 2014 followed by a high-level meeting on 4th February 2015 in Brussels. In the first years' it was an informal organization under the umbrella of DG Connect, which created a separate unit for IoT research, and provided a platform hosted by the EU platform Cordis (2015). In the meantime, it became an association under Belgium Law with 200+ members, among them other platforms and industrial associations, and many cooperating organizations and alliances (e.g. the ARTEMIS-IA Standardization Working Group [12], [13]) cooperates via members (Nov. 2016)). AIOTI has now 13 working groups as depicted in Figure , covering horizontal themes as well as "smart" domains. The working groups developed documents, which are available on their website [3].

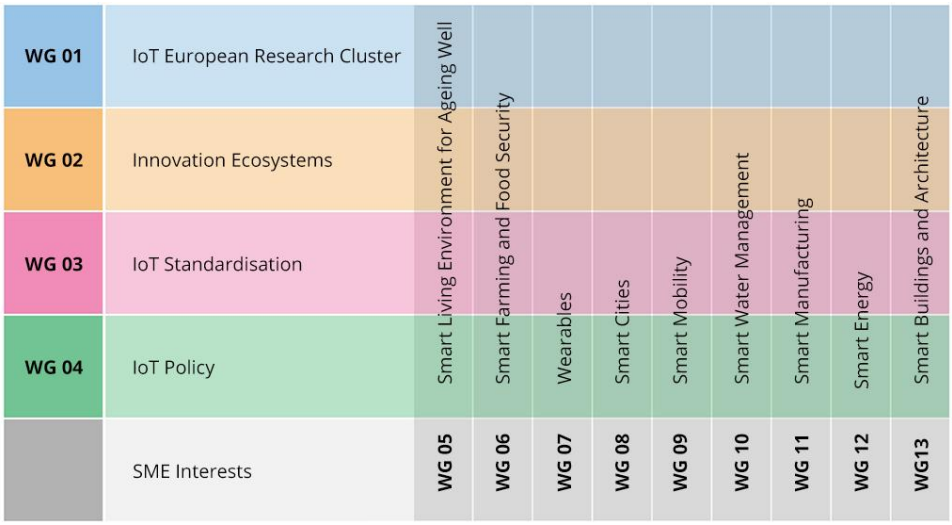

Figure 1: AIOTI – Internet of Things Alliance – Topic- and Domain Working Groups for the „Smart Universe“

This development clearly shows that it is more than a hype. AIOTI really aims at making Europe the leading region in the world to create and master sustainable innovative European IoT ecosystems in the global context to address the challenges of IoT technology and applications deployment including standardization, interoperability and policy issues, in order to accelerate sustainable economic development and growth in the new emerging European and global digital markets. The initial documents of the working groups became basis of Calls of the EC Research Programs, e.g. the so-called “Large Scale Pilots”, the first ones in the domains of “Smart Farming” and “Smart Mobility”.

One of the key findings of the recommendations was, that privacy, security and trust challenges are everywhere in the IoT – privacy and trust have to be built-in by design. There are already several known attacks on IoT-systems, e.g. a University was attacked by it’s own vending machines! They built a Botnet of 5000 machines of the Campus (IoT system, including even smart bulbs) which sent permanent request messages to seafood website which slowed down considerably all network and Internet services. The reason was a naive approach to security not separating the network parts from each other [4]. Another case was a hotel in Styria in the Alps where a Ransomware blocked access to all rooms. The owner paid 1200$ (because he could not reprogram locally in time. Fortunately, safety requirements always allow to leave a room without key as fire escape measure so fortunately people were not locked in, only locked out (the original news report that people could not leave was therefore wrong). Other ransom ware attacks were on ticketing machines in the San Francisco Public Transport area.

Another key issue is interoperability: protocols, data and semantic interoperability – therefore the AIOTI Standardization WG issued initially three reports and is very active because of the importance of standardization for huge IoT systems with many interfaces and “things”, an extremely inhomogeneous environment. These were on

- High Level Architecture (IoT Reference Architecture mapping to existing IoT Reference Architectures, e.g. RAMI4.0 for Industry 4.0, as addressed in the ECSEL projects SemI40, Productive4.0, see Acknowledgements)
- IoT Standardization Landscape (maintenance of the IoT standardization landscape, gap analysis and recommendations, cooperation with SDOs (Standardization Organizations) and Alliances, see AIOTI [3], ETSI [14], [15], CP-SETIS [13])
- Semantic Interoperability (key issue, led to many co-operations with related, but independent standardization organizations and industrial or international working groups)

Additional topics now tackled by the AIOTI Standardization Working Group, together with WG 4 (Policy Issues), are (reports available, see AIOTI [3]):

- IoT Privacy (IoT Platform, standard framework and references for "IoT Trust" and "IoT Privacy by Design")
- IoT Security (Security architecture for trusted IoT devices, baseline requirements for security and privacy, standard framework and references for "IoT Trust" based on "IoT Security by Design").

A view on the "Standardization Landscape" shows the heterogeneity of the landscape: horizontal, rather generic standards and domain specific standards, from many international and industrial standardization organizations. ETSI, AIOTI and associated groups like ARTEMIS Standardization WG, but also IEC and ISO (ISO/IEC JWG 41, Internet of Things and related standards) try to cooperate and coordinate efforts to achieve a joint view and make the "landscape" more usable (hopefully)(see Figure).

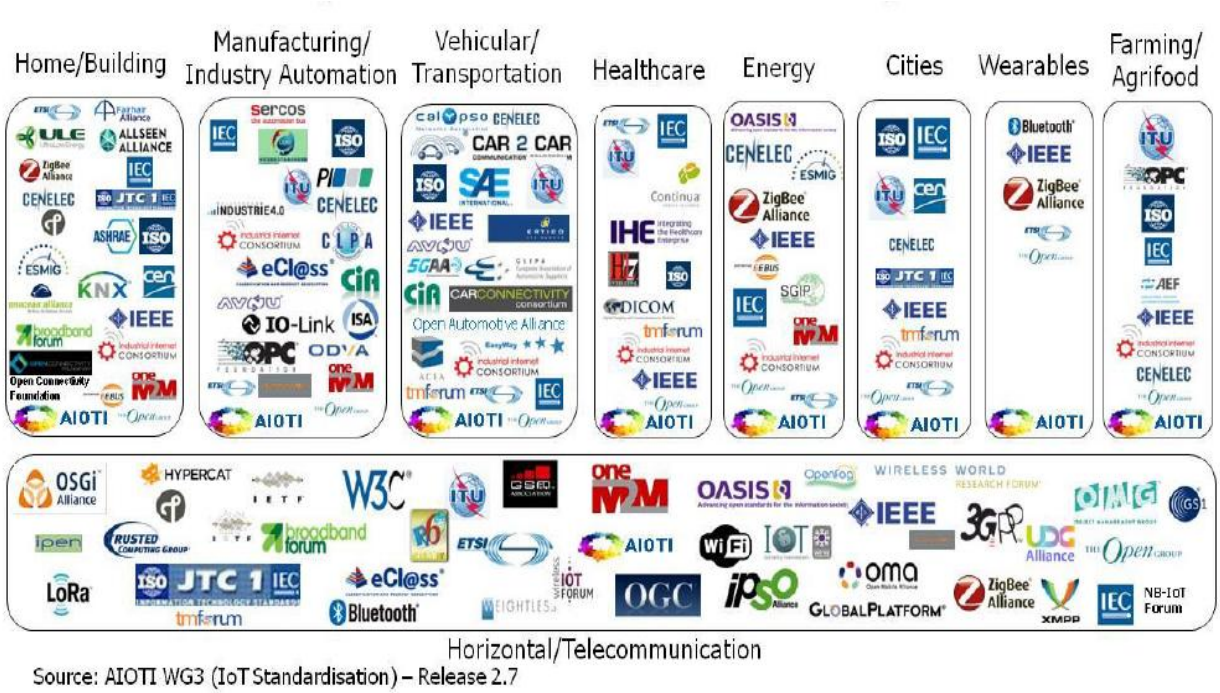

Figure 2: IoT Standardization Organizations (SDOs) and Alliances, vertical and horizontal domains (source: AIOTI)

IoT has to be seen on European level as one important component to driving the "Digital Transformation", as depicted in Figure 3. The others are "Big Data" (Analytics, Cloud, High Performance Computing) and "Intelligence and Autonomous systems" (which is somehow a revival of AI – Artificial Intelligence, with decision taking, situational awareness etc.).

"Digital Transformation" affects all industrial and smart living domains. In the ECSEL JU and formerly ARTEMIS JU, many projects focus and focused particularly on the industrial (manufacturing, production) domain, examples are ARROWHEAD (see IoT-Automation Book [2]), EMC², IoSENSE, SemI40 and Productive4.0 (see Acknowledgements), with particular tasks or work packages on safety & security and standardization, considering the IoT (IIoT) aspects of the technologies and applications. This is outlined in their Strategic Research Agendas (EPoSS [11], ARTEMIS [12]).

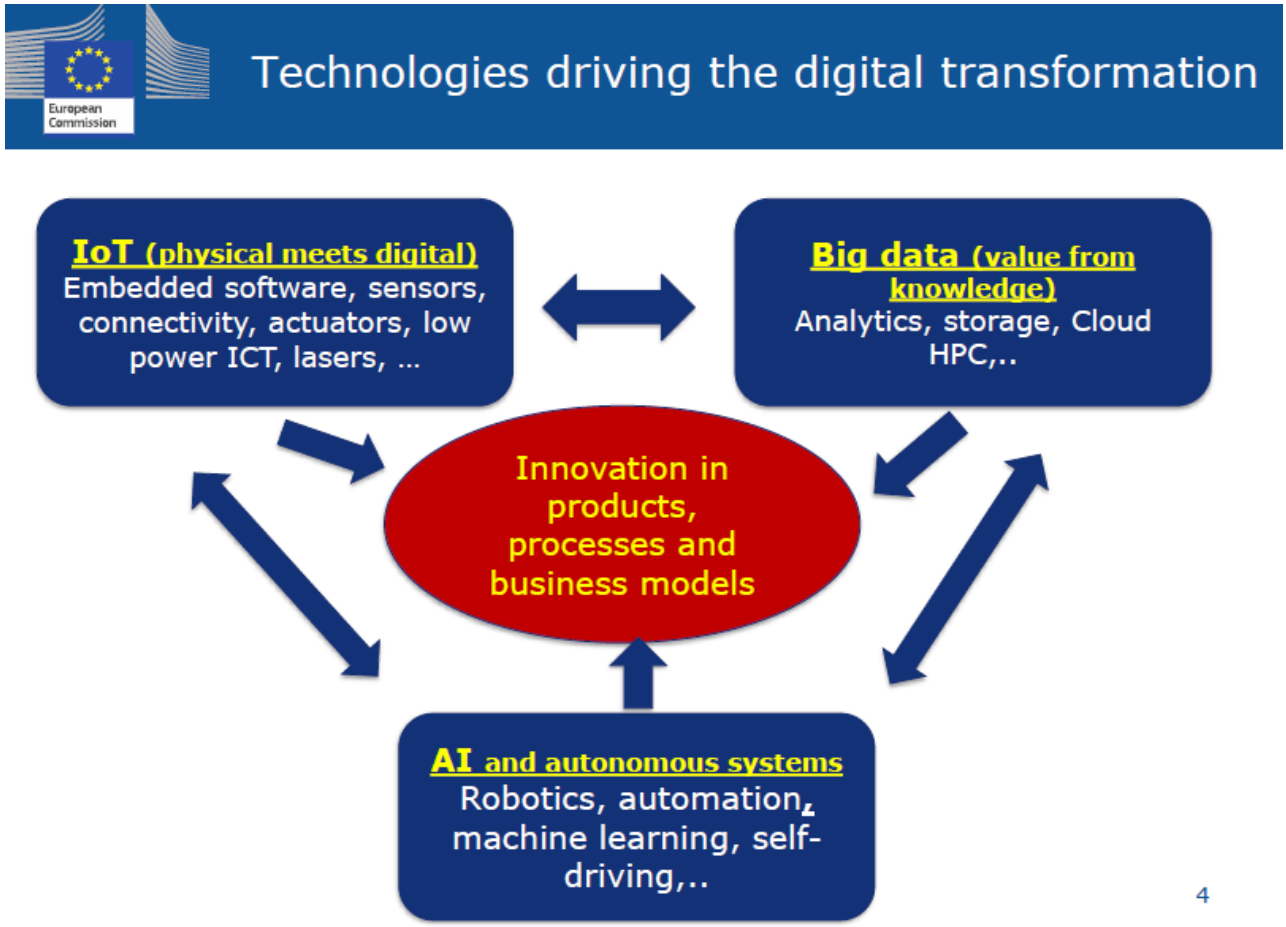

Figure 3: Technologies driving the digital transformation (source: DG CONNECT, W. Steinhögl).

3. Autonomous Systems – beyond Automated Driving!

3.1. Automotive – Automated Road Traffic

Automotive is a real mass market, and the trend towards highly automated and autonomous driving is not only because of the (funded) efforts of the EC ("Zero accident scenario") but also in the interest of the big OEMs to change the market and open up new opportunities. In any case, it will disrupt current businesses. In the announcement of the WardsAuto Outlook Conference June 6th, 2017, in Birmingham, it says:

With automakers embracing and investing in mobility services, including hailing and sharing ventures, will vehicle ownership become a thing of the past? Examples are co-operations with partners in new businesses, investments in new mobility services, particularly in urban environments. They include ride-hailing, ride-sharing (also known as carpooling), car-sharing, new businesses in fleet management and service of "car-on-demand" (driverless taxi) and, in the case of Ford, even bike-sharing endeavors:

- General Motors and Maven.
- Ford and Chariot.
- Volkswagen and Gett.

- Daimler and Car2Go.
- Toyota and Getaround.

Another example may be that for fully autonomous cars, insurance and liability will become the OEM/manufacturer's responsibility and no longer be with the driver, the driver's licence will become a vehicle licence. Challenges like these are e.g. discussed at the conference "Connected Car Insurance Europe 2017" (April 19-20, London), so it is taken for earnest by business.

Will it hurt automakers' core business of selling vehicles to those who choose to own them? Do people really want to share or hail instead of own?

That's a question of large societal impact and may change our behavior and mode of transport considerably, even the role of public transport. Particularly intermodal transport should benefit, because the choice is more open for the user of a service than for an owner of a vehicle. For example, one would no longer go from Vienna to Munich by car, but use locally autonomous cars to get to the main railway station, take for longer distances the high-speed train, and use again locally an autonomous car). In rural areas, local transport will connect to the next main line (railway, bus) easier by autonomous vehicles on demand than by regular bus services, which will very often have only a small degree of utilization. They are often not available during the weekend etc. and, in the end, abandoned in rural areas, leaving people dependent on their own vehicles or friendly neighbors! In addition, since the prevailing autonomous road vehicle mode would be short-distance, electric cars would have a much better chance, and so overall transportation would be much more efficient and environmentally sustainable!

Large European projects invest considerable efforts of the partners and EC funding in this very promising field of autonomous (highly automated) vehicles (mainly automotive, but including avionics, railways, smart (precision) farming and construction engines, robotics and semiconductors, sensors, actuators). Examples from the ECSEL JU (Electronic Components and Systems for European Leadership, Joint Undertaking, a PPP (Private Public Partnership) based funding organization and scheme within the EC Research Programme Horizon 2020) are referenced in the acknowledgements (IoSENSE, ENABLE-S3, AutoDrive). More research oriented are the projects AMASS and AQUAS, particularly with respect to architecture, Validation, Verification and Certification, and Multi-concern Assurance. The author's affiliation AIT Austrian Institute of Technology GmbH and the author himself are involved in these projects.

A European Coordination and Support Action Mobility4EU, Action Plan for the Future Mobility in Europe (2016-2018)([16]), states on major trends and emerging societal factors in this context what is expected from currently evolving technologies and R&D&I:

- Facilitating distribution of wealth and labor market development
- Enabling an inclusive society, personalization and accessability
- Safety & Security in Transport
- Environmental Protection benefits
- Digital society and IoT as benefit for sustainable growth: Availability of new products and services
- Changes in the legislative framework
- Novel business models and innovation in Transport
- Benefits for the coming increased Urbanization and Smart Cities

Even national projects are now active, not only on European level. These national efforts are not restricted to large countries like Germany and France - for example, the Austrian Federal Ministry for Transport, Innovation, and Technology (BMVIT) has launched a call to set up and run a public test region for automated vehicles, the 'Austrian Light-vehicle Proving Ground' (ALP.Lab) starting in 2017.

3.2. Autonomous Systems

But "autonomous vehicles" covers not only automotive. It covers

- Robotics (industrial, health, ageing well applications),
- Heavy machines (as demonstrated at euRobotics Conferences in civil applications like fire extinguishing, mining, snake robots),
- Cleaning services in all dimensions (large and small),
- Inspection (dangerous or difficult to access areas)
- Transport and logistics,
- Waste disposal (a smart city application!),
- Decommissioning of difficult to handle or poisonous components,
- Underwater robots off-shore in dangerous environments,
- Construction engineering (composing buildings!),
- Rescue (tunnels, mines, especially snake robots), and last but not least,
- Precision Farming.

There are many challenges to consider:

- Safety and security, privacy, dependability in general (see articles under 'Generic Challenges')
- Sensors and actuators
- Software development, life cycle issues
- System integration
- Connected vehicles, V2X connectivity
- Cooperative driving and transport systems, systems-of-systems aspects
- New mobility (multi-modality enabled by highly automated/autonomous vehicles)
- Simulation and control
- Verification and validation
- Standardisation
- Situation understanding, cognition, decision making
- Path planning, (precision) maps, localisation and navigation
- Environmental awareness, self-learning,
- Human interaction and (public) acceptance, and

- Societal, ethical and legal aspects.

Connected cooperative autonomous vehicles are adaptive systems-of-systems. In this context, we have to consider several levels of system autonomy:

- The vehicle (robot) as such (level 1, local autonomy, self-dependence),
- The fleet/swarm/ad-hoc group of connected vehicles (level 2, increased amount and chances for information and adaptation of control), and
- The regional/global level 3 (throughput, environmental friendly operation, saving of resources), which needs to be considered for traffic or logistics optimization or multi-modal transport, for instance.

There is a big difference between development and use in specialised fields of application, where trained operators and/or structured environments are involved (like construction, manufacturing, on-site operations, railways/metros, aircraft and space) and where the general public and public spaces set the requirements (road transport, smart cities/buildings/homes and care).

'Mixed traffic' of autonomous and traditional vehicles is the most demanding scenario, and in urban environments the 'vulnerable road users' (people, bicycles etc.) will still remain as partners. Therefore, the Roadmaps for automated driving foresee five levels of 'take over' from the driver, the highest one being urban traffic (see Figure). Similar levels are defined for other transport systems like railways and aircraft (see an overview in ECSEL Austria [10]).

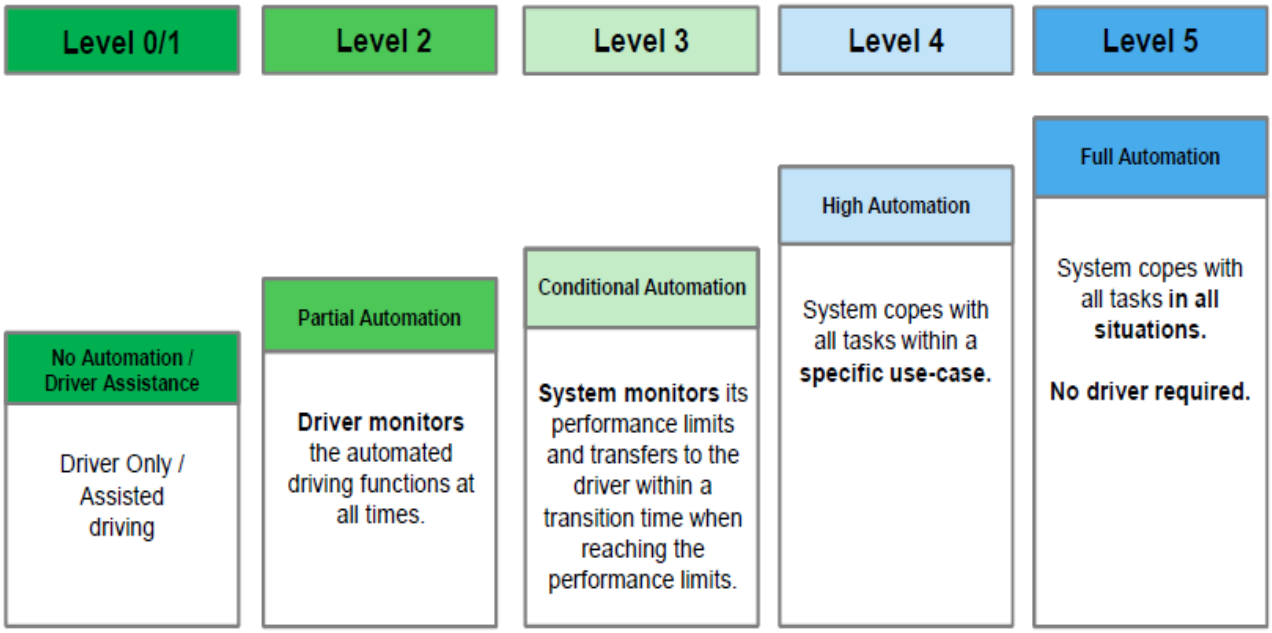

Figure 4: Source: SAE (Society of Automotive Engineers, USA) – Levels of Automation for Automated Driving

3.3. (End-) User and Public Acceptance

User and Public Acceptance are very important in case of automated driving, since for many years a mix of vehicles of different levels of automation will co-exist. This, and aspects like insurance, liability and legal framework, are particularly addressed in the ECSEL project AutoDrive (see Acknowledgements).

Major challenges in this situation are:

- Loss of control: Depending on the level of automation achieved, more or less of control is transferred to the AD (Automated Driving) system. In urban traffic, not only drivers, but also vulnerable road users (people, children, cyclists) feel uneasy because they cannot easily know what reaction to expect. There are already papers/studies around thinking how an automated vehicle should react – by warning lights, by horn, particularly, if a vehicle is almost noiseless.
- Co-existence: At the beginning, autonomous buses or vehicles will be on special tracks or streets so that encounters are not so likely as in dense urban traffic, but that would in the medium term be a barrier to wide deployment of the technology and reduce acceptance of such vehicles for individual use.
- If vehicles are not connected, so that automated data exchange is prevailing, how to address warnings, immediate manoeuvres etc. to other road users? Here again, "loss of control" is a frightening issue.
- Driver awareness: The new regulations (Amendments to the Vienna Agreement 1968 and the Global Technical Regulations for wheeled Vehicles, Geneva 1998) foresee, to facilitate the steps towards fully automated driving, that highly automated vehicles can be used, but can be "switched off or overruled" by the driver. The driver with a valid license is still mandatory and should be always aware to intervene – a requirement a human is unlikely to fulfil if in, let's say, 99% of the time, everything goes well.
- Individual acceptance may still be an issue, although recent studies show that the fascination of driving a car ism for the younger generation no longer so attractive as it was 50 years ago, and a change of behaviour towards "mobility as a service" is becoming more realistic now. Although one EC argument, that 80% of accidents are caused by humans – still may be valid "No risk – no fun"!
- For individual acceptance reasons: Should the autonomous car adapt to the individual driver's driving style? (i.e. rather smooth and slow or a little bit more aggressive, without violating the mandatory safety requirements and traffic rules?). There are already psychologically motivated stdies/papers about this issue!
- Is "machine ethics" an issue? (Decisions of autonomous systems may impact lives, and there may be undecidable situations, where in any case some person (including the driver and passengers in the car) may be hurt or killed, but who?)
- Who needs a "driver license"? The car, the OEM?
- Liability: in case the vehicle is equipped according to the new UNECE regulation [17], it has to monitor in which mode the car was operational in the moment of the accident or shortly before (still to decide by a court, maybe, what really triggered the incident!).
- Who pays for insurance? VOLVO Trucks CEO has already declared, that in case they deliver fully automated vehicles, they will take over liability.
- How to certify a fully automated vehicle to be safe and secure? Here are some proposals around, e.g. from SafeTRANS [9], which recommends to establish a public authority to collect a set of likely scenarios against which the type certification of any automated vehicle has to be validated. These scenarios have to be updated over time to "learn" from incidents in the field that are collected. There has to be a continuous supervision and learning from field observations for highly automated systems (see Figure 5). Of course, additionally there will be a set of mandatory best practices, minimum requirements on development processes, functional architecture, safe standardized degradation of systems with guaranteed minimum

residual functionality, cybersecurity and the like, international agreement on these requirements etc.

- Acceptance of Disruptive Changes in Mobility Services, Businesses, whole society? Will some professional lobby groups counteract? (e.g. taxi drivers and truck/bus drivers) (like the coachmen of horse driven carriages against the railways, or the weavers against machines (19th century)?)

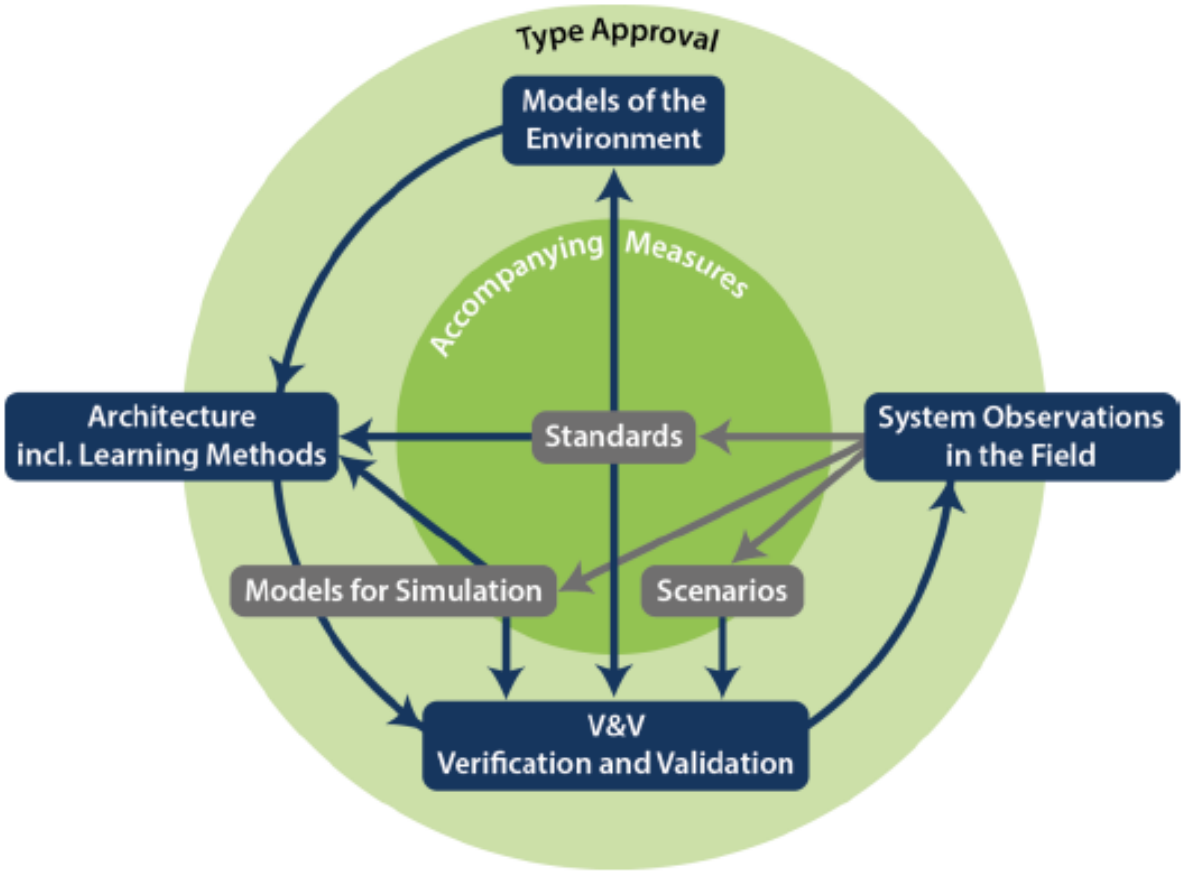

Figure 5: Key elements of a system of continuous supervision and learning from the field for highly automated systems (source: SafeTRANS WG „Highly automated Systems: Test, Safety, and Development Processes“, [9])

There are numerous risks already identified with end user behavior towards fully autonomous or highly automated systems:

- People may try to tease e.g. robots by deliberately crossing and standing their path so they have to stop or are forced to unusual paths to circumvent programmed potential critical situations
- An UK study warns that by just stepping before an autonomous car its stop is enforced automatically, and robbery/threat to life and limb easily facilitated, whereas a human driver might even overrun the dangerous persons and such avoid personal risks for himself.
- Ransomware introduced in an autonomous car during a ride or becoming active during a ride at high speed may threaten the passengers and driver to kill them, such blackmailing him to pay a considerable sum!
- Highly automated distributed energy systems (electric grids) may be attacked as part of cyberwar – examples are the Russian Cyberattacks on the Ukrainian electric power grid

(December 2016, revival just recently, see WIRED [18]). Even smart meters in Germany have no possibility for strong asymmetric encryption because of lack of resources! (Oral communication at Security Conference).

- Similar risks are evident in medical devices and hospital systems ([7])

4. Smart (Precision) Farming

Precision farming seems to be of particular interest. European regions with challenges of failing water supplies and climate change as well as environmental challenges (soil cultivation, fertilization, irrigation, plant growth and quality inspection, minimum pesticide disposal). Therefor in particular Southern Europe regions like Spain invest a lot and claim savings of water resources of up to 80% without loss in harvest!

A most impressive example (Figure 5) is from the Netherlands, where even a large number of distributed, not connected fields are optimally managed by use of many high tech means ([5]).

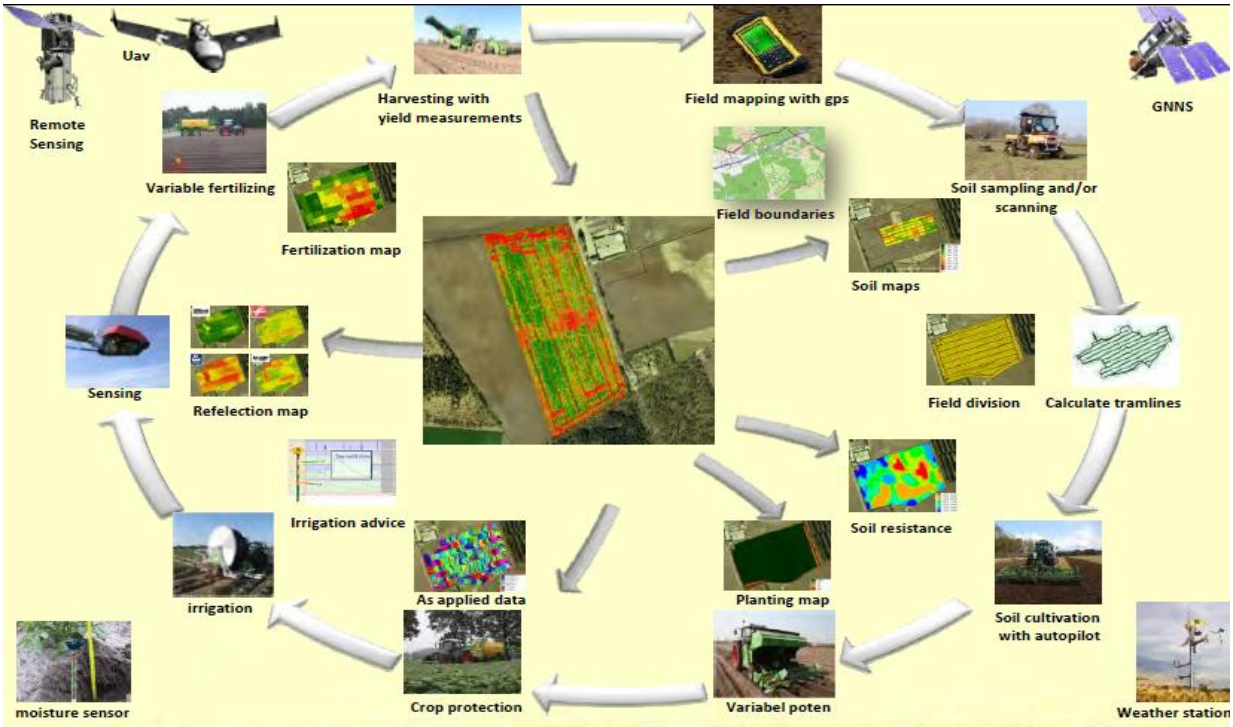

Figure 5: Smart Farming – Impressive Example from van den Borne, Ardappelen (Potatoe Farmer, The Netherlands)

Permanently monitoring soil and crop and individually doing variable fertilizing, irrigation and so on, taking into account weather data of the near future, drones, satellite data and highly automated machines for all sort of activities from soil cultivation to harvesting. Even the quality of harvested crop is registered and data sent to the customers, and everything is registered and stored that comes as information and goods from suppliers.

In an EC document are stated what the Commission expects from smart farming and precision farming technologies [6]:

- Make farming more transparent to consumers (food security and quality)
- Optimization (precise application of fertilizers, pesticides, irrigation water – positive environmental impact, reduce application of chemicals and antibioticals)

- Reduce environmental footprint (Report of the STOA – Scientific and Technological Options Assessment committee of the European Parliament) – measurable and verifiable by digitisation of agriculture.
- Optimization of the outcome: achieve “more with less”
- Making farming more sustainable
- Collaborative approaches are possible with smart farming: regional and local data required can be provided by farmers’ co-operations for all members in a region. Heavy machinery can be shared in such co-operations and supported by NGOs in third world countries – this should help to overcome sever criticism of NGOs (Greenpeace etc.) and the European Environmental Bureau that the technical skills and heavy machine overhead required are a barrier (concentrate smart farming in high-tech countries) and an environmental price tag at the same time.

5. Conclusions

Most of the ideas presented here try to highlight the fascinating opportunities for a better life for all, better and sustainable usage of resources, reduced environmental footprint and so on. Research as described here and funded by the EC and national authorities do explicitly exclude certain applications like military, espionage etc. However, we should be aware and take carefully into account that many of the achievements could be used against us as well – drones help with precision farming and building inspection and maintenance, but also as war drones. Robots can help in health (exoskeletons), ageing well etc. by keeping people longer involved and live independently, but also as in science fiction movies shown serve as a robot army. This requires careful international legislation to avoid the worst outcomes of these new technologies, and high public awareness. Politics tend to use safety and security threats as argument for more surveillance and control of people, endangering freedom and democracy.

6. Acknowledgements

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MODELLING THE SERVICE VALUE CHAIN FOR SMART CITY

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Service Modelling, Value Co-creation, Smart Service, Smart City, Service Value Chain

Abstract

With the development of Smart Cities, a large amount of service entities has been involved in the service chain. Each service entity can play different roles in different contexts, and the value co-creation between service providers and service users becomes more and more complex. In order to understand the value co-creation in Smart Cities, it is important to model the value chain of smart services. Furthermore, understanding the service value co-creation process is critical to the stakeholders in Smart City. Therefore, this paper proposes an approach to model the service value process. By applying the approach to a real-world use case of smart mobility, we can see that our model can not only provide an overall modelling view to the service value process, but can also specify the possible role changes inside the value process. The modelling results further indicate that the proposed model can be used to discover new services and value propositions in Smart City.

1. Introduction

Smart services have been considered as one of the important component of a Smart City, since the smart service is capable of connecting service providers, users, infrastructures, and communities in a common ecosystem to support the value co-creation (Saviano et al., 2016). Adapted from Vargo (2009), a Smart City can be described in terms of a complex of services exchanged by a network of actors interconnected in order to share knowledge, resources, competences, and capabilities to perform better a solution. The domain of smart services represents an emerging field to investigate and understand how networked architectures can offer a more satisfactory solution to stakeholders' needs.

In the last decade, smart services research has focused on different aspects such as human resources, relevance of the infrastructure and the ways in which processes and roles are organized. With the wide spread of Smart City applications, the challenges in smart service are imposed by the social and economic dynamics. One of the main challenges in smart service is to obtain an "active or voluntary cooperation of individuals as firms formulate and implement their strategic decisions" (Kim & Mauborgne 1998: 324). As such, modelling the service process and configuration is critical to the management in Smart Cities.

Since most previous literature has mainly focused on the conceptual definition of service, there are few contributions to build empirical pathways to investigate, verify, and in depth understand the meaning and the opportunities of value processes (Caputo et al., 2016). To bridge this gap, the paper aims to define an approach to link different perspectives of value processes for smart services. By using the proposed approach, a use case models the service value chain in Smart City. Our contributions in this paper are three-fold:

- A new approach to model value process for smart service, this approach has integrated different perspectives and views to provide a comprehensive overview of service value chain.
- A real-world use case to demonstrate how to use the proposed approach to model the services in Smart City. This provides indications for researchers and practitioners on how to conduct the model implementation.
- The proposed modelling approach for value process can be used to discover new services and specify service roles in Smart City.

The rest of paper is organized as follow: section 2 provides the background and related work of smart service and service logic. Based on the related work, section 3 has proposed an approach to model the value process, which includes a unit model and an integrated model for service value process. In section 4, we have validated and demonstrated how to use the model by a use case in smart mobility. Finally, section 5 has concluded the paper and outlined the future work.

2. Background and Related Work

Within the smart service, the service logic is acquiring an increasing relevance in supporting both decision makers and researchers in defining more effective, efficient, and sustainable managerial approaches (Barile & Polese, 2010; Badinelli et al., 2012; Lusch & Vargo, 2014). Previous contributions have focused on different aspects of service logic, for example, the implications of the service logic (Grönroos & Gummerus, 2014), instruments and approaches required to ensure its functional application (Lusch et al., 2007). However, most prior papers defined the service logic in a conceptual level and focus only on specific dimensions and actors (Basole & Rouse, 2008; Lusch et al., 2010). In order to obtain a comprehensive view of the value process for smart services, it is critical to define, model and validate the value process for smart services. As Payne and Holt (2001) stated, "customer value, shareholder value, employee value and relationship marketing are closely related and form part of a broader value process" (p. 162).

From an ICT perspective, IT technologies cannot be simply considered an instrument to support the connection among different entities but it should become a relevant pillar in analyzing, understanding, and managing all the variables that are involved in the processes to satisfy stakeholders' needs (Baliamoune, 2002; Caputo & Walletzky, 2017). Therefore, it is important to analyze the smart services using the conceptual framework for example related to the Complex Adaptive System, in which the entities in the smart services are interconnected and one entity's actions changes the context for other entities. In order to support the interpretation of smart

services, interpretative models can be used to explain social, physical, and economic phenomenon (Held, 1999; Zang et al., 2010). Since the value proposition is the central concern in smart service, it is thus valuable to investigate how to combine different perspectives, aims, and visions of entities involved in the service processes in a common conceptual model of value processes. Therefore, this paper will donate the efforts on how to model the value process for smart services.

3. Service Value Process Modelling

Based on an extensive literature review, we have identified four perspectives to model the service value process, which are the views from service provider, service user, provider-user relationship and the context. Each of the perspectives is discussed from the value perspective. According to the interconnections between the entities, we have firstly proposed a unit model for the value process. Based on the unit model, we have demonstrated how to build the value process model.

3.1. Provider's perspective

Based on the literature review from service design, the provider offers the solutions to the users' needs by combining its knowledge, resources, competences, and capabilities (Lusch et al., 2007). Therefore, the first perspective focuses on the role of service provider in defining the pre-conditions required to build a value process (Frow & Payne, 2011; Del Giudice et al., 2016). They further define the concept of 'value proposition' in terms of provider's proposals to market based on their knowledge, competences, and capabilities (Grönroos, 2008).

Kaplan & Norton (2000) stated that producers' value proposition is defined choosing among three possible strategies (1) operational excellence, in which the focus is on the delivery process (2) customer intimacy, based on the relationship with customer and (3) product/service leadership, in which the focus is on the features of proposed product/service. Maglio & Spohrer (2008) further stated that the value proposition should be central element in the providers' strategies and behaviours and it is the result of providers' capability to understand users' need and to offer a possible solution to them.

3.2. User's perspective

From user's perspective, users evaluate the solutions to their requirements based on their perceived utility, emotional state, past experience, and memories (Chapman, 2015). This perspective analyses the ways in which users define their needs (Vargo & Lusch, 2011). Thus, a number of researchers have proposed the concept of 'value in use' (Chandler & Vargo, 2011). More specifically, Vargo & Lusch (2004) states that the perception and evaluation of value is linked to the time of consumption. In the same way, Ballantyne & Varey (2006) underline that the core contribution of 'value in use' is related to the observation "that goods become valuable to customers as service appliances, as distribution mechanisms for service, so that the service value is determined at the time of its use" (p. 336) and Sandström et al. (2008) outline that the service providers cannot predefine the value because it depends by the user and consumption process.

3.3. Provider-user relational perspective

The third perspective focuses on the relationship between service providers and users (Oliva & Kallenberg, 2003). It pays the attention on the concept of 'value co-creation' underling that "value is ultimately derived with the participation of, and determined by, the beneficiary (often, the customer) through use (often called 'consumption') in the process of acquisition, usage, and disposal" (Vargo et al., 2008: 148). Furthermore, Payne et al. (2008) stated that the value co-

creation is a desirable goal because it supports providers in defining users' need and in satisfying them. The value co-creation has a relevant role in the relationship between providers and users because, as underlined by Prahalad & Ramaswamy (2000), it transforms users from "passive audiences" to "active players" opening to relevant challenges and opportunities for providers in terms of understanding market dynamics.

3.4. Contextual perspective

The fourth perspective considers that value is influenced by contextual and social dynamics. It points on the concept of 'value in context' (Vargo, & Akaka, 2009). Vargo (2008) stated that the "value creation being understood in the context of a larger value-configuration space" (p. 213). Likewise, Edvardsson et al. (2011) highlight that the value process is defined by the social interactions and the social structures in which actors are actively involved and Chandler and Vargo (2011) underline that the value processes constantly evolve as consequence of context dynamics and influences.

3.5. Unit Model in Value Process

Recognizing the four perspectives in the service studies for value process, it can be seen that it is important to build a model that can connect the different service entities. In order to propose this model, it is critical to firstly identify the entities involved in the value process (Stanicek and Winkler 2010). From the discussions and literature above, we have identified three main entities (1) The provider, in terms of an entity to propose product and service to satisfy users' need. Its proposition of value is influenced by its resources, knowledge, competences and capabilities. (2) The user, in terms of an entity with specific needs that require solution to satisfy them. Its perceptions of needs and its knowledge about the existing ways to solve its problems depends by its perceived utility, emotional state, past experience, and memories. (3) The target can be defined as a component of reality to be transformed or changed for the sake of client, which can be represented as a common goal that service provider and user both try to achieve. It represents the ways in which user and provider identify an alignment between their individual pathways in order to achieve personal aim through a shared pathway. When view the three entities from value perspective, we have found the following four value views:

- The value proposition can be explained as the ways in which a provider interprets a specific target and try to offer a solution aligned with its knowledge, competence, and capabilities.
- The value co-creation can be analyzed in terms of interactions among user and provider to share knowledge and resources and to align their orientations and information.
- The value in use, can be interpreted as the ways in which users formalize their need in specific request to providers.
- Value in context, is the results on the integration among provider, user, and target and of the interaction among their perspectives and aims in a specific target.

Based on the different value views above, we have proposed the following unit model to explain the interactions and roles of different entities in the service value process. This unit is more adapted from Stanicek & Winkler (2010) and offers the opportunities to include specific aims, roles, and behaviors.

The identification of the roles and positions of entities involved in the values processes is not absolute but it depends by the context in which they are in the specific time of observation. Over time they can change as consequences of the changes of the context. This unit model defines the

roles and positions of actors involved in the value processes only if applied with reference to a specific time and context.

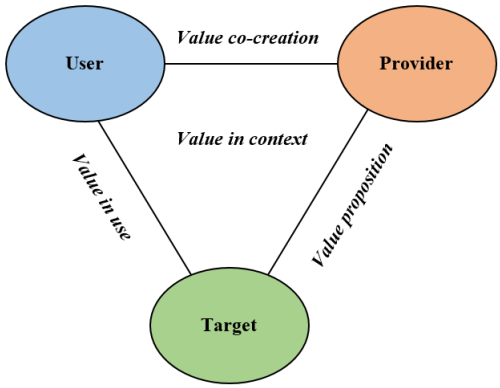

Figure 1: Unit model in value chain for modelling smart services

3.6. Value Process Model

In one service process, the role of an entity can be changed based on the context. For example, considering selling/buying of food in a store to organize a dinner with friend, observing the specific context (selling/buying of food) we could find that the entity 1 (client) is a user, the entity 2 (seller) is a provider, and the entity 3 (to organize a dinner with friend) is a target. Their roles can be changed when the context is changing. For example, entity 1 could be an employee in a company that rent cars. then when it becomes the 'work context' as a provider, entity 2 could have the hobby of football matches, then when it is in the 'pleasure context' as a user, and entity 3 could be approached by others entities in a different way for example going to a restaurant.

The roles and positions of entities involved in value processes change along the context represents a relevant problem in the studies of service design (Tsai & Ghoshal, 1998) and market dynamics (Vargo & Lusch, 2011). It requires to build a wider perspective to combine different possible evolutionary pathways in a common service ecosystem representation. We have proposed a service process model in Figure 2.

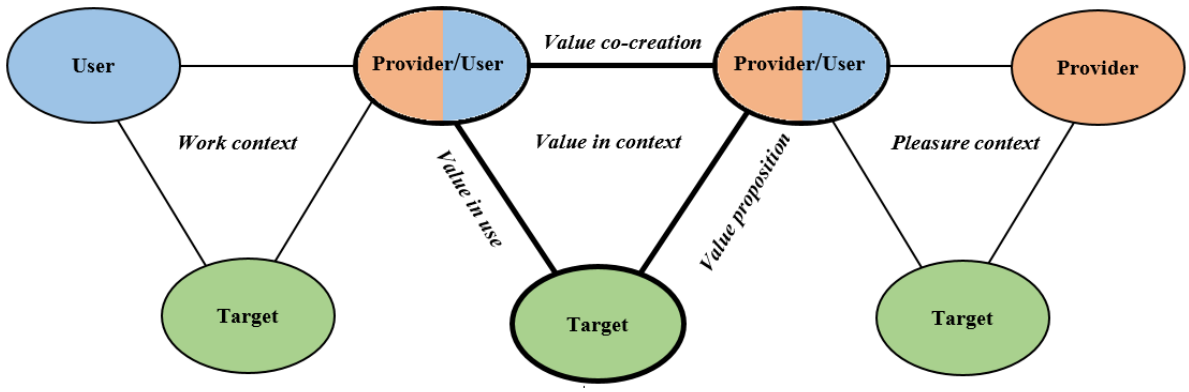

Figure 2: Our proposed value chain model

4. Use Case for the Service Value Process Model

In the Smart City, smart mobility is one of the most important areas. In order to improve the traffic situation and reduce the car emission in the city, car-sharing has been advocated in many smart cities. Considering that Amsterdam municipality plan to improve the smart mobility service by car-

sharing. One of the car sharing platforms is the WEGO platform[8] in Amsterdam that enables owners and drivers to manage the car renting. This platform also launched an app for companies to save cost and invest in sustainable mobility. People or companies can benefit from smart mobility by lowering the cost of vehicle ownership and obtain extra income.

In this scenario, we could identify a central unit model that municipality would advocate the smart mobility in the city, and require a mobile app to support the car sharing activities. As a service provider, one IT company will provide app development service to the municipality. The common target between municipality and IT company is to realize the car sharing for smart mobility in the city. To the IT company, municipality is a service user, however, when municipality provides the smart mobility services to citizens and tourists, municipality becomes a service provider. Likewise, to municipality, IT company is a service provider, when IT company would like to deploy their app into the cloud, IT company becomes a user of the cloud services from the cloud service provider. Thus, the chain of the services can be modelled in Figure 3.

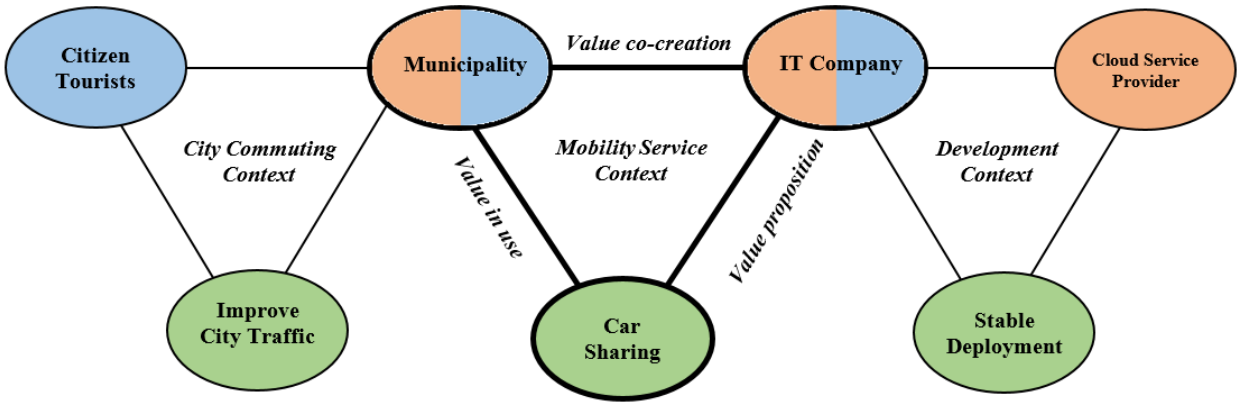

Figure 3: Model the value chain process for smart mobility services

In this service process model, we can further identify the values along the service chain. For example, the municipality and the IT company can co-create value in the smart mobility context. The municipality can generate value in use by applying the car sharing app in the Smart City. The IT company can have value proposition in terms of revenues. The different value views can be further identified in this chain process.

One interesting entity in the value process model is the one who has both provider and user roles. That means, this entity provides services to other entities and at the same time uses other services. This depends on the context. Value propositions will be different in different contexts. Inside the value process model, there can be certain entity is missing. If the service provider is missing, we can use the model to discover new business opportunities, if the user is missing, we can identify marketing problems of the service. If a common target is missing, we can find that for example the project goal is not clear or there is a lack of bilateral agreement.

Compared to other process models, this value chain model is more focused on the key actors and their value relations among the smart services. In this model the connections between the entities are value-oriented, while other process models are mostly activity-oriented. From our model, we can easily identify which actor creates value in which context. It intends to offer a value overview for the smart service chain. However, reasoning the value relations (e.g. low value in use between some entities) is out of the scope of this paper.

[8] http://oud.amsterdamsmartcity.com/projects/detail/id/2/slug/wego-car-sharing

5. Conclusion

In this paper, we have proposed a new approach to model the value co-creation chain for smart service. This approach includes a unit model and a value process model. We have considered four different perspectives for proposing the approach such as service provider, user, provider-user relationship and context. Accordingly, we identified four value views, which are value in use, value proposition, value co-creation and value in context. This model can provide a comprehensive overview of the value chain in a Smart City.

Based on the proposed value process model, we have modeled the value process in a real-world smart mobility service – car sharing. It has demonstrated how to implement the approach to model the smart service in a real Smart City. We have also discussed the advantages of using the model, for example, to identify the double roles of a certain entity, to find out the possible explanations when some entity of the model is missing. Particularly, the value process model can be used to discover new services in a Smart City. As future work, we plan to study the double-role entities in a Smart City. This can provide a detailed view for the management of the Smart City.

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DEVELOPING AN ENTERPRISE ARCHITECTURE FRAMEWORK AND SERVICES FOR SMART CITIES

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Keywords

Smart City, Enterprise Architecture, Metropolitan Area, TOGAF

Abstract

Rapidly increasing capabilities of digital technologies and decreasing deployment costs of digital systems have enabled pervasive computing technologies in Smart Cities. However, designing an integrated Enterprise Architecture across public services in the metropolitan area for a Smart City still remains challenging. Since there are various views and strategic aspects from different Stakeholders in a Smart City, how to apply the design processes from Enterprise Architecture like TOGAF ADM to Smart Cities is still unknown. In this paper, we thus propose a framework for Metropolitan Area Enterprise Architecture, which can not only coordinate different interests and objectives from the stakeholders by layered architectural design, but also provide an integrated guideline for future ICT development for Smart Cities.

1. Introduction

Nowadays, the global population became more urban than rural, for example, current forecasts indicate that global metropolitan area populations will increase by 84% to 6.3 billion by 2050, continuing the trend of urbanisation (Urban and Rural Areas 2009). This results in the challenges of broadly meeting the demand of modern societies to ensure the quality of life, sustainability, and economic growth. Proposals to address these challenges with technology are usually associated with the term 'Smart City'. In addition to technological advances, many emerging service industries create greater competitive advantages to be cost-effective and innovative (Anttiroiko et al. 2014). Among others, transportation, and environment, major bases of urban planning include the implementation of information systems, and providing a smart ICT environment.

The importance of ICT has demonstrated that the capacity of Smart Cities programs to create value for stakeholders is directly related to the information technology, processes and services and the associated business and information architectures (Borek et al. 2011). To organize these components, the Enterprise Architecture (EA) defines the structure of an enterprise (Giachetti 2010); thus, EA is an important consideration for Smart Cities. The architecture influences to a

large extent the capabilities of a City and its behavior, thus impact the quality of life, economic growth, and sustainability.

Many researchers and practitioners have described Enterprise Architecture concepts and frameworks, focusing on increasing IT efficiency while continuing business innovation. Organizations can use enterprise architecture frameworks to manage system complexity and align business and IT resources. Employed within a traditional enterprise context, EA assists in providing an integrated environment supporting the alignment of business and IT (Sasa and Krisper 2011, Clark et al. 2012). However, applications of EA concepts to government and the public sectors are relatively rare, especially when we consider and assimilate diverse interests and objectives from different stakeholders, typical design processes like the TOGAF (The Open Group Architecture Framework) Architecture Development Method may require adaptations.

There are different organizations in Europe working towards the standardization, for example, the European Committee for Standardization (CEN), the European Committee for Electrotechnical Standardization (CENELEC) and the European Telecommunications Standards Institute (ETSI) has created the European standardization to agree on common specifications and procedures that can meet the needs of business and consumer expectations. Likewise, TOGAF is a proven enterprise architecture and is a de facto global EA standard.

In this paper, we investigate the challenges in Smart Cities from an EA point of view and propose an architectural framework for modeling services and information flows in Smart Cities. more specifically, this paper develops the concept of Metropolitan Area Enterprise Architecture with layered design, which can be used to integrate different views and strategic aspects in Smart Cities. In this paper, Metropolitan Area is used as an extended concept to a Smart City, which the surrounding belt of Smart Cities.

The remainder of the paper is organised as follows, Section 2 reviews the literature Enterprise Architecture for Smart Cities. Following the principles of reviewed EA, Section 3 proposes the Enterprise Architecture Framework within the metropolitan Area in a Smart City. Finally, Section 4 concludes the paper and outlines the future works for this paper.

2. Enterprise Architecture in the Smart City

There are many definitions and constructs associated with Smart Cities. Due to the emphasis on Information and Communication Technologies (ICT) in our work, we have adopted the definition of a Smart City from International Telecommunications Union as:

"An innovative city that uses ICTs and other means to improve quality of life, efficiency of urban operations and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental as well as cultural aspects" (ITU 2014).

Accordingly, Smart Cities are innovative cities that use ICT to achieve certain objectives, such as increased efficiencies in urban operations and services as well as to thereby improve the quality of life of their citizens. Smart Cities can also be seen as entities, with organizational aspects, governance and innovation capabilities. Smart governance requires metropolitan governments to adopt a set of guiding principles to shape city growth and provide patterns for internal and external stakeholder relations. Therefore, Smart Cities can be seen as a multi-layered and multidimensional issue (Anttiroiko et al. 2014).

2.1. Design and Model the Enterprise for Smart Cities

Various information systems and services place more emphasis on governance and regulations within the public sector. Anttiroiko et al. (2014) point out that a Smart City is a city with smooth information processes, facilitation of creativity and innovativeness, and smart and sustainable solutions promoted through service platforms. The fundamental idea behind this scheme is that smart information and communication systems are needed to build smart social and public systems, which help to achieve the goals within cities and help to improve urban life. However, many case studies show that Smart Cities are difficult to realize. Cities are complex using many individual systems, involving many stakeholders and aiming to fulfill multiple aims and goals. How to integrate, plan and maintain these various systems is yet an open challenge. At the same time, cities are slowly moving to the adoption of smarter technologies and thus transformational, and planning aspects are important.

Designing an enterprise is a system engineering approach of determining the required enterprise capabilities and subsequently designing the organization, processes, services, information, and technologies to provide those capabilities (Giachetti 2010). To manage and organise the complexity, we are utilizing models as logical artifacts and representations, usually described as architectures. Therefore, architectures are used to construct blueprints of an enterprise for organising system components, interfaces, processes, services and business capabilities and much more. Architectures in the wider context of information systems are often used to model aspects of a system, especially a computer, network, software, application, services, business, and project-development architectures, among others. Architectures may be defined as "the fundamental organization of a system embodied in its components, their relationships to each other, and to the environment, and the principles guiding its design and evolution" (IEEE Standard 2007).

To describe and model aspects of Enterprises, researchers have proposed different approaches (Meyer and Helfert 2014). Early work on architectures modeled aspects of systems, often referred to as IT or system architectures. Over the years, many EA frameworks expanded their scope to include strategic and governance aspects. In addition, the focusing shifted from solely modeling and describing architectures to architecture migration, transformation, and implementation methodologies. Most frameworks follow a process and integration aim (Ross et al. 2004). Therefore, nowadays EA consists usually of two main approaches, an Enterprise Architecture Framework together with an Implementation Methodology (Rouhani et al. 2015). A common approach among prominent frameworks is the transition and implementation from strategic business objectives into infrastructure and systems design. EA aims to support and enable this transition by providing ways to design concepts of an enterprise. The terms Enterprise Architecture and Enterprise Architecture Management (EAM) are often used interchangeably (Ahlemann 2012). EA produces artifacts (Winter and Fischer 2006) and principles (Greefhorst and Proper 2011), whereas, on the other hand, EAM is concerned with the management and implementation of these artifacts, typically within a lifecycle approach. EAM is a process to plan, control, govern, and evolve an enterprise's organizational structure, business processes and services, and technical infrastructure and align architectures with vision and strategy (Meyer and Helfert 2014).

2.2. Layers and Views for Enterprise Architecture

In order to manage complexity, many frameworks use views and layers to describe elements of architectural content (e.g., strategy, information, process, service, and technology). Each view illustrates a distinct perspective meaningful to specific stakeholder groups. Layering decomposes a system into strata of allied components whose processes provide services to subsequent layers. For example, a technology layer supports an application layer which in turn provides application

services to the business layer. This structure helps to understand the scope and function of EA as they relate to boundary points from business strategy to technical infrastructure.

Core layers of EA models represent business architectures, application and information architectures, and technology architecture. General examples in the literature present simple, three-layered frameworks (The Open Group 2011) to multi-layered EA frameworks (Winter and Fischer 2006). Approaches that include enterprise strategy as a separate layer are also documented as well as the application of EA to a Smart City Context (Godinez et al. 2010). Due to the strategic importance of business IT alignment, we view EA as a hybrid enterprise function (Ahlemann 2012).

The application of the service concept to Smart Cities has been widely discussed (Anttiroiko et al. 2014). Applied to the concept of EA, services provide benefits to stakeholders within an organization and may consist of several EA processes. An EA service model (Robertson 2008) can be introduced to document the service delivery of EA; each layer offers services, and the service-oriented paradigm occurs in each architectural layer. For example, the technology architecture offers infrastructure services in the form of hardware and networks. The application architecture provides services centered on software applications and information. The business architecture is concerned with business processes and services. The business architecture, through business processes, emphasizes the dynamic aspects of workflows and activities supported by application components and infrastructures. Table 1 illustrates the EA service concept across four typical lifecycles.

Table 1: EA Services and Lifecycles

	Service Design and Vision	**Delivery Standards and Principles**	**System Description: Models and Architecture**	**Transition and Operation**
Aim	Standards Principles	Governance Planning Policies	Model Describe	Deliver Maintain Optimize
Role / Area	Strategy	Governance	Architect	Operation
Outcomes	Service Portfolio Value Principles	Service Agreements Governance Standards	Architecture Information Artifacts	Procedures Operation
Benefits	Standardisation Direction Value	Decision Guidelines Risk Reduction	Improved integration and Co-ordination	Reduced costs Resources

2.2.1. Service Design and Vision

One of the most important layers is the Service Design and Architectural vision, in which several stakeholder views are across different domains. This is analogous to a political layer, wherein

various interests and constraints are balanced to define a suitable value proposition for the enterprise. The top layer of EA typically contains business processes and services, organizational structures (including roles and responsibilities), and value drivers, which are aligned to a strategy divided into goals and objectives (Versteeg and Bouwman 2006). Following the classification presented in (Anttiroiko et al. 2014), we outline some examples for the domains transport and health in Table 2.

Table 2: Examples in Traffic and Health

	Domain Traffic	**Domain Health**
Information services	Traffic flow; Environment Information	Hospital Indicators
Interactive and Planning services	Pedestrian Flow for Infrastructure Planning	Capacity Planning for Emergency Services
Transaction services	Motor Tax and road charges	Prescription and Referrals

2.2.2. Delivery Standards and Principles

The layer of standards and principles describes common aspects and expectations to be considered when designing and operating architecture. Service level agreements capture the main expectation, where architectural vision and principles are providing the core guiding aspects.

2.2.3. System Description, Models and Architectures

This layer describes architectures with models, applications, and processes as well as information and technology architectures. Application architectures concern the combined logical capabilities, integration, and the development of specifications for individual applications, including interactions and relationships to business processes. It comprises the logical, physical, and management views that provide necessary information to establish a basis for communication, analysis, and decision-making (Allen and Boynton 1991, Xie and Helfert 2011). EA is concerned with data models, logical and physical models, data flows and transformations, metadata and standards for information storage and exchange. The technical layer of EA is concerned with an underlying infrastructure (i.e., hardware and system-level software) and technical interfaces.

2.2.4. Transition and Operations

The transition and operation layer addresses the implementation and realization of the architecture and the operational management of systems. Here Policies, Standards, and Processes are executed, and performance data is generated to inform process improvements (Helfert and Ge 2016).

3. Metropolitan Area Enterprise Architecture

With the rapid development of urban areas, we propose the Metropolitan Area Enterprise Architecture (MAEA), which is developed to provide an integrated paradigm for considering the complex systems that deliver digital services to a geographic region and its constituent political

entities. The MAEA illustrates layers of components within domains that are combined to provide services for the enterprise; those services will be then consume, governed and supported by the stakeholders, and information flows which traverse the metropolitan enterprises and facilitate interaction with the environment.

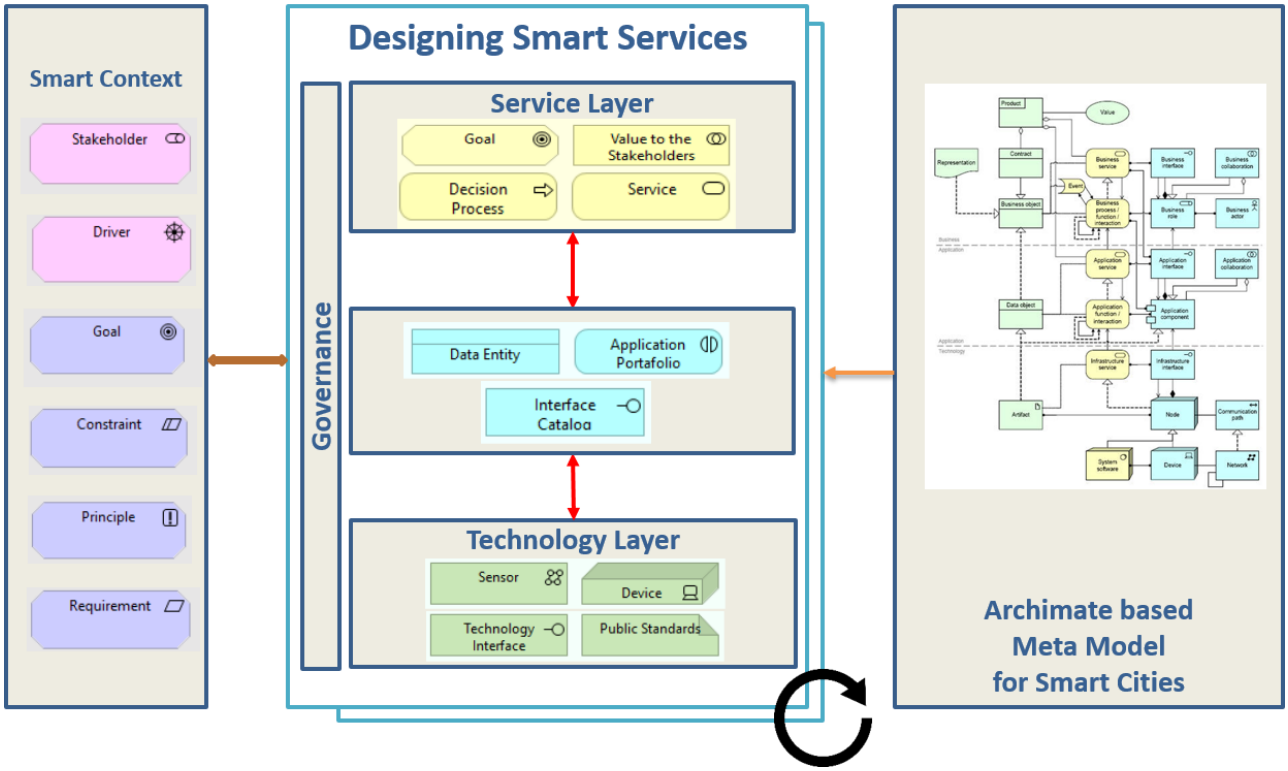

Figure 1 Metropolitan Area Enterprise Architecture Framework

Figure 1 presents a high-level, conceptual view of the MAEA. At the base, individual service architectures comprise the technology layer. Operations architectures describe the administrative and infrastructural service components. Strategic architectures shape the translation of mission, goals and policy objectives into long-term operational plans. Governance architectures set out practices for mission and policy formulation and the establishment of standards as a basis for deploying services. Stakeholder Architectures map the interested and influential cohorts of the MAEA and provide a foundation for communications planning and the design of feedback channels for service improvement and balance.

Information flow across different domains is particularly important to MAEA. Understanding the movement of information is fundamental to understanding and describing operational relationships within the MAEA and between the urban enterprise and its environment. Further, understanding and managing information flows are essential to the evolution of digital services in the urban enterprise to efficiently shape and rebalance the service portfolio with changing stakeholder and environmental requirements. An example of capturing relevant social media content as well as direct feedback from service performance can provide useful metrics for service and process improvement programs, and to inform service portfolio balancing programs.

4. Conclusion

In this paper, we have reviewed research challenges in Smart Cities and proposed applying Enterprise Architecture to metropolitan areas. Following a service perspective, we have described the layers and views in the proposed Metropolitan Area Enterprise Architecture Framework. This

framework contains different layers such as stakeholders, governance architecture, strategic architecture, operational architecture and information flows oriented by service architecture. The modeling concepts of EA can be accordingly applied over various layers. Since Smart Cities include a variety of domains and require the balancing of diverse stakeholder views and interests, this framework can be used to coordinate different interests and objectives from the stakeholders by layered architectural design. As future works we plan to evaluate the application of TOGAF and its Architecture Development Method within various Smart City use case paradigms. This planned work is to develop an approach and guidelines for applying the TOGAF methodology as a comprehensive strategic planning tool for Smart Cities.

5. Acknowledgements

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USING DATA MINING TOOLS FOR RETRIEVING INFORMATION FROM DATABASES OF TRAFFIC ACCIDENTS

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Keywords

Data mining, traffic accidents, cluster analysis, association rules

Abstract

The article describes the capabilities of selected applications, which facilitate the creation of data mining projects. The tools are compared according to several criteria, such as how user friendly they are, their ability to realize the individual phases of unified data mining methodology, the availability of modelling algorithms, and the visualization of results in the graphical maps. Last but not least, an original solution of the association rule detection algorithm, which enables bulk searches for rules in discovered clusters, is presented.

1. Introduction

For several years we have been researching the possible ways to increase traffic safety. We try to come up with solutions using smart technologies. We primarily work with the possibilities of active prevention of dangerous situations in traffic. Our goal is to design a traffic collision avoidance early warning system. The system should be useful mostly in situations, where the driver encounters the specific, seemingly safe, location for the first time. The system should evaluate the risk of a traffic accident occurring - in real time and place. And, in case of any increased risks of a traffic accident happening, warn the driver. (Lamr & Skrbek, 2016a). Warning the driver should be facilitated audio-visually, yet the driver should not be unnecessarily distracted, if the situation does not call for it. Therefore, we are also researching a form of a warning system, which would never endanger the focus of the driver.

The described early warning system consists of a control part and a user part (Lamr & Skrbek, 2016a). The user part handles the evaluation of the actual situation on the road and ensures the issuing of an adequate warning to the driver. The control part collects heterogeneous data, processes it, and then saves it into its internal database. We have written more about the data matrix which we are using in e.g. (Lamr & Skrbek, 2016b). The use of big data for scientific purposes is discussed in more details in (Pavlíček, 2015). Another important function of the control part, is the process of preparing the data and the process of creating models based on data mining techniques. You can find out more about the control and user parts in e.g. (Lamr & Skrbek, 2016a).

We want to use this article to closely describe the process which searches for clusters of traffic accidents with similar attributes. We will primarily focus on the possibilities offered by software data mining tools, which can be used to search for such clusters. The traffic accident clusters are based on the number of traffic accidents in a specific location. Furthermore, the individual clusters should be tested for whether or not they are typical in some manner (e.g. the weather conditions, time of the day, visibility, etc.).

2. Methodology

For this paper we primarily use the findings from our research of available publications in databases, printed book sources and sources available online. Furthermore, a form of analytical evaluation is used, which enables us to choose an algorithm and a tool for locating clusters and then data mining using association rules. Based on the analytical evaluation of suitable data mining tools, findings are synthesized as well as recommendations for optimal solutions of the examined topic.

3. Solution requirements

In the model creation process of the described early warning system, it is important to first search for traffic accident clusters, which are based on location information (GPS coordinates) and then test the clusters for their specificness (whether or not they are in any way typical).

Searching for, and creating clusters, is what we call cluster analysis. There is a large number of methods for creating clusters and the methods can even be divided into multiple categories. For example (Han & Kamber, 2006), divides the cluster analysis methods into the following: Division based methods, Hierarchic methods, Density based methods, Methods based on a grid, and Methods based on a model. Řezanková et al. (2009) classifies methods of cluster analysis as: Dissecting methods, Hierarchic methods and Methods for clustering large files. In data mining, cluster analysis is considered to be a method of “learning without a teacher”. “Learning with a teacher methods” create models based on historic data, while the values of both the predictors and the target variable are known. On the other hand, “learning without a teacher” methods are machine learning algorithms, which try to discover the hidden structure in data without using any training data.

As has been said previously, there is a large number of algorithms enabling the user to search for clusters - the important fact being, that for different tasks, different algorithms are appropriate. For searching for accident clusters in geographical data, mostly cluster analysis methods based on density or grid, are appropriate. For cluster searching in geo data, algorithms such as DBSCAN (Ester, Kriegel, Sander, & Xu, 1996), OPTICS (Ankerst, Breunig, Kriegel, & Sander, 1999) or DENCLUE (Hinneburg & Keim, 1998) have been developed. We have described these algorithms in greater detail in e.g. (Lamr & Skrbek, 2016a).

For testing the specificness of individual clusters, it is again theoretically possible to use the cluster analysis methods, but for easier interpretation of discovered typical attributes of a cluster, such algorithms as APRIORI can be used. APRIORI is an algorithm facilitating the search for frequented sets and furthermore, for so called association rules. APRIORI was defined in the year 1994 by Agrawal & Srikant. Association rules are implications in the following form:

$$X <- a \,\&\, b \,\&\, c$$

a,b and c are the so called antecedents , X is the consequent

The following is an example of what a particular cluster of accidents with shared attributes may look like:

Main Cause(drift) <- Visibility (worsened), Weather conditions(snowing)

The main disadvantage of methods that search for interesting implications, is the lesser accuracy compared to other methods, but they are very popular due to the fact they provide transparent and easy to read conclusions.

Creating models for the described early warning system can be realized in multiple ways. One of them is using different software products, which are more or less universal and which are suitable for our needs. One of the goals of this article is to show the capabilities of selected data mining tools to search for clusters of traffic accidents with similar attributes. The tools will be compared in regard to whether or not they contain the required algorithms, their ability to be expanded and their ability to visualize the results on a graphical map.

4. Results of the Research

For the cluster searching comparison, we have selected the following software tools/utilities: IBM SPSS Modeler, KNIME, RapidMiner, Weka, Orange, and ELKI. They have been selected because they are the most common and popular amongst the users.

4.1. IBM SPSS Modeler

The IBM SPSS Modeler (furthermore referred to as the Modeler) is a complex commercial data mining tool, which allows the user to solve data mining projects of any character ("IBM SPSS Modeler", 2016). The Modeler supports all of the phases of unified data mining methodology CRISP-DM (Cross industry standard process for data mining). Any project in the Modeler consists of so called streams, which are formed out of interconnected nodes.

The main selling point of this tool is that it is very streamlined and user friendly, mainly in the data preparation phase. It is equipped with a large number of algorithms, both for supervised and unsupervised learning. As a matter of course, it also provides nodes that enable the evaluation of models and exporting results. The latest version of the Modeler also brings the option to download node extensions directly from the environment of the application.

With regards to the needs of mining data from traffic accidents, the IBM SPSS Modeler is very useful especially in the data preparation phase - it is above all the other chosen open source projects in terms of preparing and analyzing traffic accident data, due to its streamlined approach. Tasks which can be done in the Modeler quite simply through one node, would require multiple steps and nodes in the KNIME environment. Furthermore, the Modeler can be used to discover association rules thanks to the fact that it comes equipped with nodes such as Apriori, Carma and Sequence, which allow the creation of t association rules.

The majority of modeling algorithms are "fool-proof". The Modeler can automatically adjust the variables for different types of decision trees (e.g. categorizing numerical variables). It also contains several nodes for segmentation (K-means, Kohonen maps, TwoStep, Anomaly). Unfortunately, none of these nodes are appropriate for searching for clusters in geographical data. The Modeler also enables the user to create custom nodes using the R or Python programming languages, and it is further expandable with additional algorithms, although not as many as other platforms offer. At this point in time, nodes enabling the visualization of clusters on a map, are available.

In the case of the Modeler, the data visualization aspect could take a chapter of its own. In version 18 a hotfix patch is a prerequisite - without it the extension download hub does not work properly. Another prerequisite is having the R language installed on the computer - the version that works the best for map visualization is 3.1.1 at the moment. And last but not least, it is necessary to install the so-called R Essentials for the given version of the Modeler.

4.2. KNIME

The second chosen tool is KNIME. It is an open source project which is also widely used in data mining ("KNIME", 2017). Same as the Modeler, it is also formed out of interconnected nodes. Even though it is a visual programming tool, creating streams is not as streamlined and user friendly as with the Modeler. A notable weakness is the data preparation part - as has been mentioned earlier, creating nodes takes multiple steps.

KNIME is also very easily extendable by additional nodes and it has a large user community which creates a great number of extensions for it. It needs to be said that the user created algorithms are not always completely optimized - it can happen that a task can take a large amount of time to finish when dealing with a large amount of data, due to said lack of optimization. User algorithms can be created using the Java, Python or R languages. Several algorithms originally created for the Weka project are also available for KNIME.

For locating traffic accident clusters, created based on GPS coordinates, KNIME provides the node DBSCAN and two nodes (DBSCAN and OPTICS) imported from the Weka project. The implemented variant of the DBSCAN algorithm is not optimized, though, and searching for clusters in large amounts of data is time intensive. In KNIME too, we can find the association rule search node, which should be used for identifying the typical attributes of certain clusters. To visualize the results on a map, it is necessary to import the Palladian package into KNIME, which contains, amongst other nodes allowing the manipulation of geographical data, the MapViewer node.

4.3. RapidMiner

The third chosen data mining tool is RapidMiner Studio ("RapidMiner", 2017). It is a commercial project, but a free version is also available, although it is limited to only 10,000 records. The interface is somewhat user friendly. The data preparation and classic statistical analysis phases are nicely implemented in RapidMiner. Projects are realized within the frame of a "process" and the workflow is somewhat different from the two previously mentioned tools. RapidMiner is equipped with a vast number of modeling algorithms and nodes for data import and export. Further packages and nodes can be downloaded free of charge from the built-in store. In this way, several algorithms from the Weka project can be imported into RapidMiner. RapidMiner also supports creating scripts using the R and Python languages.

Same as KNIME, RapidMiner also contains algorithms that can be used to search for clusters of similar traffic accidents. To create clusters based on geographical data, the optimized DBSCAN algorithm is available. Unoptimized version of this algorithm is also available through the Weka project algorithm extension package. RapidMiner is also equipped with the association rule generation node. Searching for association rules created using DBSCAN cannot be done as simply as it can in KNIME or the SPSS Modeler. Unfortunately, at this point in time, no extension enabling map visualization are available for RapidMiner.

4.4. Orange

The next data mining tool we will describe is Orange ("Orange", 2017). It is an open source data mining tool aimed at visualization and data analysis, for both beginners and experts. It allows both

visual programming, as well as programming through scripts written in the Python language. It is also user friendly. The workflow and the logic behind building a visual program is similar to the Modeler or KNIME. Orange is not equipped with as many data preparation options as the Modeler. And there are also not as many nodes for creating prediction models. It can be expanded through different extension packages which can be installed directly through the interface of the software. Although, the number of available extension is much smaller than in KNIME or RapidMiner. This is caused by the fact that the community of developers is not as large as it is with the aforementioned tools.

Currently, there is no internal algorithm or extension package which would enable searching for clusters based on GPS coordinates. In the case that the clusters have already been created by a different tool, they can be imported into Orange and searched with the Association Rules node. This node is available to the user after downloading the Associate extension package. Also, it is currently not possible to perform any graphic map visualizations in Orange.

4.5. WEKA

Weka is an open source software tool which is being developed at the University of Waikato ("WEKA", 2016). It combines a wide array of machine learning algorithms. Unlike other described tools, Weka has multiple user interfaces available (5 at the moment), one of which the user chooses at program startup. One of those is the so called KnowledgeFlow, which is an interface which resembles the Modeler, KNIME or Orange interfaces, both visually and workflow-wise. For data loading, Weka comes equipped with several nodes which allow loading data of different data formats. In some cases, the settings of the data source nodes are too strict and cannot, for example, easily set the encoding of the source file through the GUI.

Even in the data matrix preparation aspect is Weka not the best amongst the selected candidates. Yet, Weka is equipped with a wide palette of classification and clustering mining algorithms. Though it needs to be said that some are not entirely optimized and are slower than other implementations of the same algorithms. Machine learning algorithms can also be called through the available API (Application Programming Interface). For graphical analysis, the other tools are in some aspects better equipped. A large number of extension algorithms can be downloaded through the built-in Package Manager.

Even with regards to the options it provides for our goals, is not easily usable. For example, even right at the traffic accident data loading phase, the CSV file encoding cannot be simply selected and needs to be written into the initialization settings file. Loading traffic accident data from MS Excel files is also less than user friendly. During our tests, it was not even possible to load such a file if the number of columns exceeded 2. The number of rows was approximately 9500.

To search for clusters based on GPS coordinates, Weka has the DBSCAN and OPTICS algorithms included, although neither of those are optimized for calculation speed. For association rule searching, Weka has the APRIORI algorithm included. Map visualization of the results is not available at the moment.

4.6. ELKI

ELKI is an open source (AGPLv3) data mining software written in Java. The focus of ELKI is algorithm research, with an emphasis on unsupervised methods in cluster analysis and outlier detection. In order to achieve high performance and scalability ("ELKI", 2017). ELKI is not user friendly - it is not a visual programming tool. ELKI is not intended for preparing or analyzing data, or other visualizations.

For cluster searching based on GPS coordinates, ELKI comes equipped with the DBSCAN and OPTICS algorithms. It cannot be used for working with an entire data matrix, though, and the matrix cannot be modified either. Discovering association rules can be done using the APRIORI algorithm. Again, it is necessary to have the data prepared with a different tool. Performing data visualization cannot even be considered with ELKI.

5. Discussion and suggested solution

Analysis of the chosen data mining tools has shown, that for locating clusters of traffic accidents with similar attributes, none of them are fully equipped. The ideal tool for preparing a data matrix is, in our opinion, the IBM SPSS Modeler. For locating clusters based on geographical data, optimized algorithms, such as DBSCAN and OPTICS are necessary. Those are only available in the ELKI tool, while it cannot be used for any other tasks we require. An optimized DBSCAN implementation can also be found in RapidMiner. The unoptimized versions can be found in Weka and KNIME. Algorithms generating association rules can be found in all of the selected tools. Data visualisation can be easily realized in KNIME as well as in the Modeler, although it requires the installation of an additional extension. Most of the selected tools can be further expanded with more packages and algorithms. All of the chosen candidates allow the user to create custom scripts in selected programming languages such as Java, R or Python. A large amount of options for writing custom scripts are supported by KNIME.

Summarized comparison of the individual tools, from the perspective of specific needs mentioned in this article, is displayed in Table 1. Each tool has been rated with points in six different criteria.

Due to the fact that the detection process, of clusters with similar attributes cannot be fully automated in any of the selected tools, we have decided to implement our custom-made node. The problem is, that even though, for example KNIME contains nodes for detecting clusters in geo data and furthermore a node to detect association rules, it cannot automatically perform bulk search for association rules in the found clusters. The easiest way for us, was to implement a custom modified APRIORI algorithm into KNIME. Our solution can use the integrated DBSCAN and OPTICS algorithms for locating clusters and afterwards automatically search through all of the clusters and detect any association rules in the individual clusters.

Table 1. Comparison of individual data mining tools

Criteria	IBM SPSS Modeler	KNIME	Rapid Miner	Orange	Weka	ELKI
User experience (0-3)	3	1	2	2	3	0
Data preparation options (0-5)	5	3	3	2	2	0
The availability and optimization of cluster analysis algorithms suitable for geospatial data (0-5)	0	3	4	0	3	5
The availability and optimization of the APRIORI algorithm (0-5)	5	3	3	3	3	5
Tool extensibility (0-5)	3	5	4	3	4	1
2D map visualizations (0-5)	3	5	0	0	0	0
Total	19	20	16	10	15	11

On Figure 1 you can see a simplified workflow in the KNIME environment realizing the detection of clusters based on density, which are then tested using the custom APRIORI algorithm and further visualized using the OSM Map View Node.

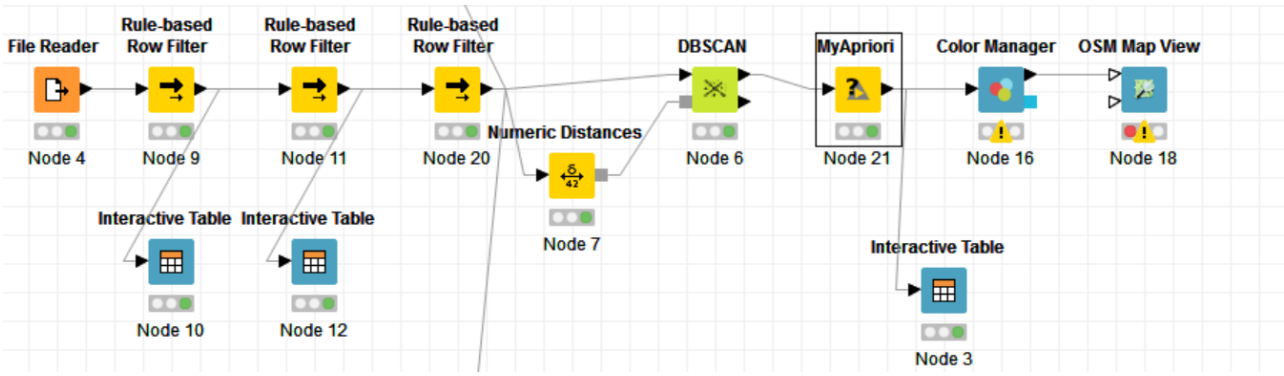

Figure 1. Example of using MyApriori in KNIME workflow

The MyApriori node enables the user, besides the choice of the basic characteristics of the association rules, to choose the variable by which the rules will be grouped, as well.

6. Conclusion

A part of the described traffic collision avoidance early warning system, is the process of searching for clusters of traffic accidents with similar attributes. This process can be realized, for example, by using a combination of different data mining tools. None of the chosen tools could allow us to realize the entire process without using external extensions. Automating the search for association rules can be realized through our custom implementation of the algorithm for a specific data mining tool.

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SESSION J: INDUSTRY 4.0 AND ENTERPRISE INFORMATION SYSTEMS

COMPARISON OF INDUSTRY 4.0 APPLICATION RATE IN SELECTED POLISH AND CZECH COMPANIES

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Keywords

Internet of Things (IoT), Industry 4.0, 4th industrial revolution, ICT innovation, Industry 4.0 readiness

Abstract

The paper deals with the evaluation of Industry 4.0 trends from the perspective of their enforcement in companies. The questionnaire compares the results obtained on the selected sample in Polish and Czech companies. The monitored areas are as follows: the degree of application of industry 4.0 principles in the companies and the readiness of strategy, management, indicators and employees. In addition, applications from the category of enterprise information systems and the penetration of industry 4.0 trends were followed up into corporate practice.

1. Introduction

Development of companies is constantly pursuing the same goals leading to higher profit. Permanently, these goals remain in their interest and emphasise higher quality, lower production bundles combined with higher flexibility of production facilities and, above all, cost reductions (including lean principles that are also reflected in lean IT trends (Bell, 2010). Investments in manufacturing branch and in IT technologies have recently gained in importance and they fall under the common concept of Industry 4.0.

The link between IT and manufacturing companies has a great prospect because the production technology and information technology (IT) are also the key strategic technologies in the following 15 years (Global trends, 2030):

- Production technology,
- IT technology,
- Health technology.

However, many of today's IT trends in manufacturing companies are not rooted now, but they have been promoted for a longer time, perhaps more recently in newer versions with new data, more integrated and more user-friendly.

2. Theoretical background

2.1. IoT as one of the key trends

Recently, the trend of Industry 4.0 has become more and more popular. This trend (sometimes called the fourth industrial revolution) certainly affects or will affect most people and most companies. Impacts of such previous revolutions have manifested themselves in various areas - not only in industry itself, but also in science, health, agriculture and trade for example. It is likely to be assumed that Industry 4.0 will have similar effects to the previous industrial revolutions (Fassman and Šulc, 2016).

Many significant consultancy companies such as Gartner Group (Gartner, 2016), BCG or Deloitte (Deloitte, 2016) present their typologies of what the current trend towards Industry 4.0 should include. Mostly the following trends are mentioned:

- cloud,
- big data,
- internet of things,
- extended reality,
- simulation, digitisation,
- digital twinning,
- various autonomous solutions,
- human and robot collaboration,
- wide range of sensors and their evaluation leading to artificial intelligence.

The cloud solution and big data are already relatively widely used and exploited nowadays and there is something like a key enabler of current changes. But the real symbol of the new trends is the internet of thing (IoT). The increasing availability of the Internet connectivity, declining the Internet connection costs, and a growing number of devices that include Wi-Fi technology and other sensors are perfect for creating IoT. IoT is one of the key trends.

It is clear that the concept of Industry 4.0 is based on industrial integration mediated by information technology. This integration involves real-time or near-real-time data sharing, information sharing, and continuous communication. This is also a potential for further development of Enterprise Resource Planning (ERP) systems.

In general, the concept of Industry 4.0 can be characterised as a transformation of production as separate automated factories into fully automated and optimised manufacturing environments. Production processes are linked vertically and horizontally within enterprise systems. To that end, sensors, machines and IT systems are interconnected within the value chain across the enterprise boundaries. For this purpose, the Cyber-Physical System (CPS) is the cornerstone for smart factories. These factories have the ability to autonomously exchange information using the Internet-based communication protocols, thus responding in real time to potential mistakes and adapting to

changing customer demand for products. Smart products create clever products that are uniquely identifiable.

Workers in smart factories do not perform physically heavy and routine activities, but rather work on creative activities. This fact has a positive effect on extending the period during which people can do their job. Work is more flexible, so people can better combine their personal and working life (Marik, 2016).

2.2. National strategies of IoT – the Czech Republic and Poland as good examples

The term Industry 4.0 is expanding increasingly throughout the world. It is mainly used in Europe today. In the United States and English-speaking countries, this concept is called industrial internet. In some countries, this concept is called an internet thing or a smart factory. The concept of Industry 4.0 has, in addition to a non-uniform title, even inconsistent characteristics. It depends on how individual initiatives or companies decide on this issue (Deloitte, 2015).

Over the last few years, more than 30 national or regional initiatives dedicated to the Fourth Industrial Revolution have been established in Europe and the European Union. The EU and national initiatives will jointly review and coordinate legislation and standardisation, implement measures aimed at achieving a digital single market, exchange the best practice twice a year at the European Forum, and report on the progress of individual European, national or regional initiatives (European Commission, 2016).

The strategical approaches of the Czech Republic and Poland are good examples.

2.2.1. The Czech Republic – National strategy to Industry 4.0

The Czech Republic has the highest proportion of industrial production in the economy as a whole in the European Union, namely, 47.3%. It is more than the most industrialised EU countries such as Germany (40.2% with EU share 27%), the United Kingdom (41.7% with the EU share 12.7%) or Italy (37.9% with EU share 12.1%).

The Czech Republic is a country with one of the longest industrial traditions and it is its people's ambition for future to remain tied to industry. Therefore, the Initiative Industry 4.0 was approved by the Czech Government in 2016 (Initiative Industry 4.0 approved by the Czech Government: https://www.mpo.cz/en/industry/industry-4-0/initiative-industry-4-0-approved-by-the-czech-government--177195/)

Table 1 Comparsion of Czech and Polish economies

	CZ	**PL**
Population	10 mil.	38 mil.
GDP	185.16 billion US dollars (in 2015)	517 billion US dollars (in 2015)
Industry share of GDP	47,3 %	45%
EU economy national share	2%	3,4 %
National Industry 4.0 strategy	National strategy Industry 4.0	National platform 4.0
Main industry 4.0 web page for company readiness	www.firma4.cz	www.przemysl40.pl

2.2.2. Poland - Roadmap to Industry 4.0

Poland was one of the fastest-growing economies worldwide pre-crisis and the fastest-growing economy in post-crisis Europe (4,6% GDP per capita growth in 1991-2008 and 2,7% in 2008-2013)

Poland is one of the most industrialised countries in EU. Poland is one of the biggest countries with such a rapid growth of added value in manufacturing sector. Polish main industries have potential to improve their capacities by digitalisation. Nowadays, the traditional ones are reporting the greatest demand on ICT products. Enhancing this trend is the main goal for the Polish government at the very beginning of digital transformation, simultaneously supporting high value added niche production. (Polish Roadmap to Industry 4.0, https://ec.europa.eu/futurium/en/system/files/ged/07_2017.01.3102.01_jan_stanilko_industry_4.0.pdf)

3. Methodology – formulation of aim and research questions

This paper deals with the survey of penetration of the Industry 4.0 principles in the Czech and Polish companies. The important questions concern the role of the selected IT trends and enterprise information system software applications within Industry 4.0 now and in the near future (2 and 5 years). The other questions ask for preparation of the Czech and Polish companies for this new trend.

The motivation for this survey was not only the current technological trends but the published manufacturing study oriented on the Industry 4.0 penetration – at the global level (Infosys, 2015) and on the national level in Germany (Eiseret, 2014).

The main research questions in this survey are the following:

1. Is your company interested in the application of the Industry 4.0 principles?
2. Does your company have the Industry 4.0 strategy?
3. Do you use suitable indicators for measuring benefits of Industry 4.0?
4. Which of IS applications are integrated within Industry 4.0 in your company?
5. In which fields do you use Industry 4.0?
6. If you do not apply Industry 4.0 in your company what are the reasons?
7. How employees perceive the Industry 4.0 trends?

4. Sample description and data collection

To enable the companies to answer the formulated research questions, a special questionnaire form, which was available on the website, was created. Data collection was carried out in the form of filling the web form in 2016/2017.

The number of 24 Czech companies (it means 14, 7% response rate) and 18 Polish companies (it means 19 % response rate) took part in the survey. It is important that the samples of companies from both countries reflect well the profile of the whole Czech and Polish economies because majority of the firms belong to the automotive branch (CZ 29%, PL 28%) and mechanical engineering branch (CZ 25%, PL 22%).

The survey participants were mostly large companies with more than 250 employees (CZ 66, 7%, PL 50%) and middle-sized companies (CZ 25%, 28%). There was also balanced ownership of domestic (CZ 58, 3%, PL 39%) and foreign (CZ 41, 7%, PL 61%) investors. Important for validity

of the data gained was the fact that often a director or a company owner (CZ 33, 3%, PL 11%) or a top manager (41, 7%) answered the questions in the form.

5. Research results

The overall results have brought interesting comparisons of the two countries – Poland and the Czech Republic. Although there was relatively small sample, the results from both countries are comparable and close in many ways. At the same time, however, they point to basic differences that lie in the relatively greater readiness of the Czech enterprises within the surveyed sample.

The results can be divided into three areas:

- Overall enterprise readiness (including whether a company dealt with Industry 4.0 approaches and whether it already had its own strategy for this trend),
- Integration with individual enterprise information system applications and Industry 4.0 trends (including integration with applications like ERP, MES, PLM, etc.),
- Selected obstacles and key prerequisites for developing the Industry 4.0 principles in companies (including issues about the effects that made the principles of Industry 4.0 unnecessary) and the state of knowledge of the subject amongst the employees.

The results are presented in the form of a spider diagram for the fast overview, representing the percentage of positive responses from both countries.

5.1. Overall readiness of companies

There are a number of models for evaluating company readiness, and there are also websites where a company can perform self-evaluation. In Germany, for example, it is www.industrie40-readiness.de and in the Czech Republic, for example it is www. firma4.cz. These models use the maturity approach and are relatively time consuming and require in-house knowledge of the assessor.

The question being studied was: Does your business deal with Industry 4.0 approaches?

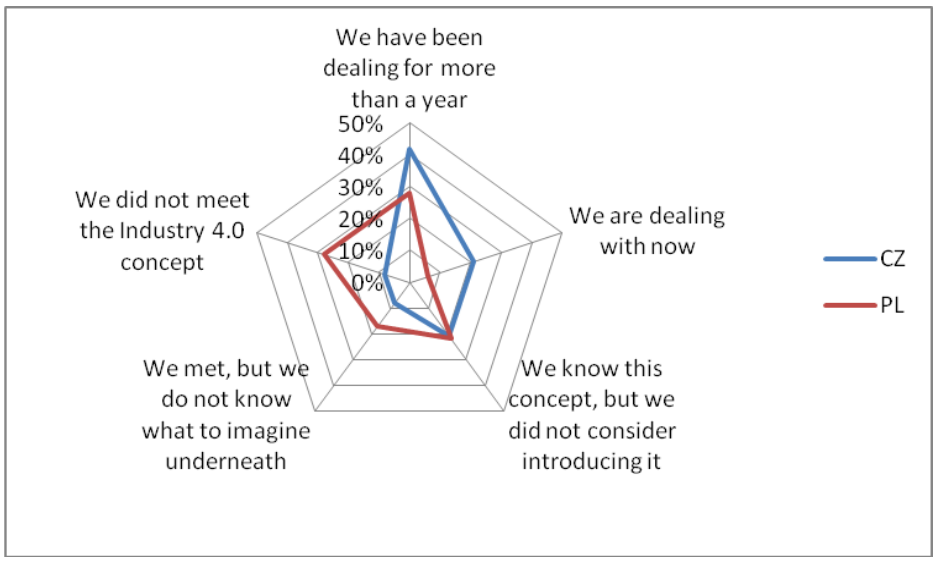

Figure 1 Does your company deal with Industry 4.0 approaches?

From the overall comparison of the responses from both countries, it is clear that the Czech companies have dealt more with industry 4.0, both in dealing with for over a year and dealing with now (PL 34% and CZ 63%). Among the Polish companies, there were more people who had not met the term Industry 4.0 yet (PL 28% and CZ 8%) or did not know what to imagine. The inquiry in this case also confirms the need for greater industry 4.0 awareness for business practice and the fact that we are still in a growing phase within the so-called Gartner hype curve.

5.2. Existence of Industry 4.0 strategy and indicators

Part of the company's readiness is the existence of a formulated approach in the form of an appropriate strategy and also the existence of suitable measurable indicators for trajectory positioning as defined by the industry 4.0 strategy. Therefore, the question that was being studied was:" If you are dealing with Industry 4.0, do you have your own strategy and benefits-finding indicators?" The question had two separate parts and thus, the answers are joint in the following chart 2.

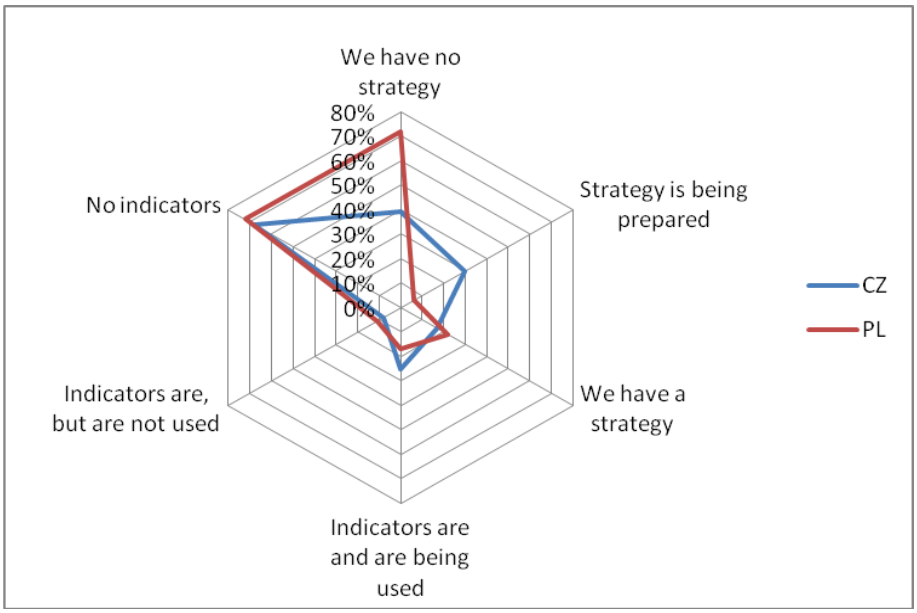

Figure 2 Does your company have the Industry 4.0 strategy and do you use suitable indicators for measuring benefits?

Regarding the question of whether or not the companies already had an appropriate strategy for Industry 4.0, the trend is again very close to the fact that more Polish companies declare having "no strategy" and fewer companies claimed it was being prepared. There is a great similarity even when answering the question of whether or not the enterprises had appropriate indicators to measure the applicability and results associated with Industry 4.0.

5.3. Integration of individual enterprise information system applications and Industry 4.0 trends

One part of the company's readiness to implement industry 4.0 is also the technical aspect of the matter. This is reflected in the new form of integration of various devices with different data formats. A very important role in this integration is played by software applications from the category of enterprise information systems that have been implemented in companies over the last decades. In particular, these are the following key applications for manufacturing companies:

- ERP – Enterprise Resource Planning,

- MES – Manufacturing Execution Systems,
- APS – Advanced Planning and Scheduling,
- WMS – Warehouse Management System,
- BI – Business Intelligence,
- PLM – Product Lifecycle Management.

The issue of integrating the main applications of enterprise information systems was based on ERP assessment as the key area.

The question being studied was: Which of IS applications are integrated within Industry 4.0 in your company?

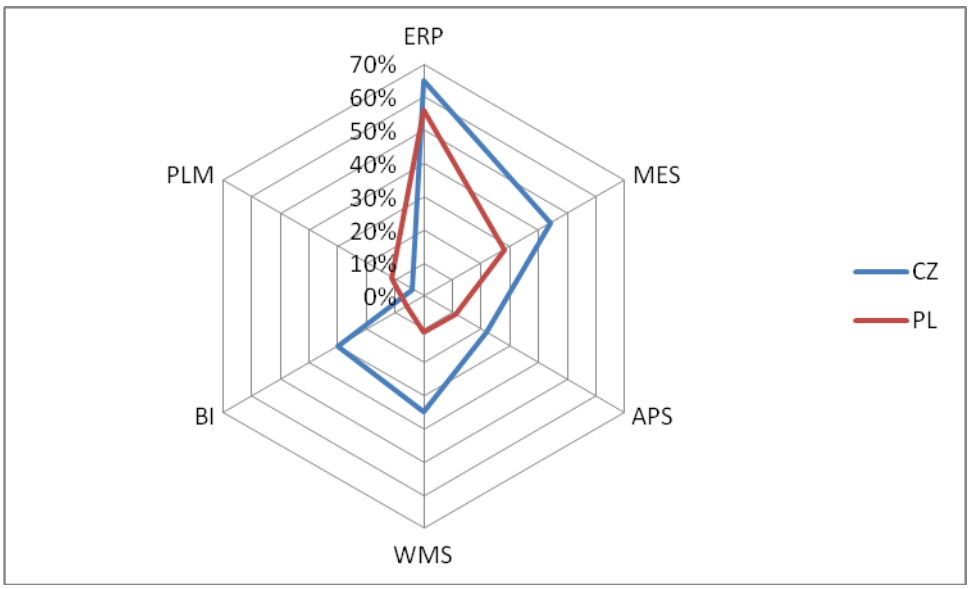

Figure 3 Which of IS applications are integrated within Industry 4.0 in your company?

Other key applications such as MES, APS and WMS have shown a higher degree of integration within Industry 4.0 in the Czech companies. On the other hand, integration with PLM application has been declared by the Polish companies at a higher level. Figure 3 presents only the most basic enterprise applications. From the interviewed companies' point of view, the Customer Relationship Management (CRM) should also be included as it is considered to be an initial application to gradual building of Industry 4.0.

Many aspects are often referred to as the main features of industry 4.0. The most repetitive features were selected to the following graph. Internet of Things (IoT) is one of them. Cloud computing and large data processing are other important factors followed by wearables, robot production and predictive maintenance.

The question being studied was: In which fields do you use Industry 4.0?

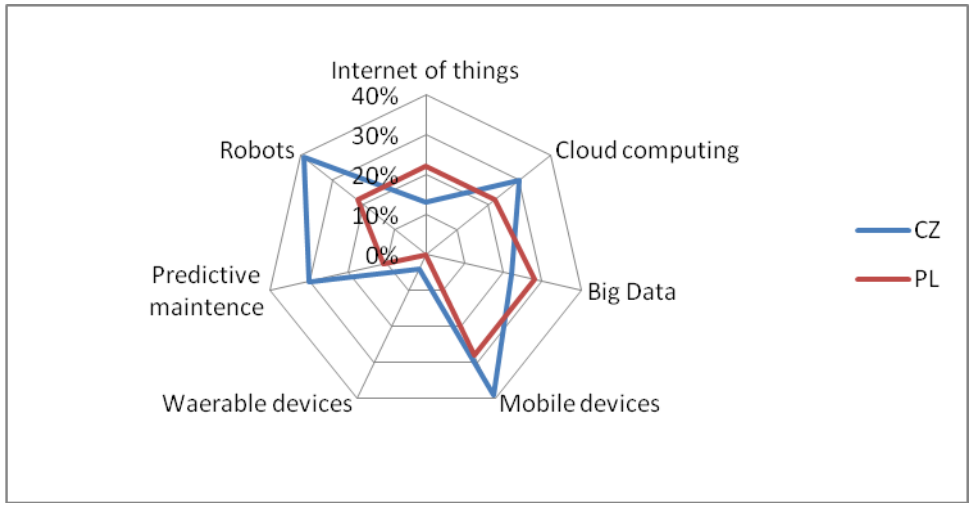

Figure 4 In which fields do you use the Industry 4.0?

The Polish companies had higher rate of big data (PL 28% and CZ 22%) and the Internet of Things (PL 11% and CZ 9%). Higher use of manufacturing solutions, such as robots and predictive maintenance, in the Czech companies is probably due to their higher involvement in the automotive industry.

5.4. Selected obstacles and key prerequisites for the development of Industry 4.0 principles in companies

The questions related to identification of the main limits for industry 4.0 are also very important.

The question: If you do not apply Industry 4.0 in your company what are the reasons

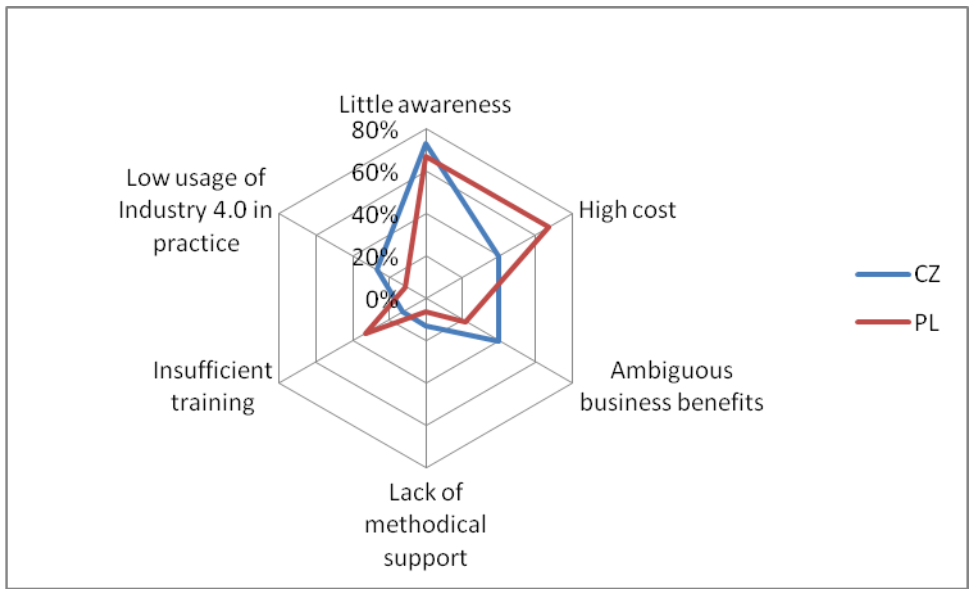

Figure 5 If you do not apply the Industry 4.0 in your company what are the reasons ?

In spite of the significant similarity of results in this area, the Polish companies highlighted more the high costs and, on the other hand, the already unclear business benefits. The Polish businesses have also emphasised the lack of training, and rather low industry 4.0 utilization rate in business practice so far.

The question being studied was: How do employees perceive Industry 4.0?

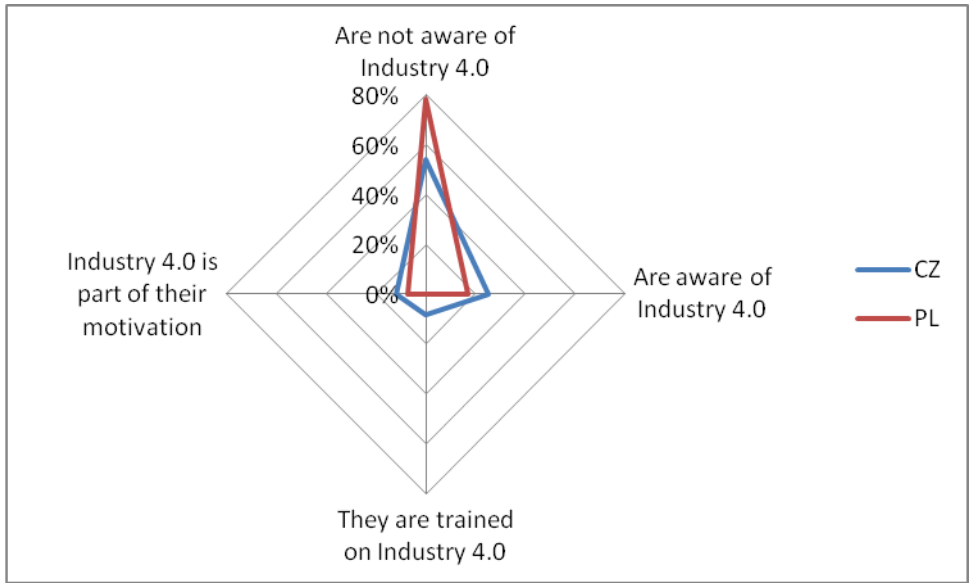

Figure 6 How do employees perceive Industry 4.0?

Figure 6 points to one of the main obstacles in the low awareness, which is undoubtedly related to the awareness and knowledge of the employees in the enterprises. Another issue has been confirmed by the fact that the employees do not have proper awareness of Industry 4.0.

Again, in this case, there is a large similarity of responses from the representatives of the companies in the countries involved in the questionnaire survey.

6. Conclusion

From the overall comparison of the answers from both countries, it was revealed that, within the surveyed sample, the Czech companies were dealing slightly more with the theme of Industry 4.0. Building the enterprise's readiness is not only based on the technological aspects, but also on the existence of an appropriate strategy and suitable measurable indicators for meeting the goals of the Industry 4.0 strategy.

However, the results have shown that businesses in both countries have consistently stated that "we do not have a strategy for industry 4.0" and that "indicators are not defined". Obviously there is huge demand for business support as well as raising the awareness of what industry 4.0 actually means. Therefore, the offered support will be focused on helping the companies to develop the necessary industry strategy for industry 4.0 and on the right indicators for measuring progress on industry 4.0. At the same time, it will respond to the need for training staff to be more informed about Industry 4.0

This will gradually increase awareness of Industry 4.0, which will be followed by a larger number of projects implementing industry 4.0. Subsequently, a wave of exploration focused on the conditions of success as well as obstacles to proper implementation and use will be possible. The area will therefore be particularly suitable for small and medium-sized enterprises for appropriate methodologies and guidance.

Nevertheless, the question is, among other things, whether the industry will still be 4.0. Even today, the industry operates with the term industry 5.0. In addition, sociologists have been working with the notion of postmodernity for more than a decade to describe our technical perspective on contemporary technologies, not only in "festive" manner.

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INTERNET OF THINGS IN ENERGY INDUSTRY

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Keywords

Internet of Things, Industry 4.0, Energy Industry, Utilities

Abstract

This paper is devoted to the analysis of the importance and usability of the Internet of Things in Energy Industry. Paper is based on research realized in utility company in Czech Republic. We are describing basic concepts of the Internet of Thing (IoT) and Industry 4.0, relation to Big Data and Information Systems in general. The most important part of the paper presents outputs of the research of business driven use cases enabled by IoT concept and technology. We analyzed possible cases where IoT can be used with more than 50 managers of this company. Applicability of IoT concept was analyzed in five different streams: Sales, Generation, Distribution, Mining and Facility. All identified use cases were prioritized based on business value and difficulty to implement them.

1. Introduction

Emerging technologies often struggle with providing enough value that will justify their adoption into business environment. The real problem with new technologies is not how to implement them but what is the reason and what new value they generate for organization. In general, user has expectations of new technology that it has better performance, is ease to use, necessary conditions exists and in general way that new technology makes sense to use (Venkatesh, Morris, Davis, & Davis, 2003). Risk of not meeting these expectations can be seen during adoption of technologies like Industry of Things (which is a main concern of this paper), Big Data, machine learning, 3D printing etc.

One vision for the future is a smart world with omnipresent sensing and actuation with inter connected smart devices enabling qualitatively new services. In this concept, Industry of Things (IoT) plays a role of utility providing services that enables creation of smart objects of a real world (Stankovic, 2014). Most global companies (56%) are viewing IoT as a strategic activity (Kalál, 2016) where the motivation for implementation is an increase in productivity (24%), decreasing time to market (22.5%) and improving process automation (21.7%). The Vodafone IoT Barometer 2016 survey identified that 63% of businesses will have launched IoT projects in the next year and 76% of businesses say that IoT will be “critical” to their future success. (Vodafone, 2016)

IoT can be described as an evolution of Internet in a way that integrates not only mobile devices but also other objects like sensors attached to cars, home appliances, different devices into one interconnected mesh (Perera, Zaslavsky, Christen, & Georgakopoulos, 2014). Smart things integrated in IoT context are able to perform three basic tasks (Miorandi, Sicari, De Pellegrini, & Chlamtac, 2012):

- Communication, the ability to wirelessly communicate among themselves, and form ad hoc networks of interconnected objects
- Identification with a digital name: relationships among things can be specified in the digital domain whenever physical interconnection cannot be established
- Interaction with the local environment through sensing and actuation capabilities whenever present

Importance of the IoT is confirmed by IDC which expects, that in 2020 IoT in Central and Eastern Europe will be presented by 1.4 billion of connected things (globally 37 billions) and the market opportunity of IoT will be 24 billion dollars. (Kalál, 2016)

Other emerging technologies are overlapping with IoT. Big Data technology could be used to handle massive amounts of data that IoT sensors can produce. Machine learning and advanced analytics are needed to process and analyze IoT data in real time. Voice based human-machine interface is the way how users will interact with devices connected and integrated in IoT world.

IoT applications were categorized by (Gubbi, Buyya, Marusic, & Palaniswami, 2013) into four application domains: personal and home, enterprise, utilities and mobile. These domains provide general classification of possible applications of IoT but real business environment usually crosses these domains. Possible applications of IoT in context of industries were identified by (Xu, He, & Li, 2014). Ability for companies to implement IoT concept and leverage new possibilities can be key to competitive advantage in the future.

Enabling technologies for IoT concept are currently under development or are emerging (Li, Xu, & Zhao, 2015). Standardization is a little bit lacking in the field of providing much needed standards for interoperability on different layers in IoT architecture (Sheng et al., 2013). Dynamic environment of evolving enabling technologies creates risks and uncertainty for organization that are willing to adopt IoT technology. Security of IoT environment should also be noted as one system aspect that must be solved robustly in distributed and omnipresent system. (Jing, Vasilakos, Wan, Lu, & Qiu, 2014)

2. Problem Formulation

Every company owning tangible assets has a lot of problems how to identify that appliance needs maintenance, that equipment is not working properly or some device needs complete replacement. When asset operator is for example trying to increase maturity of maintenance planning (from time based maintenance through usage based maintenance towards predictive and prescriptive maintenance) lot more high quality and accurate data is needed.

Problem of companies is, that they don’t know if IoT is the right technology to get the job done, how it can help them, what to require from IoT etc. Companies don’t know as well which areas could provide quick wins (often called low hanging fruits) and how to prioritize IoT use cases.

But energy companies are not only operating valuable assets. They are also providing services, selling commodities, and they serve their customers while operating on competitive market. Very important is also a need to maintain safety and security on as high as reasonably achievable level.

The aim of this paper is to provide information about importance of IoT in energy industry, to specify streams and use cases where IoT can be used in utility industry and to provide information about the most important use cases which should be solved with top priority from energy industry organization point of view.

3. Methodology

Methodology for the research comprised of execution of following steps that are compliant with case study execution described by (Yin, 2008).

Research was performed in the first half of 2016. General information acquisition took form of about 60 workshops held with more than 50 managers and subject matter experts. These workshops were grouped for five streams and organized in logic where opportunities were first identified and then they were analyzed and described to provide sufficient information for use case prioritization.

We identified two phases for the research, identification phase and analysis. Identification phase was tasked with identification of all use cases enabled or related to IoT concept and technology across five streams. These streams were:

- Sales – selling of goods and services to customers
- Generation – electricity and heat generation, operation and maintenance of power plants
- Distribution – electricity distribution and grid operation
- Mining – coal extraction and extraction site management
- Facility – real estate management

Output of identification phase was identified use cases for IoT with classification and prioritization of their potential business value for further analysis. Priority took into consideration also the ability to implement and market output of successful use case. Priorities were assigned on scale from 1 to 3 with following logic:

- Priority 1 – high value use case, additional analysis will be performed immediately (during next 6 months)
- Priority 2 – significant value, backup candidate for further analysis (during next 12 months)
- Priority 3 – some value, use case analysis put on hold
- No further analysis – low or no value, hard to market use cases, significant barriers or risks, use case postponed

Further analysis comprises of technical description of use case implementation, estimates of financial cost and financial benefit and description of constraints, assumptions and risks associated with a use case. Only best use cases were selected for further analysis, because resources were limited for analytical work.

Different criteria for use cases were evaluated:

- Use case potential type (deployed/undeployed use case, technology available/not available, too high cost)
- Usage type (prediction, reaction, trending)
- Metering frequency (ad-hoc/alarm, monthly/daily/hourly, online)
- Management type (no management, one-way, two-way communication)
- Information management (ad-hoc, mail, Excel, current application)
- Risks and challenges

Business value of every identified use case was included in its description. One page overviews were created for every stream.

4. Results and Discussion

According to the annual growth rate one of the most important areas for the IoT are freight monitoring, manufacturing operations, smart grids etc. (Kalál, 2016). Some areas identified by IDC can be directly mapped to energy industry:

- Smart Grid – electricity distribution
- Production Asset Management – generation, electricity distribution
- Smart home, Connected vehicles – sales of goods and services
- Smart buildings – facility management

During the project we identified 124 use cases. All those use cases were assigned to the relevant stream and priority was set. Overview of business streams and number of use cases in each priority is in Figure 2. Details about number of use cases and priorities are in Table 1. We have identified 8 use cases with priority one in Distribution stream (almost 50% of all use cases with priority 1). The Distribution stream has the biggest number of use cases in total (almost 36%).

Stream	Priority 1	Priority 2	Priority 3	No further analysis	Total
Sales	4	0	1	30	35
Generation	1	2	3	4	10
Distribution	8	9	6	21	44
Mining	2	6	9	3	20
Facility	2	3	6	4	15
Total	17	20	25	62	124

Table 1: Amount of identified use cases, Source: (Authors)

When we exclude 62 cases where no further analysis will be performed, than situation is different. The highest number of use cases with notable business value has Distribution – 37% (23 use cases with priority 1-3), the second one is Mining – 27% (17 use cases, but 9 use cases are with priority 3) and the third one is Facility – 18% (11 use cases and 4 use cases are with priority 1). The highest number of use cases with priority 1 was identified in Distribution and Sales streams.

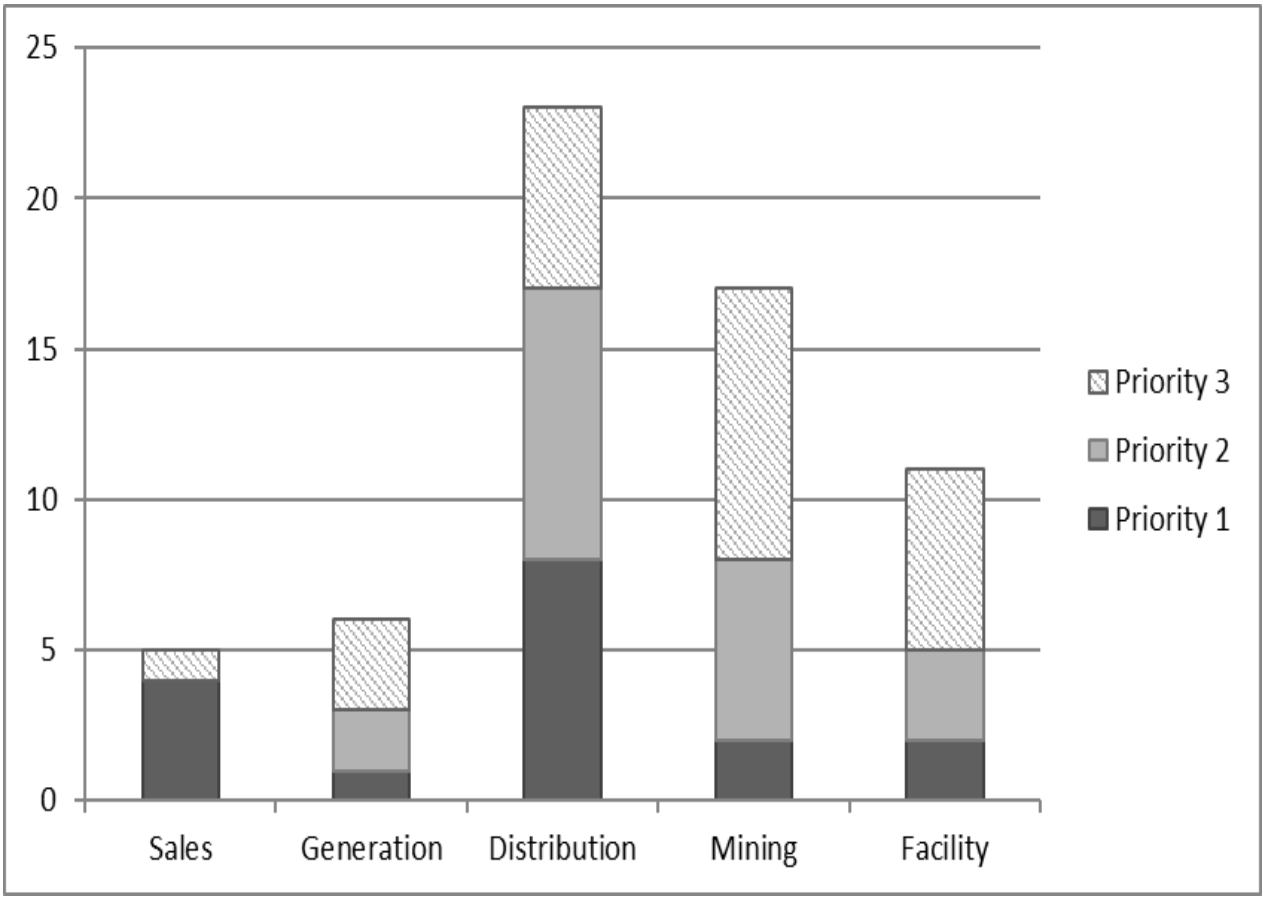

Figure 4: Number of identified use cases with another analysis across business streams, Source: (Authors)

High number of postponed use cases can be attributed to dynamic environment of customer service creation where substantial number of product ideas were identified but were later dropped because of their low intrinsic value.

The highest number of use cases with Priority 1 was identified in Distribution stream. This is caused by the fact that the highest effect can be generated in areas, where exists higher number of situations that can be solved by IoT. Currently the Distribution stream is the highest yielding stream in term of high value identified use cases.

Following use-cases with Priority 1 were identified in the Distribution stream during analysis:

- Glazed frost and high wind speed metering as detection of distribution network failure risk due to harsh climatic conditions, e.g. electricity pole failure prevention
- Transformer station metering, metered data transmission (profiles, registries, critical attributes) and basic control signals, which helps to monitor distribution network state for reliable network operation and more accurate and faster localization of failure
- Automated Meter Management (AMM) based on IoT communication for cheaper remote consumption profile reading and management of installed smart meters
- Load management (demand side management) transmission to distribution network endpoints (problematic locations, about 10 000 locations), alternative technology to current implementation of demand side management solution
- Point of delivery metering (A, B class) with IoT communication, data transmission (15min profile data, daily registers) for cheaper and more reliable remote consumption metering

- Point of delivery metering (C class) with IoT communication, consumption, consumption data transmission from high risk locations for cheaper and more reliable remote consumption metering
- Circuit breaker state on high voltage for faster failure localization with faster electricity delivery recovery
- Seal breakage detection, high risk wholesale customers, high risk retail customers, prevention of nontechnical losses – unauthorized electricity consumption

Most distribution IoT use cases are dealing with information gathered from distribution network. Some are bound to prevent network outage (e.g. frost detection or circuit breaker state), quite a lot are about effective gathering of data for further use (A, B, C point of delivery class metering, transformer station metering). Operation and maintenance of modern distribution network is based on a lot of data that can be expensive to collects. Obsolete model of tree-like organized distribution network was easier manageable than current decentralized distribution networks with smaller electricity sources and renewables. Transformation to mesh-like grid with future transition to smart-grid creates demand for cheap and reliable technology for data acquisition from various distribution network components. This data is mainly used for failure prevention, failure detection and localization, maintenance planning and consumption billing. IoT can be enabling technology in the context of distribution business.

Following use-cases with Priority 1 were identified in the Sales stream during analysis:

- Smart City – e-mobility recharging stations occupancy (actual state or change of recharging spot occupancy recharging) and providing information to customers, which chargers are vacant and can be used by them
- Operation state and failures of electric appliances and heating state (voltage, energy consumption, temperature), prevention of sudden failures, mitigation of failure impacts and direct savings on energy bills
- Remote readout on electric, water and gas meters (consumption) for accurate billing and also giving this information to customers so they can change their behavior in regards to energy consumption
- Equipment state monitoring and detection of failures, limits or critical states (state or continuous metering, proper functioning), prevention of failures due to monitoring of equipment state and notifying customer or technology specialist

Most of high value use cases in sales are about new services (appliance failure detection) or supporting emerging services (recharging station occupancy). In future, high demand will be for near real time customer energy consumption data. Consumers will be provided with precise information of their energy consumption and new services will be built on top of these data. New business models will emerge based for example on the ability to postpone consumption in time or for selling of energy reserves of homes to other parties participating in energy markets.

5. Conclusions

The concept of IoT as an evolution of Internet, which will consume a lot of resources (space in data warehouse, network traffic etc.) but which will produce a lot of usable information. This information can be used in predictive maintenance, improving production cycles, adding addition value to processes based on Just in Time method etc.

By the research we showed that there is substantial value of IoT for companies in energy sector. Our research identified different that the most important area in energy industry is Distribution and Sales from priority point of view. From view of amount of use cases is the most important area Distribution and Mining.

IoT as a technology has large value for energy utilities and we suppose that at least some of the use cases identified will be implemented using IoT technology.

Analyzed company expects, that implementation of IoT will have benefits in following areas:

- Cheaper and more reliable data acquisition and communication
- New or improved data acquisition through sensor technology
- Enablement of new services based on acquired data and/or sensor technology

We expect that implementation of IoT in energy sector will create new requirements for Information Technology specialist, new requirements for technical and software solutions and one of important areas will be standardization in the area of smart devices and enabling technologies.

6. Acknowledgement

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PROCESS MANAGEMENT IN EDUCATION UNDER CONDITIONS OF IMPLEMENTATION OF THE FOURTH INDUSTRIAL REVOLUTION

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Abstract.

In the context of the implementation of the fourth industrial revolution, education plays an important role in the preparation of society as a whole and its labor resources, in particular, for fundamental structural changes in the economy. Broad implementation of information and communication technologies and cyber-physical systems in all spheres should be ensured by the availability of appropriate competencies among graduates of higher educational institutions. At the same time, revolutionary changes in the production sphere and the economy necessitate a radical modernization of the structure and content of processes in education itself. The result of such innovations should be quite predictable, and the achievement of educational goals – manageable. Formalization of the management of processes in the educational sphere within the framework of the systemic and cybernetic approaches is carried out on the basis of mathematical models. The content of this publication is devoted to modeling and forecasting of managed learning processes, as well as ensuring the effective formation of professional skills in the context of widespread introduction of ICT tools and integration of students into the information and educational environments of the higher educational institutions. In particular, the authors propose a model for managing skills formation processes based on the Kolmogorov and Kolmogorov-Fokker-Planck equations.

Keywords

The fourth industrial revolution, management of educational processes, mathematical modeling, optimization of processes of competences` formation.

1. Introduction

The processes currently being implemented in the world economy and society as a whole are called the fourth industrial revolution in the scientific literature. This concept was first introduced by a number of researchers, following the results of the work of the Hanover exhibition (2011). In particular, they defined its essence as the widespread introduction of "cyber-physical systems" into production processes. However, later it became clear that the consequences of the evolution of the processes within this phenomenon are not restricted by cardinal changes in the sphere of production. All spheres of socio-economic relations and society as a whole will change substantially.

2. A new technological paradigm in the conditions of the fourth industrial revolution

Discussion of the problems associated with the so-called fourth industrial revolution was quite actively held at the World Economic Forum in Davos in 2016. Klaus Martin Schwab, who is the founder and the president of the above-mentioned annual meeting in Switzerland of the world leaders and representatives of the business elite emphasized the relevance of the issues related to this phenomenon and the possible consequences, in particular. It should be noted that the issues of direct development and practical implementation of cyber-physical systems are less discussed in the course of various discussions than those related to the corresponding consequences for the global economy and the world community. The attention of the scientific community is also focused on the development of strategies and concrete measures to cope with emerging challenges and threats. This is a feature of the modern stage of the reaction of representatives of the world elites on the course and development of socio-economic processes. In fact, they perceive the rapid development of information and communication technologies and their use in all industries, as some objective avalanche phenomenon, which has no sense to resist, as, indeed, attempts to control it. Effective information exchange between cyber-physical systems allows predicting the most probable trends in the development of situations, as well as adapting to changes in the environment, choosing the optimal behavior model. Such systems are united in a single network, communicate with each other in real time. The actions listed above make it possible to implement production and technological processes with the least number of erroneously performed operations, actively interact with the external environment, and timely identify the actual needs of consumers (customers) and society. In this case, the product or service itself acquires the signs of their intellectualization. And all this is carried out in an absolutely autonomous mode.

Cyber-physical systems radically change the existing relations between producers, suppliers and buyers, as well as between man and the means of production. Characterizing this situation at the World Economic Forum in Davos, Klaus Schwab (2017), in particular, noted: "The possibilities of billions of people connected with each other through mobile devices with a huge capacity and memory, providing access to the entire body of knowledge of mankind, are truly limitless. And these opportunities will be multiplied due to new breakthroughs in the fields of artificial intelligence, robotics, the Internet of things, autonomous transport, nanotechnology, materials science and quantum computers. Artificial intelligence is already here in the form of autonomous machines, drones, virtual assistants, translation programs". In fact, today a technological paradigm is being formed that not only encourages new perspectives, but also determines new social challenges associated, first of all, with a significant transformation of the labor market. According to the report prepared for the World Economic Forum-2016, probably by 2020 the introduction of new production technologies, robotic systems will lead to a reduction of 5.1 million jobs. First of

all, office workers and administrative personnel can remain without work. On the other hand, the demand for workers of occupations which actually did not exist even 10 or 15 years ago has been dynamically developing recently.

Due to the fact that the widespread introduction of means of integrated automation, the factor of payment for human labor ceases to be decisive in the formation of the final cost of goods and services produced. Therefore, gradually the production of transnational corporations located in developing countries will be returned to Europe and the US. And the developing countries themselves, which compensated until recently the shortage of modern technologies at the expense of relatively inexpensive labor, lose their industrial resources. This, in turn, will lead to a significant reduction in the volume of their gross domestic product and, accordingly, the standard of living. In particular, as a very successful businessman, the new president of the United States, Donald Trump, realizing the essence of the corresponding processes implemented in the framework of the fourth industrial revolution, is actively encouraging US corporations to return industrial production from the third world countries. Moreover, he stated his intention to create the necessary economic conditions for this.

3. The influence of the fourth industrial revolution on the state of labour-market

Apart from reducing the number of jobs, the development of technology in the process of the fourth industrial revolution can cause a significant increase in the difference between income from the use of capital and labor of workers, and obviously not in favor of the latter. Because of this, it is likely that the social inequality will increase, including gender, among workers. Some preferences will be received by specialists who have the competence to effectively perform highly intellectual work, as well as developers and designers of modern information systems. Undoubtedly, in this case shareholders and investors will have the greatest benefit. On the contrary, the demand for workers with low-skilled education and low-skilled qualifications will decrease noticeably.

The solution of the above problems, the dampening of the labor market situation, in our opinion, is possible due to cardinal changes in the education systems of both the top ten most developed economies of the world and developing countries. Joe Biden (2016) in his speech at the World Economic Forum in Davos said: "Our task is to reverse the coming changes for the benefit of society, to make more the winners instead of the losers ... States need now to start restructuring the education and training of specialists, modernizing the infrastructure to create new jobs, and developing new progressive tax laws that prevent the concentration of wealth". The report, presented by consulting company INFOSYS (2016), indicates that modern technologies will change almost all aspects of life. However, there is an opportunity to prepare carefully for the adaptation of society to these changes through the improvement of the education system. Thus, it is education that plays an important role in creating the prerequisites for the successful functioning of the economic and social spheres in the new conditions determined by the consequences of the implementation of the fourth industrial revolution.

World leaders emphasize that this task belongs to the category of not only very important, but also those that require urgent solutions. In particular, Nobel laureate Robert Schiller (2016) in his speech at the World Economic Forum in Davos noted the following: "We can not wait for the beginning of mass dislocations in our society in order to prepare for the consequences of the fourth industrial revolution. Our desire to invent something new has led us to a situation in which humanity must declare a cold war oriented toward the future and realized through a change in the education paradigm. Only in this way can we ensure this generation of people and those that will follow it, be able to use the consequences of the fourth industrial revolution for the successful achievement of

the goal. Either we all will acquire the status of superpowers in this new world that we are creating, or many of us will be left far behind, becoming victims of our own ingenuity ".

4. The fourth industrial revolution and the functioning of the education sector

Considering the career and educational realities of the youth of the nine largest economies of the world The Global Alliance of Leadership Schools (GSLA) in its report expresses an opinion on how education should develop in the 21st century. In particular, this report notes that the sphere of education in the existing form is not able to provide effective training of young people for future work. First of all, students must intensively develop their creativity, along with the development of analytical abilities. Skills development and continuous training for members of the society are necessary to realize effective work in the future. And the means of digital technologies should be quite common for educators of educational institutions and employers, so that young people can learn everything that is necessary to achieve success in their careers. It is necessary that the widespread introduction and continuous use of revolutionary innovations should become the guiding principle of the functioning and evolution of the education sector, with a view to ensuring substantial adaptability to various changes in the economy and society as a whole. And the innovations are the basis for the development of all educational strategies. Innovation management in the education sector in the conditions of the fourth industrial revolution should be fulfilled on the basis of the system approach as a methodology for effective solutions to global problems.

Moreover, employers expressed an opinion on the relevant skills for applicants for vacancies in the labor market in 2020. The list of the ten most important skills included: solving complex problems; critical thinking; creative skills; talents of management; coordination with colleagues; emotional intellect; the ability to make decisions; service orientation; negotiation skills; cognitive flexibility. Thus, creativity will become one of the three most popular skills. New products, technologies and ways to effectively implement practical work that will emerge from the implementation of the fourth industrial revolution will force a person to intensify creativity, including seeking new directions in the use of information technology, as well as creating new products and services. Some representatives of business community express even more cardinal opinion. They insist that after 2020, skills such as negotiating and cognitive flexibility will lose their relevance. Moreover, in a survey conducted by the Council for the Development of Future Software, participants in the World Economic Forum expressed the view that by 2026 some of the directors of companies could probably replace artificial intelligence. What do those who currently acquire knowledge, skills and abilities in the formal education system think about this? First, future applicants for vacancies in the labor market are quite clearly aware of the problems with employment in the future. However, almost two thirds of them believe that their prospects in resolving this issue are quite positive. This is stated in the report "Strengthening Human Capacity: Education and Skills for the Fourth Industrial Revolution", prepared by the international consulting company INFOSYS (2016) at the World Economic Forum.

Almost half of youth today believe that the knowledge of the skills that they acquired during their studies in higher education institutions is not enough to perform their practical work. They also expected a rapid career growth after graduation. Moreover, after integration into the workforce, most university graduates realized the fact that they will have to learn all their lives. It is also interesting that young people, primarily from developing countries, demonstrate the desire for creativity, continuous improvement of skills and development of skills, the development of new technologies, and the conduct of scientific research. Their number is almost twice as high as those who are willing to deal with these issues in countries with a high level of economic development and quality of life. The survey carried out by INFOSYS also revealed significant gender differences regarding the availability and desire to develop technological skills. In many countries, at least 80%

of respondents agree that their success in career development will depend on the improvement of professional skills throughout life. Moreover, a significant number of people interviewed believe that access to new, more flexible, digital tools will enable them to acquire new skills much faster than previously. For example, 70% of respondents in South Africa, India and the United States believe that they can teach themselves everything they want, without any difficulty, using available sources on the Internet. Today, the number of those who prefer to receive education and improve their professional skills outside the formal educational programs implemented by universities is growing. Massive open online courses (MOOC) have recently gained special popularity. These are all kinds of training courses with mass interactive participation, which are implemented using e-learning technologies and open access through the global Internet. As additions to the traditional materials of the training course.

5. Management of the processes of education in the new environment

Processes in the sphere of education require effective management, modernization and forecasting. A special feature of implementing the management of the educational system on the basis of the system and the cybernetic approaches is the optimization of its functioning, that is, the management of the achievement of the set goal in the best possible way. To select the method for implementing management, different variants of the predicted "behavior" of such a system are compared by applying an evaluation characterizing the quality of functioning or the degree and speed of approaching the educational goal. This assessment is a part of the objective function or a criterion for the quality of the management processes. And the formalization of the above mentioned actions is possible by modeling them. There was time when scientists of many countries paid attention to the management of social systems, including the founders of cybernetic ideas N. Wiener, W. Ashby, W. Forrester, V. Glushkov. Education is an integral part of society. The implemented of socio-economic processes and their effectiveness are important for society, they largely determine its future. In the scientific literature, there are many examples of modeling the "behavior" of the elements of educational systems and predicting the implementation of pedagogical processes. In particular, these are models developed by H. Frank, L. Thurstone, H. Gulliksen, F. Mosteller, K. Hall, M. Kuptsov (2016), V. Glushkov, M. Novikov, L. Itelson, S. Yablochnikov (2010).

Most of the models mentioned above are deterministic. However, such mathematical models of pedagogical processes in most cases give the same result with equivalent initial data. And this concerns not only the volume, but also the speed of mastering the learning material or acquiring skills. This situation weakly correlates with reality, since the implementation of real educational processes with equivalent initial data in practice almost never leads to the same learning outcomes. In this publication, the authors attempted to adapt previously known mathematical models of the implementation of pedagogical processes to the real conditions of the functioning of the educational sphere. This is quite relevant in the context of intensifying the impact of the consequences of the implementation of the fourth industrial revolution on the formation of competencies, in particular the active and widespread use of information and communication technologies, which are in demand in the labor market. In our opinion, the adequacy of deterministic models of educational processes can be improved by introducing new auxiliary variables that significantly affect the achievement of the learning goal. In particular, such variables can be: the intellectual level of students, the degree of their motivation to implement the training, the state of physical health, the perception of certain methods of teaching and pedagogical technologies, social environment; the possibility of continuous use of modern technical means and so on.

6. Modeling of the processes of learning based on system-cybernetic approach

Earlier the authors of this publication synthesized and analyzed the model of learning process formalized in the form of Markov random process with a finite number of discrete states of the system considered in a continuous time interval. A natural generalization of the previously proposed model is the Markov process, which is continuous with respect to the time and states of the system being modeled. It is assumed that for the description of the above-mentioned model it is useful to use stochastic differential equations of a fairly general form

$$d\xi(t) = a(\xi(t),t)\cdot dt + \sigma(\xi(t),t)\cdot d\omega(t), \qquad (1)$$

where $\omega(t)$ is a Wiener random process, the function $a(\xi,t)$ is called the transfer coefficient, and $\sigma(\xi,t)$ is the diffusion coefficient. In the fulfillment of a number of additional restrictions, these coefficients $a(\xi,t)$ and $\sigma(\xi,t)$ completely determine the random process we are considering, and the Markov transition functions and the probability distribution density satisfy the Kolmogorov and Kolmogorov-Fokker-Planck differential equations in partial derivatives. In this case, the above mentioned transfer and diffusion coefficients (functions) can be interpreted accordingly as functions that formalize the dynamics of the intensity of the processes of forming the competencies of students and their integration into the educational process and the information educational space.

However, with the practical implementation of our method of synthesizing mathematical models of educational processes, we have to face considerable difficulties in estimating the transport and diffusion coefficients, as well as in finding a finite solution of the Kolmogorov equation. Such differential equations, as far as the authors know, were previously analytically solved only for particular cases. Quite often, the substantial simplification of a real random process in its formalization with the aim of obtaining an analytical solution of the corresponding differential equation on which the construction and analysis of the model in the form (1) is based, level the possibility of an adequate interpretation of the results of modeling and the formation of practical conclusions. Therefore, the authors in this article propose a specific approach to the synthesis of models, which consists in evaluating the mathematical expectation and variance of the final results of the random educational process studied by the researchers $\xi(t)$. Here and below, we will treat $\xi(t)$ as a term "the success of mastering the content of an educational program" as some of the theoretical knowledge, skills and (or the totality of competences) generated by the trainee from the total volume planned by the corresponding program. We will express this quantity in relative units. Thus, the set of values of a random process $\xi(t)$ is the interval of values [0; 1].

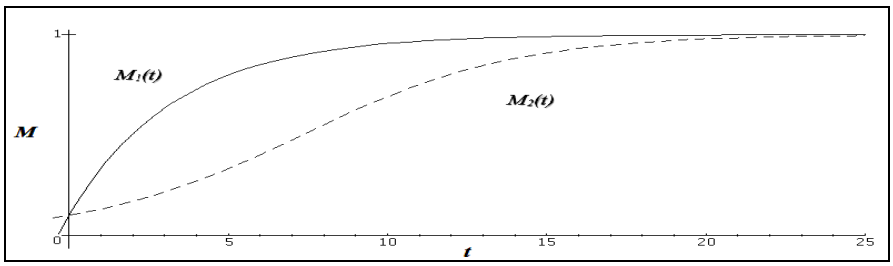

Figure 1. The trajectories of the solutions of equations (2) and (3) with equal intensities and initial average levels of knowledge ($M_i(0) = 0{,}1$ and $\lambda = 0{,}3$)

As a result of the analysis of statistical data obtained by us in the study of educational processes in a number of higher educational institutions in post-Soviet countries, the authors succeeded to prove that $\xi(t)$ the Gaussian process (for each cross section studied $\xi(t)$, the significance level α was more than 0.33 by Kolmogorov-Smirnov criterion). The adequacy of the results of the experiment

was verified by studying the processes of forming competencies among students of various areas of preparation and forms of instruction. Also, the authors found that the variance $D(\xi(t))$ decreases with time (according to the Lieven criterion α <0.03), and the mathematical expectation $M(\xi(t))$ increases (according to Student's criterion α <0.01 when pairwise cross-sections are compared) and in fact satisfies various differential equations. That means, in fact, $\xi(t)$ is not a Wiener process

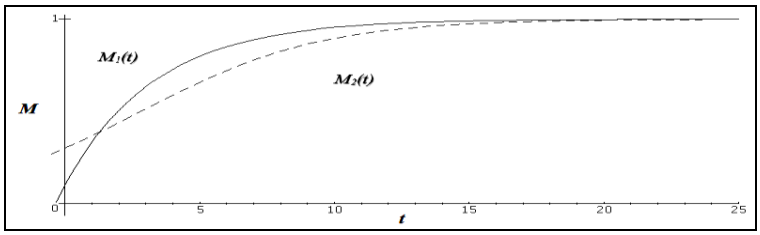

Figure 2. Trajectories of solutions of equations (2) and (3) with equal intensities ($\lambda = 0{,}3$) and different initial average levels of knowledge ($M_1(0) = 0{,}1$ $M_2(0) = 0{,}3$)

The experimental data obtained by the authors allow to state that the dynamics of changes $M(\xi(t))$, depending on the methods used to organize the educational process and pedagogical technologies, including modern ICT tools, can be described satisfactorily either by an ordinary differential equation

$$\dot{M} = \lambda(1 - M), \tag{2}$$

or a differential equation of the form:

$$\dot{M} = \lambda M(1 - M), \tag{3}$$

Parameter λ characterizes the average intensity of assimilation of the educational material.

In Fig. 1-3 the trajectories of the solutions $M_1(t) = 1 - C_1 \cdot \exp(-\lambda t)$ and $M_2(t) = 1/(1 + C_2 \cdot \exp(-\lambda t))$ are shown and, respectively, of the differential equations (2) and (3), depending on the initial data $M_i(0)$ and the intensities of means of λ. We note that only those integral curves that pass through points with coordinates $(0, M_i(0))$, where $0 < M_i(0) < 1$ have a practical interpretation. It should be noted that at the same intensity λ of the educational process, the rates of exponential growth of values $M_1(t)$ at the initial stage of training are much higher than the rates of the so-called "logistical" increase $M_2(t)$, regardless of the available initial data (Fig. 1, 2). At the same time, at the same intensity λ, the dispersion $D_1(t)$ is much larger than $D_2(t)$ (according to the Fisher criterion $\alpha<0{,}01$) for each cross section $\xi(t)$.

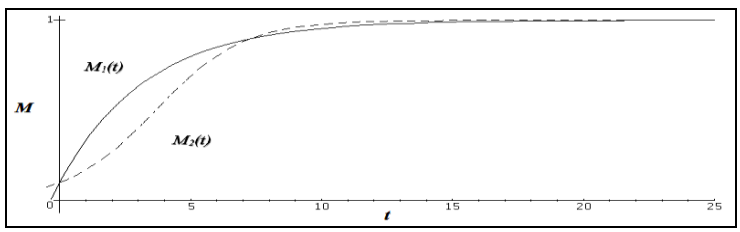

Figure 3. Trajectories of solutions of equations (2) and (3) with the same initial average levels of knowledge $M_i(0) = 0{,}1$) and different intensities ($\lambda_1 = 0{,}3$ and $\lambda_2 = 0{,}6$).

If the growth rate is higher for equation (2), then the corresponding spread of values also becomes larger than for equation (3) (Figure 3). Apparently, the correspondence between the growth rates of

the average mastery of the educational material and the corresponding values of variances is one of the fundamental patterns of the realization of a random educational process $\xi(t)$. In our opinion, this is largely due to the differences in the requirements for the development of the educational program by students in some higher education institutions and the adaptation of pedagogical techniques to these requirements. As far as $\lim_{t\to+\infty} M(\xi(t)) = 1, \lim_{t\to+\infty} D(\xi(t)) = 0$ for all implementations of the process $\xi(t)$, then this means that over time, any student (with an arbitrary set of initial parameters) can achieve an acceptable level of mastering the necessary knowledge, skills and abilities. This thesis once again emphasizes the urgency of implementing the principle of "lifelong learning", however, in fact the period of study can not last indefinitely. The time of successful learning will depend on all possible characteristics and parameters (primary knowledge, motivation, teaching methods, pedagogical technologies, etc.), which are clearly included in the model in the form of averaged values and related to the individual (random) component of the model. Due to the above mentioned fact, the task of effective management of the educational process can be formulated as ensuring the possibility of forming a set of relevant competencies in the shortest possible time.

7. Conclusions

In the conditions of the fourth industrial revolution, education plays an important role in the preparation of society as a whole and its labor resources in particular to the fundamental structural changes in the economy. It is education that should provide intellectual and organizational support to the revolutionary processes of the wide application of information and communication technologies and cyber-physical systems in all spheres of human activity, including the educational sphere. The success of the implementation of the above mentioned processes will largely determine the prospects for the development of some countries and their communities, as well as the corresponding dominance in the world arena. The formation of the necessary competences for this will largely be determined not by the initial data of pedagogical processes, but by the degree of integration of students and representatives of the pedagogical community in the information educational sphere, as well as the intensity of the renewal of pedagogical technologies, determined by completely new needs of the labor market, the economy and society as a whole.

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IDIMT-2017
Digitalization in Management, Society and Economy

25th Interdisciplinary Information Management Talks

The 25th annual IDIMT conference is continuing in its tradition as an interdisciplinary forum for multi-disciplinary, multi-national, and future-oriented research. It deals with current and future effects and challenges caused by Information and Communication Technologies (ICT) and the progressive digitalization of our lives, our society and economics by expanding its fields of applicability. The seamlessness offered by digitalization leads to a permanent transformations of daily processes, also reflected in changes in everyday life. As a consequence the interdependence between Society and Technology is increasing.

Based on a blind review process 32 submitted papers were accepted together with 13 invited papers. The authors come from 11 different countries: Austria, Czech Republic, Denmark, Germany, Ireland, Italy, Romania, Russia, Slovakia, South Korea and Ukraine.

The papers have been grouped according to the following themes:

- Digital Economy
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- Smart Systems Everywhere
- Cyber Security
- Innovation, New Business Models and Strategies
- Industry 4.0 and Enterprise Information Systems
- Corporate and ICT Performance Management
- Crisis Management
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